

Explorations on an urban interventions management system: a reflection on how to deal with urban complex systems and deliver dynamic change.

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2019

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Explorations on an
Urban Interventions Management System

A reflection on how to deal with urban complex systems and deliver
dynamic change.

Marta Alexandra Godinho Miguel

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Urban Interventions Management System

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A thesis submitted in partial fulfilment of the
requirements of the Robert Gordon University for
the degree of PhD

July 2019

Acknowledgements

I would like to dedicate this thesis to everyone who is committed to make this world a better place and to Diana, who gave me strength and motivation each and every day.

I would like to thank my mentors and advisors for guiding me during my research.

I would like to thank Professor Richard Laing for encouraging me throughout the research process and for believing in my work. In addition, I would like to thank Professor Seaton Baxter for his inspiring philosophical conversations.

I would like to thank colleagues who embraced the research findings and applied them in their classrooms and in their design process and Dr Marianthi Leon for her valuable feedback.

I would like to thank my family and friends. Without their support I would have not been able to conclude this work.

Finally, I would like to thank all those who contributed to this thesis and to my personal development throughout this research journey.

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Abstract

How we plan and manage urban development, due to unpredictable and rapid conditional changes in postmodern cities, has become an increasingly complex challenge. In turn, this calls for a paradigm shift in the way we understand and practice urban planning and design.

A resilient urban planning system must be open and flexible rather than restrictive and rigid. It must respond promptly and adequately to the fast and diverse ways cities are reorganising in response to globalisation, environmental challenges and advances in technology.

The need for a new kind of urban planning, which is able to embrace the complexity and unpredictability of the postmodern city, has been explored by several planning theorists. However, these theories were often developed from the perspective of urban planning and the city itself. In this thesis, complexity and evolutionary theories are used to approach the subject of the planning process from a perspective whereby the city is considered as the emergent and self-organising product of a sequence of interventions in the urban environment.

This research suggests a planning approach focused on the design and selection of human interventions. Within this, the strategic roles for both top-down and bottom-up interventions are investigated in relation to the formation of urban character and urban development.

The research presents and tests exploratory models, to help recognise, understand and mediate between a complex range of urban actors and external pressures derived from urban conditional changes. Findings from case studies indicate that the models are useful tools to structure and simplify the process of dealing with complex urban problems and yield useful insights into how society should perceive cities in transition, as well as adopting an ideological shift to deal with contemporary and future city planning.

Personal statement and motivation for the research

This PhD thesis is a product of who I am as a person and of my experiences as an architect, as a teacher and as a researcher. It combines both my practical experience as an architect and as a lecturer and the theoretical knowledge I have obtained while undertaking this research. It is a consequence of my questions and doubts as a human being and as a professional searching for answers in this world.

Today it is commonplace to ask architects to engage with urban design. In fact, today we cannot isolate or clearly define the role of professions such as architecture, urban design, urban planning and landscape architecture (Koolhaas et al., 1994). Although my academic background as an architect focused more on the “objects” rather than their context, I had several experiences of using the design and function of a building to introduce a bigger change in its surrounding environment. In other words, I was very often engaged with the task of using buildings for the requalification and improvement of social and urban fabrics.

Experiencing first-hand the power that design has on shaping and improving lives represented a great shift of focus for me.

First, throughout my professional experience as a designer, I looked at “the city” through the eyes of an architect. My academic background was focused on the design and conceptualisation of beautiful spaces and the science of materialising them. Nevertheless, real life and circumstances often asked me to use the design of an “object” as a tool to solve urban problems.

The second shift of focus had to do with the fact that instead of concentrating on the object and its inside world, I had to focus on what was outside: the context. I started looking at the context as a form generator. “The building”, whose basic function is to divide public and private, inside and outside, became something much bigger than that; it not only had to relate to its direct environment, but also to contribute to the regeneration of a community, to the development of a neighbourhood, a city or even a country.

This shift in focus slowly led me to look at a deeper relationship between “the building” and the city. But buildings might not be the only urban interventions that can be used as a catalyst for urban and social change. What other *human actions* can we use to nudge urban change? A new legislation, a new policy, a new education topic, a new advertisement on television ... These aren't buildings or “urban interventions”. They are actions of endless kinds and scales.

The concept of design and human actions as a catalyst for urban change led to further questions: Are the most adequate interventions unique and contextual in addressing a given issue or can we generalise them? Can we use interventions or human actions as a strategy to manipulate urban change?

Considering this, the concepts of “interventions”, “city”, “urban dynamics” and “urban change” gained a new relevance in my work and I felt the need to broaden my knowledge on the subject. My

personal research on these topics became the heart of this research's literature review: chapters 2, 3, 4 and 5.

Research approach

This research stems from the relationship between urban dynamics and its intervention at a human level – which is fundamental to contextualising urban actions.

I have used theories of complexity and evolution to learn more about the role of human actions in urban change. These theories helped me to better understand the dynamic and complex character of the urban form as well as the nature of cities and the role of *Design* as a catalyst for change.

I believe that to relate human beings to their context and to the dynamic character of change we need to venture forward with a multidisciplinary approach: “*In order to understand cities we need to venture out beyond the nominal limits of urban studies, to visit architecture, geography, history, social sciences, physical sciences and even occasionally the life sciences*” (Marshall, 2009: xii).

Perhaps some urban theorists would consider some fields of knowledge used in this thesis as inappropriate to establish the relationship between human actions and urban change. Still, as argued before by authors like Alexander (1966, 1977, 1979, 2003, 2006); Jacobs (1970, 1972); Wilson (2011); Batty (1994); Marshall (2005, 2009) and others, I believe that they can inform a more solid and more appropriate framework on which we can base our understanding of the city and urban interventions. Areas of research related to complexity sciences, emergence and evolution have already proven to bring light to the understanding of human and urban change.¹

There is the risk that this literature is seen as an over simplification of some subjects. Nevertheless, these subjects are not my area of competence and they are studied on a much deeper level in their fields of knowledge. Due to the extent of domains referred to in this text, in some cases, I will just provide a partial glimpse into the subject. I will do this to aid the understanding of how cities evolve and develop and to explore how *intervention management* can prove to be efficient in guiding urban change. The literature review was also used to define a framework to support people to deal with complexity with more awareness. It is not my intention to elaborate these subjects further beyond my field of research. My aim is to convey the idea and to invite others to collaborate and research further if they wish.

I hope that readers from others fields forgive my simplification of their subjects and correct me if any inaccuracy is detected. Still, I believe that it is precisely the embracement of so many different perspectives that adds novelty to this literature review and this thesis as a whole.

Together, evolution and complexity theories helped me to understand *urban growth* as a consequence of the tension between top-down and bottom-up urban forces. Furthermore, they helped

me to draw a picture of the city as a dynamic and open complex system which evolves and changes as a direct consequence of human actions and interrelations (Bretagnolle et al., 2010).

This definition of the city and of human interventions is consistent with the way I have experienced the several cities in which I have lived and worked. It illustrates my urban experience both as an every-day user of the city and as a professional architect aiming to improve and facilitate urban development. I hope that the findings of this research will inform other professionals who intervene in the city on a daily basis.

This research is not on urban planning, urban design or architecture. It is about the “*management of human actions*” as a tool to efficiently address the constant challenges of urban change. The result of my work aims to benefit anyone who is interested in the city regardless of professional background. It aims to invite everyone to define and understand the character of a context in relation to their own actions and therefore actively participate in the transformation of a city from their own position.

With my research I am not questioning what architecture is today. I am putting it in the general context of human interventions in the urban environment. I wondered to what extent architects could use the concept and design of buildings to improve urban development regardless of the specific constraints of each assignment. In light of this, other questions emerged: Are architects, urban designers or decision makers aware of urban complexity? Do they have to be, in order to intervene in the urban form more adequately? To what extent do the aesthetics of design matter? There are some fantastic solutions emerging from unconventional urban settlements – settlements where the built environment grows house by house, or shelter by shelter. Here, buildings, as well as many other kinds of interventions in the urban form, are creative and in direct response to the people’s needs. There are no architects or planners involved, but there is still a lot for top-down protagonists to learn from these bottom-up initiatives.²

Finally, it is important to reflect on the fact that during this research, I was exposed to emotions which eventually influenced the interpretation of the research findings. These emotions relate to the involvement of the researcher in the context of the study and they are openly expressed and form part of the data collected. Opinions, emotions and interpretations are human tools to survive; they are part of the human condition and no researcher can escape their human character. Therefore, it is better to acknowledge our human character than to try to detach ourselves from it. In the case studies presented in this research, the ethical positions and world views of the researcher were shared with all the participants and from that, several deep, honest and meaningful discussions arose.

Taylor’s (1971) ideas about social sciences support this research position:

“These sciences (social sciences) cannot be wertfrei (value-free); they are moral sciences in a more radical sense that the eighteenth century understood. Finally, their successful prosecution requires a high degree of self-knowledge, a freedom from illusion, in the sense of error which is

rooted and expressed in one's way of life; for our incapacity to understand is rooted in our self-definitions, hence in what we are."

(Taylor, 1971: 57 in Packer, 2010: 123)

Packer's philosophical arguments were used to define both the research methodology and to collect and analyse the data. The studies took place within the system composed by: the researcher, the physical context of the study, the subject of research and the participants. The elements of the system and the dynamics they have created make the study so complex that only when one is part of the system can one fully understand and interpret the information that it produced. Only when the researcher embraces himself also as a person experiencing a phenomenon in a specific context can he can engage fully with the complexity of the social and cultural background on which the research takes place. Only then can one fully understand both the system of the study (researcher, context, object of research and participants) and the dynamics created between the parts of the system. Furthermore, only when the researcher is part of the system can he fully understand how the actions of the participants initiate other actions which, in return, influence both the elements of the system and the evolutionary process of the phenomena.

Eventually, the researcher can translate that knowledge into words, but those words might be interpreted as opinions. Still, no one can say that these opinions are not relevant. They are profound once they are a product of experience. They can be seen as valid knowledge which emerged from a case studies or from a study of a phenomenon in a context and therefore they have the potential to be generalised and applied to other contexts.

The research findings analysed other topics besides architecture, urban management and design; they applied to contexts beyond the ones described in this thesis. Observations lead to suggesting that the research findings might be able to support the understanding of other topics that deal with complex systems, such as other forms of design, psychology, sociology, law, scientific innovations, etc.

Chapter 1: Introduction

Introducing the research

Chapter 1 contextualises the research topic and defines the research's hypothesis, aims and objectives.

The importance of studying the city

Cities can arguably be regarded as the ultimate triumph of man over nature (Ihde, 1990), and today we live in a world which holds an almost endless variety of urban settlements (McGee, 1971). Although there are settlements where communities live as they used to live centuries ago, or indigenous tribes relying on the rainforest to survive, there are also cities which change and evolve so quickly that they are difficult to manage (Allmendinger, 2001). Rapidly changing cities normally accompany rapid progress in transport and communication technology, with one feeding the other (Augé, 2008).¹

Due to the complex dynamics and the rapidly changing character of postmodern cities, concerns over how we plan and manage city development are increasingly becoming an everyday challenge (Allmendinger, 2001). This phenomenon urges better informed urbanism²; an urbanism that better understands and manages the fast and diverse ways cities are reorganising as a response to globalisation, human migrations and advances in technology.³

Communication technology, for example, is having a greater impact on the way we live in the city. Like the use of motor vehicles did in the past, use of the internet is rapidly changing the ways in which we use cities. The internet has changed the way we work, the way we trade, the way we communicate and the way we socialise and have fun. The internet, and technology in general, is reshaping today's cities in ways that we could never have imagined. Today, with the fast emergence of new technologies, it is even more difficult to imagine how the city will be in the future.⁴ But is this a problem? Could urban planners and designers ever predict the future of our cities or were they being hopeful imagining perfect urban scenarios? Did this approach to planning work?⁵ Why does it regularly seem that modern planned environments are often not necessarily better than traditional unplanned ones? After so much effort, resources and technology applied to develop new, more modern urban areas and modern planned environments are often perceived as worse than the unplanned ones (Jacobs, 1961; Alexander, 1966; Anand Wadwekar and Kobayashi, 2009). Very often, planned environments from the 1950s onwards are considered inhuman, ugly and brutal "concrete jungles".⁶ Is this image related to the modernism movement in architecture and planning or is it a consequence of

planning itself? Does the urban planner still have a role to play (Koolhaas et al., 1994) and how can we manage the unpredictable development of the city in a sustainable and efficient way? Do we even have to manage urban change (Dixon, 2001)?

Positioning the thesis in the context of two important debates related to city planning today

In the past, cities were comprised of defined physical areas with a clear edge. It was not only their shape but also their general common political ground and culture that gave them coherence and a sense of unity. It was that physical and political unity as well as a kind of cultural magnet that gave solidity to the urban structure. It was this sense of unity and of belonging that constituted the basis for urban expansions and exploration of new more distance areas. It was this unity which was inherent to each individual as part of a community which was extended and exchanged throughout history between different urban groups and which created the diversity we have today.⁷ This inspired the traditional view of the city as a closed and controlled system. This view inspired planning approaches throughout history which designed the city from the top down as a coherent, finished whole (Marshall, 2012). In other words, historically, city planning is associated with large-scale interventions – it is associated with masterplans, blueprint planning or “physicalist” planning (Taylor, 1998) and the design of cities (Geddes, 1915/1949; Gibberd, 1967; Lynch, 1990). Modernist planning is one example of such an approach (Marshall, 2009). Today, conclusions reached from the misfortunes of top-down creationist approaches raise questions regarding how and whether we should design and plan our cities (Marshall, 2012).

In light of the uncertainties related to urban change and planning itself, it is relevant to establish the position of this thesis in the context of the two key debates on city planning today.

The first debate regards Modernism and Neo-Traditionalism. This debate is not only present in planning but also in art, music and architecture.

One of the major lessons learned from modernism is that the future is unpredictable, and people take time to adjust to large-scale changes in their surroundings. In other words, the concept of trying to simulate the perfect future city as a finished design form and build it as a whole can bring serious urban problems (Jacobs, 1961; Jencks, 1981; Coleman, 1985; Panerai, Depaule et al., 2004; Pearson, 2006).⁸ These statements are even more relevant when one takes into consideration how technology speeds up motion and urban change. There are many other key lessons planners learned from the misfortunes of modernist planning, but this is the most significant for the argument we wish to explore in this thesis.⁹

Neo-traditional planning is normally associated with the *New Urbanism* movement.¹⁰ Many authors see neo-traditional planning as a reaction to modernist planning.¹¹ In fact the neo-traditional

kind of planning appreciates urban diversity; it has greater ecological concerns; it values the organic character of the traditional “unplanned city” as well as valuing the human scale of its built environment. Modernism and neo-traditionalism, in stylistic terms, are two completely different movements. Yet, from the perspective of urban design and the management process, they both emerge from similar basic principles. On the one hand, the ideal city behind the neo-traditional movement is the traditional “unplanned city” or *natural city*, as coined by Alexander (1966). Natural cities emerge from individual initiatives which together form the whole of the city. On the other hand, modernism and neo-traditionalism embrace a top-down creationist approach (Katz, 1994:19)¹² and both conceptualise and design the city as a final product. In this respect, they do not embrace the emergence of a city as part of a longer-term process (Allmendinger, 2001).¹³

Jane Jacobs’ (1970) and Christopher Alexander’s (1966) criticisms of the modernist movement – which in a sense inspired the neo-traditional movement – have not yet been acted upon. Their criticism was not so much about the kind of buildings or the infrastructures used by the modernist movement but rather about the process and the conceptual way of dealing with city design and evolution (Marshall, 2009).¹⁴

In this thesis, it is argued that the problems urban design and urban planning face today are not related to aesthetic concepts or kinds of infrastructure. Rather, the problems lie in their approach towards top-down design and planning. The problem is related to the scale of interventions and the strategy of creating a “coherent whole” all at once (Marshall, 2012). Following Jacobs and Alexander, this thesis is an exploration of an alternative kind of city planning and design; one that is emergent, flexible and more resilient; one that empowers bottom-up protagonists and gives a deeper meaning and awareness to top-down interventions.

Following this, the second debate concerns the question of whether we should plan the city or if we should allow it to develop organically. This question has significant consequences to the way the state and other top-down forces should interfere in the development of cities and communities.

Today we perceive the city as a complex, unpredictable and open system. In the light of such an image of the city, masterplans, development plans and other large-scale and long-term projects in a city do not make much sense (Portugali, 2011; Marshall, 2012). Actually, today we build modern architecture and modern infrastructures but, in most cases, planning has no grand plan. Some argue that this lack of a grand plan, as in modernist times, is precisely a consequence of the great modernist failures (Sorkin, 2000).¹⁵ The consequence is “urban sprawl”, pollution and other dysfunctional social organisations (Batty, 1994).¹⁶

“We now have a scatter of urban forms all over the place: a hundred miles sprawl of edged cities and out of town ‘centres’, industrials and office ‘parks’ and ‘campus’ ... We today have cities without downtowns, suburbs without cities, neighbourhoods without neighbours, ‘communities’ without civics, and many other combinations that do not seem to fit our understanding of what a city even was.”

Marshall, (2009: 5)

On the one hand one could argue that top-down planning and a grand vision is needed to guide urban growth. The *let it happen* contemporary approach of urban planning or the lack of traditional modernist planning or city design lead to what we address today as urban sprawl, social segregation and crime (Batty, 2005). On the other hand, from the perspective of complexity sciences in the understanding of urban morphology and urban development, such kinds of phenomena can be seen as a naturally emerging consequence of human adaptation to new realities or new technologies.¹⁷

In light of this, this thesis argues that we can neither plan and design the future form of the city, like in the creationist approach, nor let it grow as it pleases. It is argued here that design is always, at some level, part of the urban morphology (Marshall, 2012) and phenomena such as urban sprawl and social segregation highlight the need for top-down management of some kind. Following this argument, it is suggested that the complexity and self-organising character of complex systems as a strategy are used to reflect on a new kind of urban planning and city design. In other words, the research suggests using the capacity of the elements that compose complex systems to find their optimal function and position in relation to the other elements and to the system as a whole. It suggests a kind of planning and city design that rather than attempting to simplify the urban form tries to generate and maintain its functional complexity (Marshall, 2012) and uses a light-handed top-down design management to nudge change when needed. Several theorists and researchers are working on more dynamic ways to deal with the unpredictability of urban complex systems. Nevertheless, the exploration on this theme in this thesis is from the perspective of human actions rather than from the perspective of planning.

Human actions and urban development

Imagining and creating things is inherent to human beings and determines not only the speed but also the path of our evolution (Lane et al., 2009).

Since the beginning of our history we have manipulated our environment in a continued attempt to master the unpredictability of nature. It is in our nature to try to create a world which we believe we can control. The result of such effort is the environment where we live and who we are as humans today. During the relatively short period of human existence on the planet the built and technological environment became our natural environment (Ihde, 1990; Akkerman, 2007). Ihde even argues that we are “technological beings”. In other words, we can only perceive the natural world through technology; through the clothes and shoes we wear, the glasses we put on, or the house, the city we live in, and lately the iPads and mobile phones we use (Ihde, 1990).¹⁸

In this thesis, *human actions/ interventions* are related to technological and digital human tools but they are much more than that. They are defined as *the rational product of an individual in a*

specific socio-cultural context put into practice. This concept of human interventions relates to the human activity on the planet; it relates to the innate human nature to change and adapt the natural world to an artificial one which is more suitable for our needs. In other words, human actions or human interventions emerge from the need to relate and adapt to the environment.¹⁹ They can assume the shape of a tool, a building or an art piece. They can be related to sports, events, cultural or religious practices and habits. *Human interventions* in the urban and social environment do not necessarily need to be something physical or tangible; an intervention can be a new topic at school or a new legal system or music. It can be a new colour given to an old building, planting a tree or cleaning a lake. *Interventions* are of endless kinds, but this research will focus on *human intentional interventions in the built environment*, especially those related to architecture and urban design (Lerner, 2012).²⁰

There are two main reasons why human actions or human interventions are central to this thesis. These reasons are interrelated but are named separately for the sake of clarity.

First, a key aspect of interventions is their potential to induce change. The word intervention comes from the Latin word “*intervenere*” which means “*to come in between, to interrupt*”. It implies an action which modifies the natural course of things. This thesis explores the concept of interventions as something that occurs intentionally or unintentionally “*between events or points in time. Something that disturbs or hinders a course of action.*”

(Collins, 2009)

In this thesis it is argued that in a complex system such as a city, some interventions have the potential to change the system as a whole. Intentionally or unintentionally, one apparently small action might influence every element of the system and their relations, changing the system completely (Batty, 1994). The consequences of an intervention can be so great and complex that they are, to a great extent, unpredictable (Marshall, 2012).²¹ Nevertheless, this thesis explores a framework to define and shape human interventions as a tool to intentionally guide urban development.

The second reason why interventions are so relevant for this research is the fact that we consider the city and the city’s development as a product of a sequence of interventions. This thesis argues that ideas translated into interventions are the engine for innovation and technology, and determine the essence and character of the places we live in. In other words, ideas become interventions or action in the city. Interventions become urban layouts which in turn become the background to our ways of knowing and doing things. That background becomes the basis on which we centre our perception of the world and on which we continually build new worlds. When one intervenes in the city it determines the way in which we experience things. This experience will in return determine the way we envision the world around us and will influence the way we act on it in the future (Read, 2005).²² In urban planning, human behaviour and human needs constitute the base which is then translated in written strategies and masterplans for the city. These will then serve as guidelines for development and

therefore will shape the organisation of the space in the city and the urban network systems. They shape how, where and when people socialise, work or pray (Lang, 2005).

The literature reviewed in Chapter 3 leads us to argue that the process of human interventions in the urban environment is parallel to the process of urban development and one feeds off the other. In light of this, we consider human interventions as “urban building blocks” and as a link between human and urban evolution. Therefore, it is suggested that human interventions can eventually be used as a tool to guide urban change.

Positioning the thesis in relation to existing research areas

The needs and motives for human actions are complex ²³ and this adds complexity to urban systems (Portugali, 2011) .

“What is specific to such cultural self-organizing categories (such as the city) is that their elementary parts are human agents, each of which is itself a self-organizing system. The result is a double self-organizing process: the agents participate in the self-organization process of the city as a whole, which in its turn participates in the specific self-organization process of each individual agent

(Portugali, 1999)

The need for urban planning to embrace the complexity of urban systems has been explored by several planning theorists. Salingaros (2013) approached the subject from the perspective of form, Healey (2006) reflected on alternative planning processes, Portugali (2007; 2012) related planning and urban complexity with social theory, Marshall (2009) related the subject to evolutionary theory and Batty (2005) explored strategies to simulate urban development. All these studies informed and inspired this research; however, the subject is approached from a different perspective. The work of these researchers is built upon to investigate how to generate and maintain urban complexity but from the perspective of human interventions in the urban environment rather than from the perspective of the city or from the perspective of city planning.

This research relates particularly to the work of Marshall and Portugali. Affinity with the work of Stephen Marshall is due to the fact that he uses a similar theoretical background to sustain a similar world view. As with Marshall, we argue that rather than designing an image for the future, we better accept an open end, and we base this argument on evolutionary and complexity theories.

“... the well-intended targeting of a precise optimal outcome may be no better than choosing an incremental approach which is still very likely to reach roughly the same kind of form, but which may more surely maximise the change of each intermediate step being viable and adding immediate value.”

Marshall, (2009:267)

The work of Portugali was particularly relevant for this research because he explored complexity theory in the understanding of cities from a social and human perspective. During the last decade, Portugali has explored principles for a planning system driven from the dynamics of the city and its self-organising character. These principles and ideas were published in a variety of publications which were relevant for this research. Portugali is convinced that a dynamic planning system focused on the human capability of self-organisation would allow a flexible and resilient kind of urban planning and would allow innovation to emerge from the bottom-up. Portugali's first attempt to explore the components and structure of a kind of planning which is not dependent on predictions and speculations and that genuinely emerges with the city was in the year 2000 with the book *Self-Organization and the City* (Portugali, 2000).²⁴ Another attempt was in 2007 (Portugali and Alfasi, 2007) with the article *Planning Rules for a Self-planned City* and in 2011 with the article *Complexity, Cognition and the City, Understanding Complex Systems* (Portugali, 2011). In this article, Portugali established a relationship between the city, human actions and human cognition and explained the way these evolve simultaneously. Portugali theorised on the relationship between urban dynamics and urban evolution from the perspective of how human cognition shapes human actions.

In this research, such planning approaches for cities is further explored. We suggest a planning focused on the design and selection of human actions or interventions. The literature review investigates strategic roles for both top-down and bottom-up interventions and explores ways of designing and selecting them more appropriately, eventually avoiding undesirable collateral damage.

Research's hypothesis, aims and objectives

Stafford Beer (1983)²⁵ said that we must switch from the management of things to the management of complexity. According to many, our survival as species is directly related to our ability to master urban complexity (Grimm et al., 2008; Batty, 2017). This thesis is therefore a conceptualisation on more appropriate approaches to guide urban change.

Although the research was based on urban complex systems, its focus was not on mathematics and systems technology. The research focused on the exploration and conceptualisation of a paradigm shift in the management and planning of cities and the development of pragmatic tools to support it.

This research does not intend to suggest a way of planning the unplannable as so many other attempts have been made throughout history. The research explores forms of emergent management grounded on each context (Marshall, 2012). Following this, we suggest managing complexity through the management of a process of selection and design of human actions or *Strategic Interventions*.²⁷ In other words, this thesis argues that strategic interventions can be utilised as a tool to nudge change and address urban problems within the modern complex urban environment. With "nudging" we imply the manipulation of urban change and character. This urban planning philosophy implies the nurturing

of the self-organising strategies which naturally emerge from everyday human action in the city and use top-down interventions as a tool to nudge urban development and improve human quality of life.

The research aimed to test the applicability of the findings among scholars, designers and decision makers and add feedback to the theoretical research. In other words, the results and concepts which ground this research emerged from both deductive (from the hypotheses) and inductive (from the studies) research.²⁶ We started by investigating the research hypothesis in the literature review, aiming to explore possibilities for new strategies to manage urban change. Nevertheless, the studies gave us evidence that lead to readjustments to the initial aims of the thesis and to the reformulation of the research hypothesis. In addition, studies demonstrated strong evidence that the research hypothesis deserves to be considered and that further studies should be conducted to test further this research's assumptions, conclusions and the framework developed.

The research hypothesis

The research hypothesis is as follows:

If we design, understand and manage human intentional interventions adequately we can manipulate urban emergent change towards a sustainable development.

In order to test and explore the hypothesis, the research carried the following aims:

- To investigate urban change from the perspective of human actions.
- To explore the possibilities of a kind of urban planning focused on the selection and design of human actions rather than on the management of the urban space.
- To develop, test and validate a framework that facilitates the analysis of complex systems and supports the design and selection of more informed human actions/ interventions.

This is expanded upon through the following two main research questions which guided all the research processes and the strategies used:

- How do we relate the city, its complexity and its dynamic character to human interventions/ actions?
- How can we use “urban interventions” to nudge urban and social change more adequately?

In order to satisfy these aims, a series of objectives was formulated:

- 1) To investigate how cities emerge and evolve from the perspective of human actions. Establish a relationship between urban evolution and urban character.

- 2) To establish the role of top-down and bottom-up actions in relation to urban and social development. Establish their risks and their potentials.
- 3) To explore the meaning of *strategic interventions*. Are strategic interventions a synonym of *catalyst interventions*? Can strategic intervention intentionally nudge urban change or speed up urban evolutionary processes?
- 4) To investigate the relationship between the scale of intervention in cities and the scale of their effect. Can small and discreet interventions induce great changes in urban complex systems?
- 5) To explore the relationships between short-term actions and long-term visions.
- 6) To explore the role of design as a strategic intervention.
- 7) To explore how can we design top-down interventions more efficiently.
- 8) To postulate, test and evaluate an operational framework based on the research's theoretical approach that would lead to the design and selection of more appropriate and sustainable interventions and strategies.

Thesis structure

All research objectives were investigated through the literature review and, in addition, objectives 3, 4, 5, 6, 7 and 8 were also explored in the research studies.

Chapter 1 is the introduction. It contextualises the research and defines the research's hypothesis, aims and objectives.

Chapter 2 addressed the first two research objectives. We have characterised the bottom-up and the top-down kind of cities from the perspective of interventions in the built environment. We have concluded that there was the need for some kind of top-down management. In addition, we have established the role, the dangers and the potentials of both top-down and bottom-up interventions in relation to urban development.

Chapter 3 evaluated the conclusions reached in Chapter 2 from the perspective of complexity and evolutionary theories. In addition, we addressed objectives 3, 4, 5 and 6. These objectives were also explored in studies 1 and 2.

Chapter 4 applied the conclusions extracted from Chapter 3 to define the strategic interventions management system and explore how it could be used as a tool to nudge urban change.

Chapter 5 explored further the notion of interventions. It explored their nature and different ways they could be materialised. Chapter 5 categorised interventions in order to contextualise *strategic interventions in the urban environment* in the broader context.

Chapter 6 explored objectives 7 and 8. It synthesised the literature review findings in the form of an exploratory framework which shaped the research methodology. This framework (EIMS) was developed and tested in the research's studies (chapters 7 and 8).

Chapter 7 describes the research methodology and explains the research approach towards qualitative inquiry and the use of case studies as a research method.

Chapter 8 explains case studies 1, 2 and 3 which were developed in Aberdeen. Study 1 aimed to test the acceptance of the thesis' theoretical approach in a real 'applied' situation. The intention of Study 2 was to improve and establish the relevance of the exploratory framework (EIMS). Study 3 served to test the framework's potential to influence the design of interventions in the built environment. Chapter 9 describes Study 4 which was developed in Singapore and aimed to test and validate the research framework (EIMS) in an academic context. It focuses on testing and evaluating Objective 7.

Tables 18, 19, 20 and 22 on pages 237, 240, 242 and 306 respectively outline how case studies and qualitative research were used in the three different studies to shed light on the explorations conducted during this research.

Chapter 10 synthesises the research conclusions as a response to the research aims and objectives and discusses the research's findings. Chapter 10 describes the application of the EIMS framework in contexts beyond this research's focus and suggests possible future research.

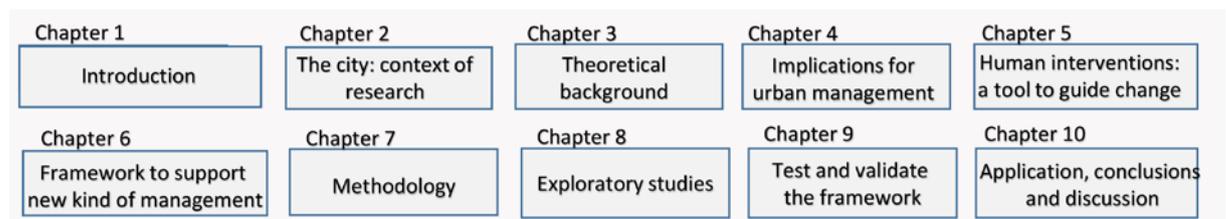


Figure 1: Chapters sequence and interrelation

Chapter summary

This chapter defines the research position in relation to two main arguments related to urban planning today. On the one hand, it expresses reservations in relation to both the modernist and neo-traditionalist approaches towards planning, which perceive the city as a finished whole. It describes the post-modern city as a dynamic and diverse, complex system; a system difficult to control or predict. In light of this, it argues that today's modern cities do not respect any creationist approach to deal with urban development; complex urban systems do not respect the rigidity of fixed designs defining future realities, such as zoning plans, masterplans and others. According to Batty (1994), the longer the term, the less suitable it is to attempt any kind of "creationist design".²⁸

On the other hand, it is also argued that there is the need for some kind of top-down urban planning; governments still need to interfere when things go wrong or when problems are predicted or naturally emerge. In other words, we can neither plan the future form of the city nor let it grow in an uncontrolled manner. Phenomenon such as social segregation and urban sprawl call for top-down

intervention of some sort (Batty, 1994) and the emergent character of the bottom-up city brings in a sense of place (Jacobs, 1961; Alexander, 1965).

The research argues for the need for a new paradigm in urban planning. Urban planning is understood and practiced differentially in different parts of the world (Friedmann, 2011). Nevertheless, we consider that most approaches share two key common problems. First is the fact that there is little communication between urban theory and practice (Friedmann, 2011). Second is the fact that we still try to define how the city will be in the future. As a response to the unpredictability of urban complex systems, this thesis encourages a kind of top-down planning that guides urban change rather than imposes it. Inspired by Portugali's findings through his many years of research, it suggests a kind of planning which is not focused on imaginary final forms or on predictions of the future, but rather is focused on solving things now as a continuous process parallel to urban change (Portugali, 2000; Portugali, 2004; Portugali and Alfasi, 2007; Marshall 2009; Portugali, 2011). This thesis has no arguments against urban planning or urban design. It just acknowledges the need for a new concept of planning based on the need to be realistic about the things we can actually plan (Marshall, 2009).

This chapter has also introduced the notion of *human interventions*. It defines them as a link between human and urban evolution and suggests that they have the capacity to influence the speed and the direction of urban change (Lane et al., 2009). It argues that all interventions (such as a new technology or a building) normally emerge as a response to human needs at that time, and they will inevitably trigger the emergence of new ways of living, new possibilities and new needs. These new possibilities and needs will, in turn, be the basis for further interventions and technologies to emerge (Haken, 2012). In other words, when a human action responds to a human aim or need, it reinvents the world around us, which in turn will influence a new human behaviour and new human needs. Consequently, changes in human behaviour and human needs will influence the way we conceive and use our built environment and therefore will determine the way we create new things (Allen, 2012).²⁹

In light of this deep relationship between human actions and urban development, the research suggests that a resilient and adaptable urban management could consist of continuous management of human actions. In other words, it suggests the management of urban change through the recognition of human interventions. It argues that a sustainable top-down management of an urban system could consist of the nurturing of bottom-up interventions and the design and selection of strategic top-down ones.³⁰ In other words, it suggests that there is the need to facilitate the emergence of adequate interventions in the urban environment and that these interventions can be used as tools to guide urban change. In this new framework of thought, the impossibility to predict change is not a problem once urban solutions arise from the emergence of problems or from concrete predictions of social imbalance (Portugali, 2008).

In short, this research is concerned with the sustainable management of urban change. Related to this, there are issues about the city, urban evolution and about city planning and design which need to be addressed. As with any complex system, the city is far from equilibrium. It self-organises and is

characterised by phenomena of nonlinearity and uncertainty (Portugali, 1997). The aim of this research is to explore ways to improve such kinds of systems and influence their emergent development. In other words, this research explores ways to nudge complex systems and direct them to become independent, self-regulated systems with the ability to evolve sustainably (Marshall, 2012).³¹ It investigates urban systems from the perspective of human actions and tries to identify ways in which these can be used as tools to manipulate emergent change. It suggests urban planning focused on the design and selection of appropriate interventions in the urban environment; interventions that cause as little collateral damage as possible and that can work as catalysts to improve the urban system or direct urban development when necessary.

Above all this research is a reflection on *in what kind of world we want to live in* and on ways in which to make our cities ready for the future challenges they might face. Implicit in it is a deep and continuous reflection on the meaning of concepts such as resilience and sustainability (Ehrenfeld, 2008).

Chapter 2: The city

Chapter 2 addressed the first two research objectives.

- 1) To investigate how cities, emerge and evolve from the perspective of human actions. Establish a relationship between urban evolution and urban character.
- 2) To establish the role of top-down and bottom-up actions in relation to urban and social development. Establish their risks and their potentials.

Chapter 2 frames the research's object of study - the City - from the perspective of interventions in the built environment.

This reflection on the relationship between people and their built environment will serve to introduce two relevant ideas for this thesis.

First, it introduces the idea that even if all cities are built with the same ingredients, each city is unique. This idea relates to the relevance of public space in the formation of urban character. It relates to human life and human interactions with other humans as well as with the environment around them. It relates to climate, culture, history and religion.

Second, it characterises the city according to who intervenes in it as well as according to the nature and purpose of the interventions in the built environment. It characterises the emergent kind of city which has no grand plan or vision for the future and the top-down kind of city which normally emerges from creationist approaches.

The knowledge extracted from this section of the literature review made in this section will serve to inform objective 2 of this research *“To establish the role of top-down and bottom-up actions in relation to urban and social development. Establish their risks and their potentials”*

And more specifically:

- a) To characterise the top-down and bottom-up kind of city.
- b) To define the roles and potential of bottom-up and top-down interventions in the urban environment.
- c) To identify these findings with kinds of city formation and city management.
- d) To frame the research's argument on why urban interventions should be preferably gentle and discreet.¹

The idea that this chapter aims to put forward is that humans shape the city with their unique ways of intervening in it. Interventions in the city are a consequence of either our daily lives or greater scale top-down actions. Nevertheless, all interventions are shaped by their physical and socio-cultural context. The uniqueness and character of human interventions shape the city, and the city shapes the people who experience it.

A city is “... a complex collective dynamic entity: a super-unit composed of components that are themselves units’. Each unit is a human being who in himself is a mirror of his surroundings.”

Marshall, (2009: 135)

“Each person, besides its natural characteristics is shaped by society, by culture in other words by the environment with which it relates”

(Ponty, 1962)

This dynamic relationship between people and urban environment emerges over long periods of time and is delicate. Intervening in it can bring dramatic changes to urban and social development, which influence human life. Such changes are unpredictable due to the complex character of the city. They can improve the system or damage it. They can interfere with human identification with the urban environment (Ponty, 1962; Marshall, 2009) therefore the research explores the potential of small and delicate interventions to nudge urban change.¹ (See pp. 149)

The relationship between humans and the built environment

Does public space shape people or people shape public space?

Cities are all made of the same ingredients. They are made of buildings, plots and public spaces such as squares and streets, nevertheless all cities are different (Batty, 1994; Marshall, 2009). ”... *buildings plug into plots, plots plug into routes, and routes all connect up to form a single system.*” (Marshall, 2009) It is the way these urban ingredients are put together that forms the shape of the city. The unit formed by these elements and the way they are put together contributes to the sense of ‘city-shapeness’ that unites all sorts of cities. Nevertheless, even if cities are all made of the same ingredients we can always identify each city as unique; we can easily identify Paris, Barcelona, London or Lisbon. So what makes each city unique?

Each of those components or urban building blocks are designed and implemented in the urban fabric to serve human life in all its shapes and forms. The uniqueness of each city is a consequence of history, culture, religion and climate; it is a mirror of the unique ways people perceive themselves and adapt to the world around them. Such factors shape the form of what is built and therefore the perception of the self and of the world one lives in. Human adaptation to a context and perceptions of the environment are what makes the “general” so unique. In other words it is our social-cultural background as humans that shapes the things we do and our interventions in the built environment; it

shapes the unique ways we build things, the events we perform and how we relate to each other (Ponty, 1962). Cities are not only made up of buildings; they are made up of people. Buildings are just an expression of the people who built them and their needs, and these vary according to the environment.

“Cities may be all different insofar as their contexts are different; they are similar insofar as humans’ beings are similar.”

(Marshall, 2009)

Context in this sense implies not only the physical setting of the city, but also political and social contexts (Benevolo, 1980).² Even if we are all the same regarding our basic natural needs such as the need to eat and shelter, culturally we have different ways of dealing with each other and with the public space of the city. The way people choose to participate in public activities or to be away from them defines the design of our buildings and defines the relationship between interiors, private areas and external public space. Buildings are ideally shaped around those human needs, which in turn, as a whole give character to the public space of the street (Till, 2009). In short, “... *a building is a visible, concrete manifestation of a social group or social institution*’ (Unwin, 2009: 117).³ The social and cultural aspects of a society influence the sizes of the rooms in a house, the way these rooms relate to the street, their form and their structure. It shapes buildings and settlements’ (Marshall, 2009: 96).

This complex interrelation between urban and social structure connects individual needs with culture, design and with urban life and economy. It is something which is built by generation after generation. When one breaks this very delicate order, it touches profound human values which rest deeply in whom individuals are and how they relate to each other and the environment. People need time to adapt to new concepts and new ways to experience the city (Alexander, 1979; Alexander, 2003-2004; Portugali, 2004; Marshall, 2009).

But, where does social interaction happen? Where is the social, cultural and political character of the city formed? Traditionally, human encounters happen in public urban places. The traditional shelters for human life and social activity are public buildings and outdoor spaces such as streets and squares.⁴ Streets and squares are where all kinds of people meet. They are cultural places and the political arena. In other words, streets are the places “for political expression and struggle, and loci of cultural identity... Streets are not only a continuous public accessible place which links together all the public spaces of the city, but they are part of the social fabric of the city (Marshall, 2009: 105, 106).

Today, humans have extended social and culture interactivity to virtual meeting platforms and to a variety of emergent communication and transportation networks (Augé, 2008). Augé suggested what he calls as *Non Spaces* as a new meeting place for the post-modern society. There is a great deal of literature exploring the relationship between advances in technology and emergent places and possibilities for human interaction. There are also explorations on how media and transport networks will influence the built environment and human perceptions.⁵ Increasing technological development

will re-shape the city and the concept of public spaces as we know it today. Nevertheless we argue that humans are social animals and it is in their nature and in their evolutionary path to interact with each other and with the environment around them (Dennett, 1996). Based on human nature we believe that public space can be shaped in endless ways but there will always be a space for human interaction.

In short, even if cities are all made of the same ingredients, each city is unique. Their uniqueness emerges from a sequence of interventions in the urban environment made one generation after another. The uniqueness of each action in the city is shaped by human interactions with each other and with the context around them. Public spaces are the places where people physically interact with each other and the built environment around them. Spaces such as a street, are social containers (Dennett, 1996: 454), they are where human diversity and interaction happen (Jacobs, 1972: 3; Anderson, 1978; Marshall, 2005). The public space is where humans form a sense of the self and the world around them (Ponty, 1962). The character of the city and the way the city is organised reflects the people who live in it and their way of living.

‘In effect, cities, streets, buildings are the way they are because they are human shaped on the inside, and moreover, socially constructed in their relations.’

(Marshall, 2009: 90)

Urban character and urban change from the perspective of planning process and human interventions in the built environment

This section defines two kinds of cities both regarding their character and their formation process: The *natural city* is the kind of city that emerges from people’s everyday life and choices – ‘the city from the bottom-up’. This nomenclature is used either to address cities or parts of a city.

The *artificial city* is the city that emerges from economic and political power and from organisations – ‘the city from the top-down’. The characteristics of these kinds of cities is defined in relation to the interventions from which they emerge. Conclusions taken from the literature review lead to argue that there is no such a thing as a pure *natural* or *artificial* city. All cities are a result of the tension between both bottom-up and top-down forces.⁶

The *natural city* ⁷

Natural cities are “... cities which have arisen more or less spontaneously over many, many years...” (Alexander, 1965).

The *natural city* is a product of a *bottom-up kind of planning*. The city is not planned or designed as a whole but from its independent small parts. Interventions are normally small and aim to

address the needs of an individual rather than the needs of a group. Such a planning approach has no grand plan or image of the ideal city of the future. The *natural city* self-organizes and it is highly complex, therefore, it exhibits the phenomena of non-linearity (Portugali, 2012).

The *natural city* is an open, diverse and very complex system which emerges from an *open system* planning process. It grows side by side with its inhabitants (Kostof, 1992). The form of the natural city is a consequence of the immediate response to the citizen's needs. The city shape is normally diverse and irregular because it emerges from small bottom-up, everyday interventions which are not part of a grand-plan for the city. They are focused on the self, they are a product of the political and cultural reality of a place and they respond to specific contextual restrictions. They are not a part of a designed composition for the city. They are small representation of the whole itself (Bortoft, 2010).

“...The ‘natural city’ is presumed to develop without the benefit of designers, subject to no master plan but the passage of time, the lay of the land, and the daily life of the citizens. The resultant form is irregular, non-geometric, ‘organic’, with an incidence of crooked and curved streets and randomly defined open spaces. To stress process over time in making of such city-forms, one speaks of ‘unplanned evolution’ or ‘instinctive growth’ ”

(Kostof, 1991)

Arguably, the emergent character of the *natural city* gives it continuity and coherence. Its irregular character, the small scale of the interventions in the built environment and the time they take to be implemented, give the city its human scale. In other words, the character and development process of the *natural city* give humans a sense of place and a sense of home (Jacobs, 1961; Alexander, 1966; Marshall, 2009).

The *planned city*

This thesis refers to “planned cities” as “... cities or parts of cities which have been deliberately created by designers and planners...” as a finished whole (Alexander, 1965).

The *planned city* is a product of a top-down kind of planning. Top-down actors involved in the planning process are: urban managers, designers, planners, decision makers, representatives of private and public organisations and institutions, among others. The *planned city* is a product of larger scale interventions which normally serve the good of a group or a community and they are normally planned and implemented as a whole. In contrast to the *natural city*, the *planned city* emerges from a “closed system” planning process (Portugali, 2012). In other words, it emerges from a rational imposition of how things should be rather than an emergent self-organising process.

Top-down organisations can normally finance larger scale interventions which involve and serve a vast number of individuals. Due to the larger scale of top-down interventions and the use of geometry, *planned cities* or *designed cities* usually look more regular; they show the control of Man over Nature through technology and geometry (Alexander, 1966; Marshall, 2009). The morphology of such urban organisations tends to be based on straight lines and geometry in opposition to a more organic character of the *natural* kind of city.

The top-down kind of city can be a fast and efficient way to address emergent needs of the population; such as the building of a hospital, an university campus or a highway. Due to the scale of these kinds of interventions, they normally change the urban character of the place and can radically influence the way people use and move in that area. They normally break the continuity of emergent change and they establish new directions of development (Marshall, 2009).

This is not necessarily bad, especially when the natural emergent development of the city does not evolve in a positive direction. In fact, this research argues that such characteristics of top-down interventions could be used as a strategic tool to nudge urban change when necessary. Nevertheless, as the literature reviewed in chapter 3 will reveal, taking in consideration what it takes for a community to fully adapt to the urban environment implies being more careful with the scale and range of influence of urban interventions in general.

In short, the *planned city* tries to bring order to what people considered to be not controlled or imperfect. Marshall illustrates this with the idea of a pile of sand: In the *planned city* top-down agents try to make a perfect cone out of a sand pile, while for the *natural city* ‘*the roughly conic shape comes naturally, according to the laws which apply to every sand pile.*’ (Marshall, 2009:83). This has great implications for the morphology and aesthetics of the city. The *planned city* is a consequence of top-down interventions which involve the mobilisation and coordination of much larger quantities of resources. These characteristics of the ‘designed city’ are reflected in the aesthetics and scale of the elements which compose it; in the ‘designed city’ urban elements are normally more standard and greater in size. In contrast to the *natural city* the *planned city* shows little or no negotiation. The design of a *planned city* is normally based on geometry. Streets are not irregular; they are made of straight lines. (Alexander, 1966; Jacobs, 1970, 1972; Batty, 1994; Marshall, 2005, 2009).

At the first glance the distinction between ‘natural’ and ‘designed or planned cities’ appears quite straightforward. Nevertheless, on the one hand, even the earliest cities show evidence of organic settlements located side by side of straight streets, ordered land, division of functions, great temples and monuments associated with religious and political power (Braudel, 2002). On the other hand, Greeks and Romans left a legacy of planned cities largely due to their efforts to colonise and spread. The military camps which could be assembled in hours proved how efficient a grid plan could be. With time, the technological developments enabled larger scale interventions and ‘pure geometry’ was

imposed upon larger areas of land. Since Greek and Roman times, the formal knowledge of geometry is dominant not only in the design of cities, but also in the design of buildings of whatever scale and function. This extreme abstraction has influenced the human mind up to today.

The *designed city* is so related to the human way of reasoning and the need of imposing order on things which goes as far back in time as the first cities. For this reason, it is almost impossible to dissociate one kind of city from the other, they merge as one. In most cases, both kinds of city grow together and reflect different realities of a society. Together they create the different characters that compose a city as a whole. Most of today's cities have highways, university campus', hospital complexes and airports, but they thrive through their emergent force; through the choices of each individual when choosing a place to live, to work to have fun; when one builds its private house or uses the public space. Furthermore, the layout and character of the city is an expression of those two forces working constantly together.⁶ This thesis that the city is a consequence of interventions which emerge from the tension between top-down and bottom-up forces.

This image of the city reflects the theoretical background discussed in chapter 3. Evolutionary theory explains urban order without design and is able to include *design* in the evolutionary process as a human adaptation to the environment (Marshall, 2009; Wilson, 2011). From the perspective of complexity theory, the differentiation between the natural and planned city is not very relevant. From the perspective of fractal geometry, the designed city can be seen as a natural emergence. According to Batty, 95% of the general form of the cities " *which exist and have existed, would be seen as being more organic than purely geometrical*" and so can be studied from their *organic perspective* (Batty, 1994).

Bottom-up and top-down interventions; roles and contributions for the characterisation of urban development

As argued before, the research aims to explore how human actions can be used to nudge urban character and urban change. In the light of this it is important to understand better the kinds of human interventions that define both the *natural* and the *planned city*. There are four structural differences between the *natural* and the *planned city* which are relevant for the understanding of urban quality of life and urban development from the perspective of human actions. These relations between kinds of urban development and kinds of interventions in the built environment frame the theoretical and practical explorations of this research.

The following characteristics of bottom-up and top-down interventions in cities are interrelated, nevertheless, they will be addressed separately to make the arguments clearer.

First, is the fact that the bottom-up interventions give continuity and coherence to the urban development (Alexander, 1966; Jacobs, 1970) and top-down ones shift and speed up the path of urban change. Bottom-up interventions are normally small; therefore they merge easily with the city as a whole (Marshall, 2009). A family house influences the dynamics of the urban environment around it much less than a hospital or a school building. Top-down interventions, due to their scale and function, have the capacity to completely change the dynamics and character of the urban environment around them (Lane et al., 2009).

The nature of urban change is not only related to the scale of human interventions it is also related to the way designs evolve and adapt to urban change. The evolution of bottom-up designs is normally more continuous than top-down ones and this emphasises the characteristics of urban change mentioned above. In the *natural city* new interventions are often adaptations of previous ones to better serve a specific need. People select, reproduce and slightly adapt an old design to create a new one that better serves their specific needs (Marshall, 2009). Because one intervention is a direct adaptation of a previous one its character remains recognizable and therefore people identify easily with it (Alexander, 1979; Akkerman, 2007).

Top-down interventions are also to a great extent a direct adaptation of a previous ones but they tend to be more exploratory. Humans have the capacity to imagine new realities and to create different ways of doing things. On the one hand, this gives the hope to re-invent solutions when the ones we use prove not to work (Wilson, 2011).⁸ On the other hand it opens the door for the creation of '*Hopeful monsters*' (Marshall, 2009)⁹; designs that are so innovative that people require time to adapt to them if they ever are to. The modernist city can be regarded as a '*Hopeful monster*'. "*Instead of a gradual improvement in streets, and blocks of flats we suddenly leap to 'streets in the air' as a solution.... If they are lucky they (these great innovations) just might work; but they are nevertheless a leap in the dark*" (Marshall, 2009: 236).

Change in the *natural city* is incremental; it emerges over longer periods of time. Change in the *planned city* is discontinuous; top-down interventions have the capacity to speed-up and redirect the path of urban development (Lane et al., 2009). As cities are highly complex systems, the consequences of such interventions are highly unpredictable; they can either improve the urban system or damage it significantly.

Second, is the fact that we can consider the *natural city* as a consequence of a genuine kind of participatory planning (Marshall, 2009). As we have seen, the *natural city* is planned and designed from its parts and, these parts consist of individuals that participate in the urban life. In the *natural city*, individual interventions are a direct consequence of human aims and needs, consequently the *natural city*, as an aggregation of these individual buildings, expresses the character and the individual choices of its citizens.

Conversely, the *planned city* expresses the will or a vision of a selected group of people in relation to a group, a problem or an ideal of what the city should be. The *planned city* is planned and designed as a whole; designers and policy makers (no single individual because normally they have not enough resources to support such investments) plan and design entire urban areas. Areas that include the design of multiple buildings, multiple streets and gardens which are organised to form a finished urban composition (Mumford, 1961; Alexander, 1966; Jacobs, 1972; Hall, 1988; Batty, 1994).¹⁰ These greater scale top-down interventions try to serve the interest of a greater number of people, therefore they are not customised. Because top-down interventions are rather standardised humans have to adapt to them.

Arguably the *natural city* expresses the needs and nature of the individuals who live in it while the *planned city* expresses the intentions or visions of a few selected individuals (Marshall, 2009). In other words, bottom-up interventions are an expression of an individual's needs while top-down interventions express a vision of the common good, or a vision of what the city should be. Bottom-up interventions construct the continuity of urban change and they characterise a process where all inhabitants take part including designers and architects (Marshall, 2009). The *natural city* deals with different ideologies through time and with specific negotiations between different actors of the city.⁶ These contextual interrelations make the history and tradition of a place and they contribute to the urban diversity and innovation (Loorback, 2007; Leeuw et.al, 2010). The variety of solutions and urban forms are one of the key factors that render each place unique (Kostof, 1991). In addition, this diversity adds complexity to the urban fabric, increases potential interactions with people and improves quality of life (Alexander, 1966; Floriada, 2002).

Third, is the fact that arguably the *natural city* tends to be more adaptable and resilient than *planned* one due to its process of formation. The *natural city* is more contextual and therefore more adapted to landscape features and contextual dynamics than *planned cities*. Despite the fact that there is no grand-design or grand-plan, the city still has a structure and an order which emerged spontaneously (Batty, 1994; Marshall, 2009). Lewis Mumford (1885-1990) analysed several layouts of medieval cities, and concluded that even if they were not deliberately designed as a whole, they were all similar. The functionality of traditional towns fits their form so well that it seems that they were designed (Mumford, 1961; Marshall, 2009).

“... *organic cities do not display obvious signs that their geometry has been planned in the large, although they may well be a product of many detailed and individual decisions which have been coordinated in the small.*”

(Batty, 1994)

The emergent form of natural cities is often an inspiration for creationist top-down designs, such as new-urbanism designs; nevertheless, in terms of the process of formation they are completely different. *Natural cities* are made up of several small scale elements, or small scale interventions, which are a direct response to their environment. The variety and complexity of their small scale interventions compose the whole of the city and reflect the local and specific concerns of the place (Jacobs, 1970). Creationist approaches see the city from the perspective of the whole. They see it as a finished design. When the design does not work it fails completely, while from an emergent perspective only individual parts will fail. In other words, in the natural city, each part emerges as a direct response to a need or a circumstance. If that need or circumstance changes that part will be replaced or will change and the city will self-organize and adapt to it. The city will not fail as a whole; as with any complex system it will search for new states of stability and it will adapt (Batty, 2005).

Fourth, is the fact that small scale interventions can be seen as a tool to test the emergent development of the city. Following this, there are things to learn from bottom-up interventions which can inform top-down ones.

One important characteristic of the *natural city* is the fact that its development is not systematic. Cities that grow organically deal constantly with success and decline. In the *natural city* the success or failure of individual interventions tests and adjusts the natural motion of urban change. Due to the normally small scale of individual actions in the city their inadequacy is normally not of key relevance for the development of the city as a whole (Marshall, 2009) but they can give an impression of how adequate a certain intervention is in relation to specific time and place in the city (Lerner, 2012). In a gentle manner, small-scale interventions can also determine the speed and the direction of urban change as a whole. This is a delicate and continuous process that does not necessarily happen for long periods of time (Wilson, 2011). Nevertheless, if the strategy does not work others can easily be tested. Larger scale interventions are obviously not as flexible. Due to the greater amount of resources used to implement them they are seen as fixed solutions rather than explorations.

It is important to take a closer look at the process of formation of the natural city's morphology not only because they are more adaptable and resilient development processes but also because often they function better than the modern planned cities. People still like to walk in pedestrian friendly streets, have a drink on a cosy terrace and enjoy public piazzas and courtyards. This is partly because of their aesthetics and their specific historical and physical contexts, but, it is also related to the emergent and continuous character of their evolutionary process (Alexander, 1966; Jacobs, 1970, 1972; Batty, 1994; Marshall, 2009).

Jacobs (1970) suggested a new and exciting way of looking at cities. She criticised authors like Ebenezer Howard, who influenced the *Garden City* movement, as well as 'decentrists' like Mumford and Stein and Bauer. She showed how their designs and visions were dissociated with everyday

human needs and therefore created spaces where life became difficult to live. In her book “*The death and life of great American cities*”, Jane Jacobs presents case studies that show systematic evidence that *natural cities* do work and that *artificial cities* have a lot to learn from them. She shows examples of overcrowded buildings and narrow streets as recipients of lives and lifestyles with which people are comfortable. Jane Jacobs challenged planners’ assumptions and her new way of looking at the urban life proved of great importance because it opened doors to the use of new scientific approaches for the understanding of urban character, formation and evolution. It opened the doors for the conceptualisation of the city as a complex self-organising and emergent system (Jacobs, 1970; 1972).

Alexander (2003 and 2006) also tried to create frameworks for explaining the diversity and richness of the urban form in the natural city. Nevertheless, he approaches the subject from the perspective of the designer rather than from the sociological perspective taken by Jane Jacobs. Like Jacobs, Alexander also aimed to change the way architects design. He aimed to make them think more socially rather than to seek a “fancy image” which looks good on an architecture magazine cover. He aimed to lend architecture more depth and emphasised the superficiality of the forms designed during the last years, especially since the 1990s. He argued that architecture walked hand in hand with developers, who rely on images to sell their buildings, and use architecture as a way of increasing profit and acceptability. Above all, Alexander emphasised systematically in his work the dissociation between modern architecture and human perceptions and he showed the consequence of that in relation to human adaptation to space (Alexander, 1966, 1977, 1979, 2003-2004).

When authors like Jane Jacobs and Christopher Alexander describe a city thriving with life, they describe it as a complex and open system which hosts a diversity of people, places and functions. Both authors recognise that the *planned city* is missing ingredients which give them the quality of life present in the *natural city*. This does not mean that should not be planned at all. It means that the new kind of planning needs to accommodate the good in the *natural city*.

In his article ‘*A city is not a tree*’, Alexander debates “*What is the inner nature, the ordering principle, which distinguishes the artificial city from the Natural city?*” and shows why according to him, the *natural city* is more human friendly than the *artificial* one.

There are three arguments in this article which are essential for this research; therefore, we will explore in more detail the findings which emerged from it.

The first relevant argument Alexander introduced in the book ‘*A city is not a tree*’, is related to the idea that interventions in the urban environment can be understood as a form of human adaptation.

Alexander argues that the generally friendlier character of the *natural city* is related to the fact that its morphology is the direct consequence of who we are as people and of our needs both as individuals and as groups. This intrinsic relationship between people and the environment they produce is what he calls ‘*deep adaptation*’.

“Deep adaptation is the process whereby the landscape, or a system, or a plant, or a town, proceeds by a series of spatially organized adaptations in which each part is gradually fitted to the parts near it: and simultaneously fitted by the whole, to its position and performance in the whole.”

(Alexander, 2003; 15)

This concept was explored further by Stephen Marshall (2009). Based on the work of these two theorists, in chapter 3 we used the evolutionary theory to describe both the natural and the designed city.

The second relevant argument Alexander introduced in the book ‘*A city is not a tree*’, was that the process of urban formation is directly related to the quality of urban life.

To relate urban character and the process of urban formation with quality of urban life, Alexander introduced terms such as ‘*tree*’ and ‘*semiattice*’. He used these two terms to theorise the difference between *planned cities* and *natural cities* on the basis of their different structural patterns. According to Alexander, these patterns relate to different kinds of urban formations which consequently relate to different levels and kinds of adaptation. On the one hand, he shows that *planned cities* are the result of what he calls a ‘*tree-like*’ spatial organization. *Tree-like* spatial organisations often produce dissociation between physical units and social systems because they separate urban functions. On the other hand, Alexander states that the *natural city* has a more complex conceptual model; a model he calls a ‘*semilattice*’. The ‘*semilattice*’ pattern, though not as easily understood by the human mind as the *tree* structure, allows the overlapping of functions and uses. Alexander argues that the complexity generated by the multiplicity of aspects which emerge from this overlapping is necessary in the creation of a ‘living city’.

The third relevant argument Alexander introduced in the book ‘*A city is not a tree*’, was that the form of the built environment determines the way we perceive and use urban spaces. He describes the built environment as a container of life, therefore changing the built form of the city will influence the way we use space and the way we feel in it.¹¹

For Alexander, the city is composed of unchanging and changing elements. The ‘physical unchanging elements’ which compose the city can be seen as the context or the scenario where the city life happens; they are the buildings and the city’s infrastructure. The ‘changing elements’ of the city are the ‘actors of the play’, the ones who create the tale. The ‘changing elements’ are a consequence of the human interaction as well as of interaction between people and a specific environment. These elements relate to each other and form a synergy or a deep-inter-relation. In other words, as a whole these elements are much greater than as individual parts of the system (Marshall, 2012).

Alexander used the arguments above to explain:

- a) How a complex structure, such as the ‘natural city, can emerge naturally?

- b) How the organisation of that structure - which is a direct reaction to human needs- emerges naturally with it?
- c) How there is an automatic interrelation between the physical and the subjective aspects of the city?

To help the reader to visualise his argument Alexander uses the example of a man selling newspapers near a crossing, and a traffic light. Alexander considers the crossing where the newspaper man is standing and the traffic light as the “*physical unchanging*” elements of the system. Those elements are the ones designers take into consideration when they are creating the *artificial city*. The changing elements of the city system are the people who buy the newspapers, the newspapers, the money they deal with, the information they exchange when they meet; those elements are beyond the capacity of the human mind to predict.

Alexander defines the example above as a *set*: “... a collection of elements which for some reason we think as belonging together...” According to him the city system is composed of millions of different sets which interconnect with each other. The complexity and diversity of the *natural city*'s system is a consequence of the interactivity between the changing parts of the different sets which compose it: for example, if one of the clients of the person selling the newspaper meets one of his friends in front of the stand and they decide to go for a drink together, two different sets overlapped and created a new one, which in the future will overlap with another set and originate other new ones. For Alexander it is this interaction of people or of the changing elements of the city which makes the sets overlap and it is this overlap that gives complexity, character and quality of life to a city. This infinite complexity of relations is something that happens spontaneously and the *natural city* is a mirror of that complexity. Alexander calls the system which expresses the complexity of the *natural city* a *semilattice*.

For Alexander (as for Jacobs), in contrast to the complexity and variety which characterises the organization of the *natural city*, the *artificial city* is rigid, simple in structure and segregated. Planners, when designing an urban area, normally focus their attention on the design of the ‘*scenario*’; on the physical aspects of the city, and on grouping things or ‘*sets*’ in distinctive areas. They design housing areas, business areas, areas for schools, enclosed playgrounds, shopping areas, hospital areas and so on. In the artificial city those specific and distinctive areas don't overlap. They are divided and subdivided by networks which themselves are part of a hierarchical structure. In other words, the planned city is based on the geometrical order and division of functions. Such kinds of urban structure suggest a linear and hierarchical organisation of closed elements which are not related to one another. There is no overlapping, no interaction and no opportunity for exchange. Alexander defines the structure of a *planned city* as a *tree structure*.

In Alexander's definition of a tree, for one element of a set to interact with an element of another set, the sets have to relate as a whole. It would be as if one member of a family would only be

able to make a new friend when the family meets this person as a group. As Alexander shows in his article '*A city is not a tree*', in the *planned city* different groups of people (*sets*) can only meet accidentally or if they actively search for that encounter. The city does not support spontaneous and casual interactions.

"I believe that a natural city has the organization of a semilattice; but when we organize the city artificially, we organize it as a tree" (Alexander, 1997).

The tree structure is simple and linear in contrast to the structure of the 'semilattice' which is complex and subtle. For Alexander *"It is this lack of structural complexity, characteristic of trees, which is crippling our conceptions of the city"* (Alexander, 1997).

This segregation of people and functions increases the need to travel. In a planned city one person has to travel through the whole town to be able to fulfil their everyday basic needs, such as the need for work, food, health or entertainment. Every day a cleaning lady needs to travel hours by bus to work for a rich family living in a fancy neighbourhood and travel back to her home in the suburbs. In this kind of planned city all humans float daily between hierarchies and functions and that increases reliance on the car as a hypothetical fast means of transport. There are many studies which prove that the need to travel daily and the need for a car raised ecological concerns and reduces the quality of human life significantly.

The need for a car is just one example that illustrates the argument that planners tend to give priority to the needs of certain groups of people and therefore the shape of the *artificial city* is a mirror of those unbalanced preferences. Both Alexander and Jacobs, even if they come from different theoretical backgrounds, argue that standard environments cannot answer equally to the different kinds and groups of people who make up part of the city. The so called *"tree structure"* way of organizing the physical form of the city goes against normal human behaviour and normal human interactions. For this reason, it becomes something imposed on people; something to which they have to adapt. This contradiction between the physical or unchanging aspects of a city and the changing ones creates a friction between the city and its users and it is the reason why, according to Alexander, *natural cities* are more human friendly than *planned* ones.

To support his theories, Alexander analysed the tree structure of urban areas like the greater London plan by Abercrombie and Forshaw, Mesa city by Paolo Soleri, the Tokyo plan by Kenzo Tange, Chandigarh by Le Corbusier, Brasilia by Lucio Costa and others. With his study he proves that traditional urban planning does not allow a place for interaction to happen, not only of hierarchies, as mentioned before, but also of functions. Spaces are not a mirror, nor a consequence of real social interactions and real social needs. *"Neither the Columbia plan nor the Stein plan for example, correspond to social realities. The physical layout of the plans, and the way they function suggests a*

hierarchy of stronger and stronger closed social groups, ranging from the whole of the city down to the family, each formed by associational ties of different strength.”

Batty used Alexander’s *tree* and *semilattice* concepts as well as his findings to study the city from the perspective of complexity theory. Like Alexander, he acknowledges the complexity inherent to the ‘changing elements’ of the city, and therefore uses the support of fractal geometry to study the dynamic evolution of the urban form. Just like Alexander, Batty arrives at the conclusion that from the top-down perspective, urban networks and hierarchies are two sides of the same coin and are related to the concept of “*tree*”. On the other hand, when analysing the same structure from a bottom-up perspective the idea of distinctive hierarchies immediately collapses. When analysing the city’s structure from the bottom-up perspective, its network’s organisation is what Alexander calls a *semilattice*. The *semilattice* is a much more complex way of spatial organization than the hierarchical way planners used to conceptualise them. It is “... *thicker, tougher, more subtle and more complex*” (Batty, 1994). This idea is the fundamental ground for the use of complexity sciences to study the city change, on which chapter 3 will elaborate more on.

Chapter summary

The first part of this chapter starts by looking at the relationship between the material city and the individuals who populate it. The city was described as something made by human beings for human beings. Street and public spaces, in general, are the places of human encounter and exchange. This exchange happens both between people and between people and the environment around them. The public space is where human diversity and interaction happen; it is the place where people form a sense of self and the world around them (Ponty, 1962). It is the place where people shape each other and the environment in complex and interconnected ways which make both people and the city evolve together.

The uniqueness of the context (its geography, culture, climate, history) shape people, and people shape the buildings and the city as a consequence. In other words, the physical city is a mirror or a consequence of different human ways of life and different needs. In return the form of the physical city shapes each individual who uses it.

“Each person, besides its natural characteristics is shaped by society, by culture in other words by the environment with which it relates” (Ponty, 1962).

This interrelation between people and places explains why every city is composed of the same elements such as buildings, plots and streets, but each city is unique.

The second part of this chapter investigates how the city morphology is formed and the ways people intervene in the city to give it shape. Urban settlements in two categories: the *natural city* and

the *planned city*. The *natural city* is emergent and self-organizes. It has little or no evidence of planning on a large scale. The *planned city* is planned and designed from the top-down. It is formed upon the growth of entire areas. Both emergent and top-down interventions are designed. Still, the small scale interventions of the *natural city* emerge from the perspective of the unit rather than the perspective of the whole.

The nature of human interventions in the built environment characterises the process of urban formation and urban morphology. The size of urban interventions is one of the key characteristics which influence not only the morphology and character of the city but also the way the city evolves. In the natural city interventions in the built environment are expressions of individual aims and needs. As they are small by nature they merge rather fast with the morphology of the city as a whole. The natural city is therefore made up of many small parts that merge as one. Each part emerges to serve a specific individual need and the city includes it and adapts to it. This emergent and self-organising character of the natural city gives urban spaces a human scale and a more organic character. But above all makes urban spaces deeply fit to serve their purpose and very often adaptable to accommodate new uses which might eventually emerge.

The emergent and the top-down way of intervening in the city is reflected in key differences not only from what affects the city's morphology but also its development. One of key differences is related with "*Time*" and another is related to "*Continuity*". Organic cities develop slower and generally more continuously. Conversely, the top-down kind of city can develop faster and change direction of development more suddenly. A third relevant difference between the natural and the planned city has to do with the complexity and diversity of the urban environment: The emergent way of intervening in the city creates the ground for human interaction and diversity (Jacobs, 1961; Alexander, 1966).

Finally, we have concluded that *natural* cities and *planned* cities merge. It is almost impossible to dissociate one kind of city from the other. They grow together and reflect different realities of the same society. Cities are made up of interventions at all scales. Some interventions are emergent and come from individual bottom-up initiatives and other are imposed and planned. Emergent human interventions in the built environment give continuity to urban change and a complex character to some urban areas. Top-down interventions address the needs of the population or visions for future urban developments. They are translated in greater designed areas and buildings such as universities, hospitals, stadiums... In short the *natural* and the *planned* cities are two sides of the same coin; they reflect different kinds of urban areas which together make the city a whole. Together, both kinds of urban areas are a mirror of the character, the values and of the organization system of a specific society. They are both the consequence of a culture, a period of time in history and of the technology available in a specific place. Emergent urban areas reflect a continuous process of urban evolution and the planned ones reflect breaks and readjustments of that continuous change. Because of this deep interconnection between the *natural* and *planned* city, Batty (1994) argues that both kinds of urban

settlement can be seen as part of the emergent development of a city and therefore they can be studied from the perspective of complexity sciences.¹³

Overall conclusions taken from chapter 2:

- The city holds human life. The city shape is a mirror of the people who live in it; therefore, each city is unique and should be treated as such. In other words, each human strategy/intervention used to address urban problems should be contextual.
- The city shape and character are a consequence of human actions or interventions. Emergent small scale interventions tend to fabricate a more complex and organic environment. Top-down larger-scale interventions tend to form a more organised environment where morphology is based on geometry.
- The way cities evolve can also be related to the nature of human interventions in the built environment. On the one hand, small scale bottom-up interventions give continuity and character to the city. They reflect a normally slower process of change. On the other hand, top-down interventions are normally larger in scale. They can speed up and manipulate the direction of change; therefore, they are normally riskier. If they don't work as expected the waste of resources is much greater as well as the impact on the urban morphology and urban life.
- All cities include both the *natural* and the *planned* kind of city. Urban form emerges from the tension between top-down and bottom-up forces.

The city is a complex system. As with all complex systems the city is unpredictable by nature. In this research we suggest looking at the characteristics of urban interventions in relation to urban character and urban change to inform a more sustainable urban design and management system. The arguments made in this chapter suggest that on the one hand small scale interventions give continuity to urban development and complexity/diversity to the urban fabric; factors which are relevant for the interaction between humans and their environment. On the other hand, top-down interventions have the capacity to shift the direction of change and have to take into consideration the good-of the whole rather than the self.

These findings help us to contextualise the research's hypothesis:

Can top-down and bottom-up interventions be combined and used to create a more sustainable urban management system? Can we imagine a system which allows the *natural* city to emerge and uses top-down forces to intentionally adjust its change?

Chapter 3: Human and urban change

Cities as complex systems in evolution.¹

Chapter 3 evaluated the conclusions reached in chapter 2 from the perspective of complexity and evolutionary theory. In addition, it addresses objective 3) 4) 5) and 6).

- 3) Explore the meaning of strategic interventions. Are strategic interventions a synonym of Catalyst interventions? Can strategic intervention intentionally nudge urban change or speed up urban evolutionary process?
- 4) Investigate the relationship between the scale of intervention in cities, and the scale of their effect. Can small and discreet interventions induce great changes in urban complex systems?
- 5) Explore the relationships between short-term actions and long-term visions.
- 6) Explore the role of design as a strategic intervention

These objectives were also explored in studies 1 and 2.

Complexity Sciences, evolution and the study of cities

In the first part of chapter 3 “What is common to all cities”, complexity theory was used to explore how changes in the building blocks of an urban system or in the way these basic elements are organised induce changes in the system as a whole.

Before developing concepts and ideas based on complexity theory and the study of cities, it is important to define what are complex systems and explain the reason for the theoretical approach:

Complex systems are “(a) ... a configuration of any given number of interconnected elements, parts or individuals, communicating with each other in non-linear ways; (b) The patterns of interactions form a collective net-work of relationships that exhibit emergent properties not observable at subsystem or individual parts levels; (c) When new contingencies occur, the network self-organizes in often unpredictable ways, and new properties emerge; and (d) By exchanging information with their environment, complex systems modify their behaviour as regards to it - they are adaptive. Concerning complex systems' processes, understanding the manner in which they communicate, respond to contingencies, self-organize and adapt requires studying the dynamical processes through which they evolve over time.”

(Leiba et al., 2012: 166)

Since Jane Jacobs (1961) introduced to an alternative way of looking at the urban form and urban dynamics, our understanding of the city as a kaleidoscope of complexity has hardly changed. Complexity sciences see the city as a complex organism evolving and changing according to specific rules and conditions (Bak,1996). The study of cities today is much closer to biology than to economy or art. As argued by Alexander (1966) complexity sciences indicate that the natural growing city is indeed more workable, more human friendly, more sustainable and more democratic.

The study of cities from the perspective of complexity theory broadly accepted that changes to either the rules or conditions on which urban systems operate influences macro scale changes in the system. Following this, part 1 of chapter 3 elaborates on the relevance of emergent change, that is, change that emerges from within the system; a self-organising process where each element of the system finds its role and optimises its potential within it. The conclusions extracted from these explorations can inform how small-scale interventions are most of the times able to trigger more adequate and eventually great changes in urban systems. It elaborates on how top-down agents can generate change in emergent urban systems from the perspective of urban syntax.

In the second part of the chapter “Why are cities unique?”, evolutionary theory was used to explain why there is the need for top-down management. It justifies the need to use norms and nested hierarchies to explore forms of cooperation and social organisation. Evolutionary theory was used to explore the role of design and artificial selection within human and urban evolution. In addition, evolutionary theory was used to reflect on the relationship between human perceptions and human creations in relation to a given context.

In short, chapter 3 explores how, complexity sciences and evolutionary theory contributes for the understanding of the urban form and the emergent process of urban and human change.

What is common to all cities?

Urban form and urban development from the perspective of complexity sciences

'A city environment is shaped not only by people who have an important influence, but by everyone who lives and works there. They shape it when they vote, choose a new front door, replace their windows, complain about broken pavement, organise a community festival, give their opinion on planning proposals, plant out their window boxes, commission building work to their business premises, or tell their children about local history.'

(Cowan, 1995)

Introduction

The 'Newton's way of science' and the use of continuous formalism in "sterilised labs" proved to be inadequate to deal with discontinuity and abrupt changes of the real world (Batty, 1994). Reality is full of examples of discontinuities and unpredictability and one of these is urban evolution.

During the last century in most fields of science the simplistic notions of 'time' as a continuous flow and of 'space' as composed by simple geometries is changing. Einstein was the first to show that space-time could no longer be treated as a continuum in which the universe existed, as if observers would see the same thing in different positions in time or space. A key factor which influenced the traditional idea of time and space was the discovery of more and more particles, much smaller than the atom. In 1927 Heisenberg introduced the notion of *uncertainty* in 'rigid sciences', once he proved that conclusion and measures were influenced by the parameters of the measuring device. Physics theorists learned that the further the phenomenon is from the direct observation the more uncertain the outcome of the observation will be. Goethe defended this argument at the same time that Newton was defending reductionism. Nevertheless history, and the new industrialized way of looking at the world as a 'machine', supported Newton's way of science (Bortoft, 2010).

Today there is a general growing idea that we need a more holistic view of the world to be able to study it. It is now commonly agreed that we are not likely to find ultimate explanations by "*knowing more and more about less and less*" (Batty, 1994:36.). According to many a more holistic theory is needed not only to help scientists to put together the fragmented parts of reality that have been studied during the last centuries, but also to bring science to another level of understanding (Ehrenfeld, 2008;

Bortoft, 2010). Complexity theory offers, to a certain extent, the theoretical ground for a more holistic perspective on things.

There are different ways of naming the theory that emerges from fractal geometry and systems theory. Complexity sciences have been named differently depending on the author and the period of time. Complexity theory was previously addressed as chaos theory, bifurcations theory and probably more. Complex systems can also be called emergent systems, self-organising systems and more. Perhaps it was Philip Anderson in 1972 who the first to write the initial definition of complex systems in an article entitled *More is Different*. He was the first to clearly define why a system is greater than its parts. This idea is the basis of the theoretical background of complexity theories and relates to the notion of wholeness described by Bortoft (2010) in his book *The Wholeness of Nature*.

"The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe...At each level of complexity entirely new properties appear. Psychology is not applied biology, nor is biology applied chemistry. We can now see that the whole becomes not merely more, but very different from the sum of its parts."

(Anderson, 1972: 393)

Key authors

The study of complexity theory applied in the study of cities started in the 1960's when authors including Prigogine (1977) and Hermann Haken (1983) became aware of physical-material systems which self-organised and exhibit the phenomena of emergence.² Previously, this phenomenon was related only to organic systems or socio-cultural systems but not material ones. Soon after that, theories of emergence and of self-organising systems were applied to a variety of domains in the social sciences as well as to the study of the urban form. The metaphor of the city as a self-organising system was first used by Prigogine (Prigogine and Nicolis, 1977) and it was studied further by Peter Allen who also relates the idea of evolution with the understanding of dynamic complex systems (Allen, 1981;1990;1997; 2012). The consequence of this was the emergence of a new domain of study of cities which is commonly addressed as complexity theory of cities.

Patrick Geddes (1915/1949) was a pioneer in identifying the deeper order of the *natural city*. He was the first to address the city's complexity and to relate it with nature. He was a pioneer recognizing that there was a deeper order in traditional towns: *'the seeming chaos was of our imagining – the product of the western addiction to mechanical order'*. Instead he recognised *'the order of life in development'*.³ Geddes was the first one to argue against traditional town planning and to address planning from an ecological perspective. He argued against the importance of understanding cities and cities evolution before intervening in them. Furthermore, he defended the delicate and gradual approach to intervene in the delicate structure of the city, which is the main argument of this thesis.⁴

Jane Jacobs led traditional urban theory to question its view of cities: Building on Warren Weaver's work, she recognised the problems of the city as problems of organised complexity. Weaver's work (1894-1978) contributed with the framework where he identified three general kinds of scientific problems:

(1) *Ability to deal with problems of simplicity*; Problems which deal normally with two variables in a sterilized environment. According to Weaver this is the subject of study of science from the seventeenth to the nineteenth century.

(2) *Ability to deal with problems of disorganised complexity*. Weaver gives the example of gas pressure, where the whole of gas mass can be studied in a relatively simple way but the trajectory of the gas particles are not known.

(3) *Ability to deal with problems of organized complexity*. Jacobs recognised the city problems as falling in the third category (Jacobs, 1965: 442-443, 445).⁵

Jane Jacobs framed urban problems as problems of organised complexity, which until then were being framed as problems of simplicity or as a problem of disorganised complexity (Marshall, 2009: 130).⁶

Alexander contributed to the understanding of cities as complex systems.⁷ He acknowledged the fact that complex urban forms can be achieved as a product of individual small actions. Furthermore, he identifies the fact that the city's complexity comes from '*the interaction of the city's different parts at different scales, and over time*' (Alexander, 1979; Marshall, 2009). This statement is today the basis of the application of fractal geometry and complexity sciences to study the urban form.

As mentioned in chapter 2, Alexander also explained the reason why emergent cities are normally more human friendly than planned ones and he introduced the notions of patterns as a hierarchical organisation of urban and social systems (Alexander, 1977).⁸ Alexander's patterns helped to frame the kind of organisations from which *organised complex systems* emerge from the perspective of urban morphology. In addition, they help link artificial and biological perspectives of urban organisation.

Finally, Alexander's critics on complexity sciences theory today helped frame the research questions and research hypothesis for this piece of work; they raise questions on how human actions and the human condition relate to the urban environment (Alexander, 2003).

Marshall (2009) defined the city as an ecosystem and used evolutionary theory to back up his arguments. Marshall and Batty (2009a, 2009b; Marshall, 2012) defined the city as a system of ecological complexity which is a vision very much aligned with Jane Jacobs' observations (Jacobs, 1961).

Thanks to the contribution of these and other authors, we can argue that the *natural city* is optimal in countless ways and in ways that urban planning was never able to improve or even replicate through design. We come now to the understanding that the apparent chaos of the natural city is the

manifestation of a deeper order. It took over one hundred years before Geddes' and Darwin's ideas were again considered in relation to urban theory and combined would shed further light on an emergent way of managing the evolution of cities. Related to this, urban theory is increasingly turning its focus to complexity science and self-organising systems as possible frameworks for city planning development (Batty and Marshall, 2012). The input of those various fields of research in urban theory is leading to new perspectives of the city as well as of city planning and management (Marshall and Batty, 2009).

Batty (2018) in his book *Inventing Future Cities*, identifies principles or themes that are applicable to all cities and uses these to study the city from the perspective of the process of formation rather than its physical boundaries and form. Bettencourt et al. (2010) used complexity theory to prove the existing of scaling laws which leads us to say that cities within the same urban system, which is normally a nation are self-similar and show similar social economical patterns and similar patterns of growth. Leeuw et al. (2010) describes cities as large scale complex social and information systems that produce open ended innovation and wealth. Notions of cities as complex open systems have been used by all key authors mentioned above and cellular automata has been intensively used to simulate urban dynamics (Arthur, 1994; Allen, 1997; Pumain et al., 2010).

While the study of the city from the perspective of complexity theory is not new, the study of planning and design under this perspective is very recent. There is very little research relating complexity sciences with the features of urban top-down interventions made by the means of planning and design. Only recently we start seeing the implications for planning to the question of *how do cities work?* Portugali shed new light on this matter with the book *Complexity Theories of Cities Have Come of Age* (Portugali, 2012). This book acknowledges the work carried out not only by established authors in the field of complexity, but also authors who are engaged with complexity theories applied in the fields of planning and design.

Complexity sciences: Relevance for the research

There are at least two main reasons to use complexity theory to investigate urban morphology and urban change:

Over the course of many centuries, planners produced simplistic plans to try to implement order to the organic growth of cities. Designs were created with the idea that the designed cities would perform better than the chaotic cities which grow organically (Mumford, 1961; Benevolo, 1980; Lynch, 1990; Kostof, 1991; Taylor, 1998). Until recently, planners looked at what is not designed as something chaotic disordered and dysfunctional. However, contemporary urban theory and complexity sciences are challenging that preconceived idea and argue that emergent cities, even if they apparently

might seem chaotic, are not necessarily dysfunctional and in some aspects work better than the planned cities (Jacobs, 1961; Alexander, 1966; Portugali, 2008).

Second, each city is unique both as a whole and in its parts; nevertheless, there is a general pattern that is present in all cities which gives them some sort of similarity in terms of their morphology and growth (Marshall and Batty, 2009; Bettencourt, 2010). General patterns present in most cities include town centres, neighbourhoods and suburbs, as well as the streets' morphology. *"While these will be manifested in different ways in each city, there will be kinds of order which will be common to all, to a greater or lesser extent"* (Marshall, 2009). It is this common order or organised complexity that is at the heart of complexity sciences applied to the study of cities.

A central problem with complexity is that it can be applied to many things and in many contexts. On the one hand that is what makes it so appealing, but on the other hand makes it difficult to define and sometimes it can become distant from practical applications (Haken, 2012; Read, 2012).⁹ Nevertheless, even if there is still no consensus about what exactly *complexity* is and whether it is a distinct scientific field, "complexity" has been absorbed by well-established fields of science such as physics and biology. In addition, despite all arguments, complexity sciences give at least a '*common ground for an approach to what one might call "theory of the city" even if it remains an open ended story*' (Haken, 2012).

Contributions and weaknesses

One of the greatest achievements of the complexity sciences in the study of cities is the shift in the understanding of the nature of cities. Today, cities are not considered as simple, closed, entropic, equilibrium-tending, linear systems as in the classical theories (Weber, 1922; Lösch, 1954; Thünen, 1966; Christaller, 1972). These days' cities are considered as complex, open systems. Such systems are far from equilibrium and are highly unpredictable due to their non-linear character (Portugali, 2012).

Actually, the idea of the city as a highly unpredictable system is one of the great achievements of complexity theory applied to urban studies. It reinforced the idea that there are many situations in which the trajectory of a system cannot be reconstructed from the position of the system at the end of the trajectory (Batty, 2009). That is to say that the form of the city cannot be understood as a continuous predictable linear sequence of cause and effect. Complex systems are by definition non-linear and therefore are unpredictable (Portugali, 2008). In the article, *Learning from paradoxes about predictions and planning in self-organizing systems*, Portugali shows that there are three key factors of urban complex systems that make them highly unpredictable: First, is the non-linear character of all complex systems. This implies that predictions cannot be made in terms of cause and effect. Second, is the fact that often the factors that induce change mutate and therefore trigger other unsuspected

changes in the system. Third, in a complex system the person analysing the models and intervening in the city is also part of the system and therefore it is influenced by it. As argued by Portugali “*some interesting implications... include self-fulfilling and self-falsifying or self-defeating predictions*” (Portugali, 2012:231).

The vision of a city as a dynamic and unpredictable complex system had significant consequences for planning theory, namely the fact that it suggests an urban planning practice as a process rather than the conceptualisation of the city as a final form. This new approach very much conforms to social theory’s approach in the study of cities, namely it echoes Jane Jacobs’ and Christopher Alexander’s view of the urban form.¹⁰

A second great achievement is the fact that new valuable planning tools emerged from the complexity theory of cities. Fractal geometry and emergence theory are the basis of the world of cellular automata and computer modelling (Mitchell, 1990; Batty, 2005). Cellular automata helps “*in terms of visualizing urban form through computer models and computer graphics, and then through the measurement of patterns in real cities and their dynamic simulation*” (Batty, 2005). In addition, it helped planners to understand better the process of urban formation rather than approach the city as a final form.

“Rather than starting with functions and proceeding to form, fractal geometry enables us to search out functions and processes which give rise to the man-made and natural patterns we observe in the real world, thus helping us not only to describe and understand reality a little better but to progress our forecasts and predictions of how the real world might evolve.”

(Batty et al., 1994)

Above all, complexity theory in the study of cities brought new tools to look into the future rather than constantly looking at the past as a base for our decisions. The increase of literature in complexity sciences and progress in computing and technology, led to the creation of computer models which became attractive tools to envision the future of our cities and support urban management and the management and urban design. Computer models enable us to look at possible consequences of our interventions in the long term rather than short-term consequences which we normally take into consideration.

These long-time predictions can enable us to view possible consequences of our actions but it is important to have in mind that urban systems are unpredictable, therefore predictions serve merely as indications (Portugali, 2012). All prediction tools such as (PSS) Planning Support System¹¹ (Klosterman, 2001) are merely tools with which a planner can play and learn from a variety of aspects related to a specific situation. They serve to better place professionals in the position of making a decision, which is always intuitive (Portugali, 2012). Models can serve us by showing the eventual

roles of architects, planners and managers in the management of urban change. Alexander (2003) defends that new methods and a new urban management process which is able to create healthier urban environments will have to be substantially different from the present commercial ones. This transition would not only imply reconsidering the way architecture and planning is taught in most of the universities, but it would also need general willingness to effectively make changes in society.

Finally, the use of complexity theory to study cities brings forward the relevance of micro-interventions as a tool to nudge change. It shows how strategic changes in the basic elements that form a complex system generate changes in the system as a whole. This thesis used complexity theories to explore this characteristic further and we will relate our findings to the practice of urban planning and design.

Understanding emergence to intervene in emergent systems

The key question in complex systems such as cities is how do they receive its order? In other words, how can a system have an inner order without being designed?

In order to intervene in a complex system such as the city, there is the need to understand how its order emerges. Complexity theory rose from fractal geometry and from systems theory; therefore, to understand the emergence of urban order from the perspective of complexity science needs to understand how fractals are formed.¹⁴

Self-similarity is, in the context of this research, the most important property of a fractal. Self-similarity means that each part of the fractal is similar to the others and to the whole (Mandelbrot, 1982).¹⁵

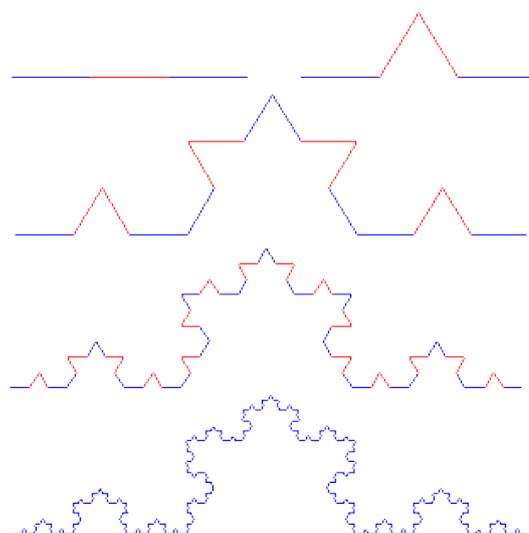


Figure 3: Von Koch Curve.

Figure 2 shows the *von Koch Curve*, a very well-known fractal which emerges from the division of each segment in three parts and the replacement of the middle segment by an equilateral "angle". These are the rules or conditions from which this specific fractal emerges. Any change in one of these rules would create a completely different fractal. The image shows just the first four steps of division but the process can continue indefinitely. After just a few steps one can see the emergent form of the fractal and this is valid for most fractals. Once we acknowledge the rules from which fractal emerges we can influence the fractal as a whole. If the city emerges from a fractal this characteristic is also applicable to cities. This conclusion leads to argue that, by manipulating the basic rules from which the city form emerges we can manipulate urban order.

As fractals are formed by the process of emergence, emergence is another concept which is of key relevance for this thesis. Marshall used the example of the Mexican wave to illustrate the phenomena of emergence: The simple act of the public standing up and sitting down forms a wave which moves around a stadium. The form of the wave and its movement are way beyond the single act of the parts (Marshall, 2009). In this sense the whole of the effect is greater than the parts. It transcends them. The parts do not even have to be aware of the consequence of their collective efforts in order to make it happen (Cohen and Steward, 1994; Portugali, 1997; Cohen and Steward, 2004; Batty, 2005).

'An emergent effect is one that arises from the interaction of individual actions, which may have their own rules, but there is no overarching blue-print. As a result, an emergent effect is one whose overall form or outcome is in some way surprising – that is, unanticipated from the (rules of) assembly of individual parts. Jack Cohen and Ian Steward have described emergent phenomena as 'regularities of behaviour that somehow seem to transcend their own ingredients.'

(Marshall, 2009: 15 1)

The phenomenon of emergence explains both natural and abstract fractals. It explains the internet network and the market behaviour.¹⁶ It explains the patterns in leafs, how a pattern of a zebra is formed from simple short logical rules of light and dark (Hansell, 2007) and it explains the regularity of patterns in a bees combs (Ramírez, 2000; Camazine et al., 2001).

Bees' colonies do not follow any grand-plan to build their "built environment". In other words, their design is not conceived as a whole. It is rather a continuous process which emerges from the efforts of the individual parts. Each bee is just doing their own thing and by all bees doing their own small thing they end up building rather complex structures. Such great structures emerge from simple rules such as picking up, carrying and depositing things (Hansell, 2007; Cohen and Steward, 1994:232; Marshall, 2009: 151; Batty, 2005:51).

“As Steve Jones (Jones, 1999) points out, for a concentric pattern to emerge, no more organization is needed than the ability for a bee to test the contents of what is in the neighbouring cell’ and according to that, they will deposit or remove honey and pollen” (Camazine et al., 2001:313-15).¹⁷

From the perspective of fractal geometry and complexity sciences the overall result of a structure is just a consequence of the strict execution of a simple set of rules. The characteristic order of the bees comb and other fractal patterns is given by the set of rules they play. That is to say, even if there might be random process involved, there is a strict set of simple rules which gives the overall image of its characteristic order (Marshall, 2009).

Understanding the emergence of urban order

Bees’ colonies were related often to cities (Ramírez, 2000; Batty, 2005; Marshall, 2009). Just like bees’ combs, the morphology of the *natural* cities is related to the emergence of an urban characteristic order. Like the bees’ comb its process of ordering is originated from the bottom-up and works itself out to form the city as a whole. There is no grand design involved in the natural city. This is the main difference between the *designed* and the natural city or in other words, between urban design and the city’s internal urban ordering (Batty, 2005; Marshall, 2009).

The idea of a deeper urban order originating from the bottom-up and a ‘characteristic structure’ of street patterns, can both be concluded from the analysis of the city syntax and from the analysis of emergent systems (Marshall, 2005). From both approaches we can conclude that there is no need for the agents to be sophisticated, they have to know the motives of their actions for order to emerge. Order emerges spontaneously as an effect of their interventions in the urban system (Portugali, 1997).¹⁸ *The ‘result is hierarchically differentiated structures that might suggest central planning:’ But central planning there is not; there are only the actions of individual elements whose coordination results from the remorseless processes of competition and adaptation.’*

(Batty, 2005 cited in Marshall, 2009: 130)

But what are the generative elements or the human actions which are repeated continuously and therefore generate the form of the city?

The research focused on two aspects of self-similarity and repetition across all urban organisations. It argues that these basic elements of the urban system can be used as *strategic interventions* to manipulate change. These elements are the building blocks of the urban system therefore they influence the system as a whole.

The first set of fundamental aspects which are similar to all human organisations are related to human aims and needs. The need to work, the need for a shelter, the need for food, the needs related to

raising children, the need to socialize and have fun, these are all needs common across all human beings. The way cities grow is deeply related to the decisions humans make to satisfy these basic aspects of everyday life. In other words, humans make daily decisions on behalf of their survival and to improve their performance in the urban space. These decisions determine the urban morphology and urban development. They take advantage both of the potentials and of the deficiencies of the urban system and they are taken on different levels and scale (Smith, 1776; Kostof, 1991; Kostof, 1992; Cohen and Steward, 1994; Camazine et al., 2001; Akerlof and Shiller, 2009). From a bottom-up perspective choices related to the place one works or chooses to live have consequences on urban networks and the organization of the urban population. These can affect economy or political decisions which can in turn affect urban growth as well as the actual morphology of that growth. For instance, one might choose to buy a cheaper house in a place with poor transport connectivity. Still, when this area is consistently populated it might make political sense to improve the transport network system in the area and therefore the value of the houses will most probably rise. From the top-down perspective, an organisation might decide to change its trade product because it sees a gap in the market. Following this choice, the market gap will be filled and probably as a consequence other gaps will arise. This will give the opportunity for others to fill them in (Portugali, 2004). In light of this, this research argues that interventions targeting basic human choices and needs can influence the urban system as a whole.

In chapter 5 we will use Alexander's *patterns of space* (Alexander, 1977) to identify the elements of the built environment that relate to the basic needs of human daily life and to the events that happen in the urban space. These elements can be translated in interventions which can arguably be used as tools to manipulate urban change.

The second similarity across urban organisations is related to the space syntax. Lynch (1960) pointed out five elements which make the image of a city: landmarks, nodes, paths, districts and edges. Golledge (1999) focused on more general elements such as points, lines and areas. Portugali (2012) elaborated on Golledge's work and showed how the understanding of the relationship between these elements could inform new tools to support decision making in the planning process. Marshall (2009) on the other hand considers buildings, plots and routes as the basic elements of the urban syntax. The research elaborates more on the basic elements suggested by Marshall because they can easily be compared with the basic elements suggested by Portugali and Golledge and can be treated in identical ways.

These basic elements, like in *von Koch Curve or any other fractal* relate to each other in a systematic and predictable way. "*Buildings plug into plots, plots plug into routes, and routes all connect up to form a single system.*"

(Marshall, 2009)

Plots are normally rectangular shaped just because it is an efficient way to divide land; there are no wasted areas and the edges are clear. Rectangular shaped plots are easy to connect both to the street and the neighbouring plot. Their dimensions depend on their functions. Roads are linear and they serve to connect places. Generally speaking, their shape is related to the topography of the place, and the places they connect. Their dimensions depend on the functions within the plots adjacent to them and the kind of places they serve. Those variables will determine the amount and kind of traffic estimated for those roads which in turn will determine their dimensions. Buildings are finished objects which can be experienced by people both from the inside and the outside. They emerge based on the dimensions of the plot, its relationship with the road, the neighbouring plots and the function they are designed to host.

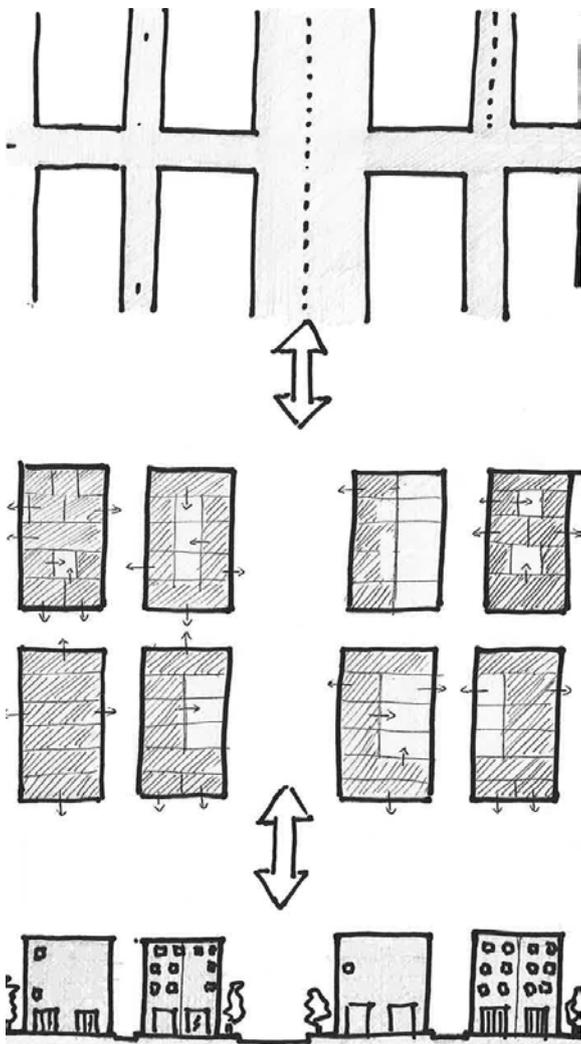


Figure 4: Street Syntax. a) All roads connected. b) Plots connected until a single building area. c) All buildings connected to the street each one with a direct and unique relation to it.

In other words, there are relationships between the position and the shape of the basic urban elements that determine a predictable urban morphology. Marshall tries to describe the urban syntax from a dimensional base. By doing that he shows the deep relationship between each of these elements and how the changes in one can originate predictable changes in the other as well as the city as a whole. In his book *Cities, Design and Evolution* (2009), he shows how the two dimensional linear

characteristics of the streets create two dimensional plans and how two dimensional plans create cities with towers and trees and lakes.

According to fractal geometry and to complexity theory, the morphology of the cities changes once the basic elements of the space syntax change or the relation between them. This change can happen to meet different cultural needs or to support different urban functions. For example, the size of the plot to build a house is normally different than the size of a plot to build a public building. By changing the size of the plot we will change the character of the street. As a consequence of such intervention different buildings will emerge and consequently different urban structures will rise. These consequences are predictable before the buildings are actually built, as soon as we know the set of rules within which they operate. In other words, we can predict or stimulate predictable urban reactions by manipulating the basic elements which compose the urban syntax.



(a)



(b)



(c)

Figure 5: Space syntax from a dimensional perspective. a) Traditional Urban fabric. Cellardyke, Scotland; b) Modern architecture but with traditional street syntax, Cumbernauld, Scotland; c) Modern urban fabric, but with bending street rules, Cumbernauld, Scotland (Marshall, 2009: 78).

The emergent reactions of the city to an intervention of this kind are only predictable to a certain extent. On the one hand, complex systems are by nature unpredictable systems; they are composed of an infinite number of elements and infinite relations between them. Not only do these

elements and their specific relations trigger unpredictable reactions to any intervention, but also both elements and their relations can change in time (Portugali, 2008). In other words, it is impossible to fully understand a complex system because of its inherited complexity and to fully predict the effects of our actions. On the other hand, complexity sciences tell us that we cannot know what the optimal state of the system will be therefore it is impossible to plan for it, at least in the traditional way (Marshall, 2012). By understanding the genetic code of the city and its building blocks we might investigate more dynamic ways of obtaining the functional complexity of a urban system; This research argues that changes in the basic units of the system can produce change in the city as a whole. Not only that, but changes in the basic rules from which the system emerged or changes in the external conditions of the system can also influence the general order of the system across its many hierarchical scales.

Implications for urban management and urban design

As mentioned in the introduction chapter, the most obvious implication of complexity theory in urban design and urban management is related to the development of computer programmes which simulate the city and its development. Still, cellular automata and computer models are not the only implications of complexity sciences in the urban planning and urban management process. They imply a different way of thinking; a paradigm shift in planning. Marshall (2009) summarises five lessons from emergence which can help us understand urban morphology and urban change from the perspective of complexity theory.

The first lesson is the fact that emergence shows us how order can be created without design or external interventions. The classical urban form – a continuous bounded settlement with an identifiable central core and annular suburbs- emerged from a cellular automata model without the introduction of any concept of centrality, suburbs, compactness, boundaries... (Marshall, 2009:206)

The second lesson is the fact that even if the individual actions are intentional and are concerned with the common good, one cannot forecast their emergent effect. Therefore, some of the probable side-effects of an intervention are not intended. There is a random element at play when intervening in a complex system once at the start there is no knowing what form will emerge.

Thirdly, urban form can be the result of individual actions; a characteristic order or pattern rises from the actors operating objective, simple and local rules. Those actors are not necessarily aware of the emergence of an overall order created on a larger scale. In addition, urban complex models emerge from local actions. These actions do not have to take into consideration what is happening in their surroundings nor have an idea of their position in relation to the whole.

Fourthly, independent actors are not creating the emergent order. That order emerges as an indirect effect of their individual actions. That emergence order can only be ‘observed from a suitable zoomed-out spatial or temporal scale’.

Finally, emergence is something generic and abstract. To find emergence one just needs to find elements and their rules of interaction and analyse the emergent effect from a bigger scale. This means that emergence and self-organising systems are applicable to both organic and non-organic contexts.

The implications of these lessons for a new kind of urban management and urban design are profound. The study of cities from the perspective of complexity sciences implies a new vision of the city and therefore the need for a new kind of urban design and urban management. It implies a kind of design and management that:

- Embraces the urban dynamic character and assumes its continuous and unpredictable change. The most common working tool and the basis to exchange information across most urban actors today is a picture of the city in a specific time (Lynch, 1981)- a city plan.¹⁹ In contrast, the city is not a picture, it is dynamic; it is always changing and self-organising sometimes in desirable ways, sometimes not. Until recently we have studied the city from the perspective of the plan²⁰; from the perspective of its overall organization in a specific time and place. Nevertheless, complexity theory defends a kind of management and design focus on the process rather than on a final form.

- Acknowledges the system by its parts rather than as a complete whole. Complexity theory suggests that urban management and design should approach the city from the understanding of its components and the nature of the relation of its part. Until recently the focus of the study and of the design of cities was on their final form. It is as if to understand a human wave in a sports stadium we focus on the wave itself rather than focusing on the set of rules by the individual spectators used to produce it (The continuous process of standing and sitting). In the context of cities this means perceiving the city from its general form rather than by according to logical of individual actions and choices (Marshall, 2009:187).²¹

- Acts delicately in the urban complex system. Complexity theory suggests the need to nurture the self-organisation character of complex systems acting on it only when and if there is the need for re-adjustments. This need might either emerge directly from the city or be predicted by cellular automata programs and by systems’ analysis. This approach implies a kind of management which focuses on nudging change rather than imposing a finished designed shape for the city. In practical terms, in the probable eventuality of emergent urban problems such as sprawl, segregation and urban ghettos (Batty, 1994; 2005), rather than tearing the area down and rebuilding it according to new urban rules, complexity theory suggests to influence that problematic tendency by changing the rules which originated the problem in the first place (Marshall, 2009: 192, 200). Complexity theory raises questions regarding the scale of built forms as well as the motivations behind them (Marshall, 2012). Individual choices of millions of people’ doing their own thing’ can explain the syntax of a place. Individual small actions in the built environment explain how the city form emerges in the absence of

large scale design and planning (Simon, 1996). From the perspective of complexity theory applied to the study of cities, human everyday life choices are the reason behind roads, plots and buildings which in turn generate complex urban forms and street patterns. Such images of cities imply designing the city from its most basic elements rather than as a finished coherent whole. This image of urban formation suggests that interventions in the urban environment should be discreet because they are, to a great extent, random regardless of the intentions behind them. As the reactions of the system are unpredictable, when possible, one could test its behaviour by interfering in it discretely and disturbing its self-regulation as little as possible.

Summary and discussion

Complexity sciences studies the City from the lenses of fractal geometry. It defines the city as an organic infinitely complex system, naturally organised in hierarchical similar patterns; a complex organism, evolving and changing according to specific contextual rules and conditions. Complexity describes a city emergence which in many points is similar to the description of Alexander's natural city and the notion view of semilattice (Alexander, 1966). From the perspective of complexity sciences, like all natural growths, cities evolve through the cumulative addition and deletion of basic units, cells or particles. In the urban structure, the basic units of the system are related with individuals and the ways they materialise their daily needs in the physic form of the city. In the built environment a basic unit can be households, firms, transportation links and so on, represented in terms of the immediate space they occupy. Those patterns exist at both lower and higher scales of social organisations. They emerge almost magically from the growth process of the city itself.

The reason why the fractal representation of the city can be so accurate is a mystery, but the fact is that it represents it well (Batty, 1994). Complexity sciences and fractal geometry can be applied to cities and help urban design and management in many ways. Above all they suggest new, refreshing and flexible ways of dealing with urban and social imbalances and invite us to think of new design approaches and methodologies to intervene in the built environment.

With regards to the research hypothesis, the most important concept to bring on board is that complexity theory offers the theoretical ground to suggest that one can change the city's morphology by changing the code that enabled its emergence in the first place. One can change the morphology and consequently the dynamics of a city by manipulating the set of rules which created it, rather than dramatically changing the form of the city itself (Marshall, 2009: 188-193). In light of this the research suggests that strategic interventions can be used as a tool to nudge that change. Strategic interventions are actions that emerge from the understanding of the system's process of formation and from the awareness of the basic elements from which the system emerged.

Complexity theory explains what is similar and predictable across all cities; complexity sciences show that the process is based partly on random organisation and partly on a simple set of rules, such as the advantage of living near the place of work, can generate something coherent and can create something recognizable as urban form (Christaller, 1972; Batty, 2005; Marshall, 2005, 2009, 2012). Complexity sciences demonstrate that the forms of naturally growing cities are related even if there are no grand-planners involved. This happens because the rules which generated them are similar. Cities emerge in similar ways because people have similar needs. Key differences emerge from the different emphasis each group gives to each individual rules and this difference in emphasis is normally related to a context and to its geographical and cultural reality (Ponty, 1962; Alexander, 1977, 1979). Evolutionary theory, will be used investigate what makes each city unique. We will investigate the evolution of cities from the perspective of human actions and we will try to establish the role of design in human and urban change.

Portugali (2012:5) highlights the fact that in the study of cities as complex systems there is little attention paid to their uniqueness: the properties that make them different from organic or material systems. In addition, complex systems pay little attention to the importance of the context as a key factor for the system's identity and development. Up to now cities have been studied as if the feedback from the environment is not an important factor for the general study of complexity. Furthermore, Portugali criticised the fact that complexity sciences did not pay enough attention to social theory and to the empirical aspects of urban life.

As a matter of fact, Alexander (2003) wondered "*how can we even say that we have a theory of complex systems, when we have so little to say about the most crucial point of all*"; the human condition in the world, human adaptation and human creations or interventions. According to Alexander, it is the complexity of the adaptation to the everyday world around us, which is potentially a rich source of science and worth a serious scientific effort.

Why are cities unique?

Urban form and urban development from the perspective of evolutionary sciences

From the perspective of fractal geometry and complexity sciences the overall result of a structure is just a consequence of the strict execution of a simple set of rules. Bees as well as termites demonstrate systematic behaviour; it is not something random. It is a behaviour inherited from previous generations, which was transformed and adapted through time according to their needs.

“this amounts to say that the functional ‘design’ of the termite mounds is a product of evolution – just like the ‘functional design’ of the termites’ bodies themselves.”

(Marshall, 2009: 150)²²

Introduction

Evolutionary theory: Contributions to the research

There are several definitions of *Evolution* more or less specific and focused on different aspects of the phenomena.²³ For the argument of this research we shall embrace the meaning of evolution as a generic concept like the concept of *emergence* or *change*. In the context of this research evolution means the gradual development of something in which that something changes into a different and usually more complex form.²⁴

Darwin (1859:435), addressed evolution as *‘decent with modification through natural selection’*²⁵ and there is nothing in this statement relating it exclusively to biological systems (Simon, 1996). From a theoretical perspective, the idea of evolution is implicit in the understanding of change in any complex system (Allen, 1981). Therefore, it is a useful theoretical tool to fill in some gaps left by complexity sciences.

Evolutionary theory was used to inform both the thesis theoretical research and the research framework which was used to apply and test assumptions extracted from the literature review. With regard to the research methodology, evolutionary theory was used to connect different sciences and relate humans and change to a context. Many authors see the quantification, the specialization and the abstraction of the scientific methods as motives responsible for enabling humanity to take a step forward and find more sustainable and fulfilling ways of life (Alexander, 2003; Ehrenfeld, 2008; Bortoft, 2010). Evolutionary theory can serve as a common ground to join together findings from different fields of research and merge together qualitative and quantitative data (Wilson, 2011). This

aspect of evolutionary theory was particularly useful to build the research models (EIMS) which were used as the basis to test and apply the research findings.

With regards to the thesis theoretical approach, evolutionary theory helped, to justify the need for some kind of top-down planning. After all *Evolution* has to do with organisms' adaptation to their environment. Survival is not about good or bad, therefore change does not necessarily emerge for the better of the system.

Evolutionary theory also helped to establish the relationship between urban environment, human actions and urban change; it helped to identify the role of interventions and design in the process of change. As argued by authors such as Wilson (2011) and Richard Dawkins (1976), in evolutionary theory it is generally accepted that some species and some things tend to survive and multiply better than others. This capacity is very much related to their adaptation to the environment. In other words the diversity of forms of adaptation is a consequence of the feed-back from specific contexts and environments. Following this argument Marshall suggests that it is adaptation and the fitness for a purpose that shapes human actions and the way we design our tools and our environment (Marshall, 2009: 161). Based on this it's arguable that evolutionary theory offers a solid theoretical background to relate human actions with urban character and urban change; it helps connecting *human interventions* with whole complex systems. The analogy between the role of human interventions in the urban environment and the role of adaptation in the biological context is one of the reasons to use evolutionary theory as a theoretical support to this thesis. In other words, evolutionary theory is used as a framework to relate humans to their physical and social context from the perspective of their actions in their physical environment.

Contributions to the research's framework (EIMS models)

Connecting with the whole of science

“One reason I am passionate about evolution is that it provides a common language for all scientific and academic disciplines that deal with the living process.”

(Wilson, 2011: 193)

By reflecting on the city in the light of evolution one is able to connect all urban problems under one theoretical perspective, - like what complexity sciences did – and to connect the city with all areas of knowledge and all problems related to human existence today.

“Most scientists aren't that interested in the bigger picture. They become engrossed in their particular problem, which causes them to be more and more specialized. The entire structure of federal funding doesn't see the bigger picture, either, and doles out money to solve specific problems,

such as smoking, delinquency, or learning disorders. Scientists are selected by consequences, just like everyone else, and before long they become encapsulated in little groups, with their own specialized language and concerns. A few remain cosmopolitan (like Tony (and me)) but mostly by virtue of their personal preferences and not because they are rewarded for it by the system.”

(Wilson, 2011: 207)

According to authors such as Ehenefeld (2008) and Wilson (2011) this segregation of kinds of knowledge isolates findings and world views into islands. According to Wilson, as long as those islands don't find a common ground on which they can share information, they are unable to contribute to a holistic view of the world and therefore it will be difficult to contribute sustainable solutions to the world problems we face today: Problems such as the sustainable management of a flourishing of human life in a context of limited resources.

Marshall and Batty (2009a; 2009b) refer to *Evolution* as a key framework to understand and address urban problems. Wilson on the other hand sees evolutionary theory as a framework to understand not only the complex place where we live, but also as the common language all sciences should use to interact and exchange knowledge; a common framework to combine forces in a new and multidisciplinary world of science. Only this new way of science can allow a meaningful step forward and start addressing the problems of human existence (Alexander, 2003; Bortoft, 2010).

Connecting with the context

Wilson (2011) used the example of economical sciences to illustrate that isolation of knowledge is only one of the problems faced by most contemporary sciences. The fact that numbers are considered to be more related to the scientific truth and human perceptions and experiences are not, is a problem highlighted not only by Wilson but also by most of the key authors mentioned in this thesis.

In addition, economists such as the noble laureate prize winner in 1988, Maurice Allais, and others engaged with emergent fields of economy such as experimental and behavioural economics also emphasise the fact that the gap between abstractions and the reality of human life as a major problem of economical sciences today.²⁶ Abstractions are not reality. They are one of the endless possible interpretations of the world. They are always a simplification of things to enable humans to give a sense to the world around them. Abstractions, normally, take away the object of study from its context and therefore erase most of its complexity. The problem with science that studies human nature is that they base their world views and actions on abstractions; The gap between abstraction and reality sometimes becomes so big that the abstraction becomes the reality on which we base our understanding of the world and our decisions (Bortoft, 2010). This fact might bring questions to the relevance and appropriateness of designs and decisions.

“A purely fictional world defined by mathematical equations acquires so much authority that it becomes the real world for the adherents. Aspects of the real world that cannot be related to the imaginary world are so dumbfounding that they are labelled as paradoxes by the faithful...Does this seem a little bit like religion?”

(Wilson, 2011: 339)

The abstraction and quantifications of sciences that study human relation such as economy can be very misleading. Economy for example is reduced to the idea of maximising self-interests without taking into consideration anyone else's interests. Mathematics is not able to deal with the human characteristics such as sense of fairness, the psychology of risk and the variety and complexity of human forms of cooperation. Besides that, it reduces “human wellbeing” to property and there is a vast amount of literature in psychology and sociology proving otherwise. According to Wilson, it is essential to bring a regulating system such as economy back to reality and use common sense rather than operating on the abstract world of mathematics which has the incapacity to deal with the complexity of human life.

Complexity science is also based on geometrical and mathematical abstractions. It is focused on what is general; therefore, one of its major limitations is to explain the uniqueness of things. In the urban context, one of the major limitations of complexity sciences is to address what is unique in each city and to relate that uniqueness to the human being and to its actions in the urban environment. In light of this, we have used evolutionary theory as a theoretical background to address the importance of the context, both physical and human. Evolutionary theory can explain humanity and human interventions in relation to a context and help relating this knowledge with a bigger meaning of human existence.

“Evolution is all about differences in survival and reproduction.”

(Wilson, 2011: 21)

Evolution has primarily to do with change and with the relationship between organisms and their environments. Evolutionary theory is about adaptations not about good or bad. This idea suits nicely with the concept of emergent development. The work of Wilson was introduced in this thesis to understand more about the complexity of contextual human adaptations. In the evolutionary context, interventions are adaptations to specific environments and the consequences of interventions are the feedback of that environment. Evolutionary theory shed light on the relevance of contextual interventions as well as their relation with human and urban evolution.

Alexander (2002; 2003; 2006) relates the importance of the adaptation to the context with the notion of continuous change. In his work he shows evidence of the risks implicit in breaking the contextual, continuous and emergent character of change. Based on evolutionary arguments Alexander

too suggests contextual delicate interventions as the most adequate way to nudge urban change towards a sustainable development.

Contributions to the research's theoretical background

Identify the role of interventions and design in the process of urban change

As complexity sciences, evolution theory can not only explain the evolution of cities from the past up to now, but it can also offer a framework to set new ways of dealing with the cities' processes of change in the future. The question is '*how this understanding can help us do better urban planning and design*' (Marshall, 2009: 247). This thesis suggests that the answer to this question has to do with the role of human actions and design in the evolutionary process. It suggests that the key is to focus on human actions and design rather than on planning itself.

Evolution implies the existence of functional order without anything or anyone planning it. It implies that continuous change and adaptation to circumstances will lead to a great variety of form in the long term, each one fully adapted to the purpose and the environment that stimulated their emergence in the first place. This process of change is in response to a need and an environment, therefore things seem to be designed to serve a specific purpose (Marshall, 2009). In the evolutionary context interventions and design in particular are adaptations to specific environments; they are changes aimed to make us, as humans, fit better in the context where we live in. Evolutionary theory explains interventions and design as specialised tools used by humans to better address the challenges that are presented to us.

Moreover, evolutionary theory is a theoretical framework open enough to include and explain both unintentional interventions, originated by every-day life activities and intentional interventions, such as the designed top-down ones. It frames all human intervention as both the engine and the consequence of the process of evolutionary change.

The evolutionary perspective suggests that gentle, small scale interventions are in general the most appropriate to nudge change in the urban environment. The evolutionary process does not have a goal or a supreme form to be achieved. It is just a continuous symbiosis between a cause and an effect that travel through time together and shape the complex and diverse world as we know it. The continuity of such process gives us a sense of predictability or stability; therefore, it is easy to understand why breaking such a process can have a negative impact in a social context. The relevance of an organism adaptation to the environment enables us to understand why humans can have problems relating to interventions which do not obey the evolutionary continuity. Drastic interventions might even be needed to readjust an unwanted path of urban change but they should be addressed with the awareness of the risks they might bring. They change the urban environment very fast and humans

might take time to adapt to it. In other words, *Evolution* justifies the relevance of micro-interventions or the reason why interventions should be managed in a continuous and discrete way (Marshall, 2009).

'If it ain't broke, don't fix it; if it don't fit, adapt it; if it's new, try it small; if it's small, let the people do it; if it works, run with it.'

(Marshall, 2009: 277)

Justify the need for a new kind of top-down planning and help to identify some of its key characteristics

Similar to complexity sciences, evolutionary theory is able to justify why certain interventions are more unfortunate than others and it can bring light to the risks of the mismanagement of urban change. In addition, by making an analogy with other biological systems, evolutionary theory can not only justify the need for top-down management but also establish its guidelines and general structure.

"Evolution has no foresight. Genes and beliefs alike spread on the basis of local advantages, no matter what the consequences over the long term. Sometimes they spread by virtue of benefitting individuals compared with their immediate neighbours, sometimes by benefitting groups compared with other groups, and so on up a multitier hierarchy of groups."

(Wilson, 2011: 35)

"The great error of economic theory is to suppose that people automatically converge on the local rules that work at the collective level merely by following their own self-interest."

(Wilson, 2011: 353)

Evolutionary theory suggests that people, like other species, do not necessarily act in favour of a common good, nor does their own good necessarily add to the good of a community. It suggests that an overview of the system and cooperation are needed to effectively guide change. On the one hand this suggests a kind of brain or central system, like an improved version of the integrated system introduced recently in Rio de Janeiro.²⁷ On the other hand, as cooperation does not happen spontaneously (Ostrom, 1990), evolutionary theory suggests the need for regulations and norms to facilitate human participation and cooperation for the improvement of common good. In other words, evolutionary theory suggests the need for a top-down urban management of some kind. This regulatory idea is contradictory to the self-organising and emergent view of the world. But it gives the possibility to address emergent urban problems such as sprawl, human segregation, ghettos, crime, and so on.

Even if evolutionary theory implies the need for a kind of top-down management, it does not define it as a rigid or restrictive system. Top-down management and norms can be used to “monitor” people’s good will. Certain kinds of norms can give identity to a group and give a sense to human actions. Norms can give group morals and ethical values. Values and trust are a powerful structure essential for a sustainable life on this planet. Some kind of regulative interventions are therefore essential to create the conditions for cooperation to grow which in consequence will influence urban development (Ostrom, 1990; Wilson, 2011).

In other words, according to the evolutionary theories both a monopoliser top-down management and a management based directly on the self-organisation of an individual are doomed to fail. Evolution explains the need for a new kind of urban and social management. It explains the reason why, like organisms, complex systems such as cities need to intentionally gather information, process it and analyse it in relation to its environment or context. It explains why there is the need for such management system to create a variety of alternatives which are intentionally designed to address a specific problem. And it explains why, only then it is possible to choose the best option.²⁸ It shows why human cooperation does not always happen spontaneously and therefore justifies the need for a hierarchical control and the need for norms.

The top-down management suggested by evolutionary theory is focused on the nurturing of the continuous emergent process of change. It suggests the establishment of values and basic rules to support a sustainable development, allowing space for emergence and self-organisation to happen: this is an essential factor for the human engagement with its surroundings.

The role of human actions and design in urban and human evolution

Allen (2012) states that urban change is related to human patterns and to the reasons behind them. The reasons behind the things we change in time according to our cultural, social and technological evolution. Therefore, any model used to understand the structure, the character and the development of the city has to be evolutionary. The city is a complex and dynamic system as well as a human creation. Like the bees comb it is a system that rises from the dynamic way its parts are put together and relate to one another. This relationship is dynamic in the sense that it changes over time without being operated by any external factor. In addition, humans are also part of the city’s system and change with it over time. These arguments amount to say that humans, human relations and human creations evolve together. One is a consequence of another.

Evolutionary theory to find out more about the relationship between human evolution and the evolution of the things we create. We will try to use that knowledge to establish a link between human interventions and human/urban development. In light of this we will explore the role of design in the context of human and urban evolution.

The conclusion taken from this part of the literature review will suggest ways in which design can be used as a strategic intervention to influence the path of emergent change. In other words, we use both notions of evolution and emergence to explain the design and apparent order of ‘natural cities’ as well as why they can give the illusion that they are planned. In addition, we explore ways how design could be used strategically as a tool to manipulate urban development.

The need for a new paradigm

The city as an ecosystem

The relevance of the use of evolutionary sciences to study the city is also related to the paradigms designers and planners use to make sense and act on the city. A *paradigm* in this context is just a simple way to understand the urban form and it is used to justify design concepts and urban decisions. In other words, the paradigm one chooses to follow to understand the urban form justifies the way one acts on the city. Consequently, finding a paradigm that envisions the city as a complex and dynamic system is essential as the basis from which sustainable urban interventions can emerge. Marshall (2009) suggests approaching the city as an ecosystem rather than the previous creationist perspectives. Creationist paradigms normally conceive the city according to three metaphors or combinations between them. These metaphors are: the city as a piece of art like Florence or Vienna; the kind of city suggested by Sitte (1889). The city as a machine like the modernist approach or the city as an organic entity with a centre as a heart, roads as arteries, parks and gardens as the lungs and so on. Such images of the city are restrictive and not applicable to define the kind of thing the city really is. They do not take into consideration the urban complexity or its dynamic character. Above all they consider the city as nothing more than the sum of its parts; therefore, planners design it in a congregative manner (Marshall, 2009:120-128).

In opposition to the creationist metaphors, the city as an ecosystem explains and resumes the city from its holistic and dynamic perspective (Marshall, 2009: 119, 139). The view of the city as an ecosystem makes it neither a finished designed object nor an organism evolving to a mature form. According to the ecosystem paradigm, the city is not composed of independent parts whose function is strictly to serve the well-being of the whole. The city is a collective entity where things evolve together and influence one another, partly through cooperation and partly through competition. The evolution of this ecosystem does not have a long-term target shape or state of development. As Wilson puts it “*the city has no foresight*”. Change is normally made through small steps which aim to respond to short-term targets. Evolution just follows a continuous process of constant readjustments and adaptations in relation to continuous new environments. Its parts are not fixed and the city can always

change in an unpredictable way. Such a view of the city can give life to new forms of urban design and management.

The evolutionary paradigm

In essence the evolutionary paradigm suggested by Wilson (2011) is similar to the paradigm of the city as an ecosystem suggested by Marshall. Wilson (2011), Simon (1996), Dawkins (1976) and others argue that it is true that “*cultural and physiological evolution differs from genetic evolution in their details, but once we take the differences into account, we can explain human diversity in the same way as biological diversity*” (Wilson, 2011). This view of humanity in the overall evolutionary context is what Wilson calls the *Evolutionary Paradigm*. The evolutionary paradigm relates human evolution to its environment; the city. It explains human evolution as the evolution of intertwined aspects of human existence which evolve simultaneously, and continuously influence one another. In other words, the evolutionary paradigm explains not only the complex and dynamic character of human, cultural, social and urban evolution but it also embraces the evolution of human creations.

The evolutionary paradigm has the potential to relate theory with practice and serve as a common language between all people intervening in the city. Wilson argues that evolutionary theory can offer the scientific ground to share knowledge across all fields of science. Therefore, it can inform a realistic and truly sustainable management system able to deal with the complexity of the human condition in this world. It can be the common ground for all sciences engaged with life and complex systems. This common ground would enable the exchange of knowledge and eventually the achievement of a more holistic view of the human condition in the world. According to Wilson, evolutionary science will only prove itself when it explains not only human diversity and human condition but also when it also provides practical answers to address the urgent problems humankind is facing today.

Based on such integrative character of evolutionary sciences this research used evolutionary theory to inform the research's theoretical background and the research methodology. On the one hand, evolutionary theory was used to explore a theoretical perspective that relates three key elements of a social complex system: humans, human creations and the urban environment. Like Alexander (2003) the research argues that only after understanding better human interventions and the way they influence the character and development of the city can we start imagining a new and more sustainable way of managing our existence in this planet; only then we can design and select strategic interventions that can lead the natural evolutionary process towards a truly sustainable development.

On the other hand, evolutionary theory was used to explore and develop the framework which is the base of this research's framework (EIMS).²⁹ Evolutionary theories inspired a framework which aims to bring together different perspectives of an urban and social system. Such a framework can then be used as a base to deal with problems of organic complexity (Weaver, 1991) and create a more

realistic and holistic understanding of the urban challenges and it can be used to inform any urban intervention, especially interventions related to urban management and design. EIMS framework is designed to acquire and exchange knowledge which could serve as the basis to select and design interventions which are more sustainable and efficient. The evolutionary paradigm served as a base for the development of a framework which aims to:

- Serve as a tool to design and select strategic interventions; therefore, relates the parts or the building blocks of the urban complex system with the whole. It brings together in one model the built environment, people and their interventions in the city. In addition, it perceives the urban form as an ecosystem; as something dynamic in a constant process of change.
- Cross information through all fields of knowledge and all kinds of potential users.
- Relate theory with practice.

In short, authors like Wilson (2011), Batty and Marshall (2009) and Simon (1996) see *Evolutionary Theory* as a solid and holistic ground able to support a kind of paradigm that would be able to:

- Accommodate urban complexity and its dynamic character.
- Explain the coherence of the *natural city* as a whole as well as its relation to its parts. Explain how the whole and the parts emerge together, or why the natural city is so fit for its purpose?
- Explain human actions in relation to a context and therefore explains both urban syntax and character.

From a theoretical perspective evolutionary theory is able to connect human nature to the urban context and the context of the whole planet. It explains the evolutionary process of human and urban change as well as the developments of human creations.

From a methodological perspective evolutionary theory can be used as a common ground reachable by all sciences and all urban protagonists. This opens the door for a possible new dimension of intercommunication and therefore enables the possibility of a truly holistic view of the city to emerge.

Human and urban evolution

Different approaches

Patrick Geddes (1915/1949) was perhaps the pioneer to relate biological and evolutionary ideas to ‘city design’ and civics. Still, he did not use those references to understand urban change, rather, he was more focused on civics and regional planning.³⁰ Geddes was interested in regional planning and the local-global conundrum. He is the father of terms like *conurbation* and *megalopolis*. His ideas were controversial; his ideas about planning came from a collective top-down perspective, but were based on his own view of biological evolution which suggested that the functionality or the fitness of purpose emerged from the bottom-up approach. This fact, together with his ideas of holism made his message seem full of contradictions (Marshall and Batty, 2009). His book *Cities in Evolution* was written almost a century ago, before highways and the internet, television or shopping malls, before the new input from complexity sciences and self-organising systems. Today, urban theorists are looking again at his work and start to use renewed evolutionary thinking to study cities.

“Geddes’ ideas were underpinned by a coherent philosophy based on Homo sapiens being contiguous with nature, with human needs and behaviour rooted in our biology and evolutionary history” (Marshall and Batty, 2009). Those ideas oblige us to have a look not only at ideas about biological evolution, but also at ideas related to cultural evolution and the evolution of artefacts and design as a product of mankind.

Geddes described cities as physical environments intrinsically connected with the social aspects of the human lives which lived in it and with their specific contextual environment. In terms of urban planning, this means to say that a city was not an artefact as a sculpture or a building that could be placed arbitrarily in space. On the contrary; for Geddes the morphology was the city was the product of its social and physical environment and should be planned according to it.

There are many similarities between the way we understand human evolution today and Geddes ideas applied to urban theory, namely the fact that humans are seen as part of their natural habitat and human behaviour is considered as something influenced by our evolutionary history. Besides that, cities are seen as products of specific circumstances. These days, complexity theory applied to study of cities adds the fact that urban structures can evolve in ways that are not predictable or under the control of planners.

Geddes generally agreed with Darwin’s interpretation of biological evolution, but he thought that Darwin placed too much emphasis on natural selection and not giving enough importance to co-operation as a means to evolve. As an evolutionary theorist, Wilson (2011) too emphasises the relevance of co-operation as a tool to help humanity to focus on the common good and therefore create

societies able to emerge in a sustainable direction. He also argues about the relevance of hierarchical organisation of social groups and rules to create the environment for co-operation to emerge.

Influenced by complexity theory applied to the study of cities, Marshall and Batty shifted from Geddes's perspective to a more Darwinian interpretation of the city. As Darwin, they give more emphasis to social interactions and the struggle to survive rather than to the idea of collective collaboration for the development of a common good. *'Geddesian evolution implies that cities somehow evolve of their own accord. However, a more Darwinian interpretation implies that change is driven by a combination of random or 'blind' variations plus feedback from the environment. And third,'* (as also argued by Alexander, *Geddes' philosophy seems to imply urban evolution as a sort of gradual unfolding, almost as if cities emerged and grew according to some kind of developmental programme. But Darwinian evolution offers no such programme: evolution is fundamentally unpredictable; change can go in any direction; today's model may well be obsolete tomorrow; and everything in the city system – businesses, technologies, land uses, building types – must be prepared to innovate and adapt to survive*" (Marshall and Batty, 2009).

From the perspective of socio-cultural evolution, Lane (Lane et al., 2009) argued that it is a mistake to base our understanding of innovation in society and culture on Darwin's theories:

First, *'when shifting from biology to social sciences, the concept of population thinking, essential to biological evolution theory, has to be replaced by the concept of organisation thinking as the primary foundation in a theory of innovation and social change. Organization thinking requires that no description of a human organisation can separate structure, function and processes.'*

(Lane et al., 2009: 481)

In other words, Darwin's theories are based on individuals while society evolves by means of organisations and groups.³¹ For Lane, social and cultural change rather than being influenced by individual actions and struggles to survive is achieved by the means and will of collective organisations. Organisations are from several areas: financial, religious, medical, military etc. and have different targets of action: family, community, city, province, nation or even wider international interests. These organisations belong to different hierarchical levels, in which, the higher levels embedded the character and function of the lower ones. In order to survive and to develop, organisations have to relate to different levels and kinds of institution and the character of their relationship changes according to the evolution of the organisations (Lane et al., 2009).³²

Furthermore, according to Lane, the lower levels are 'culturalised' that is to say they act according to the written or unwritten rules of the higher hierarchies in order to achieve efficiency of time and costs. Thus, the culture of the higher hierarchies influences the lower hierarchical levels such as the single individual. On the other hand, the culture of the higher hierarchies is influenced by the general social culture, therefore from the bottom-up; by the people.

According to Lane, no theory of the city can only be based on emergence coming from the bottom-up, once the higher organisational levels influence the shape and evolution of the city as much as or even more the lower ones. *'The national or global urban system has a much greater impact on individual cities than the individuals, households and firms living in the city can have by themselves. It is easy nowadays to observe that cities are affected by the same kind of changes all over the world'* (Lane et al., 2009: 481). Cities are not isolated. Cities are linked to cities; organisations of the same and different hierarchies are linked globally. As a consequence, global forces have the power to change a city shape, population, specialisation, etc. much faster than the individuals living in it by themselves. For example, an international oil and gas company who decides to invest in a certain region will most probably have an influence directly and indirectly on the country. It will not only influence the local community adjacent to the place of investment but also the country as a whole, at least from a political and economic perspective. There is no doubt that today as we live in a global world it is virtually impossible to dismiss or escape those global forces and therefore they have an important role to play in the socio-economic trajectory of the city.

'The emergence of a city's attributes and its socioeconomic trajectory are by no means resulting from the interactions of the local actors only. A Taking multi-level reciprocal interaction into account provides a much more nuanced epistemological position for social sciences than the commonly advocated methodological individualism.'

(Lane et al., 2009: 483)

Second, according to Lane, in the features of sociological innovation it is hard to distinguish *variation* and *selection*. According to him, *'even when they can be distinguished, they frequently fail to be fundamental, since other kinds of process, negotiation, underlines both of them.'* *'Socio-cultural change in general – is nothing but a story of negotiations structured by rules structured by negotiation'*.

(Lane et al., 2009: 12, 30)

For Lane, negotiation or the interaction between organisations and the rational ability of mankind to determinate the path through which he aims to evolve are of extreme importance to explain the way humans developed so fast (Lane et al., 2009: 35).

Third, Lane argues that we as humans achieved so much in such a short period of time; we evolved socially and technologically so fast in comparison to other animal species, due to a new modality of innovation through which *'human beings generate new artefacts which are then embodied in our collective activities, which are in turn supported by new organizations and sustained by new values'*. According to him, this pattern gets a dynamic motion; it arises from a positive feedback dynamic between change and the environment which generated so many transformations in us, in our

culture and our environment over a short period of time. In summary, Lane argues that human artefacts are imbedded in collective activities which are supported by human organisations which in turn become new values and a new basis for further development.

There are at least three relevant distinctions between Darwin's approach towards biological evolution and Lane's approach towards social and cultural evolution:

Firstly, the fact that Darwin's approach suggests the understanding of macro-scale changes from the perspective of the micro-changes over a long period of time. In contrast, according to Lane, big changes in culture and society are mainly caused by larger scale actors, like organisations and institutions.

Secondly, for Lane, decision and interventions - rather than being a product of variation and selection - are a product of cooperation and negotiation. They are a product of values which are not necessarily related to functionality and are intentionally selected.

Thirdly, and perhaps the most important for the arguments presented in this thesis, Lane argues that human actions and human artefacts have the ability to speed up and re-direct the process of human evolution.

The biologist, David Wilson, does not see any great confrontation between *population thinking* and *organisational thinking*. Wilson was able to integrate both the emergent Darwinian perspective of evolution and the top-down intentional manipulation of change in one single description of the city. He was able to establish the roles and contributions both individuals and top-down organisations offer to the development of society. Just like Lane, Wilson also agrees with the need for hierarchical groups and the need for top-down management; according to him, the health of the different hierarchical groups from which a city emerge, is of key importance for any kind of sustainable human and social-cultural development. Wilson also sees cooperation, negotiation and group values as a key reason to explain why humans evolved so fast.

Wilson also does not see any contradiction between biological evolution and socio-cultural evolution. According to the latest ideas of evolutionary theory, cultural and social evolution can be seen as part of the very pragmatic process of variation and selection, even if the process of cultural variation and selections is different than the biological one. Humans try multiple ways to adapt and respond to their environment but only some of these achievements will live as an example for further generations to follow. The selected variety of solutions able to help humans to adapt better to the environment will survive in a variety of forms. Human adaptations or ways to respond to the challenges of the environment survive in the urban fabric in the form of tools and the technology we use. It survives in our behaviour, our daily lives and in our minds. These adaptations survive in the way we perceive the world; our culture and in our belief system. As Lane, Wilson argues that in time these adaptations becomes part of our collective memory and are the basis on which we live and create new things.³³ The city can be seen as the ultimate human creation. It is therefore the scenario which

emerges from this collective memory and the background on which we build our daily life and our dreams for the future (Read, 2005).

Because of this deep interconnection between the evolution of mankind and the evolution of the environments they create for themselves, it is impossible to study the evolution of humankind without studying the evolutions of the city, the evolution of human culture and the evolution of human social relations. There are of course very sophisticated studies made in the area of human “genetic evolution”, but most of them end up studying evolution of the genes in a lab, isolating the genes completely from their environment. But isn't evolution all about the diversity of adaptations to specific environments? How can we understand the evolution of something without knowing the context that originated it in the first place? How can we study human evolution without studying urban evolution or the evolution of the human context? (Wilson, 2011) As a reaction to these questions Wilson developed several studies trying to relate DNA from people with their social and cultural background aiming to understand how one can influence the other.³⁴ For him, in order to become competent managers of our evolution we have to understand the interactions between our genes, our cultures and the way such interactions are materialised in our daily lives and on the things we produce.

From these studies he was able to relate an urban context, decisions made in life over a lifetime, the personality of a person with his/her DNA. With these studies, Wilson aimed to explain the variety of human behaviour and human actions not only in relation to different social-urban contexts but also within the same urban context. Based on his findings, he states that individual differences within a species can be explained the same way we explain the differences between species and they are a consequence of our genetic structure and our environment, and this phenomenon is also applicable to the human species (Wilson, 2011).

In short, Wilson proved that there is a direct relationship between human genetic change, human actions and behaviour and the context where humans live (both in terms of the social-cultural reality and the built environment). On the basis of these findings one can argue that changes in one of these aspects might induce change in the others and in their interrelation as a whole. For example, in an urban context experiencing social segregation might be useful to interfere in the built environment and create a place for people to interact under certain rules. A basketball field, for example, could contribute to the improvements of the relations among teenagers as well as among the audience. The micro-social dynamics which could emerge around the basketball field could eventually generate macro improvements in the area. The question is how long it would take to see the changes created by such intervention? In other words, how fast the human and social evolutionary process really is?

The speed of the human evolutionary process

“Each person carries genes that have survived in an unbroken chain since a first mutation that occurred in the distant past, which might be 5000, 50,000, 5000,000, or 5 million years ago. They also carry cultures from their past that might trace back thousands of years, judging by the crosses and golden domes that grace the churches around our city. Genetic evolution is fast enough and cultural evolution is slow enough for the two to become entwined in a double helix of their own.”

(Wilson, 2011: 204)

It might make us feel uncomfortable to think of evolution when explaining the human diversity as well as the diversity of the things we create due to idea that evolution is a slow process of change which occurs over long periods of time. The fact that humans are able to change themselves and their environment so fast makes it hard to relate the preconception of evolution with human change and human diversity.

Nevertheless, it is important to acknowledge that several time scales of change operate simultaneously and influence one another. There is “... *the timescale of genetic evolution, which is usually regarded as slow but at times can be quite fast. Then there is the timescale of cultural evolution, which is usually regarded as fast but at times can be quite slow*”. Then there is the timescale of the psychological process which according to Wilson “*can operate over the course of a human life time or even within a fraction of a second*”,⁹ such as when one takes a decision (Wilson, 2011: 6).

In contrast to biological evolution, where chance plays a big role in defining which species develop and which tools to adapt to a certain situation, humans have the capacity to decide themselves who and how they will adapt to change. The neurological processes that make us decide something has the ability to redefine completely our evolutionary path. Humans can design ways and tools to address a certain situation. Furthermore, they have the capacity to choose the best designs and improve them or adjust them to other similar situations. Following this, Wilson adds to Lane’s perspective and argues that this capacity induces a fast rhythm of change to human cultural and technological evolution and this can speed up genetic evolution.

Wilson undertook several field studies to understand the speed of human and cultural evolution and the factors which could trigger them. According to his field studies on the city of Binghamton, Wilson concluded that as long as the environment doesn’t change the evolutionary outcome won’t change or it will change so slowly that it is imperceptible to our eyes. But if the environment changes, humans will change and will adapt to it very fast; “*It will be hard to stop it from changing.*” That change can occur in a year, a week or even a day.

According to one of his studies, a group of problematic teenagers from Binghamton city responded to the changes in their environments over a period of three years; after creating a new open space where people could meet and actively participate in the embellishment of the neighbourhood, criminality diminished. This proves the deep relationship between humans and their environment and proves that changes in the environment can trigger fast human evolution. If we change people's environment appropriately we can expect to see people improving faster socially and psychologically. This conclusion is of key relevance for this research's hypothesis. With his study, Wilson explains the potential of human intentional interventions to re-direct change and to set urban development in new directions. He proves that we can intentionally manipulate human and social development by intervening in the urban environment.

“The key to change is to become wise managers of evolutionary process.”

(Wilson, 2012: 206)

Human Interventions in the context of human and urban evolution

Potentials and risks

Biological evolution occurs by a cumulative genetic change which happens from generation to generation. This change is due to three basic factors: inheritance (replication and reproduction), variation (like mutation) and natural selection (non-random selection). Natural selection is the feedback from the environment which determines the direction of mutation. In other words, natural selection is the external factor which determines a path of change. It determines who is fit survive in a certain context and therefore has the opportunity to reproduce and replicate its genetic characteristics. Adaptation to a context, fitness for a purpose or functionality can be interpreted as the consequence of the combination of reproduction, variation and natural selection, which in the long term is recognised as *Biological Evolution* (Marshall, 2009: 162; Jones, 1999: 201; Vermeij, 2004: 24).

Still, if we can dare to say that humans as specie have evolved then our evolution is surely not only related to biological transmission. Human evolution is also influenced by culture and social relations among other things. It is shaped by the ways humans express themselves in the things they create (Douglas, 2006; Holzman, 2007). Just by looking at human history, human achievements, the increase of human knowledge, technological developments, etc., it goes without saying that human societies are evolving as well as the things humans produce and need.

One of the arguments made by Lane (Lane et al., 2009), questioning how appropriate the Darwinian perspective is to understand human and urban change, engages with the role of the things we create and our decisions in the urban metamorphosis.

He argues that social and cultural change is not necessarily continuous and smooth and he relates that discontinuity to human interventions in the urban environment. He argues that change can be sudden and abrupt; human actions and innovations can smoothly shift the direction of change or trigger great mutation unexpectedly. For him, emergent change often happens through the introduction of interventions or innovations which break the continuity of change. In other words, evolution happens through the introduction of new artefacts or ideas which suddenly shifts the path of human and urban mutation. Innovations such as the use of the car and the use of the internet changed our daily lives dramatically. Internet changed the way we communicate with each other and the car changed the way we move in the city. As a consequence of that the way we design cities also changed. Today, almost all cities have generous and smooth asphalt roads for motored vehicles. *Facebook* and other social platforms became a meeting place for people. These interventions shifted the pre-established direction of emergent change; they create new urban realities (Marshall and Batty, 2009). These new realities become the environment from which new things will emerge (Jellicoe, 1961).

Lane suggests looking at the discontinuities, at the great achievements to understand the macro perspective of social-cultural development. Because Lane observes human socio-cultural evolution from its discontinuities, he dismisses the analyses of micro-processes to understand large scale-socio-cultural changes.

'First it is unlikely that all or even most large socio-culture innovations proceed by the gradual accumulation of change induced by micro-processes. Second it is even more doubtful whether these micro-processes are themselves sufficiently stationary over long time scales that they could generate large-scale changes' therefore it is argued that the 'observability' of this micro-processes is therefore irrelevant to predict long-term effects.'

(Lane et al., 2009: 20)

Lane approaches the role of *Interventions* in human and urban change from a long-term perspective; He looks at phenomena as an observer over viewing the evolution of mankind on earth. From a short-term perspective, Marshall (2009) and Alexander (1977; 1979) recommend caution when disturbing an established complex system. Both argue that people, just like organisms need time to adapt to the environment; therefore problems arise when we make unexpected and radical changes in the system. Drastic changes create discontinuities and therefore can create dysfunctional behaviours during a period of adjustment which is not even sure they it will ever end (Marshall, 2009).

Modernism is a great example of such a break in the continuity of emergent change in the built environment. Modernism emerged from exciting new technologies which changed the concept of a city but people and the way they deal with themselves and the environment did not change

accordingly. In other words, instead of a gradual change, modernists suddenly started building roads in the air and demolishing entire city centres, without being sure if they would work. Denet (1996) called these kinds of human aspirations as *hopeful monsters*.³⁵ Those blind steps can eventually work but in general they can be devastating for the city because they are very difficult to repair; a new model of a car can be replaced much more easily than a building. Modernist interventions, due to their scale and boldness, have destroyed entire urban ecosystems which in some cases are impossible to repair (Jacobs, 1961; Jencks, 1981; Coleman, 1985; Panerai et al., 2004; Pearson, 2006). This said, it is important to emphasise the fact that we are not defending that a leap in the dark is something necessarily bad. It is just much riskier than a gradual change.

Marshall argues that change should be perceived and directed as a continuous process. Due to the relevance of nurturing the continuity of the system's evolution. Following this, there are issues related to the scale of interventions which are important to consider. In other words, it is important to understand if the scope of urban change is related to the scale of the intervention.

From the perspective of complexity theory and fractal geometry small changes in the basic elements from which a complex system emerge can create changes in the system as a whole. Changes in the system can be seen in just a few levels of self-repetition (Batty, 1994, 2005). Due to the unpredictable character of complex systems small scale interventions are eventually less risky. In case of need, small scale interventions are eventually easier to adapt or replace and therefore they are more flexible to guide the system's development.

In the biological context small changes in an organism can also create great changes in the long term and tend to be harmful in the short term. In other words, organisms are already fit for their function they just become more and more accurate eventually re-shaping themselves completely. Great changes, on the other hand, tend to generate dysfunctional beings in the short term; the genetic version of so called *hopeful monsters*. *Hopeful monsters*, generally speaking, tend not to succeed because they do not fit the present needs of the organism. From the perspective of human interventions, hopeful monsters do not fit '*the social, economic and built environment into which they were to be inserted, or there being no viable paths to a future successful fit*'. They are mere speculations of the future (Marshall, 2009).

In the built environment a hopeful monster, such as many modernist interventions, make people feel '*as if we are in a forever-temporarily ill-fitting phase, like living in a building under construction: heroic in aspiration, perhaps, but uncomfortable for living in for the time being, and with an uncomfortable doubt as to whether it will ever be fit to live in*'.

(Marshall, 2009:234, 235)

The scale of an intervention plays an important role for human adaptation to the urban environment but the adequacy of an intervention as well. The adequacy of the intervention is related to the understanding of the city from which that intervention emerges. Modernist planning, for example,

tried to reconstruct a new urban order. They approached the city as a design object; as final finished form rather than from the perspective of the elements which makes the city emerge. It was as if the city was *'a fixed kind of organism, requiring corrective surgery, rather than something evolving with no knowable optimal destination'* (Marshall, 2009).

The research suggests that manipulating the system from the perspective of its building blocks might be less disruptive. Changing the rules from which both a problem and a system emerge generates a new system operating according to different rules. The system self-organizes according to the optimisation of each part in relation to the whole. In this model there is no such thing as inappropriate solutions or inadequate designs. Building forms and social behaviours emerge for a reason. When the elements that triggered that reason to exist change, the system will adapt as a whole and other building forms and forms of social organisation will emerge. Eventually the new system will generate other problems, which are by nature unpredictable.

In short, from a long term analysis, Lane studies urban change from the perspective of its discontinuities. From that perspective he sees innovation and human interventions as a way to produce change. As the engine that drives human socio-cultural evolution further; the key to direct and speed up change. From the perspective of short-term analysis, Marshall and Alexander refer to the dangers of large scale top-down interventions and fast changes in the urban environment. They argue that humans need time to adapt to environmental changes:

From these arguments we conclude that top-down interventions have the potential to intentionally speed-up and re-direct change. Nevertheless, there are relevant conditions to keep in mind in order to intervene in the system efficiently.

First, an intervention should emerge from the elements that compose the system rather than from the perspective of the system as a whole. In other words, to change an urban system, interventions should target the elements from which that system emerges. As argued previously, from the built environment perspective this would mean changing the dimension of the land plots rather than building a new neighbourhood.

Second, interventions should emerge as a process parallel to human and urban evolution as a response to a need of the present rather than emerge from imaginary forms of the city.

Third, interventions should be discrete; small scale interventions do not disturb much implemented systems. In addition, they have more potential to be adequate in the short term and still trigger great long-term changes.

The argument made here supports the research hypothesis which sustains that we can use interventions to manage urban change in a more efficient manner. In addition, these arguments start to define the key characteristics of strategic interventions in the urban environment. But with it they also bring other questions, such as:

How can we create and select strategic interventions? Can we even recognize them?

Could the design and selection of strategic interventions be the basis for a new kind of urban planning?

Design and Artificial Selection as tools to guide and speed up human and urban evolution

Natural and artificial selection

Dennett (1996) suggests that the general definition of Evolution is based on a combination of variation, inheritance and selection, even if it is primarily related to biological evolution, it is not specific about anything related to biology or life. Evolutionary theory can be generally applied to refer to the evolution of non-biological things like artefacts, languages, organisations, technology, etc (Young 1988).³⁶

‘... along with the evolution of physical forms of species, we have the evolution of organisms’ behaviour, their social systems and artefacts. In this sense, termite ‘skyscrapers’, beehives, wasp pots, beavers’ dams and spiders’ webs can be seen as a product of evolution. In turn, the successful functioning of these artefacts helps the organisms that make them survive and reproduce, and are therefore part or parcel of their evolution.’

(Marshall, 2009:156)³⁷

In opposition to the evolution of the physical form of species, the evolution of what we are and of what we produce is not the responsibility of natural selection rather it is related to intentional artificial selection (Mindell, 2006); the act of replicating and transforming something – even if it does not necessarily have to be intentional - is made by man itself by copying existing things and designing new ones. Humans, to a great extent, are responsible for the selection which will determine their path of mutation (Lane et al., 2009). The ways we use to copy or adapt something which we consider to be worth copying can be various; it can be by the use of genetic manipulation, by design or others.

According to Marshall, from the organism’s point of view artificial selection is no different from the natural one: *‘It is only ‘artificial’ in the sense that the human has purposely become the controlling external influence on selection, and considers this process one that is part of Nature.’*

(Marshall, 2009:168)

Lane (Lane et al., 2009) argues that not only the speed involved in the process of change but also the direction of change of the artefacts and the designs we create is not related to the Darwinian

idea of *'fit for a purpose'* or functionality. The speed and direction of change is not only not achieved by feedback from the environment - rather it is Man who artificially selects what is to be replicated and what it to cease to exist- in addition, the process and values used to make that selection are not necessarily related to functionality; they can be related to concepts of beauty, for example. According to Lane, this process of artificial selection is in itself always changing as a consequence of socio-cultural innovation. Since when do trends in fashion have to be functional or the way we choose a dog or a horse to breed?

Based on the arguments above, we can view Darwin's evolution as a special case in which the subjects are self-reproducing living things. In Darwin's kind of evolution there is random variation and genetic transformation, and there is no conscious intention of purpose anywhere. Still, other versions of evolution can include the evolution of non-living things constructed by external agencies, such as cultural transmission, genetic-engineered variation and artificial selection. In such cases, the evolutionary process is related to human individual actions, but it still has no long-term purpose.

This raises questions on what kind of evolutionary process would emerge if there was a consistent long-term intention behind key strategic human actions.

Even if long-term intentions behind human strategic interventions change in time, they would still give a direction to change and a certain consistency to human intentional actions. If one assumes that artificial selection plays a significant role in defining the speed and path of social-cultural development. It is arguable that if selection was systematic and consistent it could eventually optimise the process of urban development.

From the perspective of the built environment, Marshall suggests that the public authority's selection upon what can and what cannot be built can be seen as a kind of artificial selection. That selection, if it is undertaken for the short and long term common good, will overwrite the "natural selection" - or emergent market forces- that may only optimise an individual's well-being. Of course this selection has a deep relation with design itself; what we see then in the built environment is a consequence of the combination of artificial selection and design (Marshall, 2012).

Design as a form of adaptation and as a reproduction tool

Seeing design as part of evolution and evolution as part of design as a paradigm shift both in urban design and urban management (Marshall, 2009: 177).

The relationship between *design* and *Evolution* can be interpreted in two ways:

Design can be seen as a form of human adaptation. All things created by organisms can be seen as forms of adaptation or innovation to respond better to a certain need. Artefacts and other creations can be seen as tools used by organisms to become fitter to address the challenges of the environment and therefore increase their possibilities to survive and reproduce. Adaptation occurs naturally in the

development of any organisms and defines the path they take in the evolutionary process. Adaptation happens simultaneously in the evolutionary process of organisms, the tools they use and structures they create. Termites' nests, bee's hives or cities evolve with their builders once they are part of the condition for their survival as specie (Alexander, 2003; Hansell, 2007).

In the light of this, all things created by humans including their built environment can also be seen as a form of adaptation. Design is used as a method to create something able to respond better to a given challenge. In other words, human and urban evolution are linked by the things we create and therefore by design. Design can be seen as a mediator between humans and their environment; humans' evolutionary process, the evolution of human creations and design are intertwined in a simultaneous processes of change (Ihde, 1990). Lane (Lane et al., 2009) calls this interrelation as the *reciprocally principle*:

'... the generation of new artefact types is mediated by the transformation of relationships among agents; and new artefact types mediate the transformation of relationships among agents. In particular, the reciprocity principle implies that any causally convincing narrative about artificial innovation will constantly jump back and forth between transformation in the space of agents and transformation in the space for artefacts.'

(Lane et al., 2009:28)³⁸

Design can be considered as both a form of adaptation and a form of innovation. It provides constantly new tools and shapes which, in return change the environments we live in. In that process it changes us as people and our needs. Design has the ability to shape both humans and their environment, therefore it has the ability to shape a human's evolutionary path.



Figure 6: The history of Ford's cars

Design can also be interpreted as a reproduction process even if design has little or nothing in common with biological reproduction. Design can be seen as a way to intentionally replicate and adapt

something for a new purpose. As with reproduction, design is used as a method to achieve the next step of change. It is not related to the long-term time scale of evolution. Design, as with reproduction, is not *Evolution*, still both design and reproduction are part of different kinds of an evolutionary process (Marshall, 2009).

Designs can be reproduced, adapted and changed much quicker than humans' biology. One single human can produce dozens of different designs and, therefore, can create a motion of change faster than the biological one. Examples of the evolution of designs can be seen everywhere, from the design of cars, bicycles or planes. The evolution of design; its long-term changes can be seen in every tool used in our daily life and can also be seen in the designs of cities (Stedman, 1979).

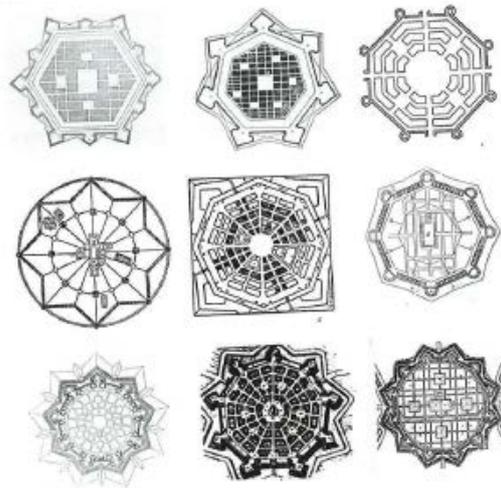


Figure 7: Ideal cities (Marshall, 2009: 78)

Figure 6 represents several representations of ideal cities which followed Vitruvius's first concept. As with the evolution of organisms, in the design of cities we can also see:

- a) Variation; Probably to address different needs and to adapt to different circumstances. Variation in the non-biological context is a product of ideas and human imagination.
- b) Reproduction; Reproduction in the non-biological context is related to the human capacity to learn from the past and from previous models
- c) Selection: Designs are selected according to their capacity to address a specific need. In the majority of cases form is either related to functionality or to aesthetics. The form which will best perform its function or that is most attractive will most probably be the selected one.

There are some common points between artificial and biological reproduction but the differences are also clear (Marshall, 2009):

- 1- There might be more than two sources of inspiration to create a plan or a design and they can be different in kind.

- 2- Each design is a consequence of a deliberate selection, innovation and variation. Its shape is designed to satisfy, in the best way possible, the requirements of the context and the function of the object of design.
- 3- The selection can be made between several specific and very distinctive designs.
- 4- Not every design needs to be built to be successful and represent a source of inspiration for future designs. An example of that are the diagrams of Ebenezer's *Garden, City* or Le Corbusier's *Ville radieuse*.

Both, looking at of the role of design in the evolutionary process as a form of adaptation or as a form of reproduction, open doors to conceive design as a relevant tool to shape, guide and speed up humans evolutionary process (Verganti, 2009). On the one hand, design can be used to create great variation; it can combine ideas which might even not be directly related and create new things from that. Design can adapt old things to new uses and imagine completely new ones. Design can be selected and adapted to new uses without having to implement all options first.

The literature review suggests that design and artificial selection have the potential speed up and redirect the path of change. Nevertheless, questions may arise related to the scale of the designs, their function and to how to relate design as a short-term interventions in the urban environment with long-term changes.

With regards to the design scale, from the evolutionary perspective, designs echoes the concepts of emergence, referred earlier in this chapter, and incorporates both the notion of a natural and artificial city. Small scale designs, as most bottom-up interventions, are normally focus on the short term and the self, like the design of a single family house or a shop. Like all small scale interventions they easily merge with the natural development of the city. They contribute to the continuity or urban change and they influence the path of human and urban evolution un-intentionally; they go with the flow. Larger scale designs, like most top-down interventions are normally more focused on the common good and emerge from long term visions for a better city. These designs aim to change human and urban development intentionally. As argued before due to their scale and their short time of implantation they normally create abrupt change in the urban system (Abercrombie, 1933; Mumford, 1938; Hall, 1988).

The research argues that Design, regardless its scale and origin is a short term action and its long term consequent changes in a complex system such as the city, are unpredictable. Short-term changes and urban development is related to long-term visions for the future. Specific short-term and local actions or interventions – as the design of a home - might be intentional and targeted to adapt to a new situation, but in general terms they do not have long-term intentions or take the whole into consideration. In this context, even if design is by nature intentional, the overall outcome is still unpredictable and therefore emergent as any other un-intentional bottom-up intervention. From the perspective of emergence and evolutionary theory, it is not relevant which processes took place to

achieve a large scale or a long-term change, because change, or the direct processes which induced it, might not be connected with the overall effect; the overall outcome of an intervention, regardless of its design or not, is unpredictable (Marshall, 2009: 172).

Even if the long term result is unpredictable, design can serve as landmarks in the evolutionary road-map to guide the evolutionary path, as short-term steps define a direction of change. Design can be therefore used as a top-down method to influence long-term urban and human change. Design or any other short term intervention will not determine the end result of an urban area, but they serve as stepping stones to guide the path of urban change towards a sustainable direction. In short, design can be used to shape human intentions for the future

“Design is the term we use to describe both the process and the result of giving tangible form to human ideas.”

(Peter Lawrence, in Ehrenfeld, 2008:157)

It relates the present with the future (Banathy, 1996); it relates short-term actions with long-term intentions. Therefore, the quality, the scale and the adequacy of a design can have an influence on the direction human evolution might take. To design sustainably is a key factor for healthy human and urban evolution. Because of this, in chapter 6 the thesis explores a framework to inform *artificial selection* and *design* or human interventions (EIMS). The framework aims to help designers and decision makers to relate short-term actions with long-term intentions and therefore help them to select and design more adequate interventions.

Summary and discussion

Implications for urban management and urban design

Part two of chapter 3 describes different ways to relate evolutionary theory with urban evolution and the evolution of human creations (Verganti, 2009). In general, evolution implies the existence of functional order without anything or anyone planning it. It implies that continuous change and adaptation to circumstances will lead to a great variety of form in the long term, each one fully adapted to the purpose and the environment that stimulated their emergence in the first place. This process of change is in response to a need and an environment, therefore things seem to be designed in a way that they are fit to serve a specific purpose. This continuous purpose of change does not have a long-term goal or a supreme form to be achieved. It is just a continuous symbiosis between a cause and an effect that travel through time together and shape the complex and diverse world as we know it.³⁹

The literature suggests that design and artificial selection serve as a mediator between humans and the urban environment; human actions are the link between human and urban evolution. In light of this design can be described as something related to artificial selection and as both a form of adaptation and a reproduction strategy. In addition, design can be seen as a tool for innovation (Verganti, 2009) and as a short-term local action that can define long-term changes in the system.

Scale of designs, can be related to the concept of the *natural city* and continuous emergent change. Large-scale designs can be related with the concept of the *artificial* – top-down – city. They refer to intentional shifts in urban evolution and with urban discontinuity.

The research argues that designs are short-term interventions in the urban environment and should have a common long-term intention for the sustainable urban development of the urban system. If the design's process of variation, reproduction and selection emerge from a common long-term intention for the future, people might be able to optimise our actions and move forward faster in a specific developmental path.

The intentionality from which a design emerges raises discussions in the academic world. First, as we have seen in the context of complexity sciences, regardless of the intentions behind human actions, the reactions of urban complex systems are by definition unpredictable. The second reason is related to the fact that intentionality is normally dissociated with evolution (Stedman, 1979). The literature review will not explore this discussion in-depth because that would imply a deviation from the focus of the research and emerge in scientific fields such as philosophy. For the purpose of this research the relevant argument to keep in mind is that, as genetic manipulation, design and artificial selection can be used to manipulate or change something in the short-term with the intention to achieve or improve something in the long-term. In other words, if we regard cities as being a consequence of a process of evolution, we can use evolution to inform their ongoing planning and design. Design can be interpreted as a reproduction system or as a form of adaptation in the evolutionary process of non-biological things. In that sense, design can be used as a tool to influence short-term changes and, therefore, guide the process of evolution. In other words, designs can act as stepping stones to guide the process of urban development.

In the light of this, it is arguable that if the intentions behind the designed form are focused on long-term visions design can be used as an intervention to strategically nudge human and urban evolution towards a sustainable path (Banathy, 1996).

Chapter 4: Managing complexity, unpredictably and dynamic change

Introduction to Interventions Management and Design

Chapter 4 applied the conclusions extracted from chapter 3 to define strategic interventions management system and explore how it could be used as tools to nudge urban development.



Figure 8: Hilary Berseth made this sculpture with help from bees. He constructs a basic framework made of wire and wax, and the bees added their honeycomb. Like in the intervention management and design introduced here, the process takes time and the outcome is to a great extent predictable, at least on the short term.¹

Is there a need for top-down planning?

The relevance of nested hierarchies²

From the perspective of complexity sciences, the city emerges from systematic actions of individuals. In other words, urban system emerges directly from its individual parts and there is nothing in between the two. Authors such as Johnson (2012) define the city as systems, of a system, of systems. Portugali used complexity theory to illustrate that ... *“the city is a dual self-organizing system: each agent operating in the city is a complex self-organizing system on a local scale, and the city as a whole is a complex self-organizing system on a global scale”* (Portugali, 2003). Portugali defines a city as subsystem which is made up of other smaller subsystems and at the same time is part of a bigger system. Similarly, systems thinking theory biology and evolutionary theory teaches us that the equilibrium in self-organising systems is related to their scale (Wilson, 2011).³ From the perspective of biological sciences it is difficult to imagine a complex organism such as the human body operating directly from the individual work of independent cells. From an evolutionary perspective, large-scale organisations cannot be the direct consequence of self-interested individual actions. Multi-cellular organisms are structured in nested hierarchies; each part of the system is composed of lower level identical systems and at the same time is part of the higher level system (Miller, 1978).⁴ Such kinds of organisational structure is not only applicable to biological organisms but also to urban networks, social and political systems among others (Bretagnolle, et.al 2010).

The American biologist, James Grier Miller, (1978) long aimed to establish a common ground where scientific knowledge could be shared.⁵ For this he developed a methodology to look at living systems based on their hierarchical organisation. He was a pioneer in applying system's theory to human social realities. He related biology and evolutionary theory with human organizations such as cities. Miller used nested hierarchies to categorise systems, therefore he implied that higher and more complex hierarchies include and extend the simple and smaller ones.

“Cells are composed of atoms, molecules, and multimolecular organelles; organs are composed of cells aggregated into tissues; organisms, or organs; groups (e.g., herds, flocks, families, teams, tribes), of organisms; organizations, of groups (and sometimes single individual organisms); societies, of organizations, groups, and individuals; and supranational systems, of societies and organizations.” (Miller, 1978)



Photo courtesy of wikipedia.org

Figure 9: Matryoshka dolls

What is interesting in Miller's work (1978) is that he was able to relate different kinds of systems; such as biological, social or even systems of stars. Regardless of the variety of systems he could integrate in his methodology, Miller focused his studies on the subset of living systems - cells, organs, organisms, groups, organisations, societies, and supranational systems. This subset relates both biological systems with social systems which are the focus of our studies.

Miller emphasises the fact that neither the sub-sets nor the hierarchies of a system are rigid or fixed. They are just the result of a long scientific tradition of empirical observation of living systems. Still, these hierarchies could be divided differently.⁶ As Miller stated, one might choose to subdivide tissue and organ into two separate levels. *"Or one might, as Anderson and Carter have suggested, separate the organization and the community into two separate levels - local communities, urban and rural, are composed of multiple organizations, just as societies are composed of multiple local communities, states, or provinces."* (Miller, 1978)

When one establishes a subset and a hierarchical organisation of a system and its subsystems, comparisons can be made between kinds and levels of living systems. These comparisons can generate new information and alternative ways of looking at things. *Inter-level generalization*⁷ or uniformities across levels and across different kinds of systems can help us to predict and identify problems before they occur. The analysis of the subsystems and the relations between them informed the research framework and the step-by-step methodology suggested to analyse complex systems (See chapter 6)

In short, based on his studies, Miller argues that just as in the biological context, in the social and political context, individuals need to function in small groups which in turn can be organised to form larger groups such as cities, regions and countries (Miller, 1978). He defends the relevance of

integrative hierarchies for a system to flourish. Nevertheless, he argues that these hierarchies should be independent and self-regulated.

As from the biological perspective, evolutionary theory also justifies a hierarchical organization of society and the need for a top-down urban management system of some kind. The need for some kind of hierarchical organisation and control emerges from the hierarchical nature of organisms' adaptation. From an evolutionary perspective, local adaptations are a consequence of selection processes of the same hierarchical level. In the nested hierarchy model, higher hierarchies structure the ways the lower hierarchies organise and interact with each other. In other words, the lower hierarchy's general structure emerges according to the higher hierarchy's demands. Following the higher level demands, the lower-hierarchy elements self-organize in such a way that they are beneficial for the higher ones.

Making the analogy between human and other organism's mechanisms of adaptation, one can argue that public and urban policies, as well as economy, have to be structured hierarchically. Only then can individuals organize themselves within each hierarchy. It is futile to think that very high hierarchies such as a nation can regulate and manage the behaviour of individuals and induce them to cooperate and contribute to the common good.

According to Wilson, one of the problems of economy today is the fact that it misses intermediate links. It relies on individual choices to organize the world economy. In other words, the world of the neo-classical economics and the free-market is based on the idea that just like bees or ants, humans, simply by nurturing their self-interest, will inevitably build a society and its systems of human interactions. In this world-view, people just have to consider their own interests and their local environments to operate in a way which will contribute to the well-being of the whole. Just like the bee they don't have to have the whole colony in mind in order to add value to it. Nevertheless, reality has proven that good will is not enough and that regulations are needed to manage goods fairly among societies. People do not always put in practice the virtues needed for such a system to operate well without top-down external control (Ostrom, 1990). George A. Akerlof (Akerlof and Shiller, 2009), the 2001 economics noble laureate prize winner, refers to norms as the missing motivation for macroeconomics to work. But if economy is based on the complexity theory perspective of self-organization why does it need regulative norms? Most probably because it is not guaranteed that the well-being of the system emerges directly from the well-being of its individual parts.

Not only can economy serve as an example of the problems emergent complex systems can generate when left without hierarchical top-down monitoring and control. From the urban perspective, urban sprawl is another example of how individual choices can harm a city as a whole.

In short, from the evolutionary perspective letting an organism self-organize without any monitoring from the top-down, or from the *higher hierarchies* can have negative outcomes, which we

cannot predict. What we know though is that phenomena such as adaptations and cooperation are related to scales (Ostrom, 1990), therefore, we suggest the need to create a regulatory system which is hierarchical, which nurtures the self-organisation within each hierarchical level and that establishes the ground for cooperation to emerge.

This regulatory idea is in a way contradictory to a self-organising and the emergent view of the world. Nevertheless, in the *evolutionary paradigm* there is enough space for the elements to self-organise and to emerge spontaneously, but self-organizations should only happen within each level. The elements within each level do not necessarily have to have the bigger picture in mind to act for the benefit of the whole.

“Adaptations at a given level of the hierarchy require a selection process that takes place at the same level... Higher level selection structures the lower level interactions to result in outcomes that are adaptive at a higher level. The final product is emergent, self-organizing and usually decentralised. The lower level units obey local rules, do not have necessarily to have the welfare of the whole system in mind, and don’t even require mind, (e.g., the cells in our body)... however, higher level selection is required to discover the local rules that don’t work” (Wilson, 2011: 353).

In other words, the biological and evolutionary perspective, argue that the city should be managed and organised according to hierarchical groups. Each element of the group should have the necessary freedom to self-organize internally and find its own role within the group and in relation to the whole. Lower hierarchical groups should be regulated by the needs of higher hierarchical levels. As in any biological systems, the well-being of the individual elements which compose the system are as relevant as the well-being of the system itself. Therefore, any sustainable management system needs to constantly operate across hierarchies and constantly relate higher and lower hierarchical organisational levels (Beck and Cowen, 2006). It is worthless to try to solve global problems without addressing local ones. It is impossible to reach global cooperation without achieving it at a local level (Miller, 1978; Beck and Cowen, 2006; Wilson, 2011). Empowering and nurturing the small groups is therefore as important as empowering and nurturing the larger ones (Wilson, 2011: 36).

Do humans need norms and rules to cooperate?

Evolution is related to change and to the relationship between organisms and between organisms and their environment. It is about adaptations not about good or bad. There are those, like bees and ants, who profit from cooperation and those who profit from being what we call *selfish* (Wilson, 2011).⁸ In the human population we have both. Generally speaking, we cooperate when it is in our interest to cooperate but, according to the circumstances, being selfish might prove to gain more advantages, at least at the short-term.

“Evolution has no foresight. Genes and beliefs alike spread on the basis of local advantages, no matter what the consequences over the long term. Sometimes they spread by virtue of benefitting individuals compared with their immediate neighbours, sometimes by benefitting groups compared with other groups, and so on up a multitier hierarchy of groups.”

(Wilson, 2011: 353)

Both forms of adaptation have strengths and weaknesses: Cooperation generally does not maximise individual advantages relative to the group while *selfishness* might (Gibbons and Sherratt, 2007).⁹ Cooperation tends to maximise the well-being of the system as a whole. One of the reasons humans developed so fast as specie is exactly due to our capacity to cooperate. Individuals can learn and develop alone, but cooperation makes one able to profit from the achievements of many others and that makes us develop much faster. Besides that, cooperation is essential in the organisational system, such as the one described above. First, only through cooperation can individuals self-organize within and across hierarchies in ways that are both beneficial for themselves and for the system. Cooperation aligned with individual autonomy within hierarchical groups enables individuals to find their own position in relation to the whole, maximising their individual contribution. Second, cooperation is essential for solving complex problems; it is essential for the nurturing of the process of creating variation and selection at group-level.

Creating the environment for cooperation to emerge

People have a natural capacity to care and cooperate (Ehrenfeld, 2008); nevertheless, this natural capacity is related to the scale of the group (Smith, 1776)¹⁰; it requires a different psychological setting to cooperate and help your colleague or friend to that of helping the unknown child who is being exploited to manufacture cheap clothing and shoes. Morally one might even feel bothered by the idea, but between this uncomfortable feeling to the decision of changing everyday life choices there is a great distance.

“our minds are already equipped to do these things (Cooperate) spontaneously at a small scale when appropriate conditions are met, but tweaking is necessary for the same process to take place at the larger scale or even at a small scale when the appropriate conditions are not met.”

(Wilson, 2011: 366)

Elinor Ostrom (1990), the economics prize winner in 2009, made a rigorous study of several police departments and proved that smaller units normally are better integrated within their communities than bigger ones and they are normally able to respond to the community problems more promptly and adequately. She also showed that the scale of such organisations should depend on the

services they provide and that each organisation should be studied case-by-case. In her studies about water management, Ostrom based her argument on the importance of decentralisation and emergence, but she also argued that positive emergent behaviours did not always arise spontaneously. They were a consequence of very structured interactions at a local level and conditions for this positive cooperation to arise had to be intentionally induced in some cases. Still, *“once the local rules that do promote the common good are winnowed from those that don’t... then the common good indeed emerges from individuals who not necessarily have the common good in mind”*.

(Wilson, 2012: 377).

Both Wilson and Ostrom argue that cooperation is more likely to emerge in small social groups and when appropriate conditions are created. So, how can we establish the ground for cooperation to emerge? How can a complex organization acquire values if it does not have them in the first place?¹¹

Wilson suggests that social groups need a *Mind*. For him, only some kind of regulation system can create a social environment where cooperation can emerge and keep that environment healthy. Wilson suggests that social groups need to establish an intention or purpose for their existence which justify and guides their actions.

According to Wilson, *Norms* can help a great deal in the establishment of human cooperation. Norms can be used to “monitor” people’s good will and to give group moral and ethical values. Values and trust are a powerful structure and give a group identity therefore they are essential to create the conditions for cooperation to grow. Wilson suggested some general norms promoting critical engagement in dialog and respect for the common good.¹² Nevertheless, he builds on Ostrom’s (1990) findings to establish the required ingredients to manage common good.

Ostrom’s studies helped define the key elements needed to structure any group which requires coordination and cooperation. As result of her studies, Ostrom draws some suggestions to enable groups to self-organize and manage their own affairs successfully:

- Clearly defined boundaries.
- Proportional equivalence between benefits and costs.
- Collective-choice arrangements.
- Monitoring
- Graduated sanctions.
- Fast and fair conflict resolution.
- Local autonomy
- Polycentric governance

According to Wilson, if you follow Ostrom’s recipe you will succeed in creating a cooperative group able to efficiently address complex problems.

Creating the environment for innovative solutions to emerge

An adequate problem solving process as suggested by evolutionary theory can be summarised as following:

- Firstly, monitor the area and the problem and gather as much information as we possibly can. For this, Wilson suggests a kind of urban *nervous system*; a single integrated database which help us to understand the city as a whole.¹³
- Secondly, establish the consensus that there is the need for a certain change so that, it becomes each individual's decision and not someone else's.
- Thirdly, establish the aims of the change in conformity with the common good otherwise cooperation won't emerge.
- Fourthly, establish an incentive system for bottom-up solutions to emerge. This can be either achieved by means of norms or compensations. As we previously argued, our minds are already equipped to cooperate when they operate in small groups. But most of the time, especially when we deal with large groups or with concerns that don't affect the participants directly, the appropriate conditions for cooperation and positive change have to be intentionally facilitated.

Ostrom's studies proved that by following such structure individuals or groups of individuals can design solutions for their problems (create variation) and decide (select) which are the most appropriate to implement. The findings extracted from the literature review suggest ways on how to organize top-down management systems, but it also offers the ground to act in social systems more adequately and monitor their changes. Once put in practice, the interventions which best addresses the problems will be the basis for new designs, new ideas and new interventions in the future. This gives evolution its continuous character which in turn gives people a sense of belonging and of commitment.

Sense of belonging and commitment are ingredients of great relevance to engage people to participate actively in making their own environment and as grounds for cooperation to emerge (Wilson, 2011).

Nudging change as a new approach towards urban planning

Richard Thaler and Cass Sunstein (2008) argue that humans, through their innate characteristics and influences from their social environment, do not always take the most optimal decisions. In light of this, they suggest the need for a top-down *tweaking* of social dynamics to induce change when

needed. Wilson (2011) goes further and says that *tweaking* is a necessary measure to manage a complex system such as a city.

Tweaking can be interpreted as the use of small interventions to nudge or adjust complex systems in order to improve them (Banathy, 1996). Nudging change is a powerful and very relevant concept from both systems theory and the evolutionary perspective. This concept grounds both a vision for a more optimal form of urban planning and the research framework used to analyse complex systems and intervene in them more adequately. The concept of nudging change as an approach for a more sustainable urban planning is the basis of the research's *Exploratory Intervention Management System* (EIMS); the model tested as a framework in the research's case studies.¹⁴

Nudging change as a way of urban management implies that the purpose of city planning and of top-down interventions is to generate an urban form which is better than if there was no intervention in the first place (Hall, 2002: 3). This does not necessarily mean the depreciation of individual initiatives in the city. It can simply mean the identification of synergies between people and between people and places and unlock them intentionally, whereas naturally they could take longer or be difficult to emerge. To unlock those synergies, we suggest the use *strategic interventions* in the urban environment.¹⁵

According to Wilson (2011), one can nudge social dynamics and unlock unwanted synergies not only by monitoring and empowering individuals and groups but also by changing their environment. Wilson study shows that when an environment changes, social change happens very fast and spontaneously. These findings support the idea that design can be used as a *strategic intervention* or as a tool to manipulate change in the overall urban system.

According to Marshall (2009) there are two ways of unlocking unwanted synergies: First is the proactive way of generating interventions which would be unlikely to arise from one individual or without coordination. An example is where an organization might design, coordinate and build a bridge, a school, a hospital, etc. Top-down interventions do not have to be necessarily big; they can be just the placing of traffic lights at the crossing of two streets, for example. Still it requires an analysis of the city from the perspective of the community rather than the perspective of the individual and requires the coordination or a group effort.

The second possibility is to intervene in the city to avoid emergent negative effects which can naturally emerge if people are left to act as they wish. An example of this is the emergence of ghettos, human segregation and sprawl (Batty, 2005).

Urban management and planning is not just a matter of designing the city; it has other physical and non-physical aspects and consequently other instruments which can be involved to manipulate change.¹⁶ City management and planning include economic, political and cultural aspects of a city. It includes the management of both the natural and the built environment as well as the networks people use to relate to each other and the place they live in.¹⁷ The vision people have of the city is mirrored in the built environment and in their economic and political strategies. It is also mirrored in the culture

and belief systems of a society. Together, these aspects of urban life make up the city as we know it, therefore, any change in one of these aspect of urban life, will change the development of the city as a whole. In other words, all aspects of society could be used as the source of strategic urban interventions; they could be used as instruments to nudge change responding both proactively in society as well as gently nudging change to avoid urban and social problems. In this research we will focus on the *design of interventions in the built environment* as a catalyst for change.

According to the evolutionary paradigm there is no correct way of intervening or designing the city. There is also no way to know in advance the effect an intervention will have in the urban environment. Solutions are contextual; they depend on specific protagonists and their environment; therefore, it is difficult to argue that one urban model is better than the other. In the light of this, rather than a manual on how to improve an urban system, the research suggests a way to approach it. It suggests that urban planning can become a more sustainable and resilient practice if it nudges, manipulates, triggers or influences change in the city rather than imposing it. The idea is to give change an open end and to be flexible to be able to deal with its unpredictability.

The research does not imply that there should be no planning. As we have seen, evolutionary sciences defend the need for some kind of top-down control. Ultimately, there is always the need to coordinate the design and building process of constructions of all scales, such house blocks, streets, squares... What the research implies though is that the emphasis should switch from the finished grand scale design towards more generative forms (Portugali and Alfasi, 2007). For example, a city counsellor can approve a division of land and legalise the urban ground in a way that social housing will naturally emerge. This approach is fundamentally different than designing and implementing a social neighbourhood as a finished form.

The *nudging approach* should not be restrictive or impose directions of development, in case there is no risk of emergent urban dysfunctions. It should rather be supportive of self-organisation and the forms that emerge from that. In other words, the aim should be to support the emergent urban structure to perform better and to improve its living conditions rather than draw a path of development (Marshall, 2012).

Similarly, one should also take into consideration the time scale and the relationship between our proactive actions with the natural response of the city. It does not make sense to build a vast finished network and wait for individual actions to fill in the empty spaces. This could generate abandoned unfinished streets amongst other urban problems. The idea is to stimulate something to happen and then respond to the natural reaction of the city, whenever it will happen and if they happen.

In short, the encouragement of nudging change as a continuous process parallel to the natural urban evolution can be a way to address the unpredictability and uncertainty of the future (Marshall, 2012). One cannot know today what the desirable city of the future will be, therefore, rather than shooting in the dark and designing what Marshall calls, *a hopeful monster* one should acknowledge

what is done well and the needs of today. Again, this does not imply the end of urban design and of the emergence of new ideas for what the future city should be. What it implies is that non-continuous change, even if it apparently can be seen as a proactive way of *'taking care about the future'* is actually more risky (Portugali, 2004); It is more difficult for something completely new to find solid grounds to emerge and humans normally need time to adapt their daily habits to completely new urban structures (Marshall, 2009).

The emphasis on urban planning as a process rather than a finished design has to do with the difficulty of choosing the right path of change in such unpredictable grounds. Master plans would only make sense if we were to know the optimal form of the city in the future, but we do not. When we put a master plan in place we expect it to function well and to need just final adjustments and minor adaptations. Nevertheless, the essence of the so well-intentioned plan might not be able to support urban change and human life as it was initially expected. For this reason rather than having one single target form of the city it is better to have an open end; *'... the well-intended targeting of a precise optimal outcome may be no better than choosing an incremental approach which is still very likely to reach roughly the same kind of form, but which may more surely maximise the change of each intermediate step being viable and adding immediate value'* (Marshall, 2009:267).

Do we have to fully understand complex systems to act on them?

Even if during the 20th century science moved to a "higher threshold", in the sense that theories tend to deal with new orders of complexity, people still fear uncertainty and might therefore believe that its needed fully understand complexity to be able to deal with it. From the perspective of city planning and city management one might fear that without fully understanding the complexity of the city we won't be able to properly manipulate the path of its development. Because of this there is the tendency to neglect the city's complexity, and therefore, continue to approach the urban form from a rather simplistic perspective (Ehrenfeld, 2008).

The fact that the complexity of the city cannot be fully understand does not mean we cannot deal with it. People deal with complex systems on a daily basis. Intuition and common sense are the tools we use to navigate in this complex world without even being aware of its extreme complexity (Berkes et al., 2000). A five-year-old child is probably able to read the time on a normal watch, which does not necessarily mean that the child or even most of the grown-up population is able to understand how the watch works. What matters is the fact that we know how to use it and that it helps us navigate through the complex world we live in.

Just as the clock is an abstraction of time there are other tools to help us to deal with urban complexity and dynamic change. Models and computer graphics are abstractions of reality which we use as a tool to help us operate in a complex world. They are often used as tools to support urban

design and management. These models are not reality they are visualisations and simplifications of it (Batty, 1994; Alexander, 2003; Portugali, 2012). As with the clock they cannot help us to fully perceive and understand the implications of our actions and the complexity of reality: The notion of *time* is much bigger than what the watch can show us. The notion of *city* is much more than models or computer simulated realities can give us. Because models cannot show us the reality in its wholeness, managers and designers need to deal with the real city as the object of study.

Humans are a product of social and urban complex systems and therefore are used to deal with complexity on a daily basis. People constantly intervene in the urban system without fully understanding it. Because people make part of the urban system, they know that certain behaviours are more probable than others and that some interventions are more adequate than others. Traditional and emergent knowledge are examples of our innate capacity to intervene in complex systems.

Simulation models help us to intervene in the urban system by showing us possible scenarios for the future. Practical and traditional knowledge show us how the urban system reacted to certain interventions in the past. The varieties of ways humans address their everyday challenges in different environments act as a library of information. They can inform us on how to deal with the complexity of social systems and with dynamic change. According to Gunderson et al. (1997) they have the capacity to relate the past with the present and re-establish resilience.

“Traditional knowledge may be holistic in outlook and adaptive in nature, gathered over generations by observers whose lives depend on this information and its use. It often accumulates incrementally, tested by trial and error and transmitted to future generations orally and by shared practical experiences.”

(Ohmagari and Berkers, 1997, in Berke et al., 2000)

Combined, simulation models and traditional and emergent knowledge give us valuable recourses to act adequately in urban complex systems and create change across its different hierarchal levels (Gunderson et al., 2002).

In light of this, there are three relevant arguments related to new forms of urban planning which are important for this research:

First, is the fact that humans have the capacity to deal with complex systems without fully and rationally understanding them.

Second, is that there is relevant knowledge generated by every-day-practices and by traditional knowledge which needs to be considered.

Third, models, digital or not, can help us look into the future but they are abstractions of reality.

Because of the fact that we cannot fully understand complexity and dynamic change in complex systems due to their unpredictability there is the need for an adaptive kind of management system (Gunderson, 1999). Due to the complex and unpredictable character of urban change, urban management has to be a continuous process; a continuous dialogue between designers, policy makers

and the city. It has to be a process of action and reaction because only then we can deal with uncertainty and unpredictability efficiently (Portugali, 2004; Portugali, 2008; Marshall, 2012). The kind of management we suggest has similarities with *Adaptive Management*.¹⁸

Relating the *intervention management system* to governance

Following the research's hypothesis, the research suggests managing the complexity of urban change through the management of interventions in the city. This approach towards urban management is denominated in this research as the *Intervention Management System*.

Termeer (2010) compared three main orientations of governing in terms of paradigm, scale definition, problems definition and dominant responses. The kind of management system we are suggesting in this thesis (*Intervention Management System*), even if it has a lot in common with adaptive governance in terms of structural organisation, differs largely in terms of focus. The kind of management suggested here focuses on the management of interventions in an adaptive way.

Even if the focus of this research is on human actions rather than governance, there are some shared challenges with adaptive governance. Namely the fact that for such an adaptive response to work, top-down forces need to quickly form an *action group* and gather strategic actors to address a given problem. In other words, the system has to be able to identify and collect the individuals needed - from within and across the hierarchical levels of the system - to efficiently address a given problem. For this, human cooperation and flexibility is put to the test. Adaptive research faces challenges related to finding the right collaborations; the right cross-level and cross-scale cooperation in order to address a specific given problem. Therefore, one expects the same difficulties in the kind of management suggested by this research.

In light of this, in chapter 6 the research proposes a tool to help relating issues with relevant scales or levels and aspects of society; a tool that serves to cross information across different actors, different scales and different levels of social organisation. And, above all, that relates human actions and design to adaptive management and to complex social inter-relations.

It is relevant to emphasise the fact that there is no one simple right way of managing complex systems. Adaptive governance might not always be the most appropriate strategy. Governance is very much related to history and culture; therefore, different kinds of governance are appropriate to different places. *Monocentric governance* and *multilevel governance* can add relevant insight in terms of strategies and the notion of governmental scales. Nevertheless, the research argues that the embracing of the unpredictable character of change is the path for more resilient management; therefore, adaptive management is a management approach that deserves serious consideration.

The exploratory tool we explore in chapter 6 (EIMS) is not related to one kind of governance. It aims to relate human actions with aspects of society and the individuals that both can address a certain

problem and suffer from it. EIMS is a tool to support the creation of strategic human actions within all kinds of governance. The research argues that regardless the issues related to each form of governance and the eventual mismatches of governmental scales, informed human actions have more potential to nudge urban change towards a sustainable path than uninformed ones.

Fundamental principles to plan and manage dynamic and unpredictable urban change

Most of the authors mentioned in this thesis defend a management system based on the process of change and argue about the importance of respecting tradition. Both evolutionary science and complexity theories emphasise the relevance of proceeding by small steps and avoiding surprising novelties. Both scientific fields agree that individuals should be given the means and tools to actively building their own city (Marshall, 2009; 2012).

Taking into consideration the dynamic and unpredictable character of the city Marshall (2009: 270-279) suggested five principles of managing urban change sustainably. These principles resume part of the arguments brought forward by the research serve to illustrate the complexity around their implementation:

- Make each step viable now
- Proceed by small steps and avoid leaps in the dark
- Avoid suppressing ‘unsolicited novelty’
- Discard moribund models
- Dissolve decision-making

In addition, evolutionary theory defends that a sustainable self-organisation system should be structured hierarchically and supported by some kind of norms or regulations. Such regulations should establish the grounds for cooperation and for ethics to emerge.

Make each step viable now

Interventions in the urban fabric should be valid from day one and land should not be sacrificed especially if the system is functioning well. This statement is prescriptive but open at the same time allowing relevant urban protagonists to focus on issues which might not be a priority for the wellbeing of the public. Marshall’s statement accommodates different perspectives on what quality of life is and the meaning of a “well-functioning social system”. Some might argue that a system works well because it is safe and clean other might argue that the same system lacks social interaction. The

interpretation a “well-functioning social system” defines the political strategies designed to intervene in the city; therefore, they define the city itself.

In addition, Marshall suggests that each intervention should only be considered finished when it is fully operational otherwise it can create problems. Nevertheless, it might be necessary to reflect on the ways feasibility is achieved, not only in terms of constructions and operationally but also in terms of adaptability to an uncertain future. One should also consider who it will benefit from the structures built, both on a short term and long term span.

As argued in chapter 2 and 3, buildings and infrastructures should be integrated with existing ones so that together they should form a whole (Portugali, 2004; Portugali and Alfasi, 2007). But is this argument always so straight forward? The question lies in the meaning of “finish, fully operational interventions” and on their ability to establish a coherent ground where innovation can emerge. There are also questions on the nature and scale of such interventions. Interventions in the built environment, regardless of their scale are not and should never be considered as finished; buildings, neighbourhoods or cities constantly improve, change and add things to adapt to new users, to human interrelations and to new relations between people and their environment. Fast growing cities are typically a permanent “construction site” nevertheless, such urban settings might allow for more wealth, which people might find a reasonable price to pay for the inconvenience or the unpleasant character of the city. Still this situation is not optimal in terms of social cohesion. As argued by Marshall, building a coherent whole not grounded on the present might be dangerous; nevertheless, others might argue that eventually unfinished structures can offer the grounds for innovation to emerge.

Proceed with small steps and avoid leaps in the dark

‘... avoid urban interventions that are either too novel – too great departures from existing known, tried and tested formats – or that are applied at too large a scale, or too suddenly, in such a way that the urban system around it has no time to adapt.’

(Marshall, 2009:271)

According to Marshall, greater leaps in novelty might be put in practice successfully in the smaller-scale increments. In other words, instead of building housing as a grand-scale plan (where no one is sure if it will work) one can choose to build each house independently. Then each designer or user can have the freedom to experiment at their own cost. That experiment can in the future be the grounds for new housing typologies but has already been tested and is therefore not a leap in the dark.

An example of this approach is Ijburg in Amsterdam.¹⁹ Ijburg it is an open-ended unfinished structure from the start. Islands are planned, plots are divided before or at the same time that contractors and buyers express their interest. This is only possible with accurate knowledge of the urban demands and by the means of technology to foreseen possible scenarios of use. Nevertheless,

the initial sterile land opens doors to imagine the future and test innovations. Its success lies on its proximity to the well-established old city, and the scale and diversity of the interventions.

Search for innovation but avoid suppressing “unsolicited novelty”

One might even consider making things differently but might be discouraged by restrictions and regulations, fixed design standards or simply by a short-sighted view of the ones in power (Friedmann, 2011). These issues might block creativity and innovation.

From an evolutionary perspective one should be sensitive to spontaneous emergent novelty instead of discouraging it. Functional novelty should be proactively supported and encouraged. Not novelty for the sake of it but functional novelty borne out of necessity can represent new and better ways of doing things.

Both Marshall and Loorbach (2007), argue that there should not only be the nursing of functional novelty but also an active search for it. From the perspective of transition management, innovation and creative ideas emerge and thrive more during periods of instability and transition; Innovations are a result of the response to specific problems people face and the way they overcome their difficulties. The strategies tested under these circumstances might even bring the solutions to worldwide problems humankind faces today. In other words, a new kind of urban management should look for new ways individuals respond to their aims and needs and consider whether their ideas, strategies or designs could be translated into urban interventions and therefore be applied for the benefit of a broader public. Small individual ideas or interventions might inform new ways of green mobility, improve general health or store energy.

A new kind of urban management should not only look at new ways of using emergent novelties but also consider past ones (Berkes et al., 2000). Eventually innovative interventions might emerge from the combination of the two. The general argument is to emphasise the relevance to reach for novelty and exploit its potential to serve a broader public.

Discard moribund models

‘If something doesn’t work, it will be ‘found out’ sooner or later. If no one wants to shop in the city centre, or sit outdoors chatting or playing chess, but people prefer to shop out of town and chat or play chess over the internet, then this may or may not be a matter for regret. But trying to restrict shops to the city centre, or contrive public vitality will be fighting a lost battle, unless – which is quite possible – people would actually wish to do those things.’

(Marshall, 2009: 274)

The idea is to allow emergent large-scale and long-term models to evolve rather than trying to force the urban form to follow our preconceived models. Following this, visions of a future city such as the ones expressed in zoning models or master plans should be disregarded. Instead of defining how things have to be a new kind of planning might better just say, for example, that heavy industry is not to be placed near housing and leave open all other possible emergent forms of organization. As stated previously, the idea is to stimulate development rather than imposing it (Marshall, 2009: 274).

In addition, as argued in chapter 3, interventions related to human needs or to the basic elements of the urban syntax can be regarded as a valid urban building block which can be strategically used to create emergent social and urban organisations. This principle implies a moral judgment of the path we aim to follow as specie in relation to what we consider to be a “moribund model”. For example, many argue that the use of smart phones and the internet is changing the way people socialise and have fun and this has consequences on the way we use the built environment. In light of this phenomena, should we consider a human physical interaction a “moribund model” or something worth preserving?

Dissolve decision-making

Marshall argues that individuals, local organizations and groups should be empowered. Attempts have been made in that direction in Europe. Nevertheless, until now in most cases we have consented to a kind of decentralisation of power where the responsibilities were decentralised but were not followed by legislation nor by economical support.²⁰ The empowerment of the individual and local organizations should be part of a new framework of thought and can only work when collective efforts are made in that direction. According to Marshall (2009:275), there are at least three good reasons for devolution.

The first has to do with democracy and giving back the people the responsibility of their own lives and choices.

The second has to do with diversity; diversity of choice but also diversity of solutions.

The third has to do with being better fit for purpose. It has to do with finding the best solutions to solve specific problems.

Devolved decision-making would mean giving people more freedom to do what they want with their private properties as well as to use abandoned spaces to serve their needs. In other words, this new kind of management imply that planning permissions should be more sensitive and less restrictive regarding individuals' initiatives. Nevertheless, such freedom should be followed by norms and rules to control public health and guide human cooperation.

Generally speaking, today planners and policy-makers try to block individual initiatives or adjust them until they fit the norm; they try to manipulate them until they can be integrated to the grand-plan of the city (Lang, 2005). The focus is then on blocking emergent ideas and creativity

rather than nurturing them. The emphasis should shift from blocking individual initiatives to nurturing them. Not giving permission to build something in the urban area should only happen when the object, for some reason, creates problems for the neighbouring surroundings. In other words, in this kind of urban planning, rules related to aesthetics and functions, percentage of ground use, the pre-definition of what a house is or the space which implies such use and so on, should not be used to stop the building activity per se.

Chapter summary and discussion

Chapter 3 elaborated on how complexity and evolutionary theory suggest a kind of urban planning focused on guiding the process of emergent change. Such management should offer the grounds for cooperation and self-organisation to emerge within and across the different hierarchical levels of society. The literature suggests that top-down interventions might be needed to guide urban development; nevertheless, they should be discreet and disturb as little as possible well-functioning emergent social organisations. The kind of management suggested in this chapter nurtures emergent forms of organisation and emergent innovations. In addition, it describes a frames design and artificial selection as tools to relate short-term actions with long-term intentions for the urban system.

The approach towards planning suggested by this research is in line with Marshall's (2012) and Portugali's (2012) suggestions for a sustainable planning strategy. Portugali suggested an alternative urban management process, one which allows bottom-up interventions to have the same impact on the city as top-down ones. He called it *planning hermeneutics*. His strategy implies a true public participation in the building of the city and a true planning democracy. Portugali's suggestion in the context of urban planning has profound similarities with Loorbach's (2007) strategies to manage transition in complex systems. The similarities of the two approaches are visible even if these explorations emerged from completely different areas of research; one emerged from complexity theory in the study of cities and the other from governance. In this research we did not approach the topic of urban planning from the perspective of governance and an institutionalized management processes. Nevertheless, we argue that strategies like Portugali's planning hermeneutics and Loorbach's strategies for transitions in complex systems facilitate the self-organising character of urban systems and give a voice to relevant bottom-up interventions (Friedmann, 2011). Nurturing emergent development improves governance in general, regardless of whether it assumes an adaptive, a monocentric or a multilevel approach (Termeer et al., 2010). The models and strategies that emerged from such studies can be seen as interventions in institutionalized systems which improve the systems functioning and prepare them to deal with change and complexity.

Adding to the basic concepts implicit in the above arguments, the research suggests a kind of urban planning focused on the management of human actions. The research argues that the design and selection of interventions in the urban environment can link short-term solutions with long-term intentions. It suggests that the design and artificial selection can be used as tools for the creation of adequate interventions; interventions able to intentionally guide the process of urban development towards a more sustainable future. The research calls this kind of planning “*Strategic Intervention Management*”.

Following this, chapter 5 will explore the meaning of *interventions* and the ways they could be used to strategically guide urban development.

Chapter 5: Categorising Interventions

The role of human interventions in urban change

Chapter 5 explored further the notion of interventions. It explored their nature and different ways they could be materialised. Chapter 5 builds on the findings of the previous chapters to categorised interventions. It contextualizes *strategic interventions in the urban environment* in the broader context. It synthesizes objectives 1) 2) 3) 4) 5) and 6) in the context of interventions as catalysts for urban change.

Introduction

Chapter 1 introduced this research as an exploration of a new kind of urban management; a management focused on the design and selection of intentional and strategic human actions. It also introduced the notion of *interventions*. Chapter 2 described the research's understanding of the city and chapter 3 used complexity and evolutionary theory to justify concepts and arguments introduced in the previous chapters and to define a new kind of urban management which was introduced in chapter 4. Chapter 5 we will explore the meaning of interventions and how can they be used to influence urban change.

Chapter 1 argued that a key aspect of interventions and the reason why they are so relevant for this research is their potential to induce change. The word intervention comes from the Latin word *intervenere* which means “*to come between*”. It implies an action or a happening which modifies the natural course of things. *Interventions* modify the present and become the grounds from where new ideas and new actions will emerge; they define future realities. In other words, interventions in the city morphology or in the city life emerge from a process of urban change and influence the direction or character of that process. Complexity and evolutionary theory explain how interventions can be seen as part of the urban evolutionary process and therefore is interesting to explore ways how can they be used as tools to guide urban change. The research frames *design* and *artificial selection* as key human interventions that can be used as catalysts for urban change.

The literature explored so far opened the door for the conceptualisation of a dynamic and adaptable kind of planning; a kind of urban planning that acknowledges human and urban evolution as two interconnected processes of change and places interventions as the link between them. This research explores the hypothesis that interventions can be used intentionally to address urban and social problems. The literature suggests that in a complex system such as a city, an intervention of

whatever kind has the potential to change the system as a whole and therefore can be used to address urban and social challenges. Urban problems emerge from the complexity of the city; they are interconnected in extremely complex networks of relations. Addressing a problem might create other problems which one was not aware of. Rittel and Webber coined these problems as *wicked problems* (Rittel and Webber, 1973). *Wicked problems* are characteristic of complex systems. They are by nature a consequence of other problems and they are always unique. There are no right or wrong solutions to *wicked problems*, nor can we predict the adequacy of our interventions in advance. Consequently, addressing such complex problems requires gentleness and humility and, above all it requires thinking in terms of process rather than about the finished form. As argued before, intervening delicately in a complex system to allow the community to adapt to change and to understand the possible unpredictable reactions of the system. *Acting small* is a way to test the system and identify unpleasant consequences before they take over the system itself (Beer, 1983).¹ Further interventions should be a consequence of the analysis of the reactions of the system. Urban design in this context should be seen as a process; a way to generate options based on a set of criteria which in itself is in constant mutation. This is the basis for a dynamic kind of urban planning;² a planning which emerges from a continuous dialog between human actions applied in the city and the analysis of the reactions of such system.³

There are many forms of urban interventions able to induce change to the development of a city. They can be related to the built environment, to the socio-cultural reality of the place, they can be political or economic. It can be a change in the in the legal system, a new subject at school, a commercial on the television... Even a letter can determine the character of a city forever (Morgan, 2008).⁴ It can be something introduced overnight or something introduced over several generations.

From the perspective of the built environment it can be something small like a bench under a tree in the main square or something big like a new university campus or a new residential neighbourhood. Interventions are of endless kinds but they all have in common the fact that they influence the path of change.

In short, intentional or unintentional, small or big, natural or artificial, all interventions have the potential to influence every element (and the relationship between elements) of an urban complex system, therefore they can change the system completely. Human actions and their consequences merge with the complexity of the city therefore they are to a great extent unpredictable. Due to the risk of undesired unpredictable consequences of human interventions, these should be delicate and seen as part of the process of urban change. This approach allows one to test the system reactions and adjust urban change continuously in an interconnected process of human actions and emergent urban reaction.

To understand better the meaning of strategic or catalyst interventions we need to categorise them and to define the ways in which they could be applied in a system. The aim is to identify and compare interventions as well as the possible changes they trigger. The categorisation established in this chapter emerges from the specific research context and from the literature review. The categorisation is structured as follows:

First level of categorisation of interventions:

- Interventions as actions or reactions
- Natural and artificial Interventions
- Intervention of events and of space
- Acute or chronic interventions

Second level of categorisation of interventions:

- Interventions according to time frame
- Interventions according to Intentionality
- Interventions according to where they were originated: Originated from the top-down or from the bottom-up.

Third we will focus on strategic interventions in the built environment.

- Isolated interventions or interventions in a system.
- Predictable and unpredictable.
- General and contextual.
- Hierarchies of interventions

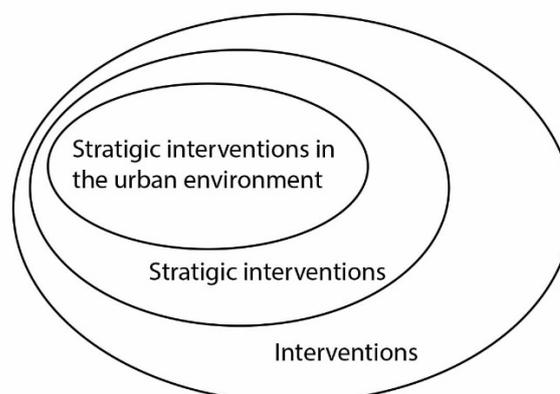


Figure 10: Main groups of interventions

General categorisation of interventions

Interventions as an action or a reaction

Interventions can be seen as both actions and reactions; one could try to differentiate intervention as actions from intervention as reactions by saying that the first implies an active attitude and the second can be seen as more passive; as emergent consequences of an active action. But this is not necessarily always so straight forward. For example, the civic centre and the heart of Aberdeen city, in Scotland, is Union Street (Morgan, 2008)⁵, which straight line cut across the existing medieval urban form, breaking its morphological continuity. Union street one of, many example in many cities all across Europe. On the one hand, Union Street can be regarded as an active action. Among other things, it was intentionally designed to produce urban change; to improve the transport networks in the city and consequently improve trade in the harbour. In fact, Union Street influenced the character, the life and the development of Aberdeen forever. On the other hand, even if Union Street is an active and intentional action it emerged naturally as a consequence of the circumstances and its specific context; therefore, it can also be seen as a natural reaction to challenges such as the traffic problems the city was facing at that time. Union Street was perhaps just the most obvious solution; it was a consequence of Charles Abercrombie's work who was already working on the roads system of Aberdeen. It is a direct response to the specific needs of the city and a mirror of the ideas and concepts popular at the time. Union Street can both be seen as a consequence of the circumstances and an active and intentional intervention.

From the perspective of predictability, one can argue that in the short term Union Street was a predictable reaction to the circumstances but in the long term it was impossible to predict the development of Aberdeen city; therefore, impossible to predict the need for such massive construction.

As argued in the introductory chapter interventions emerge from a given context and become part of it, forming the base from which new interventions emerge. In other words, both action and urban reactions build the grounds for new actions to emerge. Therefore, *Interventions* can be seen as actions and reactions at the same time. This continuous relation between interventions and emergent, unpredictable reactions is in fact the basis for human and urban evolution.⁶

But how should one approach interventions in order to design them, select them or study them? One can argue that the distinction between intervention as an action and as a reaction should be made according to the purpose of a particular project or study. On the one hand, an intervention can be studied to understand its relevance in a given context or to identify its emergent consequences. The intention of such study can either be to correct the emergent path of change led by that intervention or to reflect on its adequacy. In this case the focus is on the future; on the period of time after the interventions; the intervention under analysis should be regarded as an action. Consequently, all other consequent interventions, intentional or not, should be seen as emergent reactions. On the other hand,

one can also study interventions with the intention to design or select them. In such cases the priority is to define the reason for the intervention as well as the intentions behind it. From this perspective, the intervention should be approached as a reaction or a consequence of the system.

*Strategic urban interventions*⁷ as suggested by the exploratory kind of planning defined in chapter 4 needs to fulfil the duality of being both an action and a reaction of emergent urban change. On the one hand they should be regarded as something that changes the future. On the other hand, they should also be seen as a direct reaction to the problems which they aim to address. In other words, a strategic intervention should emerge from an integrated and holistic understanding of the problems and the context where it will be implemented. In addition, it should be seen as the ground for future interventions and emergent urban reactions.

Natural interventions and artificial interventions

The meaning given here to the terms *Natural* and *Artificial* is different from the one described in chapter 2. Here we consider *Natural Interventions*, these being a product of natural forces and of the elements. An example can be an earthquake or a volcano. Changes in climate can contribute either to better harvests or to the complete decimation of the plantations, for example. The wind blowing, the sun shining, the sound of a river, these are all natural interventions that can make our human experiences more or less pleasant. Generally speaking, natural interventions are actions or events which are not a product of man. They are actions or events where man has no control and did not directly cause them to happen. In contrast, *Artificial Interventions* are the terminology we will use to address interventions which are manmade of which were designed and thought up by humankind.

Apparently the distinction between *natural* and *artificial* interventions is quite straight forward, but in practice they are not always easy to distinguish (Zubay, 2000: 168; Vermeij, 2004: 14). Some interventions can both be seen as natural and manmade at the same time. For example, is climate change a *natural* or an *artificial* intervention? The answer to this question relates to how we see ourselves in the world and how we look at the consequence of our existence in the shaping of the planet. There is now general consensus that the carbon dioxide we produce is responsible for climate change and that this can originate events which from a superficial point of view can be seen as “natural interventions”, such as cyclones or floods (Crowley, 2000; Solomona et al., 2009).

In other words, some interventions are genuinely natural, in the way that they are not related to any human action, such as an earthquake. Others are genuinely artificial in the sense that they are a product of technology or manmade actions such as our built environment. Nevertheless, most of today’s problems or happenings that challenge the human quality of life or even our existence on the planet can be seen both as *natural* and *artificial intervention*. They are what we previously defined as *wicked problems*.

When designing, selecting or studying *strategic interventions* it is important to treat them as a reaction to such complex problems. It is important to address the essence of the problems rather than the visual side effects they produce (Ehrenfeld, 2008; Foster, 2008). In addition, regardless of how adequate an intervention might seem to be one should presume that it might be the grounds for other *wicked problems* to emerge.

Are artificial interventions a form of technology?

Technology is described in the *Encyclopaedia Britannica* as “*the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment*”.⁸ This thesis perceives technology as one kind of human action on the planet or one kind of *artificial or manmade intervention*. The concept of *artificial interventions* presented here includes and extends the concept of technology. Human interventions or *artificial interventions* are considered here as the rational product of people in a specific socio-cultural context put into-practice; they are actions which emerge from the need to relate and adapt to the environment.

Artificial interventions can engage with an endless variety of subjects and respond to all kinds of human needs not only to the ones we normally relate with technology. On the one hand, *artificial interventions* can assume the shape of a tool, a gadget or a building, which are objects considered as a product of technology. But artificial interventions can be related to art, sports, and events, cultural or religious practices... *Artificial interventions* do not necessarily need to be something physical or tangible; they can be a new topic at school or a new legal system; music or a painting. *Artificial interventions* can be a new colour given to an old building, planting a tree or cleaning a lake.

Technology and all other *artificial interventions* relate to the human activity on the planet; they relate to the innate human nature to change and adapt the natural world to an artificial one which is more suitable for human needs. In addition, not only technology but also all other *artificial interventions* shape our needs, our ways of doing things, our daily life and how we build and use our environment. They influence the speed and the path of urban development. When we build we intervene in the city; we act on it, we change it, and it is the new reality we have created what becomes the background for future interventions (Read, 2005).⁹

This thesis argues that ideas translated into interventions are the engine for innovation and technology, and determine the essence and character of the places we live in.

Interventions as *Events* and interventions as *Space*

This section discusses the relation between people, space and events. These elements are intertwined in a complex system; therefore, if we change one of the elements we influence the system as a whole. In addition, this section addresses the relevance and the role of context in relation to the character of both events and space. There are many analogies between what Alexander names as “*Patterns*” (Alexander, 1977) and this research approach towards interventions.¹⁰ Therefore, Alexander’s arguments were taken into consideration differentiated interventions into two kinds: *interventions of events* and *interventions of space*.

Interventions of space shape the physical context where they take place as well as the life of the people related to them. *Interventions of events* are related to activities, events or situations. They can be both natural and artificial; they might be a public celebration, the selling of a hot dog in the main square, a particular weather condition, or the sound of a river.

Events can happen once in a lifetime or daily. A procession to bury a loved one happens once or twice in a lifetime but one might drink an espresso coffee every morning in the coffee-shop on the corner of the street. Perhaps a procession happens once a year and there is a market every Saturday morning. During such events, the character of the place changes and life happens in a different way. Some events might reshape the character of places and of human life forever. An example of a dramatic event can be an earthquake which has the power to destroy a city and reshape the life of those who survived. Others events are temporary and as soon as they are over the square or the street comes back to its ordinary daily sequence of events.

Not only do special events characterise the urban space, our daily lives do as well. Our life is characterised by our daily routines, such as waking up having our breakfast, taking the bus to go to work, buying the newspaper, working and having lunch with a few colleagues. In the evening one might see some friends or go to the cinema, have dinner and prepare to go to sleep. In a square or a street, those patterns might be translated in the urban form by the coffee-shop on the corner of the street or the kiosk selling the newspapers, the bus stop, the terraces, the restaurants and so on. These terraces and restaurants might come to life during office lunch breaks and after working hours, while the newspaper kiosk might be more productive early in the morning. Our daily sequence of events that characterises our lives and the urban environment where we normally live (Alexander, 1977).

The events that characterise a routine either of a place or of a human daily life are not that many. If we do well in those events we will probably have a pleasant day otherwise probably not; In other words, if we perform well in our work, we had a nice lunch with our colleagues and we watched a nice movie in the evening we will probably say that we had a nice day. If the streets’ coffee shop, restaurants and kiosks are doing well probably its street life will be a mirror of that (Alexander, 1979).

All events need a place. *Interventions of space* are the background of events. They are related to the constructed environment. They are the places where we live and experience events. They are the physical shape of the room, the building, the street the square.... In other words, *interventions of events* define the physical form of the space where they happen; one sleeps in a bed and has a coffee in the coffee shop, watches a movie in a cinema and eats in a restaurant. Yes there are many kinds of beds, of coffee shops, of cinemas and of restaurants. Still we can always identify features and inter-relations which are strictly related to their basic function (Alexander 1979). These features and the relationship between the basic elements which compose space are what make places what they are.

Like the events that fulfil a human life or an urban space, there are just a few elements from which places are made. Buildings are made of walls, floors, roofs and openings. Streets and squares are made of facades, floors, openings, eventually the green of some vegetation and the sky. It is from the way and the process that these ingredients are put together that the quality of the space emerges. In other words, the quality of the urban environment is related to three key factors:

- a) The relationships between its basic elements that compose space. This factor relates to the quality of architecture and urban design.
- b) The process by which the built environment emerges. This factor relates to the notion of natural and artificial city and the way they emerge.¹¹
- c) The nature and aesthetics of the elements used to create space. This can vary according to culture, values, functional needs, taste, etc.

The nature of the elements of our built environment is related to a context. In other words, both events and space are contextual, and together they form patterns which are unique;

“... so, when we see a side walk in Bombay is used by people sleeping or for car parking... and that in New York it is used only for walking – we cannot interpret this correctly as a single sidewalk pattern.”

(Alexander, 1977: 73)

The pattern of events and space in Bombay is different from the pattern in New York. Both the spaces and the events they host are completely different. In this way, events and space are connected and cannot be separated from the place where they occur. They are the mirror of a culture and a society. The character of interventions of space as well as the events which emerge from a given space differs from context to context and from culture to culture.

Saying that an event happened within a space is obvious and not very insightful. The interesting thing is to understand the relation between the two. It is to find out how we can change events by changing the morphology or character of the space and vice-versa. Above all, the interesting thing is to understand in what way that relates to human life and life in the city. If we master the relationship between events, space and quality of urban life, strategic interventions in our built environment can

reshape the way we use buildings, streets and squares and therefore reshape the way we use the city. The relevance of the arguments made until now is the acknowledgment that we can influence the character and the development of a social complex system by manipulating events, the built environment or the relation between the two. Interventions of space can be used to trigger new events and therefore to improve human quality of life in the urban space.

The understanding of the complex relations between space and events, between people and events and between people and space is of key importance for the design of *Strategic Intervention*; interventions which are applied strategically in an part of an urban system and have the capacity to improve the system as a whole.¹²

How can Alexander's patterns inform intervention management?

Patterns as the basic elements of the system

Alexander (1977) defines the quality of a building, a square or a town, by analysing what he calls patterns of space and patterns of events. Alexander's patterns of space and patterns of events are the raw material with which we make a place. In other words, they are the basic elements which compose a complex social and urban system. According to Alexander) patterns of space and patterns of events are intertwined. Together they are what gives unique character to places and defines how we live in the city. Patterns of space and of events are interrelated with human life itself and the way we perceive the world around, therefore, any alteration in one of these patterns alters the character and human life as a whole (Wilson, 2011).

“These patterns of events are always interlocked with certain geometric patterns in the space. Indeed, as we shall see, each building and each town is ultimately made about of these patterns in the space, and out of nothing else: they are the atoms and the molecules from which a building and a town is made.”

(Alexander, 1979)

These features are the design form which emerges as a natural reaction to a problem in the urban environment or a natural human behaviour or need. One of the multiple examples given in the book is *arcades*. Arcades are seen as such key features because they connect buildings, protect people from the environment and can make a place more beautiful.

“The elements of this language are entities called patterns. Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.” (Alexander, 1977)

The relevance of what Alexander describes as patters is that they are sufficiently specific to induce a certain quality of performance to space and open enough to be materialised in a different way

every time they are used. These patterns are described in a way that they can promote interaction and diversity and therefore they can improve quality of life.

Alexander's patterns can be useful to both empower individuals to intervene in the urban form more appropriately and give designers an emergent perspective of design.

Alexander's patterns can be used as a base to dissolve decision making by giving people the tools to build their environment with a certain functional quality. From the perspective of evolutionary theory, empowering people to actively adapt the environment according to their needs would mean trusting the quality of the natural city to serve the quality of life of its inhabitants. It would mean the nurturing of continuous change and the creation of variation. The city would emerge as a process and a direct consequence of people's aims and needs and would therefore give people a sense of belonging. As Marshall's (2009) building blocks of urban syntax, Alexander's patterns, or architectural elements, could be used as bottom-up building blocks and be implemented as part of a more general system. In other words, Alexander's work can provide guidance for a standard quality of every-day bottom-up interventions still nurturing their diversity. Alexander can also be used as a tool to support top-down interventions. He gives policy makers and designers the tools to influence events and urban life by intervening or manipulating the built environment and vice-versa. When the relationship between the elements of space and the way they are related to the event that occurs in that space is known, it becomes apparent which physical elements to change in order to influence change in human behaviour.

“For the pattern in the space is, precisely, the precondition, the requirement, which allows the pattern of events to happen. In this sense, it plays a fundamental role in mankind sure that just this pattern of events keeps on repeating over and over again, throughout the space, and that it is therefore one of the things which gives a certain building, or a certain town, its character.”

(Alexander, 1979); 92)

Following the arguments in chapters 2 and 3 this thesis argues that top-down interventions should be used to nurture what Marshall calls the evolutionary tree (Marshall, 2009: 276, 281). Top-down interventions should be used to assist and direct the natural evolutionary path of change. Alexander's work gives us an important insight into the relationship between events, people and space which could help design and select adequate strategic top-down interventions able to adjust urban development. In addition, Alexander's work could add quality to bottom-up interventions and therefore support a more qualitative emergent urban development.

Acute interventions and chronic interventions

Interventions both natural and artificial can happen in the blink of an eye or take long periods of time for its consequences to be seen.

Natural interventions can be devastating and happen in a very short period of time; a tsunami can destroy a village within minutes. It can also take centuries for the consequences of interventions to be visible to the human eye. The long, cold Scottish winters shape the character of cities such as Aberdeen, and the character of the people who live in it and the way they live their everyday life. Its impact on the granite stones of the city cannot be seen for centuries to come. It defines the place where people meet, what they eat, how they move in the city. Indeed, Scottish winters arguably play a significant part in shaping the urban form and peoples' everyday lives; probably as much of as any other more *acute* intervention.

Artificial interventions can also happen in the blink of an eye or they can happen over longer periods of time. On the one hand the change of a policy, just like the earthquake, can happen within minutes and have immeasurable consequences. Changing human preconceptions can prove to be an exhausting and long process. One example of a chronic, long-term, artificial intervention could be teaching people to recycle materials, or to make more use of public transport. The efforts necessary to make people aware of their everyday decisions can prove to be a long and exhausting process. Nevertheless, in the long term, might bring tremendous benefits to life on earth.

The time to implement interventions in the built environment is very much related to their size and complexity. Human interventions in the built environment might take minutes, hours, days, months or years to implement. It goes without saying that it takes longer to build a housing block than it takes to build a street bench. An entire neighbourhood might take decades to build. During the time of its construction it will influence urban life in ways that might not be desirable. The time Union Street took to be built is an example of how devastating chronic or long-term human interventions might be for the city (Morgan 2008).

A fast artificial intervention can almost be seen as *Urban Acupuncture*, a term coined by Lerner (2012), which he described as fast and accurate interventions that can be used as a strategy to nudge change in the city as a whole. Jaime Lerner, besides being an architect and urban planner by profession was the leader of Curitiba for many years. He was the brains behind some very interesting interventions which made Curitiba an example for many cities. In his book *Acumpultura Urbana*, he explains why some interventions in Curitiba had to be made very quickly. According to him, sometimes people have to see the intervention already completed to understand the way it improves the area. To illustrate how efficient *urban acupuncture* can be, Lerner gave the example of the implantation of a pedestrian area in Curitiba as well as the Opera House which took 60 days to build. Such kind of interventions would normally take longer to implement. It is normal to take up to a year to build a building, but the issue of time was a key ingredient for the success of these interventions;

therefore extra efforts were incurred to speed up the process of construction. In other words, Lerner gave the example of relatively complex and normally long interventions to implement, whose success depended on how fast they could be materialised. Still, not all *urban acupuncture* interventions have to be complex and elaborate; one does not need 60 days to put a traffic light in a problematic crossing or a lamp in a shabby street.

As evolution and complexity sciences tell us, we never know if positive or negative consequences emerge from an intervention, but fast, small or even temporary interventions can help us to test urban tendencies before committing to more permanent decisions. According to Lerner, if the intervention addresses an emergent urban need it has a good chance of working. He suggests fast interventions to test possible dynamics of the city before introducing more permanent buildings. He suggests raising temporary structures in the empty spaces of the street, able to shelter informal encounters or any other function one might think is needed. If people actually start inhabiting these temporary structures, they can be replaced by buildings or more permanent constructions. The time of implementation is always an issue. We have to keep in mind, that if a certain dynamic is disturbed it can die. If we take too long to replace a meeting corner, people might just start to meet somewhere else. The success of an intentional artificial intervention is very much related to the relationship between the kind of intervention and the time it takes to be implemented.

Strategic Interventions

Strategic Interventions is a subgroup of *Interventions* in general. *Strategic Interventions* aim to intentionally nudge a complex system towards a more sustainable development. To define the meaning of *Strategic Interventions* in the context of this research, there are concepts related to *time*, *intentionality* and the origin of these interventions that need to be considered.

Short-term actions with long-term intentions

All interventions influence the future development of a system, but not all interventions do that intentionally. Strategic interventions are actions which aim to induce change in an urban, social system. They are actions implemented in the present which aim to influence the path of urban development.

As seen in chapter 3 from the perspective of design and artificial selection¹³, *Evolution* can be seen as the continuous process of accumulation of *short-term changes* that form a *long-term change* in the system. This description enables us to:

a) Relate *short-term change* with theories of emergence and with design and artificial selection. This perspective allows integrating design in the evolutionary process as a short-term cultural reproduction process. As argued in Chapter 3 the reaction of complex systems to short-term changes is to a great extent unpredictable.

b) Relate *long term change* with the idea of evolution; the slow, gradual and continuous process of change which tends to be quite predictable.

Long term change emerges from the process and the relationship between short-term actions and emergent social and urban reactions over long periods of time. Long-term change is related to a vision for the future. It is related to what we want for us as a species and for our cities. Such a vision can become the intention behind strategic human actions which aim to intentionally nudge development in a specific direction. As agreed in chapter 3 a vision for the future is relevant because it gives a sense to short term human actions and to the decisions we make for our communities. It justifies our interventions and gives a sense of directions for urban and social development. In addition, a clear intention gives people an idea that they are working together for a common good. These are key features to ensure human cooperation and an efficient way to guide change in a sustainable direction. The visions we have for our cities is similar to what Bortoft (2010) calls the *active absence* to define the idea of *authentic whole*. A vision is what gives meaning to human actions; it is like the subject of a book which justifies the sense and position of every word in it. With the particularity that the evolutionary book has no end and the story goes on and changes continuously in time. A vision is “*no thing*” among “*things*” but it is active; it is the engine that gives directions and sense to change and to interventions in the environment. It is what connects the whole and the parts and the before, the now and the after.

In light of this, strategic interventions can be seen as short-term, materialised parts of the whole and the vision of the whole itself. The whole shapes and justifies the parts; it gives them a meaning, a sense and a position in the context of the city as a whole, both in time and space. A vision can be translated into words and these words can be translated into guidelines to support strategic interventions. They can be translated in the kind of norms authors like Wilson (2011), Ostrom (1990) and Loorbach (2007)¹⁴ suggests as guidance for change; a guidance for the design and selection of human actions and the grounds from which cooperation can emerge.

Most probably, long-term visions will change in time and will consequently influence the intermediate steps we make. The process of urban change is dynamic and we as humans form part of it. Our ideas; the meaning we give to ourselves and the world around us changes and adapts to new circumstances. Humans evolve with their ideas and their environment and hopefully become more aware of the human condition on the planet (Beck and Cowen, 2006).

Intentionality and the common good

A vision defines the intentions from which human actions emerge. In this thesis, *Intentionality* is not only related to a time frame or a vision for the future but it also has to do with the complexity of the urban system as a whole. In other words, all actions imply an intention but this intention does not necessarily aim for the common good. We walk with the intention to move from one place to another, we eat to satisfy our hunger, we talk to convey an idea. Nevertheless, this thesis defines *intentional intervention* as those which have a greater perspective in mind rather than the immediate satisfaction of a personal aim or need. *Strategic Interventions* are intentional interventions which normally aim for long-term changes and take into consideration the urban system as a whole (Loorbach, 2007). Intentional interventions might aim to change the dynamics of a system or the higher levels of social organisation.

Complexity theory tells us that everyone intervenes in the city and everyone influences the city's development. Still, some interventions are more intentional to produce change than others. As we have seen in the previous chapters, bottom-up interventions which are the basis for city development are normally focused on the self. They have no intention to trigger a greater change. Bottom-up interventions can be intentional when the civil society (individuals or groups of individuals) self-organize to achieve a certain goal or to defend a certain cause. These emergent, organizations might have an immense impact in defining a strategy for the urban development. Friedmann (2011) calls these bottom-up interventions *Insurgencies* which emerge from an awareness of the common good.¹⁵ On the other hand the protagonists of top-down interventions may or may not have a long-term vision in mind when acting on the city. Decision makers or private and public organisations can intervene in the city either having the wellbeing of a community in mind or be focused on their immediate and private profit.¹⁶ Nevertheless, bottom-down interventions are normally focused on the self (which is fine due to their small scale) but top-down interventions should be focused on the common good. After all, that is the essence of politics and governance.

The attention to the common good and awareness of the system as a whole is of particular relevance when applying large scale interventions in the city. It is the responsibility of public organisations such as governmental organisations to have an overview of the whole and act intentionally on the city to improve it. Unfortunately, this is not always the case, top-down interventions are too often short-sighted and focused on temporary solutions; fare too often they are focused on the effects of the problems rather than on the problems themselves. They focus on short-term solutions and more concise actions (Ehrenfeld, 2008).

Table 1 sintethises the research definition of intentional and unintentional interventions originated both from the top-down and the bottom-up and contextualizes strategic interventions within the two.

Top-down Interventions	<p><u>Unintentional:</u></p> <ul style="list-style-type: none"> - Short-term, quick fix solutions: actions like injecting money in bankrupt banks or building cars which pollute the environment less (Ehrenfeld, 2008). - Interventions aimed towards the good of a few rather than the good of a community. These kinds of interventions are normally a product of corruption or a consequence of the forces of power.
	<p><u>Intentional:</u></p> <ul style="list-style-type: none"> - Interventions focused on long-term changes and on the source or essence of the problems: actions such as implementing an ecological network of public transportation and restricting the use of the car. - Interventions focus on the good of the community. Interventions that emerge from the needs of individuals, or groups of individuals, in relation to each other and to the environment. Their focus is on the good of the community.^{17 and 18} <p style="text-align: center;"><u>Strategic Interventions</u></p>

Bottom-up Interventions	<p><u>Unintentional:</u> Everyday life actions and decisions.</p> <p>Such kinds of interventions refer to every-day decisions regarding the place one works, or lives, the place where one goes shopping or has fun.</p>
	<p><u>Intentional:</u> Such kind of interventions can be called <i>Insurgencies</i>. They refer to actions which emerge from one individual or a small group of individuals which aim for long-term changes in higher scales of social organisation. Insurgent interventions can be things like a protest, the occupation of a building, a statement written on a wall, a flyer placed in an urban public place...¹⁹</p> <p style="text-align: center;"><u>Strategic Interventions</u></p>

Table 1: Relation between the intentionality of an intervention and its origin.

Top-down, bottom-up and strategic interventions

The characterization of bottom-up and top-down interventions emerge from a definition of the natural/emergent city and the artificial/planned one explored in the literature. Contrary to the previous chapters, this section focuses on *interventions* rather than on the *city*.

Bottom-up interventions

Bottom-up interventions emerge generally from human daily activity and everyday-life. They are a product of a bottom-up planning process (Portugali, 2012). As argued in the previous chapters, even if there are exceptions, bottom-up interventions are characterised by being of a smaller scale and focused on the needs of the self. It is due to these characteristics that one can argue that the natural or emergent kind of city evolves slower and is normally more predictable. Bottom-up interventions emerge by adding something slightly different than previous models to the urban fabric. These, normally small scale interventions will merge with the city form and will be the basis for future urban interventions. Due to the small scale of bottom-up interventions it is not extremely relevant that bottom -up agents have a greater vision in mind when intervening in the city. A small house will soon be seen in combination with other houses and perceived as a whole (Marshall, 2009). In the long term, one perceives this accumulation of small changes as *urban evolution* but in the short term, like all other human actions, they can be perceived as small changes to make something fit to a specific context or need.

We have argued previously that emergent bottom-up interventions generates a normally more resilient and more human friendly city (Alexander, 1966; Jacobs, 1970). But, it can also generate spaces of segregation and crime (Batty, 2005). It can also generate problems like urban sprawl and unhealthy (Marshall, 2009).

Top-down interventions

Top-down interventions, on the other hand, are related to organised groups of people with more or less social, political or/and economical power. They can be governments, private companies, NGOs. Top-down interventions are a product of a top-down planning process (Portugali, 2012).

According to organisational theory, organisations are of key importance to establish the direction and speed of development of the city (Lane et al., 2009). Organizations, regardless of whether they are private or public, normally engage with larger interventions in the city. Therefore, top-down interventions are normally a consequence of larger scale management strategies which intentionally aim to change themselves – as an institution or organisation - or their surroundings. Furthermore, urban interventions made by organisations are normally engaged with global forces; they

can reflect consideration about the macro social, political and economical aspects of society; they can take into consideration the relationship between cities, as well as between the city and the country or even the world. Top-down management has the power to make things happen quicker and can intentionally establish desirable paths of growth.

Due to the scale of top-down interventions, they are normally more invasive; as we have seen previously they tend to break the continuity of the urban evolutionary path and therefore are normally riskier. Due to the scale and possible impact of top-down interventions, it is very relevant that top-down agents, such as organisations and as decision makers, have the bigger picture of the system in mind.

Not only decision-makers and organisations which intervene in the city on a bigger scale who should have a holistic perspective of the urban system in mind. Architects, engineers and designers as the creators of such interventions should also have such holistic view of urban and social contexts in order to be able to design appropriate interventions regardless their scale.

Architecture and urban design is very much related to public governance; therefore they are of key relevance for this research. Architects, engineers and designers even have an added responsibility in the making of the city. They can intentionally shape their interventions to induce overall change in the system regardless of the scale of the design and regardless of whether the design is to serve one individual or a group. Whether if it is a private house, a garden bench, a public building or a neighbourhood, all designs can be materialised with the intention to influence a *bigger picture* of the city. Designers and designs cross all hierarchical levels of social and political organisation and they have the power to influence the system as a whole regardless of their position. This leads us to one of the questions study 3 aimed to address. *To what extent do architects have or should have a holistic perspective of the social and urban environment where they intervene?*²⁰

Strategic intervention

Strategic intervention can be either originated from the bottom-up or the top-down. Nevertheless, it is the responsibility of the top-down to have an overview of society and to manage urban change adequately. Strategic interventions embrace characteristics of both top-down and bottom-up kinds of action. They should:

- Be contextual, even if the conceptualisation of the problem in relation to the tools available to act on it can be considered from an abstract perspective.
- Emerge from an awareness of the complexity of the place; therefore, they should aim to disturb it as little as possible. In light of this, strategic interventions should be preferably of a small scale.
- Be an expression of the common good. The intention behind them should be nudging urban change towards a sustainable path.

- Be applied to speed up or to change the path of development. Their intention is to break continuity when things are not going in the right direction.

General characteristics of bottom-up, top-down and strategic interventions		
Bottom-up	Top-down	<u>Strategic</u>
Contextual and unique	Standard or general	Act on the general basic elements from which a society emerges. Nevertheless, adjusts them and applies them according to the uniqueness of each context.
Small scale	Big scale	Give preference to small scale actions.
Focus on the good of the self	Focus of the good of the whole	Focus of the good of the whole
Establish a continuous process of change. Normally such a process is slow.	Accelerates the process of development or changes its path. It can bring discontinuity.	Accelerates the process of development or changes its path. It can bring discontinuity.

Table 2: Summary of the general characteristics of bottom-up, top-down and strategic interventions

Interventions as a product of the tension of top-down and bottom-up forces

As described before, the evolution of the city as a whole emerges from both bottom-up interventions - what we call natural evolution - and the top-down, planned ones. The evolution of the city is a consequence of the interaction of individual and collective actors and of those with the environment. In other words, urban interventions emerge from the interaction between the city's everyday life and the visions and aims of public and private organisations materialized in the urban form. To build a single house or to plant a tree, a single individual normally needs the approval of an institution. It is also true that top-down actions can be blocked or reshaped by bottom-up arguments and pressures.¹⁹

Depending on the context the influence and strength of one and the other change and that will influence the shape, organisation and character of urban settlements. In addition, it influences the kind of urban life people experience (Lefebvre, 1991; Marcuse, 2009). In places such as Singapore, for example, top-down public forces have much more power over urban management than in a European democratic city, where civil society has a greater role to play.

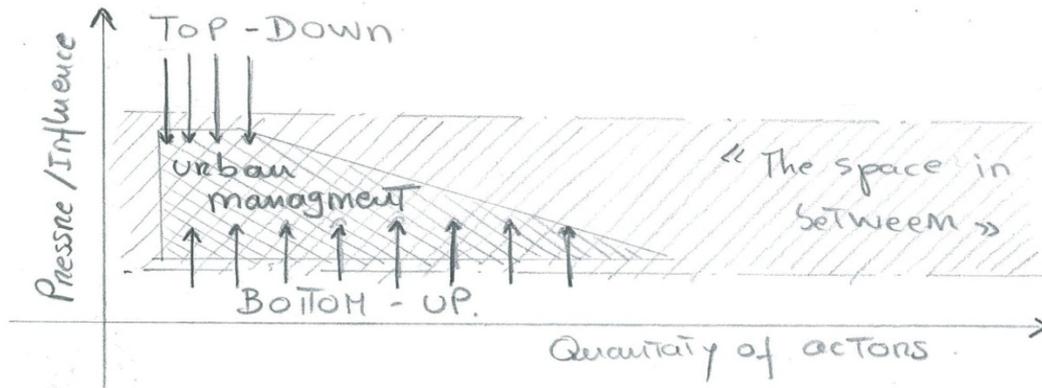


Figure 11: Interventions as a result of the tension between top-down and bottom-up forces. Adaptation of a diagram used by Terry G. McGee in ARI Singapore (2013) to illustrate the place from where human actions emerge.

Figure 9 illustrates the place of tension from which human interventions emerge; the space between the emergent bottom-up forces of the city and the top-down ones.²¹ McGee (1971) calls this space in between forces *The grey zone*.

Such a diagram can be extremely relevant to contextualise management systems in relation to a specific cultural and political environment.²² Such contextualisation can have implications in the selection and design of both strategies and interventions to apply in an urban system. This diagram can also be used to illustrate the influence each participant has in the creation and implementation of a given intervention. It can be used to analyse the number of protagonists involved in the selection and design process of an intervention and to estimate their role and degree of influence in that process. Depending on the context participants change in numbers and in degrees of influence; therefore, this diagram is to be used contextually.

In other words, a diagram such as McGee's could help to shed light on the origin and dynamic of forces one intervention would have to endure in order to be implemented. Such knowledge could help to design and select more appropriate interventions able to guide urban development to a sustainable path.

McGee's diagram is just an indication of a possible framework to place interventions in terms of their position across the different organisational levels of an urban and social system. Nevertheless, the relevance of this section is to emphasise the idea that most urban interventions are a product of the tensions between top-down and bottom-up forces. They are not just a product of one or the other. Still, they emerge either from the top-down or the bottom-up and they are shaped by the negotiations between the two. The spatial order of the city is a result of the ongoing relationships between private and public agendas. Various kinds of plans are used to communicate and to materialise interventions in the built environment. Each of these plans (such as master-plans or zoning plans) emerges as the result of negotiations between a variety of actors. In this way, not only is the city a complex system impossible to control and predict, the process of building the urban form is extremely complex as well.

According to Portugali (2004; 2008; 2012) this is the reason why, the aim of urban planning to regulate or make order out of what occurs in the city is doomed to fail.

This section explored key characteristics of strategic interventions, namely their intentionality, their relationship with the common good and their protagonists. It has also contextualized the role of *design* and the designer in the context of strategic interventions. Following this, the research will focus on strategic interventions on the built environment. In other words, the next section will focus on interventions which emerge from the intention to improve the overall good of an urban system and focus on long-term changes. Such interventions are normally the responsibility of decision makers or public organisations and they are normally a product of the work planners and architects.

Categorisation of *Strategic Interventions* in the built environment

The built environment is only one of many possible aspects of society where one can intervene intentionally to nudge urban and social change. Other areas are, for example, culture and religion, politics and economy and communication and transport networks.²³ As with the urban environment, we consider these aspects of society as the grounds where interventions can be strategically placed to serve as catalysts for change. These aspects of urban and social organization are relevant in the context of *Intervention Management System* suggested by this research because:

- a) They play a key role in shaping social behaviour and organization; they define the city and its development.
- b) They are deeply interrelated; therefore, an intervention in one of these areas has the potential to influence the others and the city as a whole.
- c) They can be considered as areas where people can actively act on the city.

The research argues that if one intervenes in one of the areas above will induce change in urban complex systems as a whole.

Isolated interventions or in a system

Complex systems are composed of subsystems which relate to each other in complex ways (Batty, 1994; Portugali, 1997). The structure of a complex system is the arrangement of its subsystems and components at a given moment in time. It is a common characteristic of both the

subsystems of a complex system and their inner-relation to change over time. The system may remain relatively fixed for a long period of time or it may change from one moment to another. This depends on the characteristics of the processes in the system and on the reactions from the environment (Portugali, 2003).

In the same way human life self-organises around basic elements of the urban environment which are normally interconnected. The system of elements of the built environment around which urban life emerges mirrors the needs of people's everyday lives. These elements are what we previously addressed as interventions of space or the basic elements of the urban syntax²⁴; they are the street, the square, the bus stop, the restaurants, the coffee shop, the newspaper stand.... When these interventions are taken into consideration independently they can be so small that they are imperceptible in relation to the whole of the city, but when they are addressed as a system they tend to gain significance. One single person catching a bus to go to work probably doesn't make so much difference to the city, but when many people take the bus approximately at the same time to go approximately to the same place this event starts to gain significance for the city and consequently for its management.

One can alter urban life by intervening in one of the parts of the system independently; such as changing the location of a bus-stop, or changing the bus-route, or can intervene in the urban and social system as a whole by acting on the connections between its parts. Altering the shape or the position of the bus stop, changing the route of the bus and adding some green space and benches to the coffee shop's square, alters peoples' everyday life experience as a whole. This way of understanding the city and intervening in it is characteristic of an emergent approach towards urban planning (Portugali and Alfasi, 2007; Marshall, 2012; Portugali, 2012). In opposition to the emergent approach, the creationist way of intervening in the city is more proactive and as we have seen before it does not always take into consideration the established emergent systems (Jacobs, 1961; Alexander, 1966; Portugali, 2004).

Strategic interventions can either be an isolated action or various actions organised in a system, but they are always emergent; they always take into consideration an overview of the urban system as well as of relevant emergent complex subsystems of events and space with which they might interfere.

A system of strategic interventions is composed of several interventions which are combined to serve a common purpose or vision. These interventions can either be of the same kind, such as several buildings placed in strategic places in the city, or of different kinds and applied in different areas of the urban system.

One single strategic intervention can have a more dramatic impact than small emergent actions. We don't build a school or a neighbourhood every day as we don't redesign our squares and streets on a daily basis. We don't change our legislation system or our transport network every day. These are interventions that change things forever and they happen occasionally. Therefore, one should see them as opportunities to improve the urban system as a whole. As strategic interventions, the place,

function and form of such kinds of intervention would still emerge from an analysis of an interconnected systems of place and of events.

Top-down interventions, regardless if they are applied in isolation or in a system, have a strategic role to reset the path of urban change and speed it up. This is because they are focused on the common good and the overall system and because they are normally a product of human cooperation and design.

The table below shows of interventions applied in a system design to improve the Union Terrace Gardens in Aberdeen and regenerate the dynamics of the city centre as a whole. These interventions were the base for case study 1 and 2 and were used to test the assumptions extracted from the literature review regarding the scale and origin of interventions, as well as their application in isolation or in a system. The information extracted from these studies helped to support the information presented in this chapter and validates the research hypothesis. Table 3 relates two kinds of strategic top-down interventions in the built environment: one isolated, large-scale intervention in and a system of small-scale interventions. The first was proposed by the winning project of a public competition. The second was proposed by this research. The potentials and weaknesses of both strategies were tested in studies 1 and 2.

Isolated intervention



Figure 12: The city Garden Project

The city garden project: An example of one rather large top-down intervention in the built environment. The project suggests a three-dimensional network of pathways linking several interconnected areas for leisure activity. This project aimed to explore new ideas on how to improve Aberdeen's city centre and more specifically the Union Terrace Gardens.

Interventions in a system



Figure 13: The Micro Project System (MIS).

The Micro Project System (MIS) is an example of a system of top-down micro-intervention in the built environment. These interventions were designed to be applied in and around the Union Terrace Gardens in Aberdeen. All interventions were designed to improve the city centre independently but they would reach their full potential when applied as a system. When implemented together they would be optimized and therefore estimated to influence the dynamics of Aberdeen city as whole.

To intervene efficiently in an urban complex system a certain degree of awareness of the systems as a whole is required as well as the subsystems of events and places related to the

intervention. This awareness will define whether it is appropriate to intervene in the system with a single action or with a system of interconnected actions.

Strategic Interventions in the built environment can be implemented in isolation or in a system. In both cases, they emerge as direct responses to the needs of the urban system. Therefore, they emerge from an analysis of the systems of space and of events which they aim to influence. They shall be organised and defined in relation to the parts of that system or the connections between them.

Interventions according to the predictability of the system's reaction

Interventions in the generative elements of social and urban organisations tend to have predictable short-term consequences (Portugali, 2000; Batty, 2005). As we have argued in chapter 3, the generative elements of an urban or social complex system are related to human aims and needs (which are translated in the built environment in the form of interventions of space) and to the urban syntax.²⁴

On the one hand, everyday life and everyday needs influence certain human decisions and actions which are quite predictable. We can expect people to try to find a place to live near the place they work. People will probably prefer to send their children to a nursery in the same neighbourhood and they will visit the local supermarket more often than any other one.

On the other hand, from the perspective of the urban syntax the relation between its basic elements (streets, plots and building), their position, their size and their shape will also determine a predictable urban morphology (Stedman, 2006; Marshall, 2009). These assumptions are the basis for all cellular automata predictions which are definitely something to take into consideration as a tool to guide urban design and urban management.²⁶ The kinds of houses which will emerge near a highway are different from the houses that will emerge near a pedestrian street in the city centre. Not only will the plots be different in size but also in character. People will choose in which environment they will live according to how much they can afford to pay for a house, if they have a car or use the public transport if they have children or not and so on. With this one can assume that some short-term reactions of the system to interventions made on the generative elements of the city are predictable even before the intervention is implemented. This predictability is connected to a deep understanding of the codes from which a city emerges. Consequently, we argue that, the generative elements of the system can be used as strategic interventions focused on short-term changes because they offer a certain degree of predictability.

Nevertheless, one needs to keep in mind that complexity sciences tell us that all complex system is considered to be non-linear and therefore in the long term they are highly unpredictable.

Interventions have the capacity to change the system as well as the generative elements which originated them in the first place, therefore, they should be miniaturised and dealt with caution. For example, the use of the “car”: The human need for fast mobility resulted in the increased use of the car. That change in human behaviour influenced the way we designed our cities: We built great highways, we cut our medieval neighbourhoods to make way for new roads²⁷ and we divided our cities into functional areas (Abercrombie, 1933; Gibberd, 1967) and we built vast car parks around suburban shopping malls and leisure centres. In summary, we shaped our cities around the use of the car to such an extent that they were more “car friendly” than “human friendly”, not to mention the ecological concerns related to that. These consequences or reactions to the increased use of the car shaped the way we look at the quality of life in the city and at urban planning today. Today planners promote mixed-function places; they promote walkable distances and pedestrian streets. Urban policies discourage the use of private transport and promote its public counterpart (Katz, 1994).

In short, complexity sciences show us how the acknowledgement of self-similar aspects of a complex system tends to trigger predictable short-term reactions from the system. This characteristic of non-linearity of complex systems relates to the consequences of all kinds of interventions regardless of their scale: a garden, a new school or even a bench and a tree, can deeply change the dynamics of an urban area and redefine it completely. It can even change the character of the city habitants (Wilson, 2011). On the other hand, complexity sciences also show us how and why in the long term the system is highly unpredictable. These conclusions support the idea of using design/ strategic interventions as short-term stepping-stones to achieve a long term vision. It Supports the idea of a new kind of urban management as the continuous process of acting in the urban system and reacting to the system’s consequent reaction. (See chapter 4)

General or Contextual

General interventions as conceptualisations of action.

Strategic interventions as unique and contextual

The literature review suggests two kinds of basic elements of a built environment which can be used to manipulate urban change. The first relates to human daily life and needs.²⁸ The representation of those in the urban morphology were translated in patterns of space by Alexander. These patterns helped defining this research’s interventions of space. The second are the basic elements of the city syntax suggested by Marshall.²⁹(See pp. 64)

Both the elements of the space syntax and Alexander’s patterns are standardised elements, shapes and measures. They are algorithmic and are almost abstract formulas which are repeated over

and over again in most of the urban settlements in the world. They are based on numbers, geometry and conventions. Elements, such as these, that we can generalise are of key importance to understand the city from a self-organising perspective and help us to draw predictions about possible urban development but they do not help us to explain the reason why every city is unique even if all cities are made of the same things.

On the one hand, human basic needs and the basic bricks of urban morphology are present in all urban forms and cross all urban scales; All humans need a shelter, all of us need to earn a living and all of us need clean air and water. Besides that, all cities are made of roads, plots and buildings. Consequently, one could say that what is predictable is also generalizable to all urban forms.

On the other hand, human actions and human perceptions are not only based on general abstract elements as the ones which compose the city syntax.³⁰ Nor do basic human needs such as the need for work or the need for a shelter determine all our actions and the way we do things. As argued before, human actions and human perception of the world are an expression of human subjectivity; they are a mirror of human culture and of different world views. As we have seen in chapter 3, human actions emerge from a specific adaptation to a specific environment; therefore, they are contextual and unique.³¹

In light of this fact there are limitations to how much we can generalise interventions. Human actions are deeply connected with the individual or group of individuals who imagine and materialise them and to a specific socio-cultural and economical context. Strategic interventions can be related to the standard components of the city but they should emerge and be shaped by the context of where they are going to be implemented. In other words, if a given intervention is a reaction to a specific need, it should be shaped and implemented according to contextual world views, and therefore will most probably be materialised in an unique way, regardless of how general the considerations behind it might be (Ramírez, 2000; Hansell, 2007).

In short, even if every city emerges from the same basic elements, each city is unique. Each city has its own internal rules and has a unique character. Strategic interventions might on the one hand be based on the basic standard elements that compose a city, such as the urban syntax and human everyday needs, but on the other hand, they should be shaped by their specific context. Strategic Interventions should be shaped by the human condition in a place and people's unique ways to perceive the world around them. In other words, general aspects of the city such as the elements of the urban syntax are to a certain extent abstract conceptualisations and therefore they are generalizable. Nevertheless, when the time comes to act on the city these elements should be shaped by the context's needs and character. Strategic interventions are therefore contextual; they related to a time, a specific place. They are unique expressions of the people who design and use them. The way we as humans choose to build a tower, the way we decorate a street or our front door, the way we design and use our

buildings, our squares and our markets, the place where we choose to place a tree or a fountain... these choices and actions are related to who we are as humans and are a consequence of specific cultures and world views. Those choices are contextual; they are a consequence of a specific way of perceiving the things around us. They are a consequence of a direct relationship between man and environment.

Hierarchies of interventions

The previous section described systems of events and systems of places as two kinds of urban subsystems. But urban subsystems can also be described in terms of scale rather than in terms of their kind. This section relates the scale of the subsystems which compose a city with the scale of urban interventions. The notion of nested hierarchies introduced in chapter 3 is used to support the concept that each part of the system is composed by lower level identical subsystems and at the same time is part of the higher level system.

In chapter 4, the work of Miller and Portugali, among other authors was used to understand the urban structure and organisation. Conclusions taken from the literature review let to consider a city as a subsystem which is made up of other smaller subsystems and at the same time is part of a bigger system. As argued in chapter 4, these conclusions lead to suggest an alternative form of urban planning. The work of Portugali is important because it relates urban organisation with complexity theory. The work of Miller is relevant because it relates biology and consequently evolutionary theory with human organizations such as cities. Alexander's work is relevant because it relates human organisations with design and human actions. The work of Alexander is used to define and categorise human actions across different hierarchical levels. Alexander's work enables to use nested hierarchies to categorise by scale interventions of space and events. This allows to establish a direct relationship between the different hierarchies of urban organisation with different scales of interventions (Salinas, 2000; 2005).

As seen previously in this chapter, Alexander defines the basic elements of all complex systems as patterns. He uses the relationship between patterns of space and of events to establish the link between the urban environment and human activity. He also uses patterns to describe problems which continue to happen in the urban environment. In addition, he describes how these patterns can become solutions or urban interventions in the built environment across different scales. These patterns are described in a way that they are specific enough to address problems and general enough to be adaptable to each circumstance and context and be shaped accordingly. Alexander's patterns are not the solution to all problems in the built environment but they can be used as a framework to help top-down urban protagonists to:

- Identify what could be used as strategic interventions in the built environment.
- Give a hierarchy and a structure to strategic interventions.

- Establish the relationship between a problem and a possible intervention to address it.

Alexander organised these patterns hierarchically so that they can be used as a language. In other words, he used the concept of nested hierarchies to give these patterns a structure as well as a position and a role in relation to one another as well as in relation to the whole.

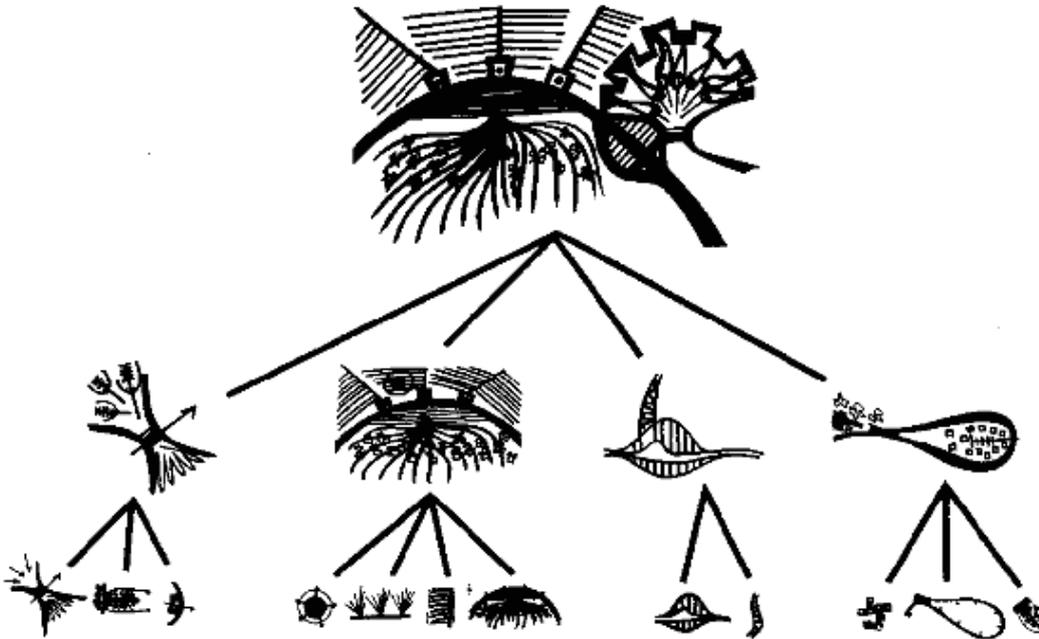


Figure 14: Alexander's conceptualisation of the components of form (Alexander, 1964: 153).

This structure enables them to be combined in multiple ways and be adapted to all contexts and needs. Alexander's patterns are just like words; they can be combined in endless ways and express the complexity of human and urban nature. When these patterns are considered as possible interventions and the complex relations within and across hierarchies are well understood, one can use them to manipulate urban and social change. In a written text this would be like changing a verb or a comma to change the meaning of a sentence.

In this session, Alexander's work will be used to categorise interventions according to their scale, because:

- Alexander relates complex systems according to the idea of nested hierarchies. Just like Miller did when describing the city from a biologic perspective.

"... no pattern is an isolated entity. Each pattern can exist in the world, only to the extent that is supported by other patterns: the larger patterns in which it is embedded, the patterns of the same size that surround it, and the smaller patterns which are imbedded in it. This is a fundamental view of the world."

(Alexander, 1977: xiii)

- “Patterns” are, for Alexander, the basic elements which compose complex systems. According to him these patterns can be seen as possible tools to intervene in the built environment. In light of this analogy it seems logical to use Alexander’s categorisation of patterns to categorise interventions according to their scale.
- Alexander’s work was previously used to support arguments and define relevant concepts in this research.³²
- As an architect, Alexander defines hierarchies of patterns from the perspective of the built environment, which is the focus of our studies.
- The set of systems on which Alexander focused his work is more related to the focus of this research than Miller’s set. Alexander focused on the study of urban and social systems; therefore, the basic element of the system is the individual rather than atoms or cells.

Like Alexander, this research’s focus is on social organizations and their built environment. The literature review leads to a description of the world as being composed of continents, continents are made up of countries, countries have regions, regions have cities, cities have neighbourhoods, neighbourhoods have places and places have objects and urban furniture. From the human perspective such hierarchical organisation can organise the world population in groups and subgroups to the scale of the individual.

By following this hierarchical organisation one can categorise interventions according to their scale just like Alexander did with patterns (Alexander, 1977). Interventions of space range from the very large such as regions and towns, down to neighbourhoods, clusters of buildings, buildings, rooms and finally detailed construction solutions. Alexander organises patterns in this linear way to enable the reader to relate the smaller patterns with the bigger ones and to be able to see how one includes and extends the other.

“A pattern language has the structure of a network. This is explained fully in the Timeless Way of Building. However, when we use the network of a language, we always use it in a sequence, going through the patterns, moving always from the larger pattern to the smaller, always from the ones which create structures, to the ones which then embellish those structures, and then to those which embellish the embellishments...”

(Alexander, 1977: xviii)

When Alexander describes a global pattern of space such as a forest (pattern 60) he relates it to the scale of the city as a park (pattern 13), to the scale of the neighbourhood as a public garden (pattern 14) and the scale of a house as a private garden – (pattern 59). He zooms in further to define private gardens according to the elements that compose them (pattern 107) such as the garden’s walls (pattern 173). Strategic Interventions can be organised in the same hierarchical order as patterns. Interventions of space can have the scale of a public bench, a building, a group of buildings, a

neighbourhood or a town. Other kinds of interventions can extend to the scale of a region and even the world, such as a change in the constitution or even a television program.

By following such hierarchical organisation of interventions, we are able to relate the scale of an intervention to hierarchical levels of social and urban organisation. This opens doors to explore ways to relate the scale of the interventions with the extent of their influence across all urban hierarchical levels.

Table 4 (Appendix 1) is the characterisation of interventions in the built environment according to their size. It assumes the character and structure of Alexander's patterns organised as *Intervention Areas of Focus* (IAF). These *Interventions Areas of Focus* cross all hierarchical levels of society but are materialised differently according to their specific purpose and the intervention scale. They represent the basic elements and relationship between elements which are the source of most human problems as well as the source of their solutions.³³ From the perspective of interventions in the built environment the categorisation made here shows examples of elements or the relationship between elements in which one can intervene to induce a greater change.

The problem with giving examples of interventions is the fact that it makes them less flexible and much more restricted. On the one hand, each of the examples given can be placed under different *Intervention Areas of Focus* (IAF): a harbour can be either seen as a place to work or as a place of trade. Because appropriate interventions are contextual, the way one looks at them has to reflect the unique needs and character of the place.

On the other hand, the scale of the interventions is not absolute. When one thinks at the scale of the world it is easy to consider a building as the unit or the micro-intervention. In light of this even if we can generally give a sense of scale to interventions, the important thing to remember is the hierarchical organisation of complex systems and the idea that each intervention is part of a higher level system and includes and extends to a lower one.

In addition, the scale of the intervention cannot be addressed exclusively from the perspective of its physical scale. The scale or the impact of an intervention in the built environment relates not only to its size but also to its function and to the spectrum of its potential users. Certain kinds of interventions cross hierarchical levels. The stock exchange building has a global relevance. One hospital might be enough to support the needs of a region. In this case, the building (level 8), will have an influence across other higher levels. In the example of the hospital, one building will satisfy the need for health across the scale of the province, the city, the neighbourhood, a group of people and the individual. In the example of the stock exchange building its influence will extend to the scale of the region, country, continent and world. Buildings have the ability to act as catalyst of urban scale across all levels of social organisation. Furthermore, buildings, as well as other scales of urban interventions, can also serve as a catalyst for change across scales because of their aesthetics, their experimental or unique character. The pyramids in Egypt, the Eiffel Tower in Paris, the Guggenheim Museum in New York or in Bilbao are just some of the many examples across the world.

Hierarchies of interventions in the urban environment can be simplified as the following:

Categorisation of interventions in the built environment according to their size		
<p>Macro-interventions</p> <p>Interventions from the scale of level 6, 7 and 8.</p> <p>They are related to the fields of urban planning and eventually urban design</p>	<p>Interventions from the scale of level 9</p> <p>They are related to urban design and architecture</p>	<p>Micro-interventions</p> <p>Interventions from the scale of level 10.</p> <p>They are related to architecture and design of furniture and objects.</p>
<p>These scales relate to the design of urban areas. These macro-interventions imply a creationist approach. Designers plan an area as a finished whole.</p> <p>Macro-scale interventions in the urban environment refer to the design of new cities, new neighbourhoods and new urban areas</p>	<p>Level 9 relates to the scale of architecture; to the scale of a building or a bridge. Buildings can be of different scales and host different functions.</p>	<p>Micro-interventions refer to the basic elements from which a building or a place is made. It can relate to the components or shape of a building, such as a door, a window or an arcade, or elements in the urban environment such as urban furniture, a tree, signs...</p>

Table 5: Categorisation of interventions in the built environment according to their size

Note: All hierarchies of interventions have the potential to influence higher levels of social organisation.

The patterns of space suggested by Alexander, can be considered the basic elements around which the urban form normally self-organises (Salingaros, 2000). These patterns cross all levels of urban organisation. The basic elements of the space syntax can be seen as the set of rules which makes the city organise itself spontaneously in a specific and rather predictable way. Elements of space syntax such as buildings, plots and routes are more evident in levels 6, 7 and 8 of urban organisation. The basic elements of the space syntax and the interventions of space are the basic bricks the research suggests as possible tools to be used as strategic interventions in the built environment on a macro-scale. They are the raw material to act at the urban level and induce change across all levels of the system.

These ingredients of space are abstract and of general consideration. They should be kept in mind when planning a strategy to intervene in a city or when designing an intervention.³⁴ Nevertheless, the uniqueness of the context and the purpose of our actions should shape the objects we build in the city.

The relevance of *Micro Interventions*

The most basic elements or building blocks of a community are each individual who acts on it. From the perspective of the built environment a *unit* can be considered to be an *object*. Nevertheless, the scale of that object or unit is not absolute; it changes according to each intervention and context of focus. Hierarchies of intervention are merely indicative. They should be adapted to each specific urban and socio-cultural reality. In light of this, depending on the context of the intervention, the unit can be considered a building (level 9) or even the smaller elements from which the building is made, such as doors, windows, steps, structures... The unit can also be the elements which dress the urban environment, such as urban furniture or a tree, a fountain, a lamp, an information board... These are the ultimate units; the most basic elements one can use as tools to intervene in the built environment. The research refers to such elements as *micro-interventions*.

Both one man and one object can be considered a micro-intervention. Both one man and one architectural object can change a country or even the world as well as the way we do and perceive things.³⁵ These units have the capacity to influence the whole not only when they intentionally plan to do so. Emergent small scale interventions that focus on the wellbeing of the self can also have a great impact on the wider community. Nevertheless, a *micro-intervention* becomes a *micro strategic intervention* as soon as the intention behind it is the good of the whole rather than the good of the self.

It is arguable that *micro-interventions* are in general more efficient to nudge change than macro ones for three main reasons:

First, they are the basic elements from which systems are made; they are the raw-material from which all hierarchies emerge. Therefore, they have the capacity to influence all aspects of society, not only in their hierarchical level but also across other levels of the system. Using a biological analogy this would mean the manipulation of a cell with the intention to induce change in a whole body. The same would be to transplant an organ to heal a person. In a text it would mean replacing a verb to change the meaning of a message. In the urban environment it would be like changing the furniture in a central square to influence the development and character of a city.

Complexity theory applied to the study of cities also suggests the manipulation of the urban system from the perspective of its basic unites. Batty (1994) supports the use of micro-scale interventions to manipulate the cities' change. In his book *Fractal cities* he refers Simon (1969) to say that "*Systems, when changed, are changed at the level of their cells rather than more globally, and in this sense, contain a degree of spatial resilience which is manifested in the persistence of their form*".

Second, both evolutionary theory and complexity theory suggest that the city system's development and its health is related to the addition and subtraction of basic elements rather than to abrupt changes.

“The fitness of the system can be damaged when growth is too quick or interventions are made at an inappropriate level” (Batty et al., 1994).

As argued in chapter 3 evolutionary sciences in the study of a city suggest that large-scale interventions are risky due to the immediate impact on the urban and social order of the place. Evolution is a step-by-step process of change. When the step is too great humans require greater efforts to adapt to the environment, and there is no certainty that humans will adapt (Marshall, 2009). In addition, macro interventions imply the use of more resources, which are wasted when the intervention doesn't work as expected.

Alexander (1964) argues that meaningful designs and decisions evolve through the elements which compose the system's hierarchy (Salingaros, 2000; 2005; 2006). Alexander defends the creation of complex structures which can only be made successfully by generative techniques. This is obvious in biology but still not obvious in planning.³⁶ Generative methodology has to do with the creation of complex organisations by step-by-step adaptation. It is deeply related to *adaptational complexity*; therefore, it would be silly to apply this concept to a design process of a finished object such as a building, but many argue that it would make sense to apply such an approach to the design of the urban space (Rudlin & Hamani, 2019).

Third, *micro-interventions* could be used as a strategy to test the ground for eventual larger ones (Lerner, 2012). The use of micro-interventions to nudge change addresses evolutionary theory's suggestions on how to manage change. It avoids disturbing continuity but it is still able to define an evolutionary path. Planners, decision makers, designers, and people in general still have the ability to imagine what the possible long-term future should look like, but are advised to be more sensitive to the fragility and complexity of social and urban systems on a short term.

In other words, strategic interventions should be preferably discreet and not restrictive. Their aim should be to unblock healthy emergent development (Marshall, 2009: 277). Strategic interventions should be used to remove barriers so incremental improvements can emerge naturally. This approach towards urban planning offers the ground to explore paths of development and consolidate the preferred ones even further.

Obviously *micro-interventions* alone cannot address all world problems. Depending on the problem and the context, organisations and greater amounts of resources might be needed to create larger scale actions or to implement small actions across larger geographical areas.³⁷ What is important to retain is the fact that the scale of the intervention is not directly related to the scale of its influence across the different hierarchies of society.

The scale of interventions can be seen from two perspectives:

- a) The actual scale of the intervention.
- b) The scale of influence of the intervention.

The scale of the intervention one might use is not necessarily related to the level of the hierarchy it aims to address. That is to say, the plantation of a tree can influence the use of a square which in turn can influence the life of the neighbourhood or even the city. The notion of nested hierarchies can help us to explore how to use different scales of intervention, to address problems in different hierarchies of social organisation.

The Broomy Hill Railway			
Relation between scale of interventions and levels of social organisation	<u>Levels of social organisation:</u> Continent: Europe; Country UK <u>Scale of intervention:</u> Interventions from the scale of level 6, 7 and 8. Scale of urban planning and eventually urban design	<u>Levels of social organisation:</u> Region, province, city, neighbourhood <u>Scale of intervention:</u> Interventions from the scale of level 8 and 9 Scale of urban design and architecture	<u>Levels of social organisation:</u> A place: Broomy Hill Railway Site <u>Scale of intervention:</u> Interventions from the scale of level 10. Scale of architecture and design of furniture and objects.
Scale of the intervention			<u>Interventions:</u> The buildings, the routes, the green areas, decorations, fences, the trains, the trees...
Scale of the intervention's influence	<i>".. Not only has this intervention had a great impact in the tourism and economics of the neighbourhood and near city, but it also influenced the life of train lovers all over Europe."</i> Participant in study 2		

Table 6: The example of Broomy Hill Railway.³⁸ Relation between the scale of one intervention and the scale of its influence in a social environment. The example of Broomy Hill Railway was given by one participant in study 2.

In short, the use of strategic micro-interventions to manipulate urban change embraces the fact that the future of a city is unpredictable. On the one hand, strategic micro interventions help to consolidate the present rather than to envision great actions and revolutionary ideas for the future. On the other hand, they can serve to explore alternative paths of development. The use of micro-interventions to nudge change allows us to deal with the city as a living thing, as an ecosystem in constant mutation. *"... like dealing with something living, but not in the manner of training or pruning a tree: it's more like training or pruning and evolutionary tree, allowing new mutations to evolve and flourish into new lineages"* (Marshall, 2009).

According to Alexander (2006), to survive on earth and continue to build living structures we have to pay more attention to the intrinsic relationship between the parts and the whole, and therefore acknowledge the influence a small intervention can have in the city. This would allow us to nurture the stability given by the continuity of step-by-step urban evolution, which in many aspects offers people a greater quality of life.

Chapter summary

The first part of this chapter characterised interventions in general. The second part defined strategic interventions and the third part focused on strategic interventions in the built environment.

The chapter started by looking at how an intervention emerges as a consequence of previous interventions and will become the cause of new future ones. Interventions and emergent reactions are so deeply interlinked that they can be regarded either way. Intentional actions can easily be interpreted as emergent reactions of the system; therefore, one might have difficulties in determining which intervention is the cause and which one is the effect; just like in the tale of the chicken and the egg. Because of this ambiguity the research argues that the definition of interventions as a *cause* or as an *effect* is dependent on the purpose of the study and where one starts to analyse urban change. If the aim is to study the future emergent consequences of one action, the intervention should be considered a cause. If the aim is to understand the social, political or economic conditions that lead to a certain event or situation, that event or situation should be considered as an emergent consequence of the system in analyses. This distinction is of key relevance for the analyses and evaluation of our actions and consequently to establish an effective ground for this research's exploratory management system (EIMS).

Secondly, interventions were characterized as *natural* and *artificial*. A *natural intervention* is the term used to address interventions which emerge from the natural environment. An *artificial intervention* is the term used to address man-made interventions. This part of the text explored the ambiguity between the two terms. Interventions, such as climate change, can be interpreted either way. Complex problems which emerge from the complexity of the urban system are called *wicked problems*. The fact that there are no right or wrong solutions to wicked problems and the fact that the solutions for these problems normally generate other unpredictable ones. This observation served as grounds to support the idea that any sustainable urban planning system should be a process which evolves side by side with urban emergent change.

Alexander's theories expressed in the books *The Timeless Way of Building* and *The Pattern Language* were used as a theoretical background to distinguish *interventions of events* and *interventions of space*. Interventions of events are related to happenings, actions and feelings; they are

related to non-material things. Interventions of space are related to the physical space of the city; to the built environment; to the place where events happen. It was suggested that we can manipulate events by manipulating space and vice-versa. In other words, if one identifies the *building blocks* from which a given event emerges, can use that information to manipulate it by intervening in the built environment. This statement supports the research hypothesis and establishes the grounds to explore a framework to relate events with space.

The first section of this chapter ended by categorising interventions in relation to the time they take to be implemented or the time they take to manifest themselves. Based on this distinction, interventions were characterised as *acute* or *chronic*. Acute interventions can be seen as the incisions of Chinese acupuncture therapy. Incisions of this kind are fast and precise and are used as a catalyst to induce change in their direct and indirect environment. Chronic interventions are implemented over longer periods of time. They might be part of a system of interventions applied during different periods of time or they might be one long-term intervention like the systematic effort to change a mentality or a world view.

The second part of this chapter was used to define *strategic interventions* as short-term actions with long-term intentions. Intentions behind strategic interventions should be focused of the common good and should emerge from a holistic perspective of the system. Strategic interventions can be emergent, such as the insurgent actions described by Friedman (2011), nevertheless, they are the responsibility of top-down management.

The need for a consistent long-term intention or vision for the future and a pragmatic way to reflect on an urban complex system as a whole were the basis for this thesis' explorations in chapter 6. In other words, the framework designed, tested and validated in this research emerged from:

- The relevance to relate human actions with long-term changes.
- The relevance to relate human actions with the overall good of the urban system.

The categorisations made in the third part of this chapter can eventually relate to all other kinds of interventions. However, they were approached from the perspective of the built environment.

The categorisation of *strategic interventions in the built environment* started by making a distinction between *single interventions* and *interventions applied in a system*. On the one hand, a building, a public lamp or a fountain can be used as a catalyst for change. On the other hand, multiple interventions (of the same or of different kinds) can be organised in a way that together they work from different fronts to achieve a common goal.

Secondly, findings which emerged from chapter 3 were used to relate interventions with notions of predictability and context. The literature leads to the conclusion that from a short-term perspective the consequences of an intervention can be rather predictable. The change of the shape of a plot will

influence the morphology of the neighbourhood. Nevertheless, in the long-term complex systems are by nature unpredictable.

The literature findings let to establish the basic elements that define a space and which can be used as tools to manipulate urban development. These standard elements combine Alexander's (1977) patterns of space and the elements Marshall (2009) identifies as the building blocks of urban syntax. Nevertheless, as strategic interventions, these elements get their meaning from a specific context. Both the design of an intervention strategy as well as the design of the intervention itself should emerge from the needs and character of the specific environment where they are going to be implemented.

Finally, interventions were organised according to their size. The research built on Miller's work and the notion of nested hierarchies introduced in chapter 3 to characterize interventions in relation to scale. Chapter 5 used the work of Alexander to relate the idea of nested hierarchies to the built environment. Miller suggests that all living systems emerge from the relationship between and within inclusive hierarchies. Hierarchies such as: cell; organ; organism; group; organisation; society; and supranational system in that ascending order. Alexander also organised what he calls patterns of space in an inclusive hierarchical order. In other words, all Alexander's patterns which we use to define the basic elements one can use to intervene in the city include and extends the previous ones. Alexander's work was used as a link to establish a logical coherence to the scale of interventions. As a consequence of this hierarchical organisation two key concepts emerged: *macro-intervention* and *micro-intervention*.

Macro-interventions relate to large scale interventions. They relate to systems of interventions applied across the world, continents, countries or regions. In the context of the built environment, macro-interventions refer to projects of the city's scale or the scale of a neighbourhood or to the basic elements of space syntax identified by Marshall (See pp.64). Micro-interventions in the urban environment refer to things such as a garden bench, a traffic light or a tree; they refer to the building blocks of urban and social complex systems. Conclusions extracted from the literatures lead to argue that the scale of the interventions is not directly related to the scale of their influence, therefore micro-interventions can have an impact on the neighbourhood, or even the city. The research argues that macro-interventions are riskier than micro-interventions. Ultimately, the consequences of any intervention are unpredictable; therefore, it's better to intervene discretely in the urban environment and try to cause as little disturbance as possible.

Strategic micro-interventions were defined as the manipulation of the basic elements from which a complex system emerges. Strategic micro-interventions are so relevant because:

- By changing one of the basic elements of the system they can trigger change in the system as a whole.
- They are small therefore they hardly disturb pre-established dynamics of the system.

- They can be used to test potential directions of change or the appropriateness of a larger scale intervention.

In short, the last part of this chapter is a way to focus on *strategic interventions in the built environment*; short-term interventions of space which take into consideration long-term aspirations for the city as well as the urban system as a whole. Interventions that on the one hand are conceptualised by taking into consideration the standard aspects of human life and the standard components of the built environment, but on the other hand are selected and designed according to the uniqueness of each context. The aim of *Strategic Interventions* is to accelerate the process of urban development or change its path.

The categorisation of interventions gives one the possibility to relate kinds of interventions with different aspects of social and urban organisation. It also helps to situate interventions in the built environment in relation to all other possible interventions which can be used as catalysts for urban change. Furthermore, it enables us to define exactly the research's interventions of focus; the ones explored in the research studies.

The categorisation of interventions enables people to study and compare them. One can see which are more accepted by different kinds of people, which are easier to implement and which have more of an impact on their surroundings. Above all it opens doors to explore tools to help design and select interventions more adequately.

The categorisation made in this chapter was translated in the framework used in the research studies (EIMS). On the one hand, this framework represents an exploration of a tool to select and design strategic interventions. On the other hand, it can be used as a systematic basis to analyse urban systems and compare different impact interventions have in the system's development.³⁹

The following tables are both a resume of the categorisations made in this chapter and a framework to categorise interventions. The kind of interventions which were studied in this research are marked with (*).

Categorisation of interventions in relation to:	General Interventions	
Their active or passive role in relation to urban and social change.	Interventions as actions * E.g. Building a bridge	Interventions as consequences or reactions * E.g. A new residential area
2- Their source	Natural interventions E.g. An earthquake	Artificial interventions * E.g. A building
3- The kinds of interventions in the urban environment	Interventions of events E.g. A procession	Interventions of space or interventions in the built environment * E.g. A fountain
4- The duration of the intervention	Acute interventions or short-term actions * E.g. A public lamp	Chronic interventions or long-term actions E.g. Teaching the relevance of recycling.
	Strategic Interventions	
5 – The intentionality of the intervention	Unintentional interventions: Intention focus on the self E.g. A private house	Intentional interventions: Intention focus on the common good * E.g. A school
6 - The origin of the intervention	Top-down interventions * E.g. A change in the legal system	Bottom-up interventions E.g. Choosing a place to live
	Categories of strategic interventions in the built environment *	
7- The quantity of interventions and the relations between them	Isolated interventions E.g. A fountain	Interventions in a system E.g. Trees+ children playground + bus stop
8 –The predictability of their consequences	Predictable: Short-term E.g. Change the shape of urban plots – Predictable urban morphology	Unpredictable: long-term E.g. Change the shape of urban plots – Unpredictable use of urban empty spaces.
9 – The environment	General interventions: Conceptualisation phase. E.g. Establish the relation between a problem and a tool to address it. Problem: segregation. Tool: sports field	Unique or contextual interventions: design, selection and implementation phase. E.g. define location, area, design, material, etc of the sports field in relation to the area of focus and the people involved in it.
10- Their size	Nested hierarchies of interventions. See table 4 and 8	

Table7: Characterisation of interventions according to the categories explores in chapter 4

Hierarchies of social organisation									
L1 World / L2 Continent / L 3 Country / L 4 Region / L5 Province / L 6 City / L 7 Neighbourhood / L 8 Place / L 9 Object / L 10 Basic elements of the system									
L1	L2	L 3	L 4	L 5	L 6	L 7	L 8	L 9	L 10
Hierarchies of interventions in the built environment according to their size									
Macro-systems of interventions			Macro Interventions				Micro Interventions		
<p>Interventions at the level 1, 2, 3, 4, 5 and 6 are normally composed of a system of interventions.</p> <p>Intervention system can be designed to influence any of these levels of social organisation but the scale of the interventions themselves is normally smaller.</p> <p>The system of interventions can be composed of interventions of all kinds. Not necessarily only interventions in the built environment</p>			<p><u>Urban planning and urban design.</u></p> <p>Interventions of the urban scale.</p> <p>E.g. A new city or a neighbourhood.</p> <p>They relate to infrastructure, connectivity and spacial organisation.</p>				<p><u>Architecture *</u></p> <p>Interventions of the scale of a building.</p> <p>E.g. A bridge, a square or a market.</p> <p>They relate to objects rather than systems or networks.</p>		
							<p><u>Design. *</u></p> <p>Interventions in the elements from which buildings and places are made of.</p> <p>E.g. A fountain, a public bench or a tree.</p> <p>A decoration of a facade, an out-door's step or a lamp.</p>		
<u>Relation between hierarchies of social organisation to hierarchies of interventions in the built environment.</u>									

Table8: Relation between hierarchies of social organisation and hierarchies of interventions in the built environment.

Note 1: This categorisation is not rigid. It serves as an indication. Depending on the context a square can be considered a *macro-intervention* as well as a bridge or a hospital building.

Note 2: All hierarchies of intervention have the potential to influence all levels of social organisation.

Relation between long-term intention and short-term action L1 World / L2 Continent / L3 Country / L4 Region / L5 Province / L6 City / L7 Neighbourhood / L8 Place / L9 Object / L10 Basic elements of the system										
Long-term intention	L1	L2	L3	L4	L5 Improving tourism in a city can influence the province or even the region.	L6	L7	L8	L9	L10
Short-term action	L1	L2	L3	L4	L5	L6	L7	L8	L9 Build a museum	L10

Table 9: An example of a possible relation between long-term intention and short-term action ³⁸

Chapter 6: The Exploratory Interventions Management System (The EIMS)

A framework to support the design and management of human actions/ *Interventions*

Chapter 6 explores research objectives 7 and 8:

- 7) To explore how we can design top-down interventions more efficiently, according to this thesis' content.
- 8) To postulate an operational framework based on the research's theoretical approach that would lead to the design and selection of more appropriate and sustainable interventions and strategies.

It synthesised the literature review findings in the form of an exploratory framework which shaped the research methodology. This framework (EIMS) was developed and tested in the research's studies (chapters 8 and 9).

Introduction

To address the objectives mentioned above and test the research hypothesis we designed two exploratory models, which together form the Intervention Management System (EIMS). The models aimed to be used as a framework to explore how this research's approach towards urban change can improve urban management and urban design. The EIMS models are both the result of the conclusions taken from the literature review and the case studies, as the research process was not linear. The *exploratory intervention management system's models (EIMS)* were used as the basis for all four studies' methodology. However, they were used differently depending on the study and sometimes they assumed more presence than others.

The models were designed to:

- Help professionals who act on the city on a daily basis to reflect on the urban fabric from a holistic perspective. The model's potential to self-educate users and stimulate people to think in complex systems from a holistic perspective was tested.

- Relate interventions with urban change and the unpredictability of complex systems. The models were conceptualised as a framework that could be used as a dynamic working tool; a framework that could be adapted according to the change of circumstances and according to the input of the people using it.
- Serve as a framework able to relate both knowledge and theory with practice. The ability of the models to translate the information gathered and analysed into design solutions was tested.
- Serve as a basis for communication across people intervening in the city and guide a deeper reflection on relevant topics. The research explored and tested the potential of the models to be used as a common language and as a framework to share information between parties relevant to the design process of an intervention in the built environment.

Before describing the models, there are some considerations which are relevant to take on board. One of these considerations is related to the use of models to address and explore complex systems. It relates to the apparent co-relation between models and the over simplification of the complexity of urban social systems. The second consideration is related to the abstract character of models and the contextual particularities of each context where they will be applied.

Models and the oversimplification of complexity

In social systems problems happen continually and at all levels all of the time; therefore people must have the freedom to respond to them adequately, otherwise the system may collapse (Allen, 2012). To do that, Peter Allen suggests three things: motivation, a target or an intention, and models. Chapter 3 referred to the nurturing of the self-organising city as a true encouragement of social participation in the construction of urban life. It also referred to the relevance of intentions as the reason behind human action (Bortoft, 2010). In this chapter we will refer to the relevance of models.

Models can help us to think about a subject from a more holistic perspective and to crystallise linkages that are not easy to see. Models can work since conversation devises where people can share their understanding on how things work and give ideas about how to address the problems. Above all, models can serve as a tool to create knowledge coming from different perspectives and scientific backgrounds.

However, there are relevant considerations to keep in mind when using models to address complex evolutionary systems.

First is the fact that there is no such thing as an objective model of the world (Banathy, 1996). According to systems theory, models always mirror the pre-conceptions of the people who use them; therefore, any model trying to represent social systems is by definition subjective. In other words,

models are conceptualisations of the complexity of social dynamics. They do not exist as such; they are abstractions. Such models help us to imagine the complexity of the world we live in but they can never represent the complexity and dynamic character of reality.

So, how can we create any model of reality able to be used as a holistic framework of thinking, without oversimplifying it?

Models as an abstract tool to study contextual urban environments

The second consideration to keep in mind is related to the idea of human adaptations to the environment as a key factor for human wellbeing. It relates to the fact that the urban context shapes human actions and behaviours; therefore, it shapes the selection and design of human interventions. Consequently, the kind of urban planning suggested by this research should reflect a deep understanding of the context. Not only this, as Friedman (2011) argues that planning in general is not something global or a universal truth, it is rather contextual. Therefore, any model which attempts to represent an urban environment needs to reflect the specificities of each unique context.

“But the pay-off (of abstract theorizing) comes only when we can limit our assertions to the context of particular socio-cultural traditions. The call is out for many planning theories, not one.”

(Friedmann, 2011: 136)

So, how can we create a model able to replicate the contextual reality of a complex urban system? Is the task of designing a framework able to contextualise humans and their actions in relation to the greater whole even achievable?

In Chapter 3 it was argued that there are basic elements common to all social and urban systems. These elements self-repeat and they justify the use of complexity science to investigate social and urban organisations. The models suggested in this thesis are defined by self-similar elements representing areas of intervention in urban systems. Even if the models suggested here, like any other model, are abstractions and general representations of urban complex systems, the way they are translated in everyday life is highly contextual.

On the one hand, the user of the models is considered an element of the system in analysis. On the other, one has to trust the human capacity to deal with complex systems on a daily basis. In light of this, we trust that users will be able to adapt the models to their best interest and to relate them to the specific urban issues they want to address.

Each user of the EIMS models will interpret them in a different way and will focus on different aspects of society. As suggested by Rotmans (Grosskurth and Rotmans, 2005) in relation to the use of models as a tool to study reality, it is assumed that what emerges from the analysis of the EIMS models is an aspect of reality, as holistic as it can be, but it is not reality itself. Nevertheless, as suggested by Thompson (1990), models can be used as a framework to compare information; therefore they can be improved and always transmit a more complete perspective of reality (Thompson et al., 1990).

The EIMS models

The EIMS is composed of two models. One refers to a fixed image of what a social and urban system is at a given moment in time. The second adds dynamism to that view. It engages with notions of time and change. As suggested by Roo and Rauws (2012), both the EIMS models and the methodology to operate them emerge from the intersection of complexity theory, transition management (Loorback, 2007) and spatial planning.

The EIMS models were designed to help people to recognise the complexity and the holistic character of the urban fabric, guiding them to act on the city on such a basis. In other words, the models aimed to help urban participants to increase their awareness of the causes and the spectrum of possible consequences of interventions or changes in social and urban systems. The thesis brings forward the argument that an increase in awareness of the complexity of urban systems will lead to the design and selection of more adequate actions in the city. In addition, it will hopefully bring a sense of responsibility to people when they act in the urban system.

Despite the fact that the exploratory models were designed to improve interventions in the urban system, they can simply be used to engage people with a deeper thought of what a social system really is. Their main value is simply to help people to reflect on human actions in relation to an urban complex system and its development.

The fact that EIMS is designed from the perspective of interventions shaped the model, its elements and the relations between them. Contrary to other models, what characterises the system is its intervention areas or the aspects of society on which one can intervene in order to improve the system or nudge its development towards a sustainable path. As we will see, such areas are related to management and legislation systems, belief systems and the built environment itself.

The EIMS models were designed to assist both the top-down and bottom-up kind of planning. On the one hand, they were designed to be used as an everyday tool to assist people involved with city

planning and city design; a tool to assist professionals such as architects, engineers, planners and transportation and environmental planning experts, housing experts and so on (Timmermans, 2012). On the other hand, the models can be used by anyone who intervenes in the city regardless of the scale of the intervention.

The fact that EIMS can serve as a common ground for both top-down and bottom-up planning represents an attempt at genuine public participation in the planning process (Marshall, 2009, 2012; Portugali, 2012); one that is based on real interventions rather than endless open consultations which normally have little effect in shaping top-down planning strategies (Friedmann, 1997).

In short, The *Exploratory Intervention Management System* models were designed to help people to relate key aspects of society and urban dynamic change with human actions. The EIMS models are general frameworks which illustrate strategic intervention areas in a complex urban system. The EIMS models invite people to use their innate capacity to deal with complex systems to meditate in the ways those general elements are materialised in each context. Such models can be useful to study, design, select and implement more adequate and sustainable human intervention. This enables top-down protagonists to intentionally nudge urban development towards a more sustainable path (Banathy, 1996).

EIMS models are a framework conceptualised to address the research hypothesis: *If we design and manage human intentional interventions adequately we can manipulate urban emergent change towards a sustainable development.* In other words, EIMS models were designed to support the design and selection of strategic interventions; interventions which can be used as tools to nudge urban and social development and address urban problems within the modern complex urban environment.

In light of this, as other models which inspired this research,¹ they were designed to support:

- The understanding and manipulation of complex systems.
- The understanding of humans and human action in relation to their environment.
- The design and selection of more responsible and aware interventions.

Following this, the research models aimed to assist the following research explorations:

- How can we design interventions in a more adequate and strategic way?
- How can we select interventions being aware of their complex relations and the unpredictable character of their consequences?
- What kind of management system gives space for innovation and bottom-down self-organisation and still nudges change in a sustainable direction?
- How can we induce actors to cooperate towards a common good?
- How can we help them to “speak the same language”?

This thesis argues that the EIMS models could improve the urban planning process in two ways:

First, they could serve as a platform for communication between the participants involved in the creation, selection and implementation phase of an intervention as well as being used to involve the

civil society in the process. They could improve communication and negotiations between experts, managers, designers, decision makers and private and public institutions involved in the design and selection process of an intervention.

Second, they could be seen as the basis for a more dynamic kind of management; a kind of management focused on the design and selection of human actions in a given environment. This kind of management envisions interventions, regardless of their kind and origin, as actions that can influence the urban system and serve as a catalyst for a sustainable urban development (Banathy, 1996).

The EIMS basic model

During the research process, several models were analysed to explore to what extent they could help to translate into a visual form the ideas we had collected in the literature review.^{1 and 2}

There are two key concepts that need to be translated into a visual form: The first refers to what is known about a given system and what is unknown and unpredictable. The literature on complexity theory and from the conclusions drawn from case studies in the context of transition management (Lorrbach, 2007) leads to conclude that what defines the character of a complex system and its unpredictable behaviour is not only the dynamics within a system, but also the dynamics between the system and its broader environment. The *MPL model* used in *transition management* was of great inspiration for the EIMS representation of this argument. It introduced us to the concept of *system internal* and *system external*.¹

The second concept that needs to be expressed in a visual form refers to the idea of nested hierarchies of social organisation. To translate a nested social structure into EIMS models, the *multilevel model* used by Geels and Kemp (2000) and Lorrbach (2007) to study transitions or *system innovations*³ was analysed. As the *multilevel model* is normally used for the analyses and monitoring of changes in social systems (Johnson, 2012), it was particularly relevant to define the methodology needed to operate EIMS diagrams. It helped to cross information through the different hierarchies of the system and to address the system from different hierarchical perspectives.

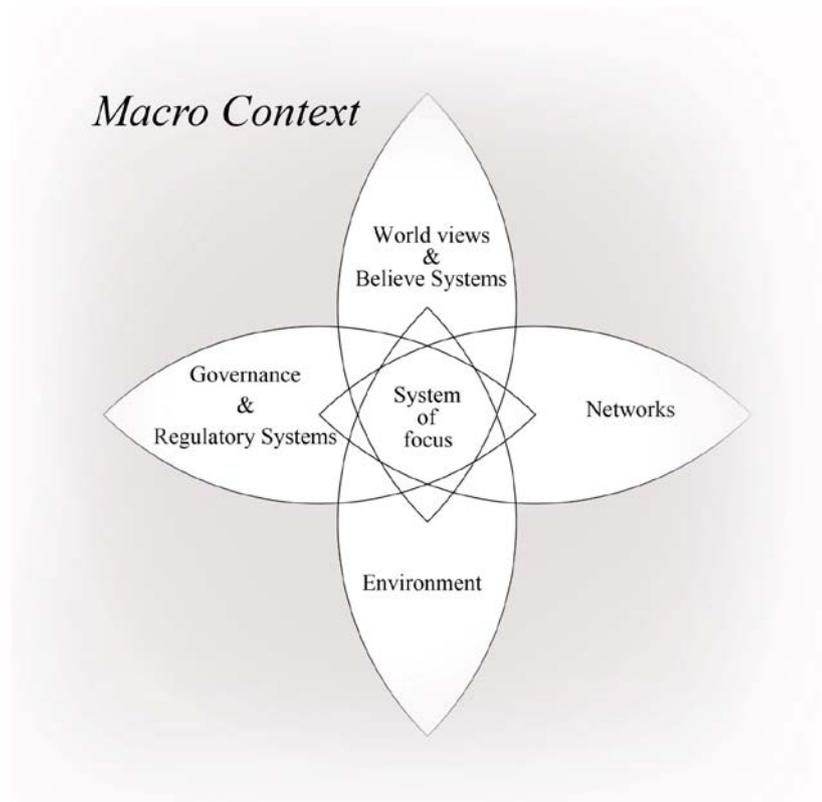


Figure 15: The EIMS basic model. It represents the four intervention areas which define the system of focus. It relates the system of focus with what is unknown about the system or its macro-context.

System internal and system external

The EIMS basic model is defined as a *system of focus*, what Loorbach (2007) defines as *system internal*. This part of the system is composed of four areas of intervention and their intersections. The *system external* is represented by the space around that. It relates, on the one hand, to what is unknown about the system or not taken into consideration and, on the other hand, it relates to the higher levels of social organisation and the macro-context.

The EIMS organised the *system internal* into four areas of intervention. These represent key aspects of social organisation which are relevant for the stability of any urban system. These areas represent the aspects of social organisation where problems compromising human wellbeing can emerge. At the same time, these four parts also represent the areas on which actors can strategically intervene in the system to improve it. The system internal can eventually have more or fewer areas of intervention depending on the context and the purpose of the analysis, but these four areas are the main general ones.

We have defined and characterised the intervention areas. This definition is not rigid or fixed; it forms part of the research explorative process. The areas we are suggesting at the moment are related to:

- **World views and belief systems:** Religion and culture. This area represents the innate shared knowledge and memory. It is the lens through which one sees the world and judges what is right or wrong.
- **Environment:** The natural and urban environment. The nature of the physical context is a key element in understanding the subject of research. Even if this research is more focused on the urban environment, the EIMS models can be used as a framework to address problems everywhere, from a wild forest to a global megacity. Therefore, it can range from a natural context to an urban context and include everything which is in between.
- **Governance and regulatory systems:** Politics, economy and regulations. This area represents the system that allows us to change goods and services on a fair and ethical basis from a micro to macro scale. It is implicit in this research's literature review that this system should be based on ethics and human nature rather than on the abstraction of numbers (Alexander, 2003; Ehrenfeld, 2008; Friedmann, 2011).
- **Networks:** Communication and transportation networks. This area represents the networks that allow us to move and to exchange ideas and knowledge.

The EIMS basic model is designed to allow intersections to happen between all intervention areas. Furthermore, the model's design allows the user to define areas of combination between two, three or four elements of the system. In addition, it allows the user to emphasise the area which is most relevant for the system of focus. An example might help to make this description more "visual": if we try to represent a human activity in the system such as trading a national good, where would we place it? Would it be regarded as a trade network or as a cultural or political and economic phenomenon? In reality all three can be considered and eventually even more. In addition, depending on the person analysing the system and the purpose of the analysis itself, one might place more emphasis on the phenomenon as a network trade and others to the fact that it represents a part of the economic growth of the place.

The intersections represented in the model allow us to address the subjectivities of the system as well as the various interpretations of its users (Grosskurth and Rotmans, 2005). Actually, most human actions and aspects of complex social systems happen in these spaces of intersection. Placing them in the EIMS model is a subjective action which illustrates the world view of the one who is using the model.

The heart of the system is the intersection of all four intervention areas.

On the one hand, the central area of the model represents human wellbeing. Human wellbeing is something contextual and sometimes not very objective. Because of this, we addressed human wellbeing from the perspective of general human needs which are easily identifiable. We use Hodgson's (Hodgson, 2011) *World System Model* to identify these key human needs^{1 and 3}: health (1),

wealth (2), food (3), water (4), security and sense of belonging (5), shelter (6), education (7) and energy (8).

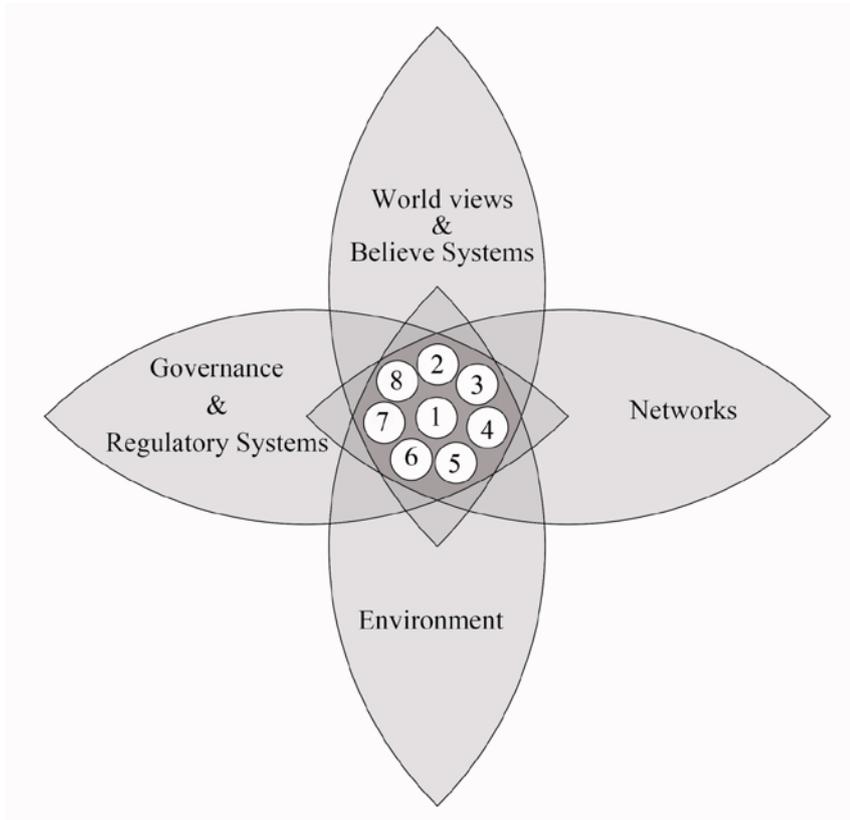


Figure 16: Relationship between the heart of the system and its intervention areas. The heart of the system is based on the World System Model. (Hodgson, 2011:13)

The heart of the system defines the system one wants to study. It should be used to characterise the challenges one wants to address when acting on the overall system. In addition, it should be used to establish the social group of focus, which in return defines the scale of the system of analysis. In other words, it defines the group of individuals the user aims to study. For example, the heart of the system is where the user defines that the investigation is focused on the criminality among teenagers living in a given neighbourhood. The central part of the system should be used to identify the focus of the system in terms of who and what to focus on.

In short, the EIMS' *system of focus* or the *system internal* is composed of four main intervention areas and the areas which emerge from their intersection. The heart of the system, which represents key human needs, emerges from the intersection of the four interventions areas and it is what defines the system of study.

Everything that lies around the four intervention areas is considered the *systems external*. The outside area of the model represents the world of multiplicity and complexity. It represents what is not controllable, the unpredictable and the unknown. It also represents the broader world and all the individuals that compose it. The *system external* relates to the *system internal*, both with complexity

and with a broader reality in which the focus system is nested. In other words, from the perspective of nested hierarchies, the *system external* can be seen as the macro level of the system of focus.

The EIMS basic model helps one to envision the holistic nature of complex systems. It defines and takes into consideration key elements to characterise an urban system and to intervene in it. In addition, the methodology needed to characterise the model leads one to formulate a vision or an intention for the future of the system. This vision will be the reason behind the interventions in the system and can become a common target among different urban actors. In other words, the EIMS basic model opens the door for a more holistic perspective of reality and can eventually stimulate cooperation between different social and urban actors.

Nested hierarchies and EIMS models

The EIMS models are based on the notion of nested hierarchies. Each element of the system and the system as a whole are composed of smaller social groups and are part of a bigger one at the same time.⁴ In other words, the world is composed of continents, continents have countries, countries have regions, regions have cities, cities have neighbourhoods, neighbourhoods have places and places have objects (Alexander, 1977). From the human perspective such hierarchical organisations can organise the world population in groups and subgroups down to the scale of the individual (Miller, 1978).

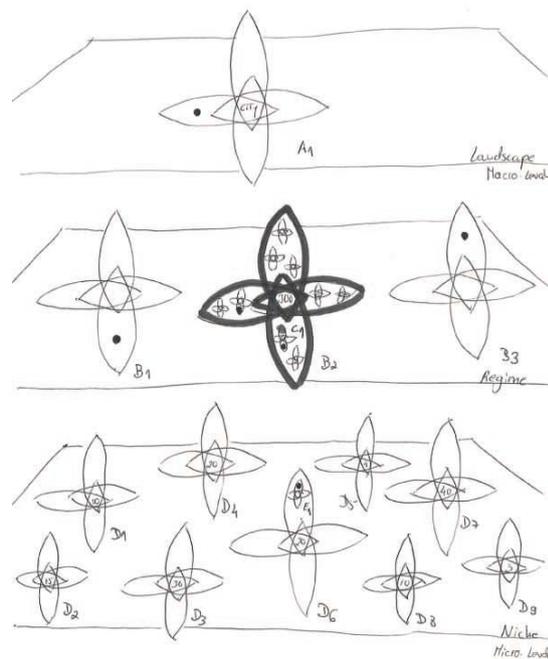


Figure17: The EIMS multilevel model is a framework of thinking. It emerges from a combination of Geels and Kemp’s multilevel model with concepts implicit in the SCENE-model (Loorbach, 2007).⁴ This image represents the conceptual approach of nested hierarchies applied in the EIMS models.

The concept of nested hierarchies applied to the EIMS model was explored in terms of “scale”. This approach was explored in the context of governance theory (Termeer et al., 2010)⁵ and it was

guided by Geels and Kemp's multilevel model (Johnson, 2012)¹. Multilevel models were interesting for this research because they represent a nested organisation of social systems, and they can be used to conceptualise strategies to act and transform established complex systems (Loorbach, 2007).

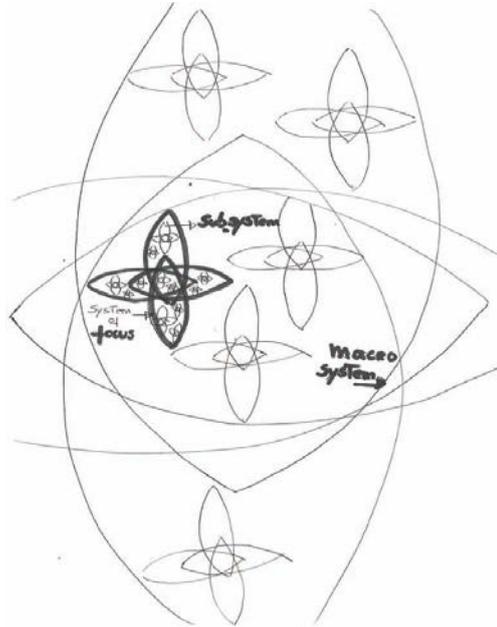


Figure 18: Nested hierarchies' organisation implicit in the EIMS basic model. Visualisation of the methodology used to characterise the system of focus. To characterise the system of focus one needs to characterise not only the four relevant aspects of the system, but also its relevant macro and sub system

However, they normally require expert skills to be used in a meaningful and efficient manner. Consequently, multilevel representations of social organisations are not appropriate for use either as an everyday tool or as a common framework to share information across different urban actors.

To be used as an everyday tool, the multilevel models need to be simplified. In EIMS basic models the notion of nested hierarchies is not explicit, as in multilevel models. It is implicit in the methodology needed to characterise the system of study.

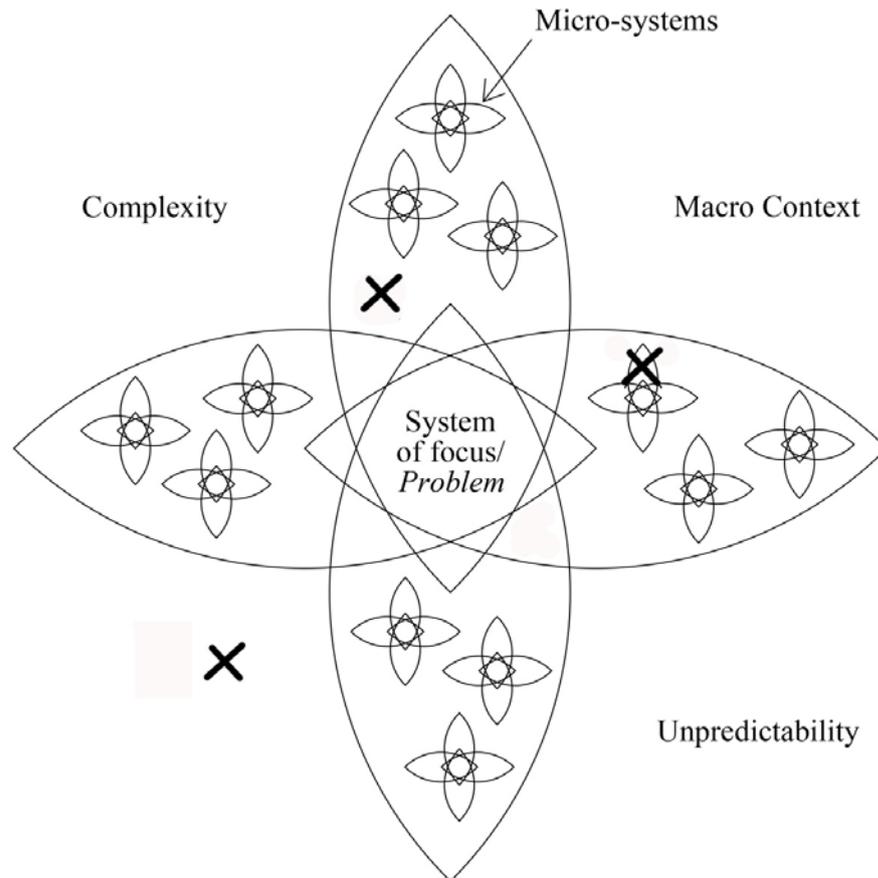


Figure19: Methodology to characterise the EIMS basic model and the system of analysis. It suggests that by defining the group of focus one defines not only the system of analysis but also the macro-systems and the subsystems relevant for that specific study. The macro-system is what we previously addressed as the system external. The subsystems are the systems that characterise what we previously addressed as the system internal. These subsystems might be subdivided and organised in infinite ways and they define not only the problems one wants to solve but they are also used to define and contextualise a solution.

In light of this, on the one hand it is of key importance to define clearly the heart of the system or the exact system one aims to study. It is important to define who and what we want to analyse because that clarity will help to define the subsystems which are relevant for that analysis as well as helping to relate the system of focus to a greater whole. Following the example above, the investigation about criminality among teenagers could lead us to say that the total group was composed of 50% Scottish, 10% Moroccan and 40% English. Of these, 50% were Catholics, 10% Muslims and 40% atheists. These subgroups help define our group of focus and help relate it to problems of a higher hierarchical level, such as integration, regional imbalances and the history of the country.

On the other hand, the nested hierarchical character of the system should also be used to reflect on the solutions, or strategies to respond to a problem. All intervention areas are also characterised by smaller self-similar systems. In this way, interventions can be applied or generated by any specific subsystem or macro-system and be represented accordingly in the EIMS basic model.

The characterisation of the macro-system is also relevant for the understanding of the system of focus. The outside circle which defines the macro-system is just a simplification of very complex issues. To contextualise a system with its macro-context one needs to reflect on the things the system needs from its environment and what it can give back (Banathy, 1996).

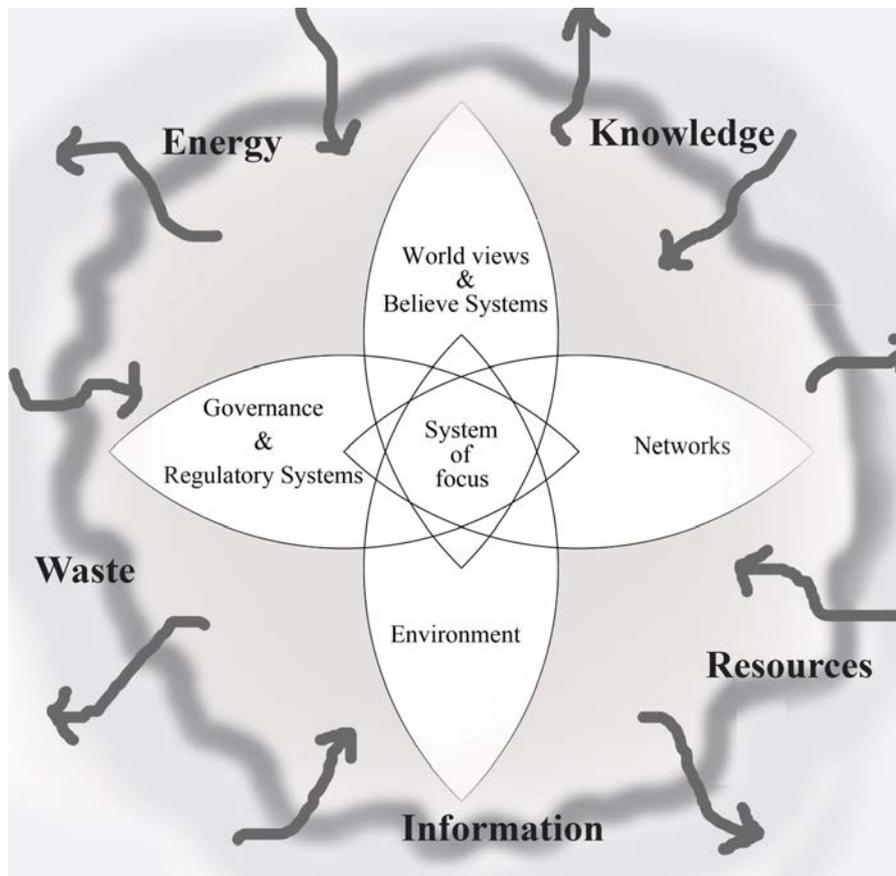


Figure 20: The EIMS models and the representation of the macro-system. It represents an exploration based on systems theory on how to relate EIMS models with a broader environment or a macro level of the system. It represents a way to contextualise the system of focus in relation to a greater whole by identifying what the system needs to exist and what it can give back.

Defining the needs and possible contributions of the system can be of key relevance in finding a strategy to address a given problem or to formulate a vision or common aim for the future (Loorbach, 2007). The characterisation of the system of focus in relation to the macro levels of the system might help to discover the uniqueness of the system in relation to the whole. This can help define types and areas of intervention which transform that uniqueness into a contribution that benefits the system as a whole. Following the example above, the investigation might reveal that most of these teenagers depend on social security to survive. Nevertheless, some are interested in sports, others in crafts and others in helping people in need. These ingredients might be the basis to reflect on strategies to unlocking unwanted synergies in the system as a whole.

An important issue to take into consideration is that the analysis of EIMS models is dynamic; systems and subsystems should be erased or added when needed.

In short, the EIMS basic model is able to perform all the tasks of the multilevel model but it has a more simple and pragmatic form (Timmermans, 2012). It is able to relate the system of analysis not only with the macro levels of the system, but also with the micro levels of social organisations.

The way the model engages with the notion of nested hierarchies can be represented in the model but is directly related to the methodology needed to characterise the system one aims to study. The EIMS basic model works as a framework that crosses all levels and areas of any social system. It is scales; it can be used to characterise both an individual and a society. It can be used to reflect on the dynamics of a country or even the world.

Until now, the EIMS basic model has been described as a framework to characterise social complex systems in a holistic manner; a framework of thinking. The next section examines the potential of the model to relate social complex systems to human actions.

Interventions in the context of the EIMS

One of the main contributions of EIMS models is that they relate interventions or happenings to a specific context. The interventions on which one wants to focus the analyses can be marked on the EIMS basic model. In other words, this annotation represents the kind of human action of focus in relation to the background system.

One can consider either past interventions or future interventions. One might aim to understand how past interventions shaped the reality we see today or speculate about how a possible intervention can shape the future development of an urban system.

On the one hand, depending on the study, interventions can be marked according to their hierarchical position in the system or the hierarchical level of their source; that is to say, the building of a basketball field can be marked as an intervention in a specific subsystem because it's targeted at influencing the dynamics in behaviour of a specific sub-group. However, it can also be placed in a higher representation of social organisation because it is a government initiative. Normally speaking, it is assumed that strategic interventions originate from the top-down; therefore, the interventions are normally marked on the target group one aims to manipulate. Interventions can target both groups and sub-groups of focus and macro levels of a social organisation. Therefore, they can be placed both inside and outside the system of focus.

On the other hand, interventions are also marked according to intervention areas. In other words, adding to the categorisation made in Chapter 5, one can use the model to define the aspects of the system in which one aims to intervene. That is to say that one can use the EIMS models to define strategic interventions both in terms of their kind and in relation to a social hierarchical level of focus.

A basketball field would most possibly be marked as an intervention in a subsystem of the built environment.

The general characterisation of interventions explored in Chapter 5 is independent from the EIMS basic model. Each of the four intervention areas of the system include the categories explored in Chapter 5 and eventually many others that were not addressed in this thesis. All interventions, regardless of their position in the system, need to be categorised according to their scale, according to the time they take to be implemented, to their strategy of implementation, to the predictability of their consequences and so on. Regardless of this categorisation, interventions can be marked in all intervention areas and their intersections defined by the model.

In short, a strategic intervention of analysis is defined in the context of the EIMS by the combination of the categorisation explored in Chapter 5, its place in relation to the system's hierarchical levels of social organisation and its position in relation to the system's intervention areas.

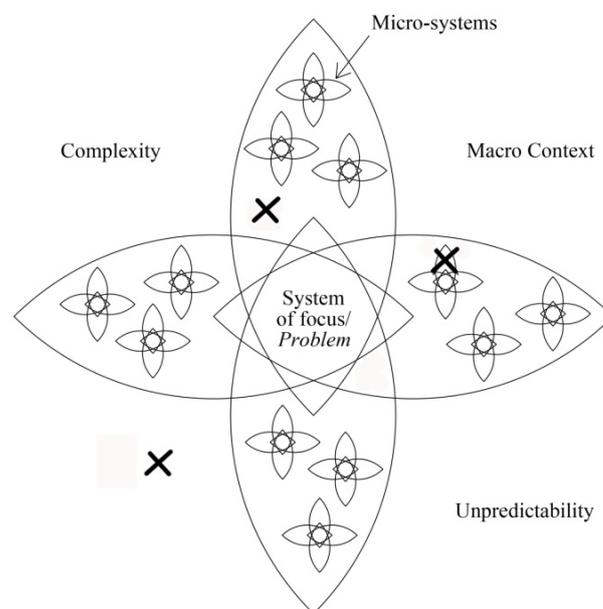


Figure 21: Relationship between key concepts presented in the literature review with the EIMS basic model. The image exemplifies how to characterise interventions in relation to hierarchical levels of social organisation and in relation to the systems intervention areas.

In short, Figure 20 represents the relationship between the system of focus, the macro-system, relevant subsystems and different kinds of interventions. This relationship explains both the intention behind each intervention as well as the role and position of each intervention in relation to the whole system.

Interventions are defined in terms of their type by relating them to the model's four areas of intervention. They are defined in terms of the hierarchical levels by relating them to the system's subsystems and macro-system.⁵

The EIMS basic model relates interventions to a specific time and a place. It relates interventions to one another as well as to the system as a whole. By making this relationship visual,

other relationships might be explored and new ideas or solutions might emerge. Consequently, the ability of this model to serve as a basis to support dialogue and exploration on urban systems was tested in case studies 1 and 4. In addition, all four case studies investigated in this thesis have explored the potential of the EIMS basic model to give a more holistic perspective of urban and social systems and inform the design and selection process of strategic interventions.

Who would use the EIMS basic model and for what?

We argue that the basic EIMS model can be used as a tool for professionals to analyse their intentions in relation to a specific context before they act on it. Professionals such as designers, architects, planners and decision makers could use this everyday toolkit to establish views and strategies of action, and select and design interventions without having to have a profound knowledge of the overall complexity around the system of focus. The exploratory diagram will hopefully enable the user to keep key aspects in mind when reflecting on a place, a city or a country, and when designing and selecting interventions to act on it. We suggest that the EIMS basic model can help professionals to:

- Characterise the context of intervention from a more holistic perspective.
- Establish common world views and a common vision for the future.
- Establish a strategy to achieve that ideal.
- Decide in what area/areas to intervene.
- Decide what kind of intervention/interventions should be used to address the problem more efficiently.
- Decide at what social organisational level it would be more appropriate to intervene.
- Select the most probable efficient strategies or action.
- Analyse how the micro and macro levels of social organisations influence the system in focus.
- Design and conceptualise interventions in general and more specifically design buildings and public spaces which better serve human life and human development.

In the case a professional requires more structured and in-depth analysis of a complex system, he can integrate and apply existing analytical methods within the EIMS framework. The multi-criteria decision-making (MCDM) for example is a technique that can be used to support the selection of materials in the built environment having in consideration multiple criteria and uncertainty. Such framework is not intuitive and requires a certain level of expertise to be put into practice. The methods applied in Multi-Criteria Decision Analysis (MCDA) are varied and are used according to specific demands of the selection process. They include AHP: Analytical Hierarchy Process; GIS: Geographic Information System; ANP: Analytic network process; PROMETHEE: Preference Ranking

Organization Method for Enrichment Evaluation, the FAHP (Fuzzy Analytical Hierarchy Process) among others. These methods can be applied in isolation or in combination and they serve to help framing the analysis in different perspectives (Seddiki and Bennadji, 2019). These methods can also be used in the context of EIMS, as they help to collect and synthesise information in a variety of aspects and configurations. EIMS is the framework that helps to contextualise the analysis and make sense of the information collected; EIMS brings together segregated aspects of a complex system and combine them into a holistic understanding of the whole.

Summary

The EIMS basic model helps to relate social systems and the challenges they face with human actions. The model can be either used to find the source of a given problem or to design and select interventions or strategies to address that problem.

The EIMS basic diagram aims to represent society as a whole and illustrates the unpredictable and complex character of social systems. It is a framework of thinking which aims to express the impossibility of controlling complex systems. It is a framework where human actions are marked and urban reactions are analysed in an open-ended and continuous process.

The EIMS basic model helps define a clear common vision for the future and establishes the role of each part in relation to the whole. These are key contributions of the EIMS basic model to establish the grounds for cooperation within and across different hierarchical levels of the system.

In addition, the EIMS basic model can be used as a common ground to share information between different urban actors.

Testing the validity of these suggestions was the focus of the research's studies but more studies still need to be carried out. Study 1 was designed to test the applicability of the model in a real-life situation. Study 2 was designed to test the acceptance of the model and its clarity. The original model was adjusted according to the conclusions drawn from this study. Study 3 was designed to test in what way the model influences the design process of an intervention in the built environment. Finally, Study 4 applied and validated the EIMS models as a pragmatic framework to analyse and intervene in urban complex systems.

The EIMS dynamic model: *From a picture to a film.*

The EIMS basic model represents a snapshot of reality of an urban system in a specific time. The EIMS dynamic model relates a social reality to time and change. In other words, the EIMS basic model helps to relate *interventions* to a holistic picture of a specific social system. Still, it does not help visualising the dynamic and emergent character of that system. Consequently, the EIMS basic

model cannot be used to study or manage urban or social change. To study changes in a social system one needs a model that builds on the EIMS basic model but adds dynamics to it.

The EIMS dynamic model embraces all the concepts behind the EIMS basic model; it is simple and pragmatic but also engages with concepts of self-organisation and dynamic change. It makes visual the notions of time and evolution as well as shows natural and emergent change.

The EIMS dynamic model can be used to represent human actions in relation to a social context but it also enables its users to envision and reflect on the consequences of their actions over time. Therefore, it can be used as a framework to guide the management of change from the perspective of human actions. It helps to contextualise human actions not only with the present reality of a social system but also with its past and future. It helps to monitor the emergent reactions of a social system to an intervention and therefore it allows the user to react to these changes in a consistent manner.

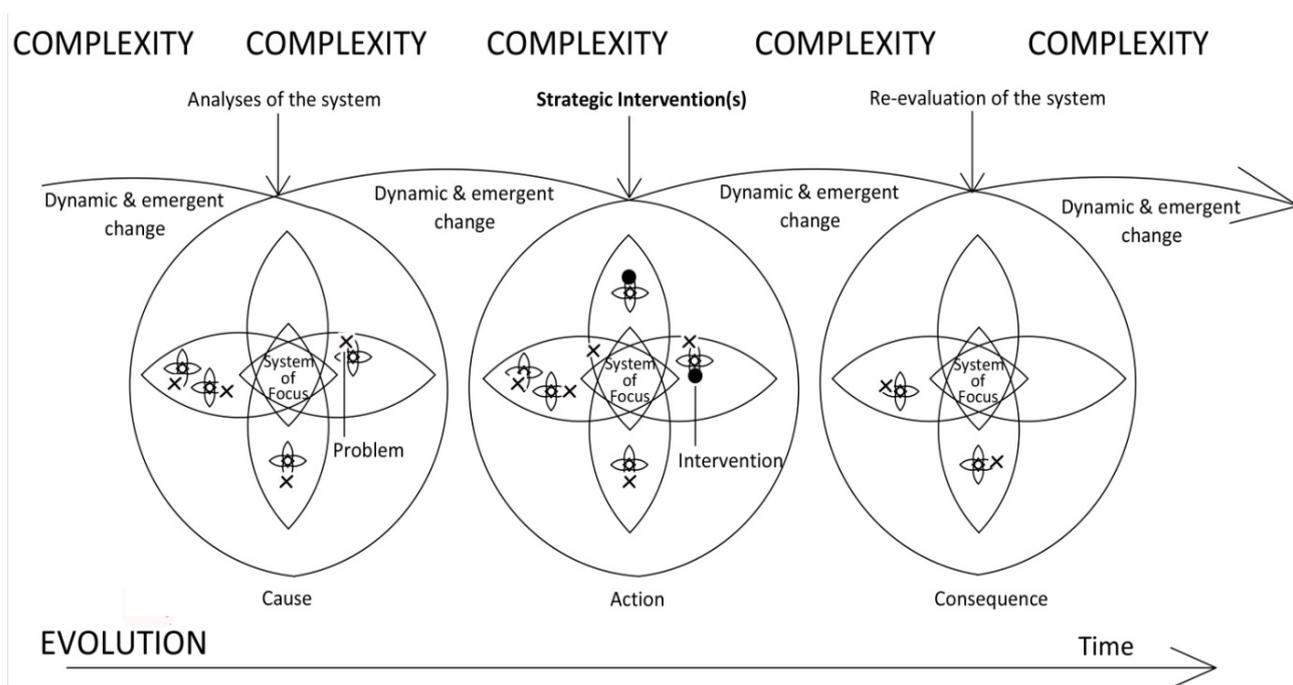


Figure 22: Relationship between the EIMS' operational phases and the process of urban and social change.

Figure 22 represents the exploration on the EIMS dynamic model. The model represented here is based on EIMS basic model, but it adds the notion of:

- a) Time and dynamic change
- b) Self-organisation and emergent systems.

Following this, the new concepts introduced in the dynamic model are therefore: *complexity*, *evolution* and *dynamic change*.

Complexity refers to unpredictability; what is not controllable; the unknown; the broader whole; and the system external. Complexity is represented as the background. It is the ground where everything happens.

Evolution refers to time and continuity, and is also represented as a background of the systems and the interventions applied in it.

Dynamic change is related to the self-organisation of the system. It relates to the process of natural change and to the new social realities that emerge from it. This idea is represented in the form of a continuous loop which holds a sequence of snapshots – basic models – representing different chronological realities of the social system one aims to analyse.

Intervention refers to an action or a happening in relation to a specific context in a specific time.

Representing interventions in relation to time

In the EIMS dynamic model, interventions can be seen either as a cause of change or a consequence of other interventions. In other words, interventions can be perceived as:

- a) The cause of a future reality. Something that triggers change, regardless of whether that change is drastic or merges with the natural development of the social system. The time of an intervention is represented by an arrow placed at the intersection points of the dynamic change's loop. This representation of interventions states them as the cause of a future reality and it places them as the *intervention of analyses*. Following this, unexpected and significant happenings that cause abrupt change in the system should also be marked in the same way. They should be regarded as interventions that happen at a given time and influenced systems evolutionary process of change.
- b) The consequences of change, of a happening or of an action. In other words, interventions can be considered as a sequence of happenings or actions which emerge as a reaction or a consequence of an initial intervention.⁶ Interventions as consequences are analysed as part of the evolutionary process of change. They are implicit in the representation of the loop of change. In other words, consequences of previous happenings or actions merge with the notion of dynamic change. These consequences merge with the natural self-organisation of the system therefore they should be analysed in the context of evolution and the unpredictability of complex systems.

Representing interventions in relation to a context

The EIMS dynamic model enables the user to visualise interventions from several angles within a period of time. Therefore, interventions should be marked not only in relation to time but also according to their nature. They should be specified in the EIMS basic model represented within the loops of change. This enclosed area within the loops of the model represents the reality of a given

system at a given time. By specifying the intervention within this model, we are defining the character of the intervention and where in the social system that intervention took place.

The EIMS basic model is always in the background of the dynamic one because it is the basis for comparison and observation. The basic model represents a chronological sequence of pictures of the system in analyses. Conclusions should be taken from the comparison of at least three realities of the system at three different stages of the process of evolutionary change; for example, before the intervention, at the time of the intervention and after the intervention.

The EIMS dynamic model should be used to reflect on the possible future consequences of human action or to learn from the consequences of past interventions. After analysing the process of change of a system within a period of time decisions can be made to intervene in the system again or let it follow its natural evolutionary process.⁷

Characterisation of the EIMS dynamic model

Firstly, the interventions that emerged from Phase 1 and 2, the gathering and analysis of information, should be marked as actions or strategies in the basic model either inside or outside the system of focus and in any of the petals of analysis. This information should be translated to the dynamic model which should serve as a basis to reflect on the dynamic change of the system. It should serve to reflect in which ways the strategies proposed could impact each aspect of the system and the system as a whole.

Secondly, interventions should be marked in relation to time. An intervention of focus should be interpreted as a cause of change. It should be marked with an arrow on the line of the loop of change which encloses the basic model. In other words, interventions of focus should be seen as an action which will trigger change in the system; therefore, it should be marked in the continuous loop which represents dynamic and unpredictable change.

Thirdly, if the purpose of the study is to select or design strategic interventions, the user should use the models to reflect on possible reactions of the system in different points in time. Users should try to speculate on several possible future scenarios and use the models to think on the impact of actions in the short term and in the long term. To do this the user should reflect on the possible influence of the intervention in all four intervention areas of the system and try to imagine how one can influence the other. These explorations should be places within the evolutionary loops of the dynamic model and should be considered as part of a continuous evolutionary process.

This exercise will oblige the user to think in terms of complexity and unpredictability. The aim is not to predict the future of urban and social systems. As argued in the literature review, that is an impossible task. The aim is rather to engage the user in thoughts about the consequences of their actions and how those actions will eventually shape the future reality of the system.

If the purpose of the study is to monitor or understand the process of change of a system in relation to a given action, then the study should also take into consideration the reality of the system prior to that action. In other words, to understand the process of change one needs to engage with the notion of urban and human evolution; therefore, one needs to consider the past, present and future to perceive a direction of change. Only then can one eventually make the link between a motion of change and a specific intervention. (See Fig 22)

Operational and methodological approach

This section describes how to operate EIMS models to extract information and act on a complex system as well as to foster cooperation and group participation. It will also describe how the models can be used to support a management process as well as the design and selection of interventions. The models and the step-by-step approach to implement them as a framework of thought are designed to support the selection and design of more contextual, appropriate and efficient human actions.

The EIMS framework emerged from the literature review and the studies developed in Aberdeen. The application of the models was tested and validated in an academic context in Singapore. On the one hand, the operational and methodological approach described here has similarities with the one suggested by Loorbach (2007) to guide and implement changes and innovation in institutionalised systems. On the other hand, it is the result of constantly adjusting the models as a response to the challenges the users faced when using them.

First phase: Define the system of study at the present moment

To define the system of focus one needs to define the EIMS basic model.

The first step is to clearly define the model's core: The core of the model establishes a social system of analyses and/or hypothetical problems to be addressed. This is the phase where general meanings and world views are established. The assumptions made here will give a reason to all the steps and decisions that will come after. At this phase the social group of analyses and the definition of the problem are temporary. They will change or will be adapted according to the information gathered by following the methodological process. At this stage the definition of the EIMS model's core is just the seed to start the process of analyses. It is the seed that enables one to address the system from different perspectives and start making the links between different aspects of society.

The second step is to characterise the system from the perspective of its key intervention areas. To characterise the different areas of analysis of the basic model users need to have in mind the

hierarchical character of the system and therefore need to consider the variety of relevant subsystems within each part. This is the time to reflect on the needs or challenges implicit in the different intervention areas of the system and to define what contributions these areas of the system can offer to improve the subsystems and the system as a whole.

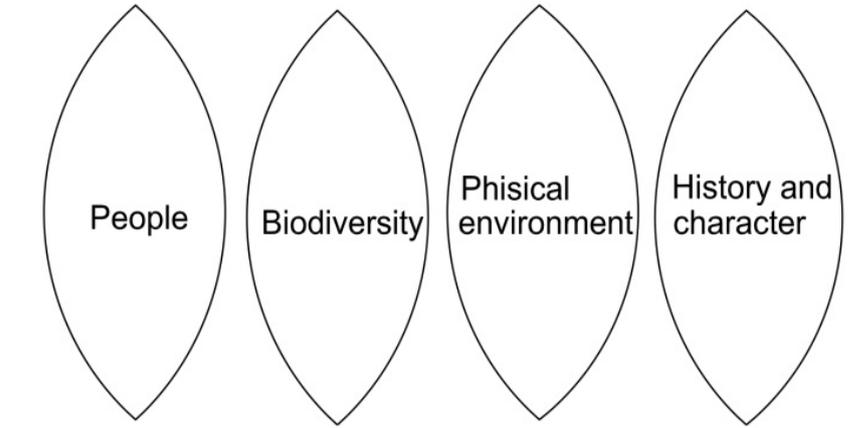


Figure 23: Diagram representing possible areas of analysis of an urban complex system

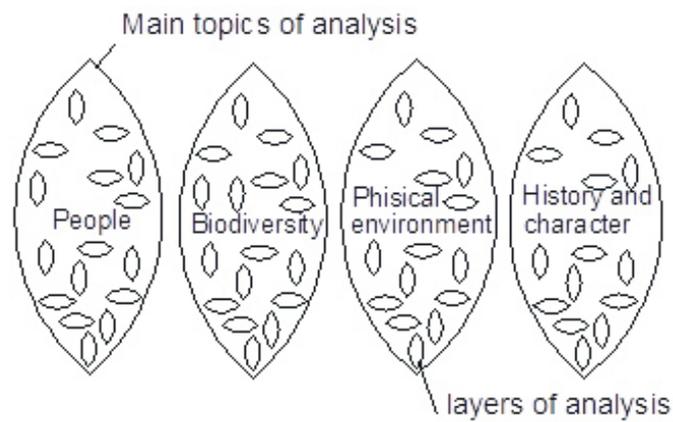


Figure 24: Diagram representing layers/subsystems of analysis within each research topic

The third step is to look at the model again and try to see it as a whole. Users are invited to intersect the information regarding each aspect of the system and their subsystems and look for patterns, inconsistencies or opportunities that might emerge from the overlaying of information.

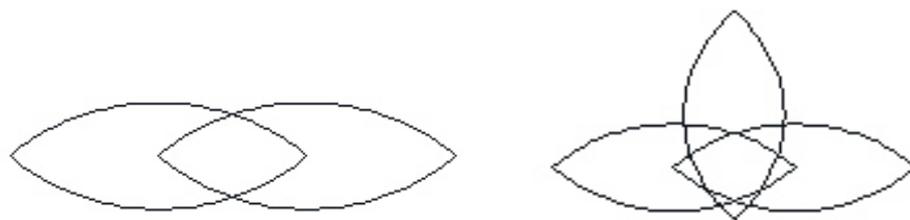


Figure 25: Diagram representing the analysis of the intersections of two or three layers

The analysis should aim to define what is unique in the system as well as the deeper source of its problems. As a result of this analysis, the research question should be better defined, the social

group in analyses might be adjusted and the vision for the future of the system might change. In other words, as a consequence of this integrated and more holistic analysis of the system, the core of the model and the areas relevant for its holistic understanding should be readjusted in order to synthesise and illustrate more appropriately the complex problems that become apparent from the analysis of the system.

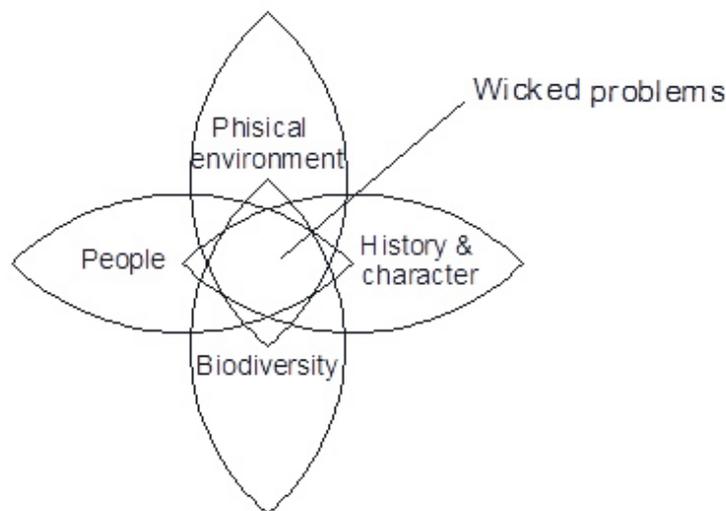


Figure 26: Specific areas of analysis translated into the EIMS basic model. Representation of the issues of focus

The fourth step: Redefine the system of focus.

As a consequence of the previous steps, possible misconceptions will emerge; also, relevant areas of analysis which were not initially had been taken into account. The source of the problems is revealed rather than its side effects. Step 4 gives the opportunity to reflect and synthesise what was learned so far and redefine the system of focus. At this point, a clear focus group should be identified as well as its relationships with other subgroups in relation to all areas of analysis. The key issues that needed to be addressed should now be defined, as well as the unique strength and opportunities the system in analysis has to offer.

The first phase of the application of the EIMS models serves to characterise the basic model in a way that it gives a clear idea of the system of focus and relevant subsystems at one point in time. This is the phase when one identifies source of the system's problems, and defines the system's needs and its potential. Phase 2 focuses on change and future development. It explores ways/strategies on how to react to the system to manipulate it in efficient and sustainable ways.

EIMS models can be used by independent individuals or groups. In either case, now comes the phase for reflection and/or discussion. This is the time to debate about the system's problems and the character of actions that need to be taken to improve quality of life within it. At this stage, the EIMS

basic model can become a common framework and a shared language which can be used as a common base for discussion. This reflection will lead to a more precise definition of the problems and of the intentions behind our actions, which in turn will shape the design and the selections of the interventions.

Second phase: Reflect on strategies and interventions that can produce effective change in the system of analysis

The fifth step is to think of the system as a complex ever-changing entity. It is the time to engage with the notion of time and unpredictable change in relation to the interventions suggested for the system. Now is the time to apply the EIMS dynamic model.

The fifth step is to define a vision for the system and possible strategies that can contribute to improve the system as a whole. The literature review suggests framing this reflection from the perspective of basic human needs: health, wealth, food, water, security and sense of belonging, shelter, education, energy and the building blocks of space syntax (morphology and scale of streets, plots and buildings). This is the phase to clearly define strategic actions to address the system's problems, who will benefit from these interventions and in what way.

This phase is to try several alternatives and select the best option. To select or define an action one has to take into consideration the knowledge acquired and has to reflect on different strategies and possible different future scenarios.

According to Hodgson (2011), this is the phase where we look at the connections between the elements of the system and explore future possible consequences. This is the moment when we deal with the unpredictability of a complex system and define the best strategies to deal with it. In the context of Hodgson's "games", this is when the *wisdom consul* comes forward and shares its perspective of the issues in hand in light of a more holistic vision of the problem. In the context of *intervention management*, this is also a time for sharing perspectives, ideas and knowledge. This is a time where both EIMS models can serve as a basis to share information and strategies across different hierarchical levels of the system as well as between actors operating in different areas of the system.

By reflecting on the future consequences of several strategies in the context of the whole complex systems, one should be able to select what apparently is the best option

Third phase: Translating intentions into realities; defining or designing the selected strategies

The following steps are very specific to the nature of the system in analysis and the aim of the analysis. If the purpose is pure analysis, they might not even be required as they focus on the translation of abstract concepts and intentions into specific actions and interventions.

The sixth step is to translate abstract strategies suggested to improve a given system into specific actions defined within a specific time and place.

At this point the general idea about the desirable strategic interventions is formed. By now the user should know the intentions of the interventions and their character. In addition, it should be clear where exactly in the system the intervention is going to be implemented and which areas or levels of the system it aims to reach.

These conclusions can be translated into a final model or a summary diagram which will serve to define further the interventions and bring together the professionals needed to implement them. In the context of interventions in the built environment, these conclusions can be materialised in the form of a sketch or a list of design intentions or a *design brief*. This will be the basis to defining the design concept which, in turn, will give shape to the design form.⁸

Before implementing the intervention, one should verify if there were significant changes in the system during the process of negotiation and design. If there were significant changes in the system or in the system's dynamics, the intervention should be re-evaluated or adjusted accordingly.

Fourth phase: Implementation

The seventh step focuses exclusively on the implementation and materialisation of the actions and interventions that emerged from the process guided by the EIMS framework.

When interventions are related to design, Step 7 serves to translate the vision and concept formulated previously into a design form which can then be physically implemented into the urban system.

After designing or characterising the selected interventions, the time comes to implement them. This is the phase when one actually implements an intervention in the system of focus or in the context of analysis. At this stage the model can serve as a basis for communication between all participants in the implementation process. This is when the pragmatic character of the model and its potential as a tool to induce cooperation will be put to the test. At this stage the model has to be clear in expressing a common intention and transmit the idea that all participants have a key role to play and are themselves part of the system.

Fifth phase: Monitoring the system

The eighth step is the monitoring and constant analysis of the system in a continuous loop starting from Step 1 and ending in Step 8. The monitoring phase should relate to a top-down concern

with the dynamic and unpredictable changes of a system. In other words, the analysis of the system's reactions to an intervention is only relevant for top-down management of long-term urban change.

In this context, the EIMS models can be used as a tool to support the monitoring of the system and suggest interventions to readjust it when is needed. This role of the EIMS models is then to guide and support the kind of management suggested by this thesis;⁹ it relates to the hypothesis of managing urban and social change through the management of human intervention.

The kind of management suggested by this thesis implies all the phases of the methodology suggested here. It requires:

- The analyses of the system at several points in time
- The selection and design of the intervention
- The implementation of the interventions
- The monitoring of the system's change

When the system is not emerging towards a desirable direction, the intervention management cycle should be reinitiated. In other words, when the system is not developing as expected, another intervention might be needed to readjust the path of urban and social change, and the EIMS operational process should start all over again; one would need to define the system again and the strategic interventions needed. After these interventions have been implemented in the system, the monitoring phase should start again. This process would consist of acting strategically in the social system, monitoring the system's reaction and acting on the system in case it's needed.

In the case of the self-organisation of the system being satisfactory, no strategic intervention would be required. Having an overview of the general dynamics of the social system in analyses might be relevant to allow one to address the problems promptly and adequately as soon as they emerge or even before they emerge. Cellular automata models can support this more pragmatic analysis. Eventually, information can be shared between the models and more informed conclusions can be drawn.

In short, as concluded from the literature review, one acts on the city based on its reality at a specific time and space. Regardless of whether interventions triggered the expected consequences, the system will readapt and change will occur. Interventions always have to address the consequences of the previous ones; therefore, an analysis of the system is always required before intervening in it. According to this research, the constant process of analysis of the reality of a complex system before intervening in it is the most efficient way of addressing complex problems. The step-by-step methodology described also defines a flexible way to deal with the unpredictability of complex systems which can eventually lead urban and social development in a sustainable direction.

The first four phases and six steps described here were applied and tested in the context of Study 4. Nevertheless, the phases described here do not necessarily have to happen in this given order. The sequence of the operational steps is related to the users' intentions when using the models.

The EIMS models can be used to:

- a) Explore possible interventions to address a given problem.
- b) Explore possible interventions to achieve a certain intention for the future.
- c) Explore the adequacy and possible emerging consequences of a given intervention.

In the first possibility it makes sense to start by using the models to explore the problems, formulate an intention for the future and finally explore interventions which satisfy both.

In the second possibility it makes sense to start using the EIMS model to explore the adequacy of initial intentions in relation to a present context, both from the perspective of micro and macro social organisations. Secondly, it makes sense to explore the challenges and potentials which could be used as interventions and, finally, reflect on the intervention itself.

In the third possibility it makes sense to start the study from the perspective of the intervention. From here the models could be used to explore how the interventions could be adapted to address contextual challenges or to merge more easily with the implementation context.

Monitoring the system is a role for experts and it was not the focus of our studies. The research's case studies focused on professionals such as architects and decision makers, and on the way they could use the EIMS framework to contribute to the sustainable management of the system from an emergent perspective.⁹

The EIMS framework could ideally be translated into a computer program or an application. Such an application could be used to facilitate and direct the user's explorations through the reflection process. In the present research, the exploratory theoretical models were used to test the impact of such a framework in the creation of more adequate interventions in the built environment. In the future, computer modelling could be used to bring more depth to the study and explore alternatives. The findings collected from the use of such a model could form the basis for a new tool to support the design and selection of both top-down and bottom-up interventions.

Chapter summary

The EIMS models are a visual representation of the most relevant assumptions which emerged from the research's literature review. In the literature review such concepts were addressed independently and perhaps the links between them are not even very clear. Nevertheless, they intertwine to shape the EIMS basic model presented here.

The concepts which gave shape to the EIMS basic model are:

- Cities are all made of the same things and yet they are all different. There is need for a general framework to be used as a guideline to think about specific complex systems in a holistic manner.

- Social and urban systems are complex systems. Complex systems are impossible to fully understand or predict.
- Society is organised in a nested hierarchy structure. A system is made of subsystems and is part of a bigger system.
- Each system or subsystem is a whole. Therefore, conclusions taken from subsystems or aspects of a system can inform the system as a whole.
- Intervention areas are representations or perspectives of the system as a whole.
- Human actions are adapted to specific environments. If we understand the environment better our actions might be more appropriate. Therefore, the framework should be able to relate people with their environment and actions.
- *Strategic interventions* can be used as a catalyst for changes in the system as a whole.
- *Micro interventions* disturb the system's self-organisation less.
- A common intention or vision for the future is needed to establish the ground for human cooperation.

The models are designed as both an exploratory working tool to support the design and selection of interventions and a framework to test the main conclusions drawn from the literature review.

The models are especially designed to support the work of professionals, who intervene in the city daily. They aim to be a working tool to help professionals to reflect on the intentions behind their action in the context of social complex systems. These models can serve either to support the selection or design of interventions or strategies of action. The EIMS models can also be used as a framework to support a new kind of management system, one that is based on a continuous dialogue between human actions and emergent reactions of the system.⁷ The EIMS dynamic model aims to help its users to manage the process of change by facilitating the selection and design of strategic interventions. In light of this, the EIMS dynamic model serves as a framework to:

- Analyse complex systems.
- Relate interventions or short-term actions with long-term visions or intentions for the future.
- Visualise the influence of one action across different aspects of the system through a period of time.
- Visualise the influence of one action across different hierarchical levels of the system through a period of time.
- Design and select more adequate interventions in complex systems.
- Monitor change and support a coherent and continuous dialogue between intentional human actions and emergent reactions of the system.

- Share information and a common vision across hierarchical levels of the system and across the people involved in the process.

The EIMS models put both the problems and the solutions of social systems in the contexts of complexity and uncertainty. In addition, they engage with notions of time and of cause and emergent effect. Hopefully, EIMS models will bring more awareness to people and give them a sense of responsibility for their actions.

The EIMS models are a tool to analyse the reality of any social system at any given time. They are a tool to define strategies to intervene in the system adequately. The EIMS models can be used to support the selection and design process of strategic interventions or strategies. They can be used as a tool for communication across different hierarchical levels and people involved with different aspects of the system. Additionally, the models can be used to form coalitions between the people involved with the intervention management process. Finally, the EIMS models can be used as a tool to support *Intervention Management*; they can support the dialogue between men and their environment. And the strategic interventions that emerge from that dialogue can be used to guide the process of urban and social change.

Tackling the problem and the acknowledgment of the situation emerge from the methodology needed to use the models; they emerge from the elaboration and the analysis of the models themselves. The models and the process of defining them will lead to an intention which in turn will lead to a definition of an intervention. A clear conceptualisation of the intervention will lead to its design and its implementation in the urban fabric.

We used four studies to test the applicability and the acceptance of both the models and the methodology to use them. We tested the models from the perspective of decision makers and future architects and construction managers. We used three studies to develop the models themselves and to adjust Phase 1 and 2 of the methodology. A fourth study was undertaken to apply and validate that the models are a framework to support the design process of architecture and urban design. Further tests are needed to test the EIMS framework in other contexts; further tests are needed to validate the efficiency of the models as communication tools to guide top-down long-term urban management.

EIMS models are not fixed or complete; they are just possible models to help professionals to manage urban and social change by designing and selecting more adequate human actions. The relevance and efficiency of the model is strongly related to the people using it and the context of the situation.⁹

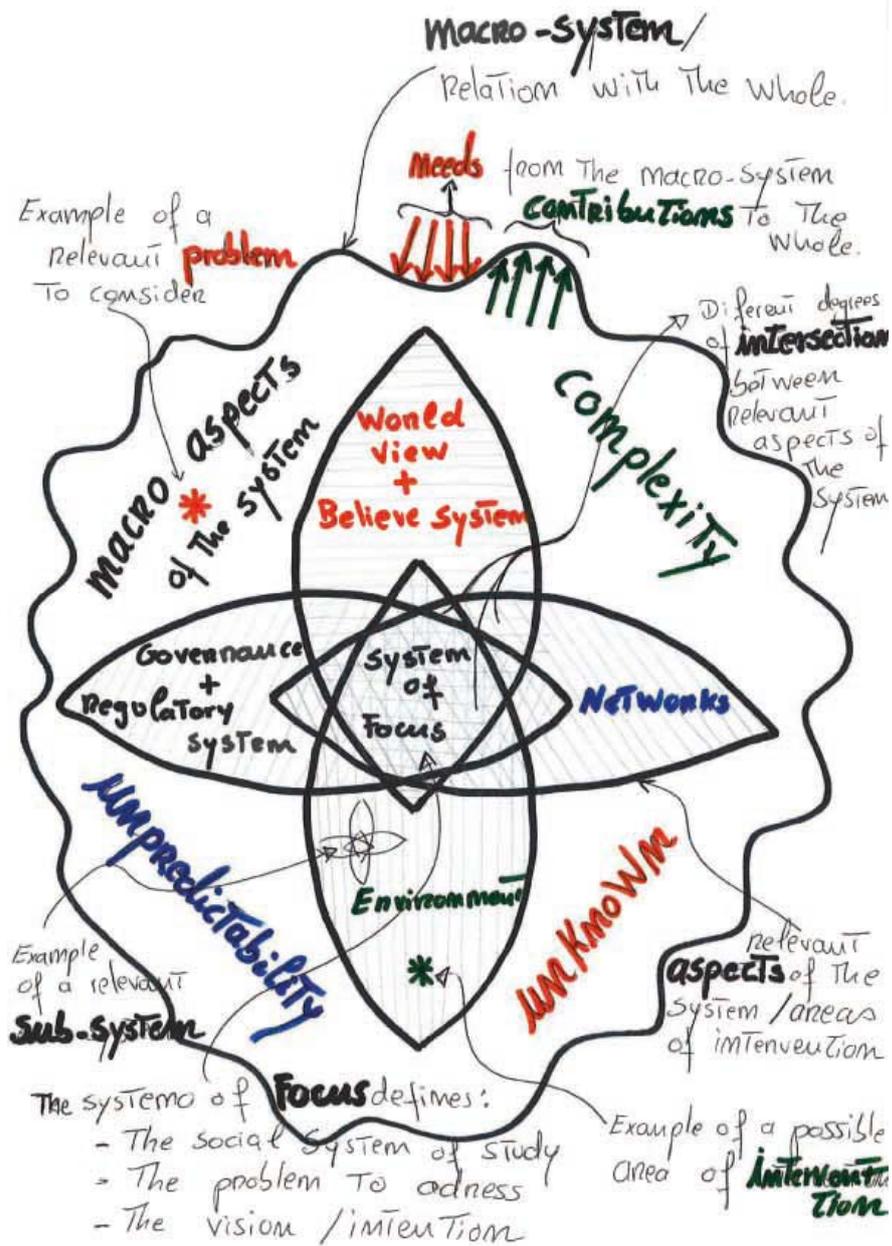


Figure 27: Summary of the research explorations to design the EIMS basic mode

The EIMS models were used and tested in the following way:

In Study 1, the models were used to test to what extent EIMS could facilitate a decision-making process. The models were translated in the questions introduced to all participants. The arguments which emerged from that were used to justify and defend different interventions suggested to the research site. In other words, the research exploratory diagrams were used to frame a common vision for the future of Aberdeen. They were used to frame the discussion about the possible consequences of each intervention in relation to urban dynamic change and the key aspects of urban life, such as politics, economy, culture, transportation and communication networks and so on.

Study 2 tested the models' ability to be used as a tool to guide people to visualise more holistic future scenarios for the city. Arguably, this could improve the selection process of interventions and

therefore facilitate the emergence of more adequate interventions in the urban environment. The models were used in combination with another research tool *The micro-project system* project. On the one hand, they were translated into questions which aimed to test the acceptance of the use of micro-interventions as a tool to redirect urban change. On the other hand, they were used as working tools to define interventions and analyse the emergent change of an urban system.

In Study 3, the models were used to test to what extent they would influence the design concept, design process and the design object. They were used to test different possibilities to support the emergence of sustainable and holistic design concepts. The diagrams were used as a background to frame the students' way of thinking; they were used as a framework and were translated into strategic questions to inspire students to reflect on the city from a more holistic perspective.

From these studies adaptations were made to the models as well as their implementation steps. Lessons were learned regarding their applicability and how people make use of them. From these findings Study 4 was designed.

Study 4 is more comprehensive as it was developed across a one-year period and tested the models and its implementation steps in different academic contexts. The aim of this study was to use the models to explore possibilities to guide the conceptualisation of master-planning and architecture. On the one hand, it aimed to explore possibilities on how to bring together design, as a short-term action, and a vision or a long-term intention translated into the concept behind the design form. On the other hand, we used the models to try to bring together the material city and human experiences and perceptions of space. The nurturing of this deep relation would eventually promote social engagement and improve the quality of urban life (Jacobs, 1961; Alexander, 1966; Alexander, 2003; Wilson, 2011).

Chapter 7: Research methodology

Research explorations and research strategies

Chapter 7 defines the methodology to address research Objective 8):

8) To test and evaluate an operational framework based on the research's theoretical approach that would lead to the design and selection of more appropriate and sustainable interventions and strategies.

Introduction

The preceding chapters have dealt with issues regarding evolution of the city, planning theories and theories of intervention. In doing so, we have identified strands of theory which can be used to help in understanding how designers and decision makers might consider cities from a new and innovative perspective. This chapter sets out a methodology to study this within the contexts of design, design education and public decision making, which together develop a hypothesised structure for use by designers and public decision makers.

Qualitative inquiry

Why use qualitative research?

According to Packer (2010) qualitative research is useful in studying *historical ontology*. Historical ontology, according to Foucault, involves a critique of what we are saying, thinking and doing (Packer, 2010). On the basis of this, Packer argues that this way of knowing relates to politics and ethics. Politics and ethics relate to who we are as a person and to how we deal with each other and the world around us. Qualitative research can thus inform the ethics of decision making, which in turn can guide new ways to manage our resources and our environment.

Qualitative research has the potential to become – when it acknowledges its own inconsistencies – an investigation that could create new ways of being; an investigation “*that would be scientific*”

without being disinterested, because we need knowledge that is relevant, not knowledge that is disengaged”.

(Packer, 2010)

There are two relevant issues to be addressed in order to realise the full potential of qualitative research. The first relates to evolutionary theory and the concept of sustainability; it relates to the understanding of ourselves and how we see human beings in relation to the world. The second relates to the inconsistencies in the methodology normally used to undertake qualitative research.

Qualitative research, sustainability and evolutionary theory

Packer suggests a re-conceptualisation of social sciences, one that would be deeply related to a new understanding of who we are and our position in the world. As argued in the literature review, the new social sciences suggested by Packer also include humans in the evolutionary process that relates all living things with their surroundings. In other words, Packer relates qualitative research, sustainability and evolutionary theory, key concepts of this thesis. According to him, a new kind of qualitative research can integrate both the biological aspects of human existence and human culture and social nature. It can help us to understand the unquantifiable aspects of who we are and our capacity to change (Packer, M.J.2010:6).

Up to now we have considered ourselves different or better than other animal species and that has given us the right to exploit the world as we know it. Now it's time to reconsider not only our position but also our responsibility towards the planet. Humans have achieved an unprecedented social and cultural complexity and that gives us a great deal of responsibility for our future as people and the future of all those on this planet.

Consequently, qualitative research can help bring new understanding to our existence and to our relationship with the world around us. In addition, it can help us to relate ourselves to the world of the things we create. Therefore, qualitative research can lead us towards alternative options for a sustainable existence.

The potential of qualitative research is not being sufficiently explored: *“This potential is, I believe, profound. Attention to human forms of life, to the subtle details of people’s talk and actions, to human bodies in material surroundings, can open our eyes to unnoticed aspects of human life and; learning, unexplored characteristics of the relationship between humans and the worlds we inhabit, and unsuspected ways in which we could improve our lives on this planet.”*

(Packer, M. J. 2010: 3)

Qualitative research: The objective study of subjectivity

To realise the full potential of qualitative research, we have to be critical and acknowledge its inconsistencies and the inconsistencies of its methodologies.

“... Much qualitative research is stuck in contradiction and anxiety, and it is crucial to understand why. By refusing to abandon a posture of detached neutrality, much qualitative inquiry today continues to bolster the attitude of domination. Neutrality is equated with objectivity and viewed as genuine knowledge. This kind of research promotes a way of knowing other people that leave them a feeling of misunderstood and treated as objects, and fails to recognize either the political and ethical dimensions of understanding or its own transformative power. When we understand another person, we don't merely find answers to our questions about them. We learn, we are changed, we mature. Contemporary qualitative research, with a few welcome exceptions, fails to recognize these things or even allow space for such recognition in its repertoire of techniques and its methodological logic.”

(Packer, M. J. 2010: 5, 6)

In this research the researcher was neither detached nor neutral.

The researcher actively participated in the studies and defended the findings of the research. The results include the researcher as both one of the participants in the study and as elements that influenced and inspired the research process (Heller, 2004; Waddington, 2004; Bortoft, 2010; Packer, 2010).

Qualitative research was the methodology used to explore the complex world of human perceptions and experiences. In other words, qualitative research was used to learn about each individual and each unique way of experiencing a certain phenomenon. The knowledge taken from that experience influenced the research's assumptions and perceptions of the world and the research's process and methodology.

Above all, this research approach helped in designing and conceptualising the framework to study the research exploratory planning system, a key ingredient in this research's methodology. The results presented in this thesis are not a final interpretation but a personal interpretation of the data. As suggested by Packer, we intend to bring a meaning to the narrative of the users of our models. We have tried to articulate what has been said to shed light on this research methodology and theoretical framework. We have used interviewee's words to give answers to the research questions (Packer, M.J.2010:122).

On a personal level, using qualitative research transformed the author both as a researcher and as a person. The information gathered changed the author's world view and helped to improve the research process.

Packer's alternative way of enquiry

Some have criticised the qualitative research method as lacking scientific rigor. In a qualitative study the researcher is the sole resource for collecting and analysing information, therefore questions might emerge regarding his influence in the process. Wellington (2015) warns that the researcher can influence the researched but, as Hammersley & Atkinson argue in their book on reflexivity of the researcher, this requires “*explicit recognition of the fact that the social researcher, and the research act itself, are part of the parcel of the social world under investigation.*” (pp.101)

Following this, Packer calls for the need for a new kind of inquiry as the traditional empirical-analytical approach to inquiry is not able to capture the complexity intrinsic to relationships between the researcher, the topic of the research and the studies' subjects. Parker advocates for an inquiry that is able to embrace the social and cultural ground where data is being collected as well as the subjectivity of both the interviewer and interviewee.

An inquiry that studies “the ways subjective and objective, self and other, psyche and culture, person and context, figure and ground, practitioner and practice live together, require each other, and dynamically, dialectically, and jointly make each other up” (Shweder, 1991, p1).

(Packer, M. J. 2010: 139)

Husserl, Schutz, Berger and Kant share the idea that the reality as we know it is something constituted; for them, reality is based on the way we know things and that knowledge establishes the order which in turn enables us to relate with the world. They have different opinions about where this knowing is formed or where it is located, but neither of them was able to establish relationships between subjective experience and objective reality or demonstrate how subjective experiences define the world we live in.

According to Packer, the inability to demonstrate how subjective experiences define the world we live in is due to the fact that they all avoided making ontological claims, to the extent that Husserl (1982) avoided claiming the existence of the object of experience.

“The root problem is that, far from avoiding all ontological assumptions, each of these analyses presumed a basic ontological distinction between subjectivity and objectivity, between the world as the individual experiences it and the world as it really is, between appearance and reality. This dualism of ‘the two realities’ is inscribed in the structure of Berger and Luckmann’s book, divided into sections on Society as Objective Reality and Society as Subjective reality.

Once one accepts the Kantian dualism of things-in-themselves and things-as-they-appear, it seems that one can study only an individual’s sense of reality, their experience of reality ... this kind of construction – a construction of knowledge of the world – can never successfully draw a distinction between what is valid knowledge and what is mere opinion.”

(Packer, M. J. 2010: 165,166)

For Merleau Ponty (1962) and Heidegger (2011) this dualism does not exist. For them, both “*objects and subjects, not just ways of knowing, are form in practical activity*”. Still, they avoid the problems of dualism but they both lay on abstractions of time (Heidegger) and body (Merleau Ponty). Packer suggests adding the contribution of Garfinkle (1967) to the contributions of Merleau Ponty and Heidegger to establish a theoretical background that enables us to explain dualism and that helps us to see the world in new ways. Based on the ideology of *radical realism*², Packer (2010: 203) states that the way we experience the world is visible and if it is visible one can study it. Furthermore, “*we can envision a qualitative inquiry that asks and answers questions that the “objective study of subjectivity” cannot frame ...*” (Packer, 2010: 105,106). Nevertheless, this involves a new way of expressing ourselves as researchers and of formulating questions.

“These sciences cannot be wertfrei (value-free); they are moral sciences in a more radical sense than the eighteenth century understood. Finally, their successful prosecution requires a high degree of self-knowledge, a freedom from illusion, in the sense of error which is rooted and expressed in one’s way of life; for our incapacity to understand is rooted in our self-definitions, hence in what we are.”

(Taylor, 1971: 57 in Packer, 2010: 123)

In light of this, a significant part of the conclusions drawn from the case studies presented in this research can be seen as opinions. Still, the observations and questions raised during the studies, as well as the opinions or conclusions presented in this thesis, are based on the inside experiences of the researcher – one of the elements of the system which composed the study itself.

The research defined that the case studies’ system was composed by: the physical context of the study, the subject of research, the participants and the researcher. The elements of the system and the dynamics they have created make the study so complex that only when one is part of the system can one fully understand and interpret the information that it produced. The research argues that each participant, including the researcher, is a whole; each individual has in itself the characteristics of a group and of the context. The problem is that normally, for the sake of objectivity, the researcher tries to detach from the subject of research and studies the individual as the sum of the parts (Packer, 2010: 71; Bortoft, 2010).

In other words, the research argues that only when the researcher embraces himself also as a person experiencing a phenomenon in a specific context can he engage fully with the complexity of the social and cultural background in which the research takes place. Only then can he fully understand both the system of the study and the dynamics created between the parts of the system.

Questions emerge almost naturally within the system and its dynamic interactions. The fact that they emerge from the complex dynamics of the system makes them understood by all participants and the matter for new questions to emerge. In other words, only when the researcher is part of the system will they be able to understand the role of the participants’ interventions in the research study’s

context; only then can he fully understand how the actions, the questions or difficulties of the participants originate from other actions, other questions and other difficulties which in turn influence both the elements of the system and the evolutionary process of the research.

Eventually, the researcher can translate that knowledge into words but those words might be interpreted as opinions. Still, no one can say that these opinions are not relevant. They are profound once they are a product of experience. They can be seen as valid knowledge which emerged from a case study or from a study of a phenomenon in a context and therefore they have the potential to be generalised and applied to other contexts (Heller, 2004; Waddington, 2004; Packer, 2010).

In short, in the four studies of this research, each part of the system in the study was regarded as a whole, including the researcher: both the researcher and the participants in the studies had their opinions, their world views and a history behind them. During the studies, the researcher was exposed to emotions which almost certainly influenced the interpretation of the data. These emotions relate to the involvement of the researcher in the context of the study are openly expressed and form part of the data collected. From the perspective of evolutionary sciences opinions, emotions and interpretations are human tools to survive (Lane et al., 2009); they are part of the human condition (Arendt, 1973) and no researcher can escape its human character (Packer, 2010). Therefore, the research argues that it's better to acknowledge our human character than try to detach from it. In the studies described in this thesis the ethical positions and world views of the researcher were shared with all the participants and from that basis, several deep, honest and meaningful discussions arose.

Case studies as a research methodology

Why use case studies?

The research used case studies to explore and test a hypothesis and to test the acceptance and applicability of the EIMS framework in a variety of contexts. Furthermore, it explored the case studies' potential to identify problems, redefine and adjust the thesis methodology, framework and theoretical assumptions (Sampson, 2004; Creswell, 2007).

The case-study strategy was the methodology chosen because of its capacity to shed light on the understanding of a phenomenon in a specific context and for its ability to apply that specific knowledge to broader contexts (Hartley, 2004). Case studies provide the researcher with a holistic view of a certain phenomenon because evidences are obtained from several sources.

Yin (2013) argues that case studies should be used when “how” and “why” questions are asked. The investigator is unable to manipulate the behaviour of people participating in the study or has little control over the events. It is important to develop the study within a specific context as the context is important for the understanding of the phenomena under study; between the phenomena and the context there are no clear boundaries. The four case studies described in this thesis relate to all of the above, especially the fact that the researcher had little control over the phenomena and aimed to study the research tools in relation to specific contexts and behaviours.

The first three studies developed during this research were exploratory, therefore different research focuses and techniques were used. The aim was to learn more about their potential and their challenges and to use that knowledge to design future research studies (Sampson, 2004). The aim of the first three studies was to study different aspects of the problem; it was to acknowledge different perspectives and different ways of using the thesis’ exploratory framework for the definition of potentially more meaningful and effective interventions in urban complex systems. The exploratory character of the first three cases studies was also used as an opportunity to confirm or deny the relevance of the selected focus groups to inform the research (Creswell, 2007: 127). Case study four emerged from the findings of the previous ones and focused on testing and validating the impact of the application of the EIMS framework as a tool to support the analysis and manipulation of complex systems in an academic context.

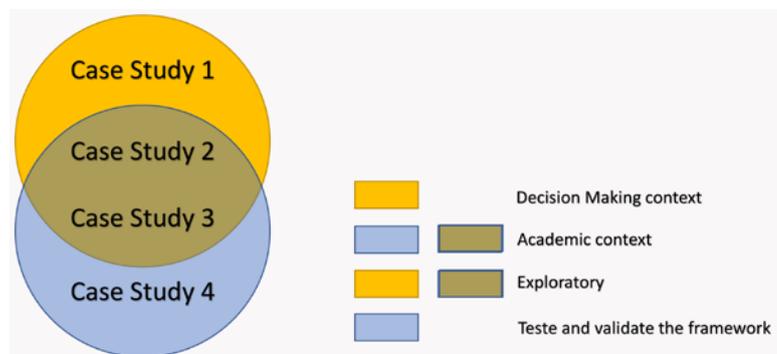


Figure 28: Case studies’ intent and focus

Validity and reliability

Some have criticised the case study as a research method that lacks scientific rigor.

Besides the fact that in case studies data is typically collected and analysed by one person, Wellington (2015) points out that case study research carries two other inherent recurrent problems:

- Case study resources may not be generalisable based on one case study
- Issues of validity

The research aims to generalise the research findings by selecting representative cases, by using a standard framework to sustain the research methodology (EIMS) and by identifying the specific processes and factors that guided and influenced the actions and behaviours of the participants.

Both the methods and the methodology used for this research were replicated multiple times and used to study different academic contexts. Besides academic contexts, the same EIMS framework and research methodology were used to study the practice of urban management and the influence of decisions and design to direct urban change. Triangulation and comparison of broader sources of data help to test and enhance the validity of the findings. Triangulation was made not only through the comparison of data collected from different sources but also based on assessment made by different individuals.

Research methods

In this section, the discussion will focus on the research methods used to collect data relevant to the research. Both qualitative data in the form of words and quantitative data with numbers were collected in this research. The comparison of such an analysis was used to give a more holistic understanding of the findings. Qualitative information is in the form of direct quotes from the focus group interviews and from open ended question presented in surveys. Qualitative data is also translated in observations recorded by the researcher during each study. The quantitative data collected is presented in the form of graphs. There were several methods of data collecting that will be further explained whilst describing each study, namely specific documents that were analysed, all relevant to the research theme, such as the assessment criteria matrix used in Study 4. This section will elaborate on three methods that were used across all case studies presented in this research:

- Focus group interviews
- Field observations
- Questionnaire/survey research

Interviews

Interviews can gather information that other methods of data collection are not able to, such as thoughts, ideas, emotions, perceptions, values, biases or prejudices told through the lens of the interviewee (Wellington, 2015). Although this might benefit the research, it is extremely time consuming and, as Mason (2002) cautions, there might again be issues related to the influence of the researcher in the data collected and the fact that interviews are not to establish facts but to establish a sort of inherent “truth” experienced by the interviewee (Wellington, 2015). Semi-structured interviews were performed in three of the four studies presented in this research. These interviews were guided by a list of closed and open-ended questions (Walliman, 2006). The exact wording and order of the questions were not determined ahead of time (Merriam, 1998), allowing the interviewer to be flexible and respond to the situation in hand, eventually accommodating for unexpected insides.

All participants were informed that they were being recorded and agreed to participate in the interviews.

Field Observations: Studio consultations, design reviews and critique sessions

Hennink et al. (2011) stated “*observation is a research method that enables the researcher to systematically observe and record people’s behaviour, actions and interactions*” (pp.170).

Observation enables the researcher to obtain detailed information in a natural social setting; in this case most observations were taken in the context of design studios or in meetings with relevant protagonists for the different case studies. Observation requires multiple tasks such as methodically watching, listening, asking questions and taking note of people’s behaviour, verbal or nonverbal interactions and expressions.

In all case studies the researcher was part of the social context where the observations took place, either in the position of a tutor or a moderator. According to Schensul et al., cited in Hennink et al. (2011) participant observation is defined as “*the process of learning through exposure to or involvement in day-to-day or routine activities of participants in the research setting*” (pp.179).

Another benefit of the observation method is related to the participants that may not be willing or able to express certain topics. Wellington (2015) also argues that it is almost impossible to describe behaviours in words; following this, Merriam (1998) argues that observation “*is the best technique to use when an activity or event can be witnessed, when a fresh perspective is desired, or when participants are not able or willing to discuss the topic under study*” (pp.96).

Again, there might be questions relating to the subjectivity of the data collected; for this reason other methods were used and triangulated to validate the findings presented in this research.

Questionnaire/Survey research

For Wellington (2015), the survey is the essence of fact-finding endeavours. The data collected from a survey can be both quantitative and qualitative in nature. Survey questionnaires have been used in studies 2, 3 and 4 (appendices 3 and 7). The questionnaires were used to supplement the qualitative data gathered through observations and interviews and to expose any bias in the findings. The surveys were crafted so that students needed to express agreement or disagreement in relation to a giving topic, and followed with an open question to elaborate on their selected choice. This allowed for relating quantitative with qualitative data and therefore extracting more objective reasoning behind the participants’ replies to closed questions. Following Wellington, 2015, the surveys started with the most direct and easy questions and built up from there. All surveys were short and questions random to avoid any perception of pattern.

Summary of the studies' design		Study 1	Study 2	Study 3	Study 4	
Methodology	Qualitative research	*	*	*	*	
	Case studies	*	*	*	*	
Focus groups	People involved with the practice of urban planning	*				
	Academic environment		*	*	*	
Intervention of focus: Strategic interventions in the built environment	Micro intervention	*	*			
	Mid-scale intervention			*	*	
	Macro intervention	*	*		*	
Data collection	Semi-open interviews	*		*	*	
	Questionnaires/Surveys		*	*	*	
	Field observation	*	*	*	*	
	Document's analysis	*	*	*	*	
	Analysis of information on the internet	*				
	Sketches and notes	*	*	*	*	
	Ethnography	*	*	*	*	
Research context	Aberdeen city centre			*		
	The Union Terrace Gardens - Aberdeen	*	*			
	Singapore's city centre/ Duxtain Plain Park + Pulau Ubin				*	
Research tools	MIS: Micro-intervention System <u>Aim:</u> Investigate the acceptance of the planning strategy explored by the research; the use of strategic interventions as a tool to nudge change.	Presented visually	*	*		
		Described orally	*	*		
	EIMS: Exploratory Intervention Management System <u>Aim:</u> Improve the models and test their applicability as a tool to imagine, create and select interventions that can lead to a more sustainable and human friendly urban environment. Questions: - Are the EIMS models	Presented visually		*	*	*
		Described orally	*	*	*	*
		Operated by the participants		*		*

	<p>applicable in real-life scenarios? In what way?</p> <ul style="list-style-type: none"> - Are they useful? - What are their potentials and weaknesses? - How can we improve them? 					
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Table 11: Summary of the research studies' design

	Research aims	Study 1	Study 2	Study 3	Study 4
General	Develop a deeper understanding of the dynamics in the design process of interventions in the built environment.			*	
	Develop a deeper understanding of the dynamics in a real-life process of selecting interventions in the built environment.	*			
	Develop a deeper understanding of Aberdeen's urban context and its built environment.	*			
	Develop a deeper understanding of the relations and dynamics between top-down and bottom-up forces in Aberdeen; Explore the influence individual participants and organisations have in the decision process and in the decision product.	*			
	Develop an exploratory theory for a sustainable urban management. Gather contributions from the participants that might lead to new theoretical approaches.	*	*	*	
	Explore the participants' general innate awareness of the city as a complex and unpredictable system.	*	*	*	
	Test the awareness of the change an intervention in the built environment can bring to the overall character and dynamics of the city.	*	*	*	
MIS	Test the acceptance of micro interventions as a tool to nudge urban change	*	*		
	Test the acceptance of self-organisation and unpredictability as part of governance and governance as a process of nudging change.	*	*		
EIMS	Test potential of the models to self-educate users and stimulate people to think in complex systems from a holistic perspective.	*	*	*	*
	Test the capacity of the models to be used as a common language and as a framework to cross information between all parties involved in the design and selection of interventions in the built environment.	*			*
	Explore to what extent the models are able to help people be aware of the unpredictable character of complex systems.	*	*	*	

	Test the applicability in a real-life situation of the EIMS models as a framework or a selection tool. Test the capacity of the models to improve the selection process of interventions.	*	*		
	Test the applicability in a real-life situation of the EIMS models as a research framework or a design tool.			*	*
	Test the capacity of the models to improve the adequacy of design concepts.				*
	Test the capacity of the models to improve the quality of the design forms.				*
	Test the capacity of the models to support the design process.				*
	Test the capacity of the models to support the research and analysis process.				*
	Test the capacity of the models to support the design methodology.				*
	Test the clarity of the models and identify the difficulties participants would have in operating them.		*		*
	Investigate if a more holistic awareness of urban complex systems influences or adds complexity to the design process and their design object.			*	*

Table 12: Relationship between the research aims and the studies' explorations

Chapter 8: Studies 1, 2 and 3

Studies developed in Aberdeen

Chapter 8 focuses on the research objective 8

8) To postulate and test an operational framework based on the research's theoretical approach that would lead to the design and selection of more appropriate and sustainable interventions and strategies.

Introduction

Chapter 7 established the use of case studies and qualitative research as the methodology to guide the research explorations. Chapter 6 introduced the EIMS models¹ as a visual representation of the literature review's findings and as a framework to guide us through the analysis of a complex system and to establish more appropriate and sustainable interventions in the system. Besides bringing more awareness to people, EIMS was used as a tool to explore the last two research objectives and test the research hypothesis. EIMS models were also used as a framework to ensure objectivity in the research process. In this chapter we will address how this methodology was explored in four case studies.

The case studies developed in Aberdeen had three main aims:

- 1- Investigate the acceptance of the planning strategy explored by the research; the use of strategic interventions as a tool to nudge change.
- 2- Improve and question the validity of the exploratory framework developed in this thesis; we used the studies to address questions such as: Are the EIMS models applicable in real-life scenarios? In what way? Are they useful? What are their strengths and weaknesses? How can we improve them?
- 3- Test the relevance of the models in real-life contexts.

Study 1 tested the acceptance of the philosophy behind the EIMS models and its possible applicability in a real-life situation. It also tested the openness of decision makers to use micro interventions as a strategy to nudge urban change. In addition, this study served to develop a deeper understanding of the dynamics in a real-life process of designing and selecting interventions in

Aberdeen's built environment. The data was largely collected from the researcher's personal experience as part of the intervention's selection process.

Study 2 tested the acceptance of the thesis exploratory management system (EIMS) in an academic context. Study 2 also tested the clarity of the EIMS models and the difficulties participants had in operating them. It also tested how effective the models were as a tool in guiding people to emerge with a deeper evaluation and understanding of complex systems and their dynamics.

To explore the acceptance of the use of micro interventions in Study 1 and 2 an additional research tool was used: MIS (The micro-intervention system)² The *micro-intervention system* was used in combination with the EIMS models.¹

Study 3 focused on the role of architecture as a potential tool to nudge urban development. The case study was used to test future architects' awareness of the deep relationship between the built environment and human character and how one deeply influences the other (Ponty, 1962; Wilson, 2011). This case study also aimed to test students' awareness of the city as a complex open system (Portugali, 2000). In addition, Case Study 3 tested to what extent the EIMS models would increase students' awareness and in what way that awareness influenced their design process, their design concept and their design object.

The studies developed in Aberdeen focused on the city centre area.³ Nevertheless, studies 1 and 2 focused on the Union Terrace Gardens as the research context⁴ and Study 3 was open to any specific site within Aberdeen city centre.

Study 4 was developed in Singapore in an academic context as well. This time the case study focused not only on the testing but also on the validation of the EIMS framework. It tested the ability of the models to improve students' awareness of complex systems and the relevance and adequacy of their proposals. It also tested the framework as a step-by-step methodology which can support and enhance the design process.

Introduction to case studies 1 and 2

Study 1 tested the acceptance and applicability of the management system suggested by the research in a real-life situation and Study 2 tested it in an academic context. The studies focused on two distinct but correlated issues:

- a) Little attention has been paid to the potential of using *micro interventions* to nudge urban change. These studies tested the acceptance of this urban management strategy as an alternative management system.
- b) Explore the applicability of the EIMS as a framework to help the selection and negotiation process of intervention in the built environment.

We used the *micro-intervention system* (MIS)² to test the acceptance of *micro interventions* as a tool to nudge urban change. The *micro-intervention system* was presented as an alternative to two other large-scale interventions suggested to the same site.

The concepts behind the *explorative intervention management system* and the EIMS models² were used to investigate and improve the process of selection of interventions to be applied in the *Union Terrace Gardens* in Aberdeen. In addition, Study 2 tested the clarity of the models and the efficiency of their operational methodology.

Research context: *The Union Terrace Gardens*

Both Study 1 and Study 2 focused on *The Union Terrace Gardens*⁴ as the context for the interventions of study. The gardens are situated in the heart of Aberdeen city in the UK.³

Union Terrace Gardens (UTG) are situated in the small Denburn Valley which passes under *Union Street*, “the centre” of Aberdeen city. Along with the gardens, the valley is now the route to the railway and to the oversized Denburn Road, elements of which have a very strong impact on the character of the area.

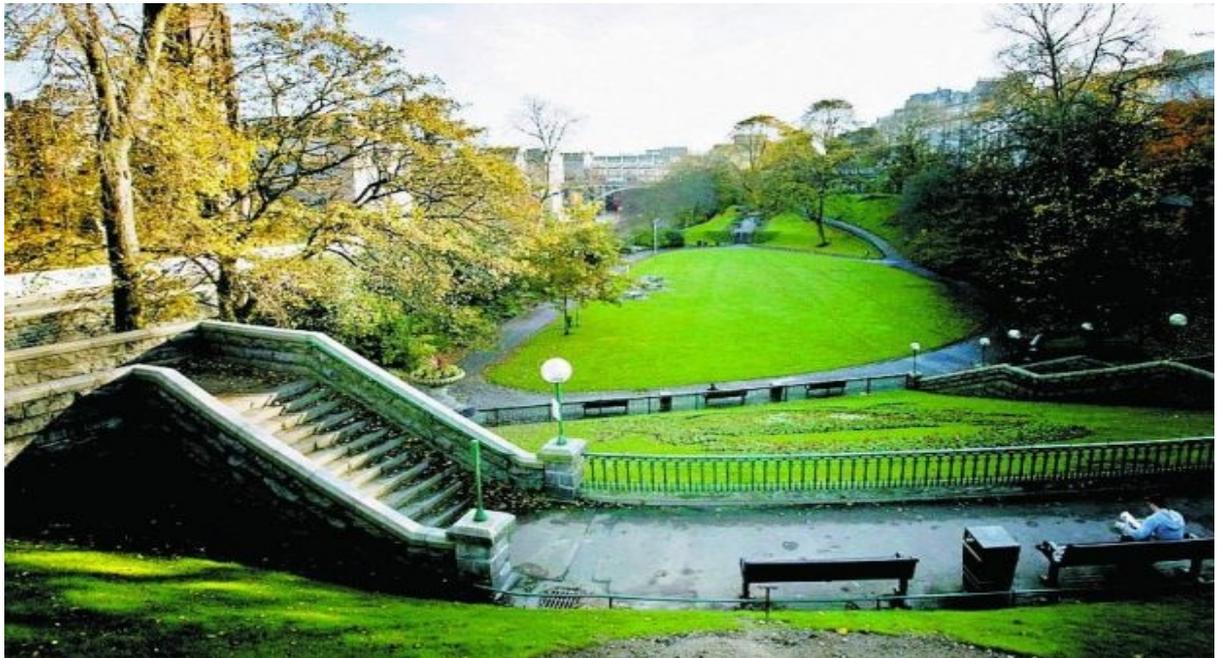


Figure 29: North view of the Union Terrace Gardens. Street perspective taken from Rosemount Viaduct.



Figure 30: Google map's aerial view of the Union Terrace Gardens and its direct urban context.

Besides being considered by many as the heart of Aberdeen, one of the unique particularities of this garden is the fact that it links two different levels of the city as well as two different historical periods. The gardens link the “higher city” – Union Street and the urban areas which emerged after the construction of Union Bridge in 1805 – to the “lower city” – the medieval neighbourhood which relates the old city of Aberdeen with the harbour.

This difference in height is best appreciated from the top of the *Union Bridge*, with its majestic arches over the Denburn Valley, which expresses the topography challenges involved in building Union Street. From Union Bridge one has a magnificent view from above, over the gardens, the old carriageway which is still functioning and the old building of Belmont Street. Without being an archaeological site, this view reveals Aberdeen's history at a glance.

The gardens are framed by the busy urban life of Union Street and by *His Majesty's Theatre* and the library.⁴

“They (the gardens) remain not only a surviving fragment of the original level of town, but they mark the place where the new city soared above the medieval town, a memorable part of Aberdeen's heritage.”

(Morgan, 2008)

Context of selection

Study 1 focused on the selections between three possible interventions for the Union Terrace Gardens: the *micro-intervention system* (MIS); ACSEF's Intervention *The City Square* (CS); and the Peacock Visual Arts' Centre (PVAC).

Study 2 focused on the selection between only two interventions: the *micro-intervention system* (MIS) and ACSEF's Intervention *The City Square*.

Option 1: *The micro-intervention system: (MIS)*

Following the findings from the literature review, the research suggested the *micro-intervention system (MIS)* as a strategy to improve the character and dynamics of the gardens and the city as a whole. The *micro-intervention system* is the translation of the literature review's findings in an urban design proposal for the *Union Terrace Gardens* in Aberdeen. The project was developed at the *Robert Gordon University* in a workshop conducted by the *Prince's Foundation* in August 2009.

The *micro-intervention system* proposal used strategic micro interventions in the built environment to improve the character and social dynamics in the gardens and consequently the dynamics of the city. The acceptance of the management approach suggested by the *micro-intervention system* was tested in studies 1 and 2. The *micro-intervention system* was very much in line with what the *Friends of the Union Terrace Gardens* versioned for the place.⁵ The research suggestion implied the preservation of the existing site and the implantations of a system of small-scale strategic interventions to trigger urban change.

The project aimed to address two main urban problems: urban connectivity and the lack or the misuse of the gardens.

Urban connectivity:

Aberdeen city centre is characterised by the simultaneous existence of two urban levels which express two different ways of experiencing the city: the lower Aberdeen and the higher Aberdeen. The lower Aberdeen is nostalgic, represents the comfort of history, and connects the green fields of the valley with the harbour. It's a particularly charming place for pedestrians. The higher Aberdeen represents the more modern and dynamic city – the city of consumerism and the internet, made for traffic and the use of a car.

The system of interventions suggested that Union Terrace Gardens was designed to establish continuity within each of these two different urban levels, which at the moment is fragmented. In other words, the proposal versioned the UTG to become the connection point between the lower and the higher Aberdeen.



Figure 31: The MIS project's strategy

The lack or misuse of the gardens:

Addressing the problem of connectivity will automatically bring more people to the gardens and that can address problems related to urban criminality. However, connectivity alone might not be enough, therefore other interventions were suggested to enhance the social life in the gardens. Following the patterns suggested by Alexander, the micro-intervention system suggested interventions to attract both seasonal social activities and people to the gardens on a daily basis.

The *micro interventions* suggested in the project are focused on the manipulation of the basic elements of the garden that have the potential to change human behaviour and human dynamics and therefore have the potential to change the urban and social system as a whole. The interventions suggested are small in scale, therefore they disturb as little as possible the emergent organisation of the system or any existing synergies related to this urban area.

Some of the interventions suggested were part of the original drawing of the gardens and many others were suggested by the people of Aberdeen.⁶

Each intervention aimed to address specific urban problems but they also relate to each other in a system (Geels and Kemp, 2005). Each of them has consequences to the broader use and character of the gardens which in turn will define the way other interventions will be perceived and used.

The designer's work was to make each independent intervention work as part of a bigger whole – a system which can have a positive impact in the dynamics of the city as a whole. Therefore, the interventions suggested by the project should be applied as a system. Nevertheless, there are some interventions which have more strategic relevance than others. And eventually they could also be implemented one at a time; however, the improvements in the gardens would probably be much fewer than when interventions would work together to support a common vision for the city.

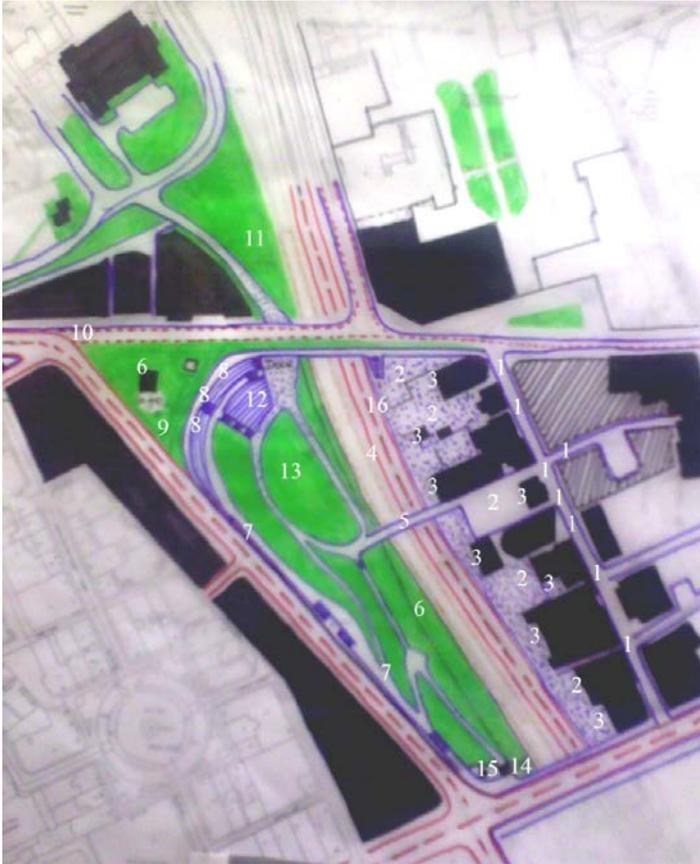


Figure 32: The MIS project's interventions. Together with Table 10 (Appendix 2) this image illustrates and describes the interventions suggested by the micro-interventions system for the Union Terrace Gardens.

Option 2: ACSEF's Intervention *The City Square*: (CS)

The City Square implied covering the Denburn Valley, bringing it to the level of Union Street. According to the people involved in this plan, this would be the most efficient strategy to solve connectivity problems and to increment the gardens' area. Furthermore, it would cover the railway and Denburn Road, features that according to many diminish the living qualities of the gardens. The several floors of underground space would be home to parking and necessary functions to support life both at square level as well as in the underground levels. The underground area could be eventually used to host Peacock Visual Arts Centre and commercial purposes.⁷

The City Square was estimated to cost £140 million. Sir Ian Wood offered £50 million of his private fortune to support this particular intervention. This proposal was supported by Aberdeen City and Shire Economic Futures (ACSEF) who created a special internal group to support and promote the project, such as the *Project Management Board* and the *Project Advisory*.

In opposition to the MPS, this proposal was supported by investors and big corporations.

Option 3: *The Peacock Visual Arts Centre: (PVAC)*

In 2007, the *Peacock Visual Arts Centre* suggested implementing their new home at the *Union Terrace Gardens*. They made their intention public by promoting a project developed by Brisac Gonzalez, where 3D animations suggested a very dynamic and modernistic building. With Brisac Gonzalez's project, Peacock Visual Arts would guarantee £9.5 million of funding from which £4.3 million was donated by the Scottish Arts Council, SAC.

The project would extend in length along the west side of the gardens. It would cover a great part of the garden's area and would imply the cutting of the old elm trees; however, it would respect the topography of the place. To give back part of the green area taken from the city, the different level roofs of the building would be planted with vegetation. To address the problem related to the difficult access to and across the gardens, the building was shaped to form a number of ramps which would make the connection between the two levels of the city smoother.⁸

All three strategies suggested that the gardens had a similar vision for the site and for the city, and therefore were presented as catalysts for a wider urban change. In addition, all three suggestions were intentional, originated from the top-down and implied the manipulation of the built environment. Nevertheless, the proposal suggested by Peacock Visual Arts emerged from the need for new installations rather than an active will for changing the urban dynamics. Both Peacock Visual Arts' and ACSEF's interventions emerged from local organisations and from individuals deeply connected to Aberdeen city. The MIS emerged from an architect and researcher with no personal references in the city. It emerged from a rational contextual analysis guided by the EIMS models to understand the problem and the urban morphology. Theoretical support emerged from the research to identify the basic elements of the UTG which could be manipulated to trigger greater change in Aberdeen city.

The next tables show the categorisation of the interventions suggested for the Union Terrace Gardens in the context of case studies 1 and 2. This categorisation follows the conclusions taken in Chapter 4. It was used as a basis for comparisons, therefore as a guide for the case studies' conclusions.

Categorisation of interventions in relation to:

1-Their active or passive role in relation to urban and social change	Interventions as actions: 1- MIS 2- CS	Interventions as consequences or reactions 3- PVAC
2- Their source	Natural interventions	Artificial interventions 1- MIS 2- CS 3- PVAC

3- The kinds of interventions in the urban environment	Interventions of events	Interventions of space or interventions in the built environment 1- MIS 2- CS 3- PVAC
4- The duration of the intervention	Acute interventions or short-term actions 1- MIS 2- CS 3- PVAC	Chronic interventions or long-term actions
5- The intentionality of the intervention	Unintentional interventions: Intention focus on the self 3- PVAC	Intentional interventions: Intention focus on the common good 1- MIS 2- CS 3- PVAC
6- The origin of the intervention	Top-down interventions 1- MIS 2- CS 3- PVAC	Bottom-up interventions
7- The number of interventions and the relationship between them	Isolated interventions 2- CS 3- PVAC	Interventions in a system 1- MIS
8- The predictability of their consequences	Predictable: short-term 1- MIS 2- CS 3- PVAC	Unpredictable: long-term 1- MIS 2- CS 3- PVAC
9- The environment	General interventions: Conceptualisation phase.	Unique or contextual interventions: design, selection and implementation phase. 1- MIS 2- CS 3- PVAC
10- Their size	See Table 4 - Appendix 1	

Table 13: Characterisation of the three interventions investigated in studies 1 and 2 in relation to the categories explored in Chapter 4

Legend:1- **MIS** = Micro Intervention System2- **CS** = ACSEF's City Square3- **PVAC** = - Peacock Visual Arts Centre

The main difference between the three alternatives presented in the table above is the fact that the *micro-intervention project* was presented as a system of small-scale interventions and the other two proposals suggested defined, isolated, bigger scale interventions. PVAC's is a reaction to the needs of an institution. Nevertheless, because it represents the Centre of Arts in Aberdeen, it has a significant public relevance and therefore one can argue that it also serves a common good.

Hierarchies of interventions in the built environment according to their size			
Macro systems of interventions	Macro interventions		Micro Int.
Intervention system can be designed to influence any of these levels of social organisation but the scale of the interventions themselves is normally smaller.	<u>Urban planning and urban design</u>	<u>Architecture</u>	<u>Design</u>
The system of interventions can be composed of interventions of all kinds. Not necessarily only interventions in the built environment.	Interventions of the urban scale.	Interventions of the scale of a building.	Interventions in the elements from which buildings and places are made.
	2- CS	3- PVAC	1- MIS

Table 14: Relationship between hierarchies of social organisation and the hierarchical position of the interventions investigated in studies 1 and 2

Study 1

Key features of the study

- The case study was bounded by time and place: data was collected over a period of nine months and was related to the *Union Terrace Gardens* in Aberdeen.⁴

- The focus group consisted of key protagonists in the negotiation and selection process regarding two big-scale interventions suggested for the UTG in 2008 and 2009: the City Square and the Peacock Visual Arts Centre
- The system studied was: the Union Terrace Gardens, protagonists of the negotiation and selection process of an urban project. There were representatives of the government, private organisations and citizens. The research's hypothesis translated into two research tools: the micro-intervention system (MIS) and the research's exploratory framework (the EIMS models) and Marta Miguel as a researcher and as a person (Garfinkel, 1967; Packer, 2010)

Aims of the data collection

- Test the acceptance of *micro interventions* as a tool to nudge urban change. Test the acceptance of the urban management system suggested by the research; in other words, test the acceptance of self-organisation and unpredictability as part of governance and governance as a process of nudging change.
- Test the applicability of the exploratory framework (the EIMS models) as a selection tool.
- Explore the influence individual participants and organisations have in the decision's process and in the decision's product.

Methods used to collect data

The study was conducted on two levels; research was carried out to investigate the city's culture, history and morphology. Data was also collected during meetings with key urban participants.

To become more acquainted with the city, its social activity and the theme of study, the researcher analysed the system from various perspectives including the historical development of Aberdeen and the Union Terrace Gardens (Morgan, 2008).^{3 and 4} During the historical analyses of Aberdeen's development, the researcher related the public discussion in analyses to a broader context of *interventions* that took place throughout Aberdeen's history. Interventions, such as Union Street, helped to justify or contextualise in terms of scale the two interventions suggested for the city.

A study made in RGU in 2006 entitled *Urban Connections* (Aberdeen City Growth) gave an overview of the feelings Aberdonians have about the gardens as well as their suggestions to intervene on site to make the gardens more adapted to their needs. This information supported the MIS project to a great extent.

Sketches and notes were made during several walks through Aberdeen city centre. This data was also used to inform the MIS project.

Observations were made and notes were taken during two encounters at the *Union Terrace Gardens*, organised by The *Union Terrace Gardens' Friends*.⁵ During these casual meetings we engaged in conversations with eleven participants about their intentions and choices for the gardens. The same questions were asked to several personal friends and acquaintances born in and living in Aberdeen.

Information available on the internet regarding the public discussion was systematically analysed, especially reports published on the local press website such as: www.thisisnorthscotland.co.uk and <http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-19247094>. Public opinions published in blogs and articles were also analysed, such as: <http://www.theguardian.com/uk/scotland-blog/2012/aug/27/aberdeen-city-gardens-mistake>, <http://www.guardian.co.uk/uk/scotland-blog>, <http://dcdoolan.wordpress.com> or <http://www.johannabasford.com/blog-article/195>. The research collected also had information from comments on *Facebook* and postings on the sites supporting each one of the proposals: <http://www.friendsofutg.co.uk/>, <http://www.thecitygardenproject.co.uk/>, <http://www.peacockvisualarts.com/>, among others.

The information gathered helped to identify urban problems and the urban character of the city. This information informed the EIMS models used by the researcher and therefore helped formulise the researcher's questions and remarks during the meetings.

Over a period of nine months, the researcher participated actively in public and private discussions about the Union Terrace Gardens. The researcher participated from the perspective of an independent participant, with no particular personal interest in the gardens.

The meetings evolved around the research's main topics. The MIS was used to suggest the use of micro interventions as a strategic tool to manipulate change. The researcher defended the project, assuming a position in the discussion, and therefore defending the use of micro interventions as a valid strategy to guide urban development.

Questions based on EIMS models were formulated to inquire about the selection process. The aim of these questions was to test if people's choices were based on an awareness and holistic perspective of the place and if they had taken into consideration the unpredictable character of urban development. The EIMS models were not explicitly shown but they guided the meetings in the form of questions. In other words, all questions, arguments and remarks made by the researcher had the prior intention of leading participants to think according to the EIMS principals. The models were not explicitly shown due to the fact that the meetings were mostly organised by third parties and were focused on the discussion of the problem matter and the selections between possible interventions proposals.

The meetings involved key participants in the *Union Terrace Garden* discussion and they were the main source of data collection in this case study.

Besides the Provost and the official representative of the city council urban department Councillor Kate Dean, the MIS strategy and the concepts behind the EIMS models were presented to:

- Ms. Rita Stephen - Development Manager - ACSEF
- Mr. Sandy Beattie - City Council - Planning and Policy
- Mr. John Michie - Key member of ACSEF's Project Management Board comprises and member of the project advisory group.
- Mr. Dave Blackwood - Member of the ACSEF's project advisory group.
- Mr. Lindsay Gordon
- Kevin McCormick
- Alasdair Craigie.
- Mr. Ken Mc Ewen
- Fraser Munro – Architect behind the *ACSEF's project*
- Brisac Gonzalez - – Architect behind the *Peacock's project*

There are audio records of the meeting with Mr. John Michie and Fraser Munro. However, the research conclusions are mostly based on the researcher's personal participation in the research context. The data was mostly collected from observations and notes taken during the meetings.

There were also e-mails exchanged between Mr. John Michie and the Lord Provost which gave an insight into how these specific individuals would relate to the institutions they represent and the theme of research.

In short, focus meetings were used to explore the acceptance of the use of micro interventions to nudge urban change and to test the applicability of the EIMS model in a decision-making process. Case Study 1 was particularly interesting for learning about the political and social dynamics of the city and meeting people involved in urban policies and key urban decisions.

The fact that the researcher was new in town and assumed a clear position encouraged discussion among the participants. Interesting and profound discussions emerged about the city, the interventions suggested and about the participants' personal and rational assumptions on the subject.

Furthermore, both the MIS project and the arguments and questions raised based on the EIMS models forced people to explain the reasons behind their intentions. This was of key importance to understand what the facts considered by the participants were and the participants' preconceptions and perceptions about the topic.

Research findings and discussion

Research findings regarding the MIS project and use of micro interventions as a tool to nudge urban change

The MIS strategy was very well accepted by the *Union Terrace Garden Friends*. They identified their suggestions with the project and new suggestions emerged from in-depth discussions on the subject. They suggested additional small interventions like recovering the public toilets and implementing a ramp to improve access to the gardens.

In general, they did not want to change the morphology or character of the place, therefore they supported the MIS. Still, it seemed to them that there were only two realistic options on the table and therefore they decided to take the side of Peacock Visual Arts Centre. In other words, during the informal conversations it became apparent that people were supporting Peacock's project because they felt that as individuals their voices were not being heard. Because of this general feeling, they decided to join forces with Peacock Visual Arts Centre to at least bring ACSEF's proposal down. In any case, the *Friends of Union Terrace Gardens* actually wanted the gardens as they were and they were very enthusiastic about the MIS strategy, although they felt powerless to fight against the corporations.

All eleven persons addressed during both the gathering of 27th February and the one of 12th June 2010 were very emotional about preserving the gardens and uninformed about the projects. On the one hand, they were defending the Peacock project, without realising that the project would imply remaking most of the garden's area. Most people did not realise the fact that the green presented in the 3D renderings was actually just green roofs where no trees can grow. On the other hand, when asked if they knew what functions were placed at the subterranean levels of the *Union Square*, they would quite promptly reply "parking", even if ACSEF's proposal did not specify any programme in particular for the underground levels at that point in time.

The MIS was introduced by the *Prince's Foundation* to the Lord Provost as an adequate strategy to intervene in the city. However, the participants representing the other interventions and powerful private and public organisations did not see the MIS strategy as a valid alternative.

All top-down participants identified their preferred interventions as catalysts for urban and social change of the city as a whole and opened the door to study further this research's hypothesis. In other words, all participants were very supportive of the overall theme of this research. In opposition to the appreciation of the *Friends of the Union Terrace Gardens*, governmental agencies and leaders of powerful corporations did not take the MIS project seriously; they did not see how small-scale interventions could bring greater benefits to the city. Several participants defending the *City Square* option were happy to say that they were eager to take the risks and possible economical loss related to such a large-scale intervention. Some argued that at least something was being done and that the

small-scale actions suggested by MIS would have no effect on the dynamics and character of the city. The scale of the interventions suggested was often justified with the fact that Aberdeen has a history of large-scale interventions such as Union Street. In addition, the discussion regarding the gardens was often associated with the discussion about the pedestrianisation of Union Street, which was a topic indirectly debated during the focus meetings.

The fact that the MIS was so welcomed by the Friends of the Union Terrace Gardens and so disregarded by representatives of private and public organisations raises questions regarding:

- The difficulty bottom-up interventions have in being acknowledged and implemented. (Loorbach, 2007; Friedmann, 2011). It makes one question the innovative strategies which are not being heard because they cannot cross the institutionalised structures of power.
- The relations of power between the private and public organisations and their impact in the negotiations and selections processes that guide urban development (Greenleaf, 1977; Morgan, 1997; Knowles, 2002; Sheard and Kakabadse, 2007).
- The influence of the *self* and *emotions* in the decision-making process (Bazerman and Chugh, 2006; Morse, 2006).
- The link between big-scale interventions with positions of power. In other words, how power is expressed in the built environment (Huxtable, 1984; Leeuwen, 1992; Markus, 1993).
- The influence 3D renderings have on the selection process of interventions in the built environment, as the MIS was the only proposal not translated into 3D renderings (Daft and Lengel, 1986; Suh and Lee, 2005; Daugherty et al., 2008; Landa et al., 2013).

Research findings regarding the use of the EIMS models as a selection tool

The arguments and theoretical background that support the EIMS models did not influence people's choices. People had similar visions and ambitions for the future of the city. They all aimed to intervene in UTG to improve the city's overall dynamics and character. However, they did not agree with the shape, scale or design of the interventions. The concepts behind the EIMS models were used to justify all interventions equally; therefore, in this case study they did not help in the selection process. Following this, at least two issues should be considered. First, the EIMS models were not introduced at the start of the selection process. When we introduced the models, ideas were formed, conclusions were taken and alliances were made between people. Further tests are needed to test if the results would have been the same if the EIMS models had been introduced at an earlier stage of the selection process. Second, perhaps the EIMS models were too general to be able to be used in a more refined selection. Consequently, additional studies should be done in other real-life contexts to test:

- A different methodology.

- A more specific framework.
- The influence of the self in the decision-making process.
- The way human individual imaginary gives a new meaning and shape to an external object.

Even if the exploratory system did not help in selecting the shape and scale of the interventions, it was a great basis for discussion. It led participants to relate their interventions to bigger issues relevant for Aberdeen city. It helped participants to relate each intervention to the broader context of urban complex and dynamic change. The strategic questions raised during the meetings were useful tools to establish priorities and visualise the targets aiming to be achieved. This study suggested that the EIMS models can probably be used as a common ground for communication between all actors involved in the city design and planning. They can serve to connect top-down urban actors and eventually cross that information to the city inhabitants and the world of academia.

In short, on the one hand this study suggested that the EIMS models have the potential to help people to define intentions, strategies and visions for the future. It suggested that the models can help participants to reflect on the in-depth problems and relate them to different areas and levels of the system. On the other hand, this study suggested that the models were inappropriate to be used as a selecting tool once participants had already established positions and, therefore, preconceptions which were difficult to alter.

Emergent findings and discussion

Study 1 reinforced the argument that every intervention is a result of the tensions between top-down and bottom-up forces (McGee, 1971; Beer, 1983). However, it also made clear that individuals have less strategic power in the decision-making process than organisations and institutions (Loorbach, 2007; Lane et al., 2009; Friedmann, 2011).

Independent individuals and the private sector were more expressive about their convictions. That enthusiasm was reflected in the actions they took to make their voice heard and to manipulate the selection process. People published in blogs and websites, they made protests, wrote thousands of letters and much more. Private organisations invested a great deal of money and effort to promote their preferred intervention during the negotiation process. The public sector assumed a much more passive approach both in terms of financing and in terms of expressing a clear position. The public sector had the last word on the selection process and their preference changed when the party in power changed (Morse, 2006).

Study 1 proved that ideals and preconceptions are very difficult to change and that they play a key role in the decision-making process (Koprowski, 1983). Personal beliefs influenced both the preferences and actions of the public and private sector. Personal convictions led to various interpretations of facts and numbers, and led people to take unimaginable actions to bring their point across (Morse, 2006). Ideals and visions are both based on emotional and rational perspectives of the world. Together they shape decisions and therefore the interventions we make in the environment (Morse, 2006); they become the intentions that shape human interventions, therefore they cannot be neglected.

Morse shows the relevance of emotional self-awareness to justify feelings and avoid the “bounded awareness” phenomenon, which causes people to ignore relevant information when making a decision (Bazerman and Chugh, 2006). EIMS models did not make people change their minds but it addressed the above problem in the following way: on the one hand, it made people reflect on their emotions by having to justify what they considered to be a rational choice (Bazerman and Chugh, 2006). On the other hand, EIMS models helped participants to formulate questions and look at the problems from a different perspective, significantly reducing the possibility of overlooking important information (Hammond et al., 2006)

As argued in Chapter 3, Study 1 also proved that common ideals and a vision induced human cooperation. Like in living systems, people and organisations self-organised internally and between each other to form alliances to defend their common beliefs and intentions for the city (Greenleaf, 1977; Morgan, 1997; Knowles, 2002). As argued in the context of governance and decision making, groups were indeed actively formed (Sheard and Kakabadse, 2007). They were formed around the different ideals for the site (Polzer and Kwan, 2012) which expressed psychological similarities between the participants (Jaina and Tyson, 2004) and similarities of meaning (Duck, 1994). In the research context it was clear that people in the same group similarly interpreted the information given by the EIMS modes.

People cooperate on the basis of how similarly they interpret events and give a meaning to things, but that meaning does not have to be exactly the same. People and groups made compromises and therefore formed a coalition with groups who shared a similar perspective of things but were not entirely similar (Richerson et al., 2001). For example, coalitions were formed between the *Friends of the Union Terrace Gardens* and the “*Peacock friends*”. These groups defended the relevance of preserving the historical buildings in the site and its topography. Nevertheless, the *Friends of the Union Terrace Gardens* had to compromise on things, such as keeping the historical oak trees which characterise the site (Gregory, 2011). These coalitions were formed to join forces against the *City Square* alternative. These compromises illustrate the challenges the bottom-up voice has to overcome to be able to cross institutionalised organisations and be materialised in the urban form (Loorbach, 2007; Lane et al., 2009; Friedmann, 2011).

The process of coalition forming between groups is well documented in management sciences. For example, Jaina (Jaina and Tyson, 2004) argues that coalitions are formed not only because of similar world views and meaning systems (Duck, 1994) but also based on personal judgments of competence to complete a given task. As a matter of fact, the *Friends of the Union Terrace Gardens* saw the Peacock Visual Art group as a more capable and representative organisation able to compete more equally with the City Square alternative.

Following this, the study also observed that, as suggested by Greenleaf (1977), the management and advisory groups created by *Aberdeen City and Shire Economic Futures* (ACSEF) combined both a formal and an informal part. The formal part managed the operations needed to promote the proposal and to acquired extra funding (Morgan, 1997; Knowles, 2002) and the informal part was based on relationships between people (Greenleaf, 1977; Morgan, 1997; Knowles, 2002) built on similar meanings given to things and on similar interpretations of themselves and the world around them (Duck, 1994; Jaina and Tyson, 2004).

Finally, this study raised the question of how 3D renderings and images in general influence the decision-making process (Daft and Lengel, 1986; Suh and Lee, 2005; Daugherty et al., 2008; Landa et al., 2013). Despite how undeveloped the designed proposals were, their images were the basis for the discussions during the selection process. All participants, both from top-down and bottom-up, were defending their ideas based on 3D images of the projects which did not give any in-depth information of the projects themselves. Most of the time, participants had no idea of the project's content or the challenges related to its materialisation. This raises the question of whether the basis for the selection of interventions was the design feature or the quality of the 3D images presented. In light of this, having the MIP presented in the form of sketch plans and sections and no 3D renderings might have contributed to the fact that it was not considered seriously by top-down protagonists next to the 3D visualisations of other proposals.⁹

Study 2

Study 2 investigated the same issues as Study 1 but it focused on an academic context. Study 2 tried to address the questions:

- Did building management masters students see any potential in the use of micro interventions to nudge change?
- How did they respond to the research's exploratory system (the EIMS)?
- Were students able to operate the models?

Key features of Study 2

- The case study was bounded by time and place: data was collected during a 30-minute workshop and was related to the UTG discussion in Aberdeen.
- The focus group was the 2009 MSc students from Robert Gordon University (RGU) – *Scott Sutherland School of Architecture and Build Environment*.
- The system studied in Study 2 was: Aberdeen, discipline topic (sustainability), the research's hypothesis translated in the MIS – a drawing suggesting the use of micro interventions as a tool to nudge change, the research's exploratory framework (the EIMS models), the students, and Marta Miguel as the researcher.

Aims of the data collection

The aims of the data collection focused on the validation of the research's theoretical background and the use of microinterventions (MIS) as a tool to nudge urban change and the validation of exploratory models (the EIMS). These can be further defined as the following:

Aims of the data collected in relation to the research's theoretical approach:

- Test the acceptance of the use of *micro interventions* as a tool to nudge urban change. Test the acceptance of the concept of self-organisation and unpredictability as part of governance and governance as a process of nudging change.
- Test the awareness of the students to the depth and degree of change a micro intervention can lead to.
- Develop an exploratory theory for sustainable urban management.
- Gather contributions from the participants that could lead to other theoretical approaches.

Aims of the data collected in relation to the exploratory models (the EIMS):

- Test the acceptance and applicability of the exploratory model as a tool for professionals such as designers and decision makers to think and act in urban complex systems.
- Test how operational the exploratory models were. Analyse the participant's difficulties in using the models and use that information to improve them.
- Gather new ideas and contributions from the participants to design or readjust the EIMS models.
- Analyse to what extent the EIMS models influenced participants to develop a more holistic view of Aberdeen city centre.

- Analyse to what extent the EIMS models influenced the way participants acted on a specific urban problem.

Methods used to collect data

Study 2 was divided into three main parts. The last part was subdivided into two different approaches to the study which related to two different kinds of students participating in the activity.

Part 1 consisted of a lecture to introduce the research's theoretical background and the EIMS models. In Part 2, the study was introduced and explained to the participants. Students were introduced to the *micro-intervention system* (MIS) and ACSEF's Intervention *The City Square* (CS). These interventions were introduced as two possible strategies to address Aberdeen city centre's loss of population. Students were asked to use the EIMS models to choose the best option and justify their selection. To support the discussion and frame it in the research context, a big screen displayed the *EIMS basic model* and the plans of both interventions.

Part 3 was used for discussion and to collect the data. Students present in the classroom were divided into three groups of four. A questionnaire¹⁰ was used to collect data from the discussion within the groups. The presentation of the students' conclusions was recorded. Students had to announce their selection and justify the reason for their choice. Notes and observations were collected during the lecture's break as well as during the students' discussion time. The notes gathered describe perceptions, feelings and ways of being in the classroom. They refer to questions posed and also the way participants used the MIS and the EIMS models to reflect on themselves and their environment.

Students participating in the workshop via the internet were asked to apply the EIMS models in real-life situations.¹¹ They were asked to use the models to investigate in what way an intervention of their choice changed their living environment. Participants submitted their conclusions both in a written format and represented on the EIMS models. This data was used to test the clarity and operability of the EIMS models and contributed largely to their improvement.

In addition, data was collected from internet discussions on RGU's Moodle platform. These discussions emerged spontaneously among the students and between the students and the lecturer and were of key relevance to the changes made in EIMS' first models.

Research findings and discussion

To extract meaning from the research's conclusions we compared the different kinds of data collected during this case study. The comparison of the conclusions taken from the questionnaire with

the conclusions taken from the written assignment and the web discussions allowed us to relate the participant's awareness of social complex systems. Those conclusions could then be related to the EIMS models and the methodology needed to operate them.

The findings extracted from Case Study 1 were compared with the findings extracted from Case Study 2. This allowed for testing the theoretical background of this research in two different contexts and drawing conclusions from that.

In other words, the research findings emerge from the comparison of different sources of data collected within Study 2 and between data collected in studies 1 and 2.

Research findings regarding the MIS project and use of micro interventions as a tool to nudge urban change

In Study 2 there was a consensus identifying the strategy of using key micro interventions to steer change as the best alternative presented. Students defined the MIS strategy as cheaper and faster to implement, posing fewer risks and possibly achieving similar aims for the future of Aberdeen city. They all agreed that micro interventions are more flexible and easier to adapt or replace to address new needs and circumstances.

As seen in Study 1, the students' views of a sustainable way to manage urban change contradicted the opinion of several representatives of public and private organisations who represented the urban department of Aberdeen City Council. Ironically, a key public servant, a member of the government, saw more difficulties in the implementation of the *micro interventions* suggested by MIS than in the implementation of the macro intervention suggested by ACSEF. This conclusion leads to suggest that there is the need to investigate further the relationship between top-down representatives and the scale of the interventions they prefer for the built environment.

The fact that bottom-up representatives and academic representatives see *micro interventions* as a relevant strategy to manipulate change and both private organisations and public institutions prefer bigger scale iconic interventions leads us to reflect on the relation of power and its symbolic manifestation in the built environment (Markus, 1993). As described by Paul-Michel Foucault, power has always been a property of social organisations, and allied to power there has always been the fascination with symbols of dominance materialised in the built environment. These symbols are often related to scale and height (Huxtable, 1984; Leeuwen, 1992; Markus, 1993).

For Pierre Bourdieu (1989), symbolic power is a way to state a reality. For others, such as for the participants in Study 1, it is a way to invite a new reality in. As mentioned by the participants, the priority of both *City and Shire Economic Futures* (ACSEF) and *Peacock Visual Art Group* was not to use the UTC as a tool to address any specific need of the community. The aim was to use the UTG to

improve the overall quality of life in the city as well as the urban character and dynamics. The aim was to use the UTG to create an image and an identity of Aberdeen city in relation to the world (Acuto, 2010).¹² The aim was to invite tourism and foreigners to live in the city (Zukin, 1997) and contradict in this way the fact that the city is losing its population (Wiechman, 2007).¹³

Both *Peacock Visual Art Group* and *City and Shire Economic Futures* (ACSEF) suggested interventions in the built environment as a strategy to invite more people to the city and guide them to use the city differently. Both were representations of symbolic power in the built environment, aimed to get people to act according to the meaning they imply (Anderson, 1987). Due to the character and scale of both suggestions, they would deeply influence human actions, the way people move in the city (Bourdieu, 1989) and human social interactions (Sassen, 1999); *Peacock Visual Art Group* suggested a more cultural environment while ACSEF suggested a more trade-oriented environment. These environments would affect the urban character and urban dynamics, which in turn would influence the character of the people who use them (Sassen, 1999).¹⁴

On the other hand, both *Peacock Visual Art Group* and *City and Shire Economic Futures* (ACSEF) aimed to create an icon; a global landmark (Eben, 2001), something that can be related to the “Bilbao-effect” (Rybczynski, 2002). Both suggestions focused on the strategic potential of iconic architecture to attract global attention and therefore change the dynamics of the city (Debord, 1994). However, due to personal ideals and interests, they could not agree on the form, character and function of such an icon.¹⁵ *Peacock Visual Art Group* focused on the aesthetics of the architectural object to create this global icon. *City and Shire Economic Futures* (ACSEF) focused on the contextual features of the site and the greatness of scale of the intervention to achieve the same purpose.

Research findings regarding the use of the EIMS models as a selection tool

On the one hand, this study suggested that the EIMS models were well accepted and that the EIMS basic model might have helped participants to think in more depth about social complex systems. On the other hand, it gave relevant information on how to improve both models.

Operating the models influenced the depth of the student’s analysis: all participants were able to refer and relate several distinct aspects of the EIMS basic model and use these relations to define their system of focus. The students who were asked to operate the model engaged in the analysis of the system in much more depth. The group of students who operated the model noticed a shortage of areas available to represent interventions in relation to urban complex systems; in other words, students felt the need for more adequate intersections in the EIMS basic model, intersections which would represent their interventions of focus more adequately.

Visualising the model also influenced the students' analysis: students who dealt with the physical representation of the EIMS dynamic model engaged with the notions of unpredictability and dynamic change; they could foresee a sequence of events over longer periods of time. They could relate short-term actions with open-end future scenarios for the city as a whole. The students who were asked to imagine future scenarios for the city without the support of the EIMS dynamic model did not show evidence of awareness related to unpredictability and continuous change. They were quite certain in their statements on what the future would bring and on what it should look like.

In light of the findings mentioned above, we relate the participants' different expressions of awareness of the city as a complex, dynamic and unpredictable system to two differences in the methodology used to test EIMS models.

The first difference has to do with the active use of the models: the students in the class were asked to take the EIMS basic model into consideration as a framework of thinking but they were not asked to actively use models. The students engaged with the assignment had to operate the EIMS models actively and that guided them to reflect on the city in a deeper and more dynamic manner.

The second difference is related to the visualisation of the models: the students in the classroom had only the EIMS basic model displayed on the classroom's screen. The EIMS dynamic model was implicit in the questionnaire but it was not displayed. Conversely, the students engaged with the assignment had both models presented in the assignment sheet and examples explaining how to operate both of them. This might have influenced the way students perceived the unpredictability of complex systems.

In short, the fact that the models were presented to the students in different manners led to different outcomes. This finding suggests that the EIMS models helped participants to think in terms of the whole system, continuity and dynamic change. From Study 2 we can conclude that the participants performed better in the presence of the models than they performed when they were absent. They engaged with deeper and more holistic thoughts of the system when they were asked to operate the models.

Implications for the research process and for the models' design and the methodology to operate them

In terms of the applicability of the models in a real-life situation, the assignment proved that adjustments had to be made. The participants were not using the models as expected, therefore key changes had to be made in order to make them more operational. This conclusion had significant implications for the research process and for the conceptualisation and representation of the EIMS models:

First, this study led to further research of relevant literature. The aim of such research was to clarify important concepts such as the categorisation of interventions described in Chapter 5 and relate them to the models' design. Study 2 showed that there was the need to:

- Categorise interventions. This led to the explorations made in Chapter 5.
- Express in the model the notion of nested hierarchies and the idea that the model can be applied to all scales of complex systems. This led to explorations on the relationship between scales of complex systems (Miller, 1978) and scales of interventions (Alexander, 1977) and the relationships between them. In addition, it led to redefining the model's core and the meaning given to the space around it. It led to the concept of *system internal* and *system external* explored in Chapter 5 (Loorbach, 2007).
- Relate the concepts of interventions to the notion of problems and intention. These notions were explored in Chapter 3 in the context of evolutionary theory. This exploration culminated in changing the focus of the models from "the intervention" to "the intention" for the system's future. Currently, it is the relationship between the intention and the problem of focus that defines the core of the EIMS basic model.
- Relate interventions and changes with the notion of time. This led to the concept of interventions as short-term actions and intentions as eventual long-term changes.
- Find a more consistent methodology to operate the models. This led us to explore the methodology and models used in *Transition Management* to introduce innovations in institutionalised systems.¹⁶ These explorations were translated in a completely different methodology to operate the models, which was tested in Singapore in the context of Case Study 4.

Second, this study led to changes in the representation and organisation of both EIMS models.

With regards to the EIMS basic model:

- The title and the terms used to define intervention areas in the models changed.
- The physical representation of the model changed, allowing more intersections between different aspects of the model to occur.
- The idea of *nested hierarchies* and of *system internal* and *system external* was introduced.
- The idea of the model as a framework was introduced. In other words, the idea of a scales model applicable to all scales of social systems and interventions was introduced. This concept was also tested in Case Study 4.

With regards to the EIMS dynamic model:

- The notion of intervention as an action and a reaction was introduced.

- The notion of *time* is now related with the notion of *evolution* and the notion of *dynamic change* is now related to the notion of *self-organisation* of the system.
- The notion of nested hierarchies was introduced.

As mentioned, Case Study 4 aimed to test and validate the improved models that emerged from Case Study 2's findings. Case Study 4 also tested the methodology used to apply the models and the idea of using the models as a framework to guide and give depth to the thinking and design process. In addition, it tested the ability of the models to engage and relate different scales of complex systems and their ability to be used as a platform for communication and collaboration.

Adjustments made in the EIMS basic model

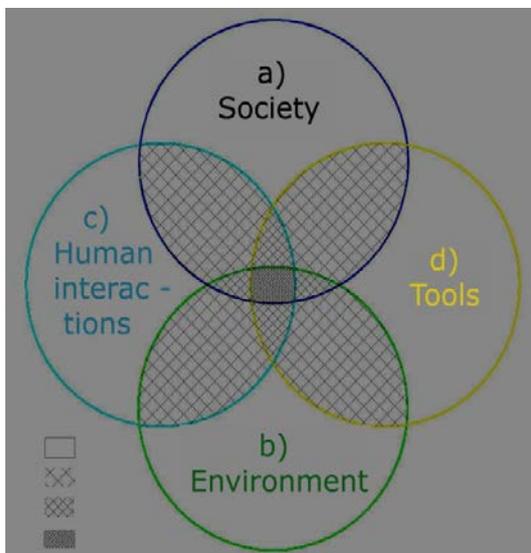


Figure 33: EIMS basic model before Study 2

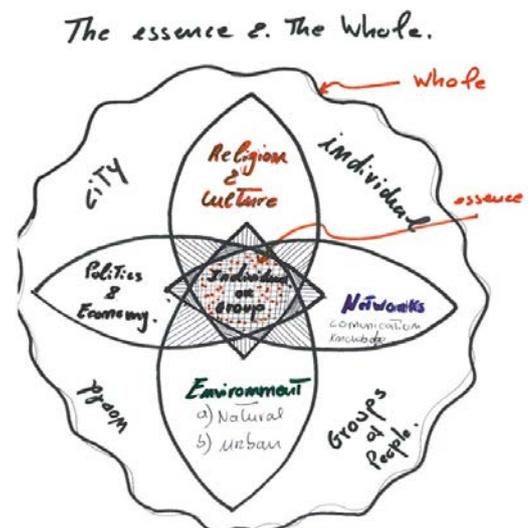


Figure 34: EIMS basic model after Study 2
This model is the one introduced and explained in this thesis

Adjustments made in the EIMS dynamic model

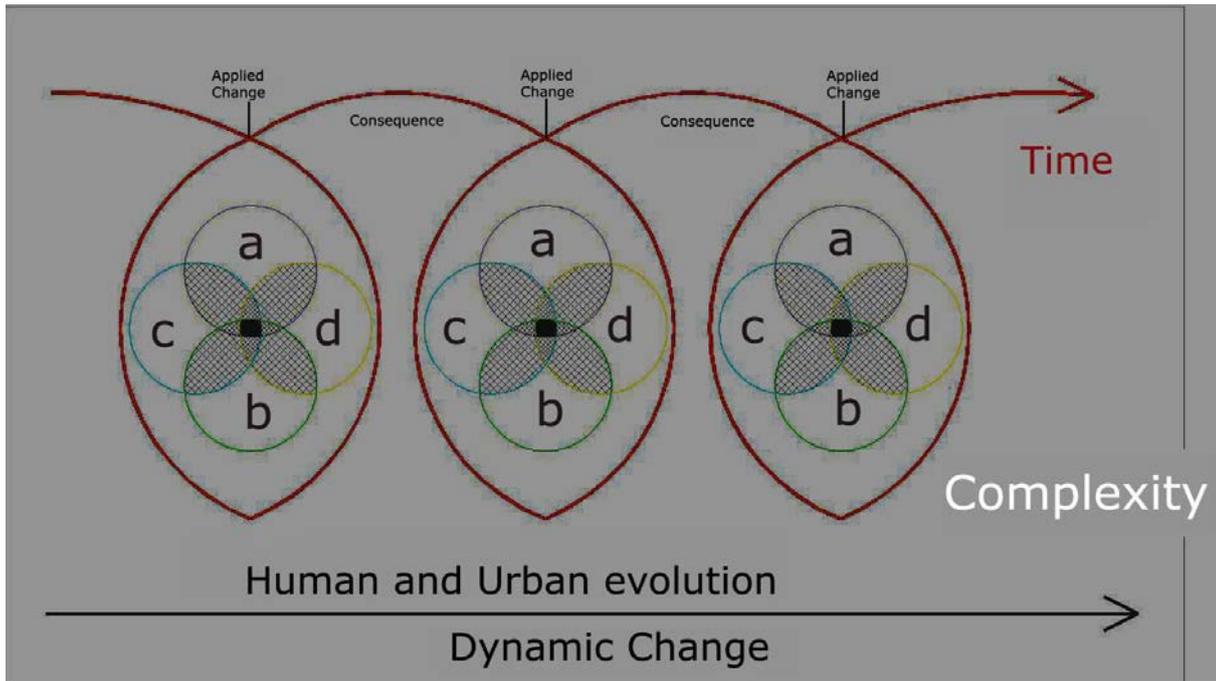


Figure 35: EIMS dynamic model before Study 2.

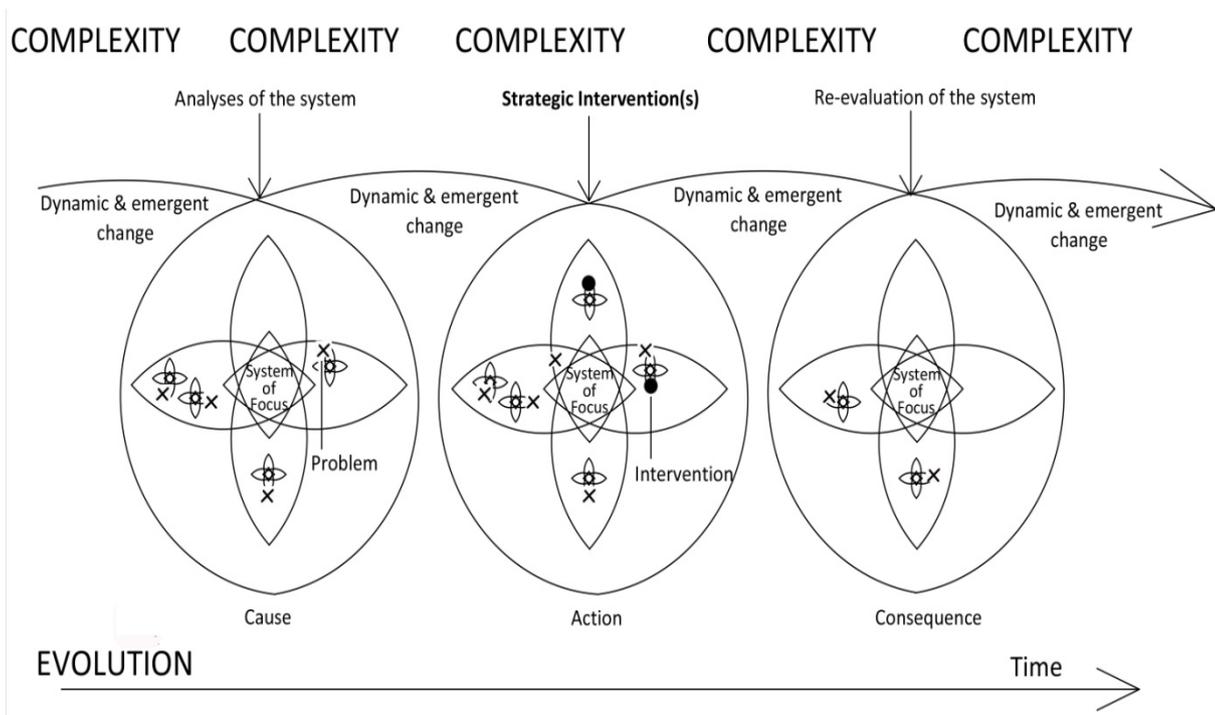


Figure 36: EIMS dynamic model after Study 2

Study 3

Although architects are recurrently asked to intervene in the city, there is not much known about how aware they are of the city as a complex and dynamic system and if they use that awareness in the design process. In light of this, there could be questions about how to use architecture as intentional intervention to nudge urban change.¹⁷ Design and architecture are particularly interesting kinds of interventions because they can both be originated from the bottom-up and the top-down and in both cases they can be used to change the character and development of spaces.

This study questioned if a deeper understanding of the urban context adds complexity to the design process and in what way it influences the design object. The study addressed the following research questions:

How did architecture students respond to the exploratory system (EIMS)?

How did the exploratory system influence their urban awareness?

Did that change or shift in awareness influence their design process and their design object?

Context of the research

Like studies 1 and 2, Study 3 focused on interventions in Aberdeen city centre.³ However, these interventions were not restricted to *The Union Terrace Gardens*. Students had to select a site, investigate the problems they wanted to address – both in relation to the site as well as in relation to the city as a whole – and explore architectural forms and functions able to address these problems. All interventions suggested by the students were characterised as the following:

Categorisation of interventions in relation to:	Interventions in Aberdeen city centre suggested by the students	
1-Their active or passive role in relation to urban and social change.	Interventions as actions *	Interventions as consequences or reactions
2- Their source	Natural interventions	Artificial interventions *
3- The kinds of interventions in the urban environment	Interventions of events	Interventions of space or interventions in the built

		environment *
4- The duration of the intervention	Acute interventions or short-term actions	Chronic interventions or long-term actions
5- The intentionality of the intervention	Unintentional interventions: Intention focus on the self	Intentional interventions: Intention focus on the common good *
6- The origin of the intervention	Top-down interventions *	Bottom-up interventions
7- The number of interventions and the relations between them	Isolated interventions *	Interventions in a system
8- The predictability of their consequences	Predictable: short-term *	Unpredictable: long-term *
9- The environment	General interventions: Conceptualisation phase *	Unique or contextual interventions: design, selection and implementation phase *
10- Their size		See Table 4 - Appendix 1

Table 15: Characterisation of the interventions investigated in Study 3 in relation to the categories explored in Chapter 4

Relation between long-term intention and short-term action L1 World / L2 Continent / L 3 Country / L 4 Region / L5 Province / L 6 City / L 7 Neighbourhood / L 8 Place / L 9 Object / L 10 Basic elements of the system										
Long-term intention	L1	L 2	L3	L4	L5 *	L6	L7	L 8	L9	L10
Short-term action	L1	L 2	L3	L4	L5	L6	L7	L 8	L9 Architect ure *	L10

Table 16: Relation between long-term intention and the short-term actions regarding the interventions investigated in Study 3

Key features of the study

The case study was limited by the number of students, the time and place. Data was collected from seven students during a period of three months. Decisions regarding the sample constituency and the number of participating students were related primarily to the academic constraints of the discipline in which the research took place.

- The focus group was a 2009 group of final year architecture students from *Robert Gordon University (RGU) – Scott Sutherland School of Architecture and Built Environment*.
- The system studied in Study 3 was: Aberdeen, architecture, the research hypothesis, the research's exploratory framework (the EIMS models), students, the teacher responsible for the group, the design process and the design object and Marta Miguel as researcher.

Aims of the data collection

In relation to the research's theoretical-background:

- Test the acceptance of the research's theoretical framework, namely concepts of self-organisation, unpredictability and governance as a process of nudging change.
- Develop an exploratory theory for sustainable urban management.
- Gather contributions from the participants that might lead to other theoretical approaches.

In relation to the EIMS models:

- Test the acceptance and applicability of the exploratory model as a tool to support professionals such as architects to think and act in urban complex systems.
- Gather new ideas and contributions from the participants to design or to readjust EIMS models.
- Analyse to what extent the EIMS models influenced participants to develop a more holistic view of Aberdeen city centre.
- Analyse to what extent the EIMS models influenced the design concept, the design process and the design object.

Study 3's research process

This study was divided into four main phases. The last phase was subdivided into two different approaches to the study. Phase 1, 2 and 3 were introduced before the students started their design process while Phase 4 took place a week before the final presentation.

Project Schedule	Analytical and Precedents' research	Conceptualisation of the project	Design process	Final presentation	Output
Phases of data collection		Introduction to the research: Phase 1: lecture Phase 2: questionnaire Phase 3: one-to-one meeting		Analyse the students' results Phase 4: Part 1: interview Part 2: observation during the students' presentation	
Duration	1 month	1 week Phase 1: 1 day Phase 2: 1 week Phase 3: 1 day	3 months	1 week Part 1: 1 day Part 2: 1day	1 day

Table 17: Relation between the pedagogical process of design and the phases and methods of data collection.

Phase 1 consisted of a lecture to introduce the research's theoretical background and the EIMS models. In Phase 2 the models were presented as a framework of thinking. At this point, students were given a questionnaire which guided them to think about the urban system from the perspective of the EIMS models. The students were asked to reflect on Aberdeen's urban environment based on the EIMS diagrams and they were given specific questions to guide them through that process.

Phase 3 was a one-to-one meeting where the students were guided to relate the conclusions they took from the questionnaire with a design concept. At this stage students were introduced to the relevance of whole systems strategy and were guided to relate that to their design process (Blizzard and Klotz, 2012).

In the last phase of the study, Phase 4, the students were interviewed and asked to reflect on the answers they gave in the questionnaire, which was presented to them at the beginning of the design process. In addition, they were asked to identify in what way phases 1, 2 and 3 influenced their initial opinions, their design concepts, their design process and their design object.

Following the interview, the researcher observed the students' last presentation in the classroom. The aim of the presentation was to help students to focus on the most relevant aspects of their project and to guide them towards the final presentation. In this context, the researcher evaluated the projects both from the perspective of the research as well as from the perspective of an experienced architect and teacher. The aim was to analyse whether the students were able to express the considerations they took from the initial analysis of the urban system in the design object.

Research findings and discussion

The conclusions taken from this study are a result of the triangulation of information across all sources of data collection within the study. We crossed information collected from the students' analysis of the urban context at two different stages of the design process with the observation of their presentations and the critical analysis of their designs. Our conclusions are as follows:

General findings

During the first stages of the case study, during phases 1, 2 and 3, the students were very enthusiastic about the thought of the city as a complex and unpredictable system. They showed interest in a more socially orientated approach to design, which led to interesting design concepts. As soon as they were left to work alone, they focused more on the aesthetics and technical aspects of the design form.

Students generally did not relate their buildings with the macro levels of the system. They also did not engage with thoughts related to unpredictability even if they were aware of the fact that the city was in continuous change. A sign of this is that most of the students did not think of alternative scenarios for the city nor did they imagine alternative uses for their buildings, even if they were asked to. Most of the students related their designs to the "bigger picture" and thought about the possible influence of their interventions on urban and social development, only because they were asked to at several stages of the research process. This raised questions related to the lack of continuity in the use of the EIMS models and philosophy as part of the design process:

- Were the models not adequate?
- Was it a lack of the students' maturity as architects? (Akin, 2002)

- Was it the fact that the students were trained to be focused on other issues and that they were probably going to be evaluated according to different priorities? (Saint, 1983; Broadbent, 1995)18
- How can the methodology to operate the models be integrated in the design process?

These and other questions were addressed in Case Study 4.

Research findings related to the acceptance and applicability of the EIMS models

The students stated that the new theoretical framework was helpful in relating their projects to a context and its problems. It helped them to be more aware of the human aspect of things (Rapoport, 1977) rather than focusing exclusively on aesthetics and technical issues. This is a great achievement for the EIMS models because the gap between the students' abstraction and human reality is well-known in the academic context of architecture (Stringer and Mikellides, 1980).

To help students to relate their projects to their physical and human context, schools such as *Sheffield School* are experimenting with students' participation in real-life scenarios. Their reports show very satisfying outcomes (Barac, 2012). Study 3 suggests that the EIMS models could also be used as a tool to address this problem and therefore narrow the gap between architectural design, its context and its users. Most of the students argue that the research's theoretical framework helped them to formulate their building's concept. Most argue that EIMS models did not influence the shape of the design or their design process. Knowing that the design concept is the generator of the design form makes such arguments rather questionable. The fact that students could not see the inconsistency of their statement raises questions about their maturity as architects, especially because one of the main skills to learn in an architectural school is how to translate abstract concepts into material forms (Akin, 2002).

Most of the students mentioned that the system did not create extra difficulties in the design process, nor in translating their design aims into a shape. It simply brought new priorities which gave new meanings to their concepts and consequently to their projects. Most of the students argue that if the system had been introduced better at an earlier stage of their studies it would have changed the way they look at architecture and urban planning.

The fact that the social and human aspects of design were perceived as almost a novelty for the final year students of architecture raises questions regarding:

- The students' present awareness of cognition of space and in what way that shapes emotions and performances (Kuller, 1980).

- The relationship between design and ethics. It calls for the re-evaluation of the social and ethical dimension of aesthetics and design (Humphrey, 1980; Smith, 1980). It calls for a re-evaluation of the contributions of design in society both as a materialised form and a way of understanding the world (Alexander, 2003; Ehrenfeld, 2008).
- It makes one wonder about the way in which *design thinking* (Lawson and Dorst, 2009) is underestimated as a kind of knowledge (Sennett, 2008), and its potential to trigger innovations in human dynamics and society (Cross, 2011; Dorst, 2011).
- How one teaches and defines aesthetics (Berger, 1960) and design and in what way we are transmitting that knowledge to the students (Read, 2002). Above all, it raises questions on how lecturers are relating architecture and design to the city and the human quality of life.

The critical analysis of the projects at the end of the design process showed that some projects did not express in their shape the concepts that originated them. This fact suggests a certain degree of students' immaturity as professionals of architecture. In other words, this might express the difficulty students have giving shape to an idea. However, this finding requires further study, because it could also be related to design priorities established by the lecturer or by the university, or it could be related to inadequate design processes and methods (Akin, 2002).

One of the projects which could generate a significant positive urban change in Aberdeen city was made by a student who was not interested in the bigger scale of the urban context. This particular student just considered the urban form to integrate the building in its direct surroundings. He focused on the object itself and its aesthetics and materialisation. Other studies must be undertaken with urban design students and architecture professionals to compare the results, but this finding opens a key question to this research: do we have to clearly define the role of architects, urban designers and urban planners to assume that a good design is automatically a catalyst for improvements in the urban environment? What is more relevant for the appropriateness and adequacy of a strategic intervention, the quality of the design or the designers' awareness of urban and social complexity?

Study 3 suggested that the students were highly influenced by the tutors and their contributions to the design. To take meaningful conclusions from this finding, other studies should be carried out to address the questions:

- Would the EIMS models have more impact in the design process if the participants were less influential and more mature professionals? This would imply the test of the models among professionals rather than students.

- Would it make a difference to the students' design process, concept and object if the EIMS models were introduced at earlier stages of their academic experience?

Study 4 addressed both of the questions above.

In short, the most relevant finding extracted from Case Study 3 was the fact that, according to most of the students interviewed, the EIMS models did not add further complexity to the design process and help them to be more realistic about their designs proposals. In addition, most of the students argued that the models influenced their design concept. Even if they do not think that the models influenced their designed object, it goes without saying that one is deeply related to the other.

This study also raised the question of whether an awareness of the system is relevant in order to intervene strategically in the city. It introduced the question of whether a good design is not enough to act as a catalyst to improve urban dynamics.

Emergent findings

By observing the tutors' comments given to the students before the final presentation, the researcher realised that lecturers did not place much emphasis on the topics related to the EIMS models. The focus was mainly on the aesthetics and technical issues of the design rather than on the social and human aspects of it. From the data collected we could also not see any examples of tutors' comments on the city as a complex system, neither on the influence new buildings could have in the development of the city or even the site.¹⁸

We believe this finding deserves further study.

The fact that, as a teacher of architectural design, the researcher has identified gaps between the students' proposals and the topics mentioned above and the fact that those issues were not addressed by the tutors could be due to three possible reasons:

- a) The human and social perspective of the design as well as the city complexity was addressed at the beginning of the design process. During the process of developing the building in more detail, both students and tutors stop relating their design decisions to the social and complexity aspects of the site and shifted their focus to construction and detailing.
- b) As the critics were given just a week before the final presentation, the lecturers might have considered the level of critique which would stimulate the accomplishment of the project. In other words, critiques evolving basic issues of the project could influence the students' determination to accomplish the assignment (Beinart, 1981).

- c) The pedagogical emphasis of either the lecturer or the school is not one of the issues pointed out by this research (Akin, 2002). Both lectures and academic institutions can focus on ideals of beauty or principles which are passed on in the format of precedents and literature. These pedagogic tools in turn will shape the students' concepts as well as their architectural forms (Saint, 1983; Broadbent, 1995).

From the emergent findings we conclude that it is not only important to further investigate the reasons behind this particular finding, but also to study further the extension of the influence lecturers have on: the design concept, the design process and the design product.

There are studies which suggest that giving autonomy to students, both during their analytical research as well as during the design process, gives a sense of ownership and responsibility to the project which is normally translated into greater results (Manisa, 2012). Following this, and based on Study 3's findings, we suggest that the EIMS models could contribute to the improvement of the students' performance by assisting them as individual critical thinkers. We argue that the EIMS models could support the individual process of collecting relevant data, make links across relevant information, draw conclusions from analysis and translate findings into design concepts and forms. Following this, Case Study 4 tested the models as a tool to support the analytical research in a studio context and as a tool to support the design phases which link the design concept to a finished form.

It is important to take into consideration that all findings which emerged from Case Study 3 should be contextualised in RGU's 2008/2009 academic year. In this context, guidelines for deliverables served as framework for the students' assessment and therefore as a constraint that shaped the students' design process and design object.

Chapter summary and discussion

In the three case studies described above, we have used the EIMS models to explore ways to select and design interventions more efficiently. In the studies described, the research tested the EIMS models both in an academic context and in real "applied" situations. The results that emerged from the case studies conducted in Aberdeen led to conclude that the models were generally well accepted by participants. The EIMS models were efficient in helping to describe the character and the current state of a complex system and to identify relevant subsystems. They gave a sense of urgency to act in the city and they helped to formulate a vision for the future of specific social systems. In other words, the models helped participants to define intentions and identify key problems of the system. Moreover, the models helped participants to think of social complex systems in more depth. They helped the

participants to relate their action to micro and macro levels of social systems and to relate their actions to different aspects of urban life and to different intervention areas.

Participants who operated the models engaged with a deeper level of analysis than the participants who were just asked to use the model as a framework of thinking. The challenges found by the students operating the models were used to improve them as well as to establish a clearer methodology to operate them.

In the real-life scenario of Study 1, concepts of complex systems, unpredictability, dynamic change, nested hierarchies and others proved to trigger relevant discussions about the problems Aberdeen city is facing today. Alongside that, questions related to these topics helped participants to reflect on the intentions behind the interventions they were suggesting for the city. In addition, such topics helped participants to engage with a more holistic perspective of the urban and social system to reflect on the consequences of their actions. In light of this, we argue that the EIMS models could eventually be a good basis for discussion and to establish strategies and priorities. This hypothesis was tested in Case Study 4.

However, the arguments used to lead the participants to reflect according to the EIMS models proved inappropriate in helping the selection of interventions. The EIMS models did not help to establish a form of cooperation between different groups of participants and did not influence the participants' preconceptions. The arguments introduced in the discussions were used to defend and justify very different interventions. Further study should be carried out where the participants are asked to actively operate the models and the models are introduced in the beginning of the selection process. Conclusions should then be drawn by comparing the results of both studies.

In studies 1 and 2, we used MIS (*The Micro-Intervention System* project) to investigate how open decision makers and students of building management were to the management approach suggested by the research. From these studies we have concluded that top-down protagonists were more supportive of larger scale interventions; for these participants, big-scale interventions were perceived as being more effective and the risks related to them were understood as necessary and worth taking. Students and representatives of the *Friends of Union Terrace Gardens* could easily identify the benefits of micro interventions as a management tool.

In general, architecture students argued that the philosophy behind the models influenced their design concepts and did not add complexity to the design process. Some even argued that if such models had been presented earlier in their studies, they would have influenced their priorities in design.

The analysis of the projects proposed by these students showed that they had difficulties giving shape to their concepts. In other words, the design object did not always satisfy their initial intentions. This observation needs further study because it does not necessarily imply a deficiency in the models.

It can be related to the students' immaturity as a design professional or to the role of the teachers and the university in the design process.

In addition, we have concluded that one of the potentially more adequate projects to improve the urban character in Aberdeen city centre came from a student who was not particularly interested in the EIMS models or in social or environmental concerns. This project was also one of the most developed ones and the student proved to be more confident in the design process than the average. This conclusion raises questions of whether to intervene in the city strategically, one needs to be aware of its complexity. As argued in Chapter 3, we can estimate the short-term reactions of a complex system to a certain intervention. Nevertheless, in the long term, we can never predict accurately the system's behaviour. Complex systems are unpredictable and, regardless of how aware one is of the system, it is impossible for the human mind to really grasp its complexity. Therefore, it is impossible to define the long-term consequences of our actions.

Study 1	Aims	Findings	Literature
General findings	Develop a deeper understanding of the dynamics in a real-life process of selecting interventions in the built environment.	Study 1 reinforced the argument that every intervention is a result of the tensions between top-down and bottom-up forces	(McGee, 1971; Beer, 1983)
	Develop a deeper understanding of Aberdeen's urban context and its built environment.	The UTG are misused. The gardens are either undervalued or regarded as a key part of the city. There are differences in the city both across and within different urban heights.	
	Develop a deeper understanding of the relations and dynamics between top-down and bottom-up forces in Aberdeen; Explore the influence individual participants and organisations have in the decision process and in the decision product.	Individuals had relatively less strategic power in the decision-making process than organisations and institutions. However, their determination significantly influenced the decision-making process. Bottom-up participants felt their voice was not heard. Bottom-up participants and the private sector were expressive and enthusiastic about their position. The public sector was more reserved.	On the strategic power of bottom-up and top-down interventions: (Loorbach, 2007; Lane et al., 2009; Friedmann, 2011). (Greenleaf, 1977; Morgan, 1997; Knowles, 2002; Sheard and Kakabadse, 2007).
	Develop an exploratory theory for a sustainable urban management. Gather contributions from the participants that might lead to new theoretical approaches.	The study was relevant to reflect on the role of the self in the decision-making process. This led to include the decision maker as part of the system of analysis and its complexity. In turn this new perspective led to key readjustments in the organisation and in the methodology to operate the EIMS models.	
	Explore the participants' general innate awareness of the city as a complex and unpredictable system.	All participants were able to relate the scale of the garden on a global scale. They were also able to relate the urban environment to other aspects of urban society and urban development. Nevertheless, these reflexions were to a certain extent simplistic and envisioned primarily the possible short-term, direct consequences of an intervention. Participants did not reflect much on the unpredictable character of complex systems. They had defined ideas of how the future should be and had a clear image of how the future would be as a consequence of	On creationist paradigms in architecture: (Sitte, 1889; Corbusier, 1924; Benevolo, 1980)

		their elected intervention.	
	Test the awareness of the change an intervention in the built environment can bring to the overall character and dynamics of the city.	All participants were aware of the relevance of interventions in the built environment as a tool to nudge urban change. They aimed to use the UTG to create Aberdeen's image and identity in relation to the world. They aimed to invite tourism and foreigners to live in the city and contradict in this way the fact that the city is losing its population.	On iconic catalyst buildings: (Debord, 1994; Eben, 2001; Acuto, 2010) On tourism as a catalyst for urban development: (Zukin, 1997)
Findings regarding MIS, the use of strategic micro interventions as a tool do nudge emergent dynamic change	Test the acceptance of micro interventions as a tool to nudge urban change.	The MIS was accepted by bottom-up participants but it was disregarded by both private and public organisations. <i>Union Terrace Garden Friends</i> saw the potential of micro interventions and added suggestions to the MIS. They suggested additional small interventions like recovering the public toilets and implementing a ramp to improve the access for the gardens. Organisations' representatives did not see how small-scale interventions could bring greater benefits to the city.	On the relation of power and its symbolic manifestation in the built environment: (Huxtable, 1984; Leeuwen, 1992; Markus, 1993). This literature is relevant in the discussion which emerged from the comparison of these findings with the ones which emerged from Study 2.
	Test the acceptance of self-organisation and unpredictability as part of governance and governance as a process of nudging change.	The concept of human self-organisation as a relevant aspect of governance was not a relevant issue for most participants, both as individuals and as representatives of organisations. Representatives of organisations were happy to say that they were eager to take the risks implicit in unpredictable changes in the urban dynamics as a consequence of bigger scale intervention.	On a new paradigm for urban planning and urban design: (Alexander, 1966; Jacobs, 1970; Allen, 1981; Friedmann, 1997; Allmendinger, 2001; Marshall, 2012; Portugali, 2012; Salingaros and Caperna, 2013)
Findings regarding EIMS, The Exploratory Management System	Test potential of the models to self-educate users and stimulate people to think in complex systems from a holistic perspective.	EIMS models helped participants to relate each intervention to the broader context of urban complex and dynamic change; they helped them to reflect on the problems in depth and relate them to different areas and levels of the system.	On the need for a holistic and systematic thinking to reduce the possibility of overlooking relevant information: (Hammond et al., 2006)

		EIMS models helped participants to formulate questions and look at the problems from different perspectives, reducing significantly the possibility of overlooking important information.	
	Test the capacity of the models to be used as a common language and as a framework to cross information between all parties involved in the design and selection of interventions in the built environment.	EIMS models were a good basis for discussion. The strategic questions posed during the meetings were a useful tool to establish priorities and visualise the targets aimed to be achieved.	On the need for a common language for a sustainable urban management and design: (Ostrom, 1990; Alexander, 2003; Bortoft, 2010; Friedmann, 2011; Wilson, 2011)
	Explore to what extent the models are able to help people to be aware of the unpredictable character of complex systems.	EIMS triggers thoughts on how to use the interventions suggested in alternative ways, which demonstrated an increase of awareness of the unpredictable character of dynamic change. Nevertheless, EIMS was not able to make participants question the benefits of small-scale interventions.	
	Test the applicability in a real-life situation of the EIMS models as a framework or a selection tool. Test the capacity of the models to improve the selection process of interventions.	EIMS did not influence the selection of intervention.	
Emergent Findings	The use of 3D images influenced participants' perception of the interventions.		(Landa et al., 2013)
	The self, personal perceptions and emotions influenced the selection of interventions and therefore influenced the decision-making process. Ideals and visions are both based on emotional and rational perspectives of the world and these are very hard to change.		On the influence of the self in the decision-making process: (Koprowski, 1983; Bazerman and Chugh, 2006; Morse, 2006)
	People self-organise and form groups; they cooperate on the basis of how similarly they interpret events and give a meaning to things, and that meaning does not have to be exactly the same.		On group formations in organisations and society: (Greenleaf, 1977; Morgan, 1997; Richerson et al., 2001; Knowles, 2002; Sheard and Kakabadse, 2007)

Table 18: Summary of the findings which emerged from Study 1

Study 2	Aims	Findings	Literature
General findings	Develop an exploratory theory for a sustainable urban management. Gather contributions from the participants that might lead to new theoretical approaches.	To clarify important concepts and relate them to the models there was the need to explore further: - interventions' categories - concept of nested hierarchies - how to define internally a complex system and how to relate the system to external conditions which influence it - the strategic relevance of intentionality - alternative methodologies to operate the models.	On nested hierarchies: (Alexander, 1977; Miller, 1978) On the notion of system internal and system external: (Loorbach, 2007) On the relevance of intentionality to speed up and direct change: (Ostrom, 1990; Loorbach, 2007) On how to operate frameworks and models as a tool to guide change: (Loorbach, 2007)
	Explore the participants' general innate awareness of the city as a complex and unpredictable system.	Similar to the findings which emerged from Study 1, without the presence of EIMS models, students did not engage with notions of complexity or unpredictability. All their statements about the future of Aberdeen as a consequence of an intervention were certain.	
	Test the awareness of the change an intervention in the built environment can bring to the overall character and dynamics of the city.	Similar to the findings which emerged from Study 1, all participants were aware of the relevance of interventions in the built environment as a tool to nudge urban change.	
Findings regarding MIS, the use of strategic micro interventions as a tool do nudge emergent dynamic change	Test the acceptance of micro interventions as a tool to nudge urban change.	The use of micro interventions as a tool to nudge urban change was well accepted among the participants.	On the relation of power and its symbolic manifestation in the built environment: (Huxtable, 1984; Leeuwen, 1992; Markus, 1993). This literature is relevant in the discussion which emerged from the comparison of these findings with the ones which emerged from Study 1.
	Test the acceptance of self-organisation and unpredictability as part of governance and governance as a process of nudging change.	Students perceived the research approach towards governance as a novelty. Nevertheless, they showed great interest and acceptance.	
	Test potential of the models to self-educate users and	Students who dealt with the physical representation of the EIMS basic	

Findings regarding EIMS, The Exploratory Management System	stimulate people to think of complex systems from a holistic perspective.	model could relate short-term actions to open-end future scenarios for the city as a whole. Operating the model influenced the depth of the students' analysis of the urban system.	
	Explore to what extent the models are able to help people to be aware of the unpredictable character of complex systems.	Students who dealt with the physical representation of the EIMS dynamic model engaged with the notions of unpredictability and dynamic change; they could perceive a sequence of events over longer periods of time. Operating the model influenced the depth of the students' analysis of the urban system.	
	Test the applicability in a real-life situation of the EIMS models as a framework or a selection tool. Test the capacity of the models to improve the selection process of interventions.	The study was not conclusive because the selection process happened within a closed group and we only had access to the group's final conclusion. Further tests should be carried out using a different methodology to collect data.	
	Test the clarity of the models and identify the difficulties participants would have in operating them.	The participants were not using the model as expected; therefore, key changes had to be made in order to make the models more operational. The group of students who operated the model noticed a shortage of areas available to represent interventions in relation to urban complex systems. In addition, to complete the assignment the students felt the need for more adequate intersections in the EIMS basic model, intersections which would represent their interventions of focus more adequately.	

Table 19: Summary of the findings which emerged from Study 2

Study 3	Aims	Findings	Literature
General findings	Test the acceptance of the research theoretical framework, namely concepts of self-organisation, unpredictability and governance as a process of nudging change.	The research's theoretical approach was well accepted among the participants.	
	Develop an exploratory theory for sustainable urban management. Gather contributions from the participants that might lead to new theoretical approaches.	The students suggested introducing the EIMS concepts earlier in their learning process and evaluating how that would influence their development as architects.	
	Explore the participants' general innate awareness of the city as a complex and unpredictable system.	Students generally did not relate their buildings with the macro levels of the system. They also did not engage with thought related to unpredictability even if they were aware of the fact that the city was in continuous change.	
	Test the awareness of the change an intervention in the built environment can add to the overall character and dynamics of the city.	All students aimed to use architecture to address an urban problem.	
Findings regarding EIMS, The Exploratory Management System	Test potential of the models to self-educate users and stimulate people to think in complex systems from a holistic perspective.	The models led the students to engage with a deeper evaluation of the social and human aspects of design. This exploration was perceived as almost a novelty for the final year students of architecture.	On cognition of space and in what way that shapes emotions and performances: (Kuller, 1980) On the re-evaluation of the social and ethical dimension of aesthetics and design: (Humphrey, 1980; Smith, 1980) and (Alexander, 2003; Ehrenfeld, 2008).
	Explore to what extent the models are able to help people be aware of the unpredictable character of complex systems.	Most students did not explore any alternative use for their buildings even if they were explicitly asked to.	On the ways in which design thinking is underestimated as a kind of knowledge and its potential to trigger innovations in human dynamics and society: (Sennett, 2008; Lawson and Dorst, 2009; Cross, 2011; Dorst, 2011).
	Test the applicability in a real-life situation of the EIMS models as a framework or a design tool. Test the capacity of the models to improve the adequacy of design concepts, the quality of the design forms and the design process of	Most of the students argued that the research's theoretical framework helped them to formulate their building's concept. They stated that the new	On the human aspects of the urban form: (Rapoport, 1977) On the gap between the students abstraction and

	interventions.	theoretical framework was helpful to relate their projects to a context and its problems. It helped them to be more aware of the human aspect of things rather than focusing exclusively on aesthetics and technical issues.	human reality: (Stringer and Mikellides, 1980)
	Investigate if a more holistic awareness of urban complex systems influences or adds complexity to the design process and their design object.	Most of the students mentioned that the research's theoretical approach did not create extra difficulties in the design process, nor in translating their design aims into a shape. It simply brought new priorities which gave new meanings to their concepts.	
Emergent Findings	The students were very enthusiastic about the thought of the city as a complex and unpredictable system. In addition, they showed interest in a more socially orientated approach to design. As soon as they were left to work without the guidance of the model's philosophy, they focused more on the aesthetics and technical aspects of the design.		On the way we are transmitting knowledge on aesthetics and design to the students: (Read, 2002)
	The critical analysis of the projects at the end of the design process showed that some projects did not express in their shape the concepts that originated them.		On the lack of students' maturity as architects: (Akin, 2002)
	One of the projects which could generate a significant positive urban change in Aberdeen city was made by a student who focused on the object itself and its aesthetics and materialisation.		
	The students were influenced by the tutors and their contributions for the design.		On the relation between the student's design and priorities of assessment: (Saint, 1983; Broadbent, 1995)

Table 20: Summary of the findings which emerged from Study 3

Chapter 9: Testing and evaluation of the EIMS

Study 4: Application of the EIMS models in Singapore

Chapter 9 focuses on the research objective 8:

8) To test and evaluate an operational framework based on the research's theoretical approach that would lead to the design and selection of more appropriate and sustainable interventions and strategies.

Study 4 was designed to test and evaluate the EIMS, building upon findings from the previous studies. It responds to questions that might arise related to the consistency of the implementation of the models in relation to the design process, sample size and duration of the previous studies. Study 4 was designed to test the EIMS models and their operational methodology and focused on interventions from the scale of buildings and the neighbourhood (see Table 4 - Appendix 1). The study was implemented based on the conclusion extracted from previous studies that the EIMS framework does not add complexity to the design process, but it rather changes its focus. Based on this, the study focused on testing and validating the impact the EIMS framework has on the design process and the design product.

Key features of the study

The case study was limited by the number of participants, time and place; data was collected from a research group of 45 participants, and over a period of 10 months. Decisions regarding the sample constituency and the number of participating students were related primarily to the academic constraints of the disciplines in which the research took place.

- The focus group was a 2018 group of year 2 students of the Diploma in Environment Design. Temasek Polytechnic. Singapore

- The system studied in Study 3 was: Singapore, architecture, urban design, the research hypothesis, the research's exploratory framework (the EIMS models), students, the teachers, the design process and the design object and Marta Miguel as researcher.

Aims of the data collection

- Test and validate the EIMS models as a framework that facilitates the analysis of complex systems and supports the design of more informed human actions/interventions.
- Analyse to what extent the EIMS models influenced the design concept, the design process and the design object.

Background information

Study 4 was developed in Singapore¹ in the School of Design of Temasek Polytechnic, more specifically in the Diploma of Environment Design (EVD). Temasek Polytechnic was established in 1990 and it presently includes six academic schools and 30 part-time courses, 37 full-time diploma courses, with over 15,000 full-time on-campus students.

Environment Design (EVD) is an interdisciplinary diploma that involves a seamless integration of Architecture, Landscape Architecture and Urban Design – three highly demanding, distinct yet complementary disciplines. This means that students not only need to grapple with very complex concepts in each area of study, but they are also required to assimilate their learning holistically.

EVD operates in a real arena, that of the city which requires a deep appreciation and understanding of the habitat that we occupy. The design of urban spaces within the city comprises complex factors that interact and impact each other. Following this, the students are required to tackle both complex sites and demanding briefs; not only the learning outcomes are broad but also the sites allocated to students for study and analysis are multifaceted and require an understanding of various issues and design variables. In this scenario, it is important that students do not operate in silos because that could lead to the inability to “connect the dots” or relate interdependently complex concepts across the disciplines. Because of this, the integration of complementary subjects is a huge hurdle and challenge facing the EVD teaching team that requires an innovative approach to teaching and learning.

Due to the nature of the diploma and the need to teach students to decode and analyse urban complex systems and the wicked problems they entangle, the team is using the EIMS framework in

subjects such as **Sustainable Design 2**, **Urban Design Studies**, and during the site analysis phase of all three **Integrated Design Studios**.

Study 4 focused on a group of 45 second year students and was conducted as a longitudinal piece of research from 26th April 2017 until 22nd February 2018. The study was divided into two parts. The first part was developed in the context of the subject *Sustainable Design 2* which was offered from 26th April 2017 until 16th June 2017. The second part was developed in the context of the subject of *Urban Design Studies* which was offered from 23rd October 2017 until 15th December 2018. Each subject content is delivered in 45 hours during two lessons per week of three hours each. In both subjects, the students were divided in two tutorial groups per subject. A subject leader ensured that the classes were conducted according to a scheme of work and the EIMS framework was used across both tutorial groups. The EIMS framework was introduced to the students in the context of *Sustainable Design 2* and it was further applied in the context of *Urban Design Studies*. In other words, the subject of *Urban Design Studies* was a follow up of *Sustainable Design 2* as the urban systems in analysis are greater in size and complexity. Both subjects were designed to support the conceptualisation and design of project work developed in the context of *Integrated Studio 2* and *Integrated Studio 3* respectively. Because of the integration of subjects, the field observations for this study were made both during the subjects as well as during *Integrated Studio* time which amount to a total of 90 hours of field observation during each part of the study, therefore 180 hours of observation in total.

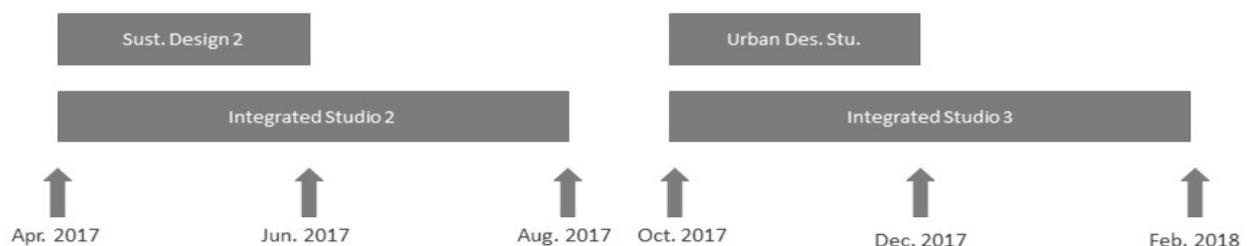


Figure 37: Duration of Study 4 in relation to EVD year 2 students' academic context

It was ensured that the observations did not interfere or influence in any way the studio setting during studio sessions, design reviews, consultations or critiques. As far as the proceedings of the studio sessions are concerned, nothing in the teaching and learning settings was altered in terms of intended learning outcomes.

Studio spaces are large open rooms with individual working stations that students can move and adapt freely. This open space concept allows each tutorial group to be seamless, therefore information and learning can be openly shared across tutorial groups.

At the beginning of each study, students were introduced to the fact that they are being brought through a design process that starts from inception to concept, design development, sketch design, schematic design or design development, detail design and final proposal. These consist of the five

generic phases of the design process suggested by van Dooren et al. (2014). A copy of the design brief is enclosed in Appendix 5 and of the assessment criteria rubrics for all stages of the project were given to the students at the start of each subject (Appendix 6).

The subject of *Sustainable Design 2* aimed to introduce students to the comprehensive site analysis process by applying the EIMS framework, which leads to the proposal of design strategies that addresses environment sustainability issues with consideration for the community. The learning outcomes focus on the holistic understanding of a community and make students realise the contradictions and wicked problems embedded in the notion of sustainability.

The project site was Pulau Ubin – Singapore. Pulau Ubin, which literally means "Granite Island" in Malay, is a small island (10.2 km²) situated in the north east of Singapore. Rubber plantations and granite quarrying have supported a few thousand settlers on Pulau Ubin historically, but only 38 villagers live there today, supporting mainly the eco-tourism industry. It is one of the last rural areas to be found in Singapore, with an abundance of natural flora and fauna. The island is one of the last areas in Singapore that has been preserved from modern urban development. Its wooden house villages and wooden jetties, relaxed inhabitants, rich and preserved wildlife, abandoned quarries and plantations, and untouched nature make it the last witness of the old "kampong" Singapore that existed before modern industrial times and large-scale urban development.



Figure 38: Pulau Ubin – Singapore

The subject of *Urban Design Studies* introduces students to the meaning of social sustainability and sustainable urban development. It refers to key urban design principles for the design of resilient

and sustainable cities. In this subject, participants apply the EIMS framework once again to analyse complex urban forms and suggest urban strategies to nudge urban change towards a sustainable future.

In opposition to Pulau Ubin, the project site is located in the heart of mainland Singapore and it is highly urbanised. It sits at the intersection of New Bridge Road and Kreta Ayer Road and is very much like a piece of an incomplete jigsaw puzzle within Singapore's city centre. The site leads to Duxton Plain Park, which is characterised by the backs of shop houses and greenery lining the linear path connecting New Bridge Road and Yan Kit Road. Historically, Duxton Plain Park makes use of the land previously occupied by the Singapore-Kranji Railway Line. Although the noisy trains were unpopular among the residents when in operation, they became redundant in 1914 and were eventually dismantled in 1925. The park now finds itself within close proximity to a variety of both old and new landmarks, yet its urban role as a node or connector does not seem fully realised.



Figure 39: Duxton Plain Park – Singapore

The subject of *Sustainable Design 2* served as a platform to introduce a research methodology using the EIMS framework which will be applied across the students' course of study in the *Diploma of Environment Design*. The framework explored in the subject is an adaptation of EIMS models which focused on the characterisation of an urban complex system in a given moment, the identification of the system's imbalances, the generation of an intention, and the exploration of strategies to act on the system. The submission requirements for this subject were the analysis and interpretation of complex systems and a concept masterplan explaining the students' vision for the site

as well as showing a synthesis of all strategies suggested for the island. This exercise was developed during the course of 15 lessons: two lessons per week during a period of approximately two months. The whole process was closely guided by tutors and by the specification of each requirement clearly presented in the subject briefs.

The subject of *Urban Design Studies* served as a consolidation of the framework introduced in *Sustainable Design 2* which is in the context of *Urban Design Studies* applied to a larger and more complex urban system and with limited guidance by the tutors. *Urban Design Studies* survived to test the framework's ability to give autonomy to the students and guide them to be more self-directed learners. The submission requirements in this subject were similar to the ones requested in *Sustainable Design 2*; they involved the analysis of relevant urban systems and how they influence one another, interpretations of the information gathered and a concept masterplan defining the vision for the site and the strategies suggested to nudge the area towards a more sustainable development. This time, even if the area analysed was much more extensive and complex in nature, students were given only five lessons and two weeks to complete their work. In addition, students were given four lessons (two more weeks) to study the historic layer of the site in greater depth. The process to develop this exercise was not closely monitored by tutors. Tutors acted as observers and consultants when students requested guidance. The subject briefs were more open and did not specify in detail the submission requirements.

In the context of both *Integrated Studio 2 and 3*, students were required to translate the findings that emerged from the research and analysis and their vision for the site into a spatial form. The students followed the design process stipulated by the subject syllabus but were requested to use the EIMS models to test their ideas and the spaces proposed. The design of the architectural objects proposed to the site was developed during a period of 16 weeks – two lessons a week, three hours each lesson – which amounts to a total number of 96 teaching hours. Students were asked to present their proposals three times during the 16 weeks of design development. Presentations took place according to the different stages of the design process and students were asked to use the EIMS framework to defend their work (see Figure 48 and Figure 49, pp.267). For the final presentation, students were requested to use the EIMS framework to articulate the narrative to explain their project which included the deliverables requested by the subjects and the integrated studio.

Learning and teaching methods

Both subjects introduced students to a studio-based learning approach of learning-by-doing in a studio environment. The subjects centred around the conception of learning as an active engagement. The aim was to encourage students to drive their own learning. In this process, the students extensively engaged in collaborative learning activities in a studio setting. Teaching methods included

short lectures, which were used sparingly to facilitate the understanding of new knowledge, and assignments which involved hands-on activities that encouraged exploration (Appendix 5). In addition, verbal and graphic presentations were required of students as a means to hone their communication skills and to gauge their understanding and application of the concepts. Field trips were incorporated to broaden the students' exposure and experience of the various subject topics.

Assessment and Presentations

Formative assessment was conducted during teaching sessions. These sessions included design reviews and consultation sessions, a form of desk reviews which were conducted on a one-to-one basis on draft of the assignments periodically. The lecturer used the information obtained during these design reviews and consultations to gauge the students' learning progress and provide them with appropriate feedback. Further opportunities were provided, based on the feedback, for the students to act and improve. A series of individual and group assignments incorporating presentations was designed to assess students' ability to apply and communicate the concepts learnt in the classroom. The assessment took into account the design process and outcome.

The assessment of each assignment was conducted by two tutors. The marks and comments that contributed to the findings presented in this research were moderated among them. Assessment was based on the assessment criteria that is given to the students in advance and is used as one of the research methods (Appendix 6).

Integration of the EIMS framework into the design process

The EIMS framework was translated into a step-by-step process, capable of being employed as a framework to support the design process. The methodology used in this study was designed to test the following research aims and objectives:

- the ability of the EIMS framework to facilitate the analysis of complex systems
- the ability of the EIMS framework to support the design and selection of more appropriate and sustainable design strategies and solutions

Following this, Study 4 also tested the ability of the EIMS framework to:

- enhance the participants' analytical skills and critical thinking
- enhance the communication and collaboration across participants
- enhance the efficiency of participants during the first stages of the design process

The next section describes the design process and how the EIMS framework was strategically imbedded in it to test the research aims and objectives.

Design process

The design process is characterised by working steps that define different stages of problem solving to achieve a certain design solution. These stages relate to the designer's thinking processes and to the process of generating and developing ideas (Boden, 1991).

These steps can be divided into five main phases:

- 1 understanding the defining of the design context and the design problem
- 2 defining design goals
- 3 ideation and the exploration of possible solutions
- 4 evaluation and the testing of the design solution
- 5 materialisation and implementation of the final outcome

This process is not a linear; it builds continuous feedback loops that generate new information, new concepts and possible new solutions. It is an interactive process of trial and error which evolves almost organically into a solution (Cross, 2008).

Models to define the design process have emerged from the design field (Schön, 1991; Cross, 2008) as well as from engineering perspectives (Krick, 1969; Pahl and Beitz, 1995) and have been adapted and applied in the context of the architecture, engineering and construction (AEC) industry.

An adaptation of Paul and Beitz's model, suggested by Leon (2015), was used to illustrate the general framework that characterises the design process followed by this study's focus group. Paul and Beitz's model was used because it clearly defines a sequence of stages, and links working steps with decision-making steps to path the way from an ill-defined design problem to a solution. This framework offers the ground to articulate how EIMS models bring depth to the design thinking process and rearticulates the sequence of the design process.

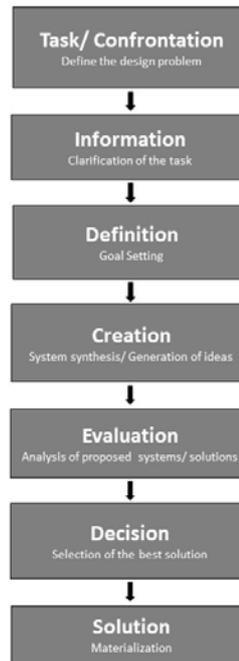


Figure 40: General process for solution finding adapted from Pahl and Beitz (1995), in Leong (2015)

Defining the design problem is normally the first step in any design thinking process approach. The design problem normally comes in the form of a client's or a tutor's project brief, depending on if it is in an industrial or academic context. Design problems define the start of the designer's creative process to create an object or solution that meets the client's or tutor's aims and satisfies specific constraints. Constraints or limitations might be predefined or emerge from the understanding of the design context and/or the design brief.

Design problems are often unclear in terms of goals and constraints (Simon, 1973). They share common traits with 'wicked problems' as they are normally not well defined, their outcomes are not clear, they relate to and are defined by an infinite number of variables, they operate in a context of unpredictability and their constraints are unknown (Tong and Sriram, 1992). There is also no defined, objective solution for design briefs and problems (Rittle and Webber, 1973).

After defining the design problem, there is the need to define the complex system that generates it. This implies a collection of information relevant to the understanding of the design's social, economic and physical context among others. This information is then analysed, evaluated and used to redefine the focus of study and identify key related issues that can impact on design solutions. Only when the design problem and the system of analysis is clearly defined can one proceed to brainstorm ideas, define a concept and develop possible solutions (Cross, 2008).

From the understanding of the complex system in analysis and the issues and constraints inherent in it, design goals and strategies are defined, which in return will become the ground for design concepts and ideas to emerge.

During the next stage – the generation of ideas – designers synthesise and evaluate their possible solutions for the design problem deriving from the information gathered during the previous

steps and the strategies and goals previously defined. The ideation phase is when concepts are formed and positions are taken to address the design problem. During the ideation phase, objectives are defined, constraints are identified and priorities are established. A vision is formed to guide the exploration of the design form, the clean definition of the design program and define basic guidelines of possible aesthetical outcomes.

When the concept design is defined and meets the goals and strategies defined initially, the design thinking process comes to an end. The subsequent steps of the design process are focused on how to translate the concept into a reality; they refer to the detailed development and the design's materialisation and implementation.

Most design process models emphasise the relevance of the initial stages of the design process, especially the conceptualisation phase. The initial steps of the design thinking process are fundamental to establishing a meaningful correlation between the system of analysis or the design context and the meaning, form and relevance of the design solution. The process of collection and analysis of data happens without the support of any framework and it is up to the designer to define the topics of research, which will then influence the assumptions made about the design's context and therefore the nature and relevance of the design solutions.

The meaningful articulation between the design context and the design solution can only emerge from the understanding of the design context in a holistic way. This requires the analysis of vast and complex information that is not easy to grasp by the human mind in the short timeframes both industry and academia have to respond to. The risk is that relevant areas are neglected and others are prioritised based on the personal choices of the individual analysing the system and that might have implications on the relevance and adequacy of the design solutions.

The EIMS framework was used in this study to support the initial steps of the design process and to “nudge” the designer to analyse complex systems in a holistic manner and develop more contextualised strategies to improve or change the system in analyses. The EIMS framework was also used to facilitate communication and participation across participants.

Application of the EIMS framework in the design process

Study 4 explored the use of the EIMS methodology as a tool to provide depth and consistency to the thinking process developed during a design process, and tested in what way it influenced the design object.

Phase 1: Understand/Empathise:

Phase 1 concentrated on applying the EIMS basic model as a methodology to enhance the analyses of the site. This first part led participants to understand the different urban systems that characterise the place and the way they interrelate and influence each other. It also served to define the intrinsic core problems of the site and how these relate to each part of the system.

Following the operational methodology described in Chapter 6, pp.181, during this phase participants were requested to:

Step 1: Define the system of analysis/focus and hypothetical problems that need to be addressed.

Step 2: Define relevant layers of analysis to understand the system in a holistic manner. These layers defined not only aspects of the system but also potential areas to intervene in the system and manipulate its path of change.

Step 3: Analyse the system by overlapping the layers of analysis. Participants are invited to look for patterns, inconsistencies or opportunities that might emerge from the intersection of two or more layers.

Phase 2: Define design goals:

At this point participants were invited to define their vision for the site as well as a system of interventions to address its issues and enhance it as a whole. In this phase the strategies should be conceptual but are grounded on the conclusions taken from a systematic macro analysis of the site and the understanding of the intrinsic relations between different aspects of the system.

During this phase participants were requested to:

Step 4: Redefine the system of focus: after a holistic analysis of the site, participants should be able to identify the core/source of the problems or issues that are apparent in the system. This can guide to changes in focus.

Step 5: Participants are requested to define a vision for the future development of the system of focus. They are also requested to define strategies that address the core problems of the system and improve the system as a whole. Strategies can refer to all different aspects of the system of focus and should themselves work as a system.

Step 6: Participants are required to translate the abstract strategies into a design brief. The design brief should include defined and specific information about the project, such as design concept and specific programs and dimensions. The aim of this part of the study is to understand to what extent a deep understanding of the site influences the students' choices in terms of programs established on the site.

Phase 3: Ideation:

Exploration on the macro scale:

The EIMS framework was used to translate abstract strategies into a concept for masterplans. The articulation of the strategies and their translation into a masterplan triggers multiple possible solutions, which are then translated into different prototypes that can be used to test and select the best options.

Exploration on the micro scale:

The EIMS framework was also used as a tool to support the ideation and prototype phase of an architectural object. This was the phase where participants defined a design brief and developed general form explorations. At this point the study also tested the ability of the EIMS framework to guide participants to relate micro interventions to the macro understanding of the site. The aim of this part of the study was to understand to what extent a deep understanding of the site influenced the students' choices of form in relation to the context.

Step 7: Translate abstract strategies and the design brief into prototypes. When it refers to the macro scale, ideas are explored in the form of concepts for masterplans. When in relation to a smaller site, sketches and models are produced to explore form.

Phase 4: Evaluation:

Step 8: Presentations: Participants were required to present their work and address tutors' feedback in order to select or improve design solution. The process of producing prototypes and testing them is a continuous loop which happens both in formative consultations and in summative presentations.

Phase 5: Materialisation:

Step 9: Participants were required to produce technical drawings and the specifications necessary for the building to be conceived in a real scenario. It deals with safety, regulations and building technological skills. This phase still needs to respond to all the previous ones but it is more technical in nature.

Implementation in class

To guide participants through the design process, a series of submissions and presentations were defined to seal the end of each design phase and assess clear steps of the EIMS framework. Each phase and class presentation had to be slightly adapted to respond to specific learning outcomes of the subjects, specific timelines and unpredictable constraints that emerged during the design process. Nevertheless, the design process phases were translated into the following stages and submissions: *Site Analysis, Design Brief and Masterplan, Concept Design/Ideation, Sketch Design, Schematic Design, Detail Design and Technical Portfolio and Final Design.*

The diagram represented in Figure 39 articulates the relation between the adaptation of Pahl and Beitz’s design process model, the steps of EIMS framework and students’ summative presentations and submissions. The diagram represents the general timeline that guided the participants through the design process both in parts 1 and 2 of this study.

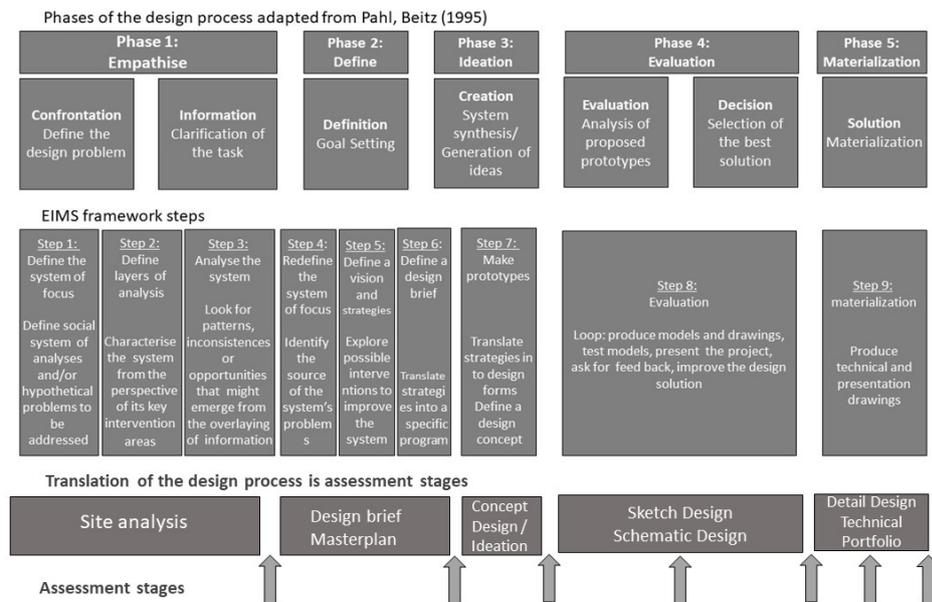


Figure 41: Interrelation between design process, EIMS framework and assessment stages

Site Analysis submission marks the end of Phase 1 of the design process and assesses steps 1, 2, and 3 of the EIMS framework.

The site analysis stage is the time when participants are requested to empathise and understand the design context. Site investigation is made in groups of five or six participants and normally extends over two weeks. In the context of *Sustainable Design*, as it was the first time participants were introduced to the EIMS framework, they were directed to investigate specific complex systems, such as the “circulation networks”, “biodiversity”, the “cultural and historical heritage” of the place and “people”. In the context of *Urban Design Studies*, participants were asked to define relevant areas of

research by themselves. Participants were required to collect information related to at least two different scales: a macro scale, which should refer to the island of Pulau Ubin, in the context of *Sustainable Design 2*, or Singapore in the context of *Urban Design Studies*, and the micro scale which refers to the project site. Tutors were not expected to give direct instructions to participants but rather probe them with questions to guide them through the process of identifying relevant information, relevant resources and methods to analyse the data. At this point, participants were required to collect data directly from the site, collect information from government building authorities, internet, books, etc. Participants were required to select and filter vast amounts of information in a very short period of time. They were also required to translate raw information in layers of graphics that were directly relevant to an understanding of the site. At this point, some guidelines were given, such as the scale of the drawings that needed to be presented, to assure some level of standardisation and to facilitate collaborations and exchange of information across groups. To facilitate the process of gathering and analysing information tutors encourage the assemble information that might trigger disparate assumption among students. This triggered debates and discussions in class that guided students towards more in-depth data and critical analysis of facts. The involvement of the tutors was minimal to ensure that students self-directed their learning and found their own position in relation to the topic of analysis. According to the scheme of work, the last two or three sections were given for the students to synthesise all the conclusions taken from the analysis and translate it into critical information about the project site. Conclusions were taken from the intersection of information related to different scales and areas of analysis. The intersection of different aspects of the site analysis guided students to understand the information holistically and avoid silos. To guide students in this process, one of the submission requirements was a SWOT analysis. The SWOT analysis guided students to sort, evaluate and organise information into the four categories: strength, weaknesses, opportunities and threats.

This synthesis of the analysis formed the foundation for the rest of the design process.

The site analysis presentation exposes the depth and the rigor of the analysis, the innovation and critical interpretation of facts and the ability to synthesise complex information into a variety of formats.

Design Brief and Masterplan submission marked the end of Phase 1 of the design process and assesses steps 4, 5, and 6 of the EIMS framework.

This is the phase where participants define goals and strategies to address the specific issues of the site. The design brief is an individual submission. The design brief is a document that includes the following information: title of the project, a SWOT of the site analysis where participants have to specify the issues they aim to address, a vision for the site, objectives of their proposal, strategies on how they will achieve their vision, target users, program with approximate areas and case studies.

The project brief aims to synthesise the information collected into specific guidelines to support an architectural project. The masterplan synthesises on a macro scale the holistic vision for the whole

area, includes and extends the project site, and relates it to the overall vision for the place. This exercise aims to guide participants to relate different scales and see the relation between micro interventions as catalysts and bigger changes at the macro level of the city. As before, tutors act as facilitators, guiding participants when necessary by posing relevant questions. Individual consultation started to occur at this stage as part of the design teaching and learning pedagogy. The masterplan and the design brief served as a reference to the rest of the design process and participants were repeatedly asked to refer to it to explain their design strategies and decisions made during the rest of the design process. Both the design brief and the masterplan were updated and adjusted during the design process as participants matured their ideas and their proposals increased in sophistication. Both the masterplan and the design brief were presented again in the final presentation so that tutors could access the final design holistically, including the reasoning behind the architectural design form.

Assessment at this phase focused on critical understanding of facts and their translation into effective and clearly defined actions.

Ideation and Sketch Design submission marks the end of Phase 3 of the design process and assesses Step 7 of the EIMS framework.

This is the phase where participants have explored different prototypes to respond to the goals and strategies previously defined. During this stage and the those following it, participants undergo a great amount of design activity which can be conceptualised by a framework suggested by Doreen et al. (2014). Participants needed to think in relation to the specific context of the design and respond to specific outcomes. In addition, they needed to follow a general direction which in this case was already established by the masterplan and the design brief. The design brief and masterplan gave participants boundaries which led to consistence and coherence throughout the process and supported the development of the design. Finally, participants explored and experimented with form. They needed to make associations, generate alternatives, compare them and evaluate them.

Assessment at this stage focussed on the level of exploration of the student and how the form responds to the project brief.

The activities during this stage were generally the in-studio consultations where tutors prompted participants to explore form to respond to the guidelines established previously. These were group or individual conversations that Shreeve and Batchlor (2012) identified as “the primer mode of instruction” where tutors and participants “engage in order to develop knowledge”.

Sketch Design and Schematic Design submission marks Phase 4 of the design process and assesses Step 8 of the EIMS framework.

This is the phase where participants developed a form that was generally defined previously. At this stage, participants organised the program and established dimensions and therefore translated ideas into an objective form. At this stage, the assessment focused on the quality and depth of the development of the selected design solution.

Detail Design/Technical Portfolio submission marks the end of Phase 5 of the design process and assesses Step 9 of the EIMS framework.

This phase focuses on the materialisation of the design solution. Participants were invited to define structure and construction details for their projects, still relating their design solutions to the initial guidelines established in the project brief. Assessment focused on the technical skill of participants and their ability to graphically represent their design solution.

Final Design submission was a comprehensive presentation that explained visually and verbally both the design process and the design product. It included the site analysis, masterplan, summary of the design brief, form explorations, final design, materials and finishes, construction details and structural solutions.

At this stage, assessment was holistic and focused on how the final design responded to a comprehensive process and addressed the specific issues of the site.

Data collection – approach and design

In this study several methods of data collection were used to triangulate the findings and identify any possible bias in the data collected. Chapter 7 elaborates on the research's perspective on observation, surveys and interviews made to the participants because these research methods were used in the studies developed in Aberdeen and Singapore. This session elaborates on the use of assessment criteria and field observations in the studio context as research methods because they were used exclusively in this case study. The diagram below summarises how and when the data was collected during the research process.

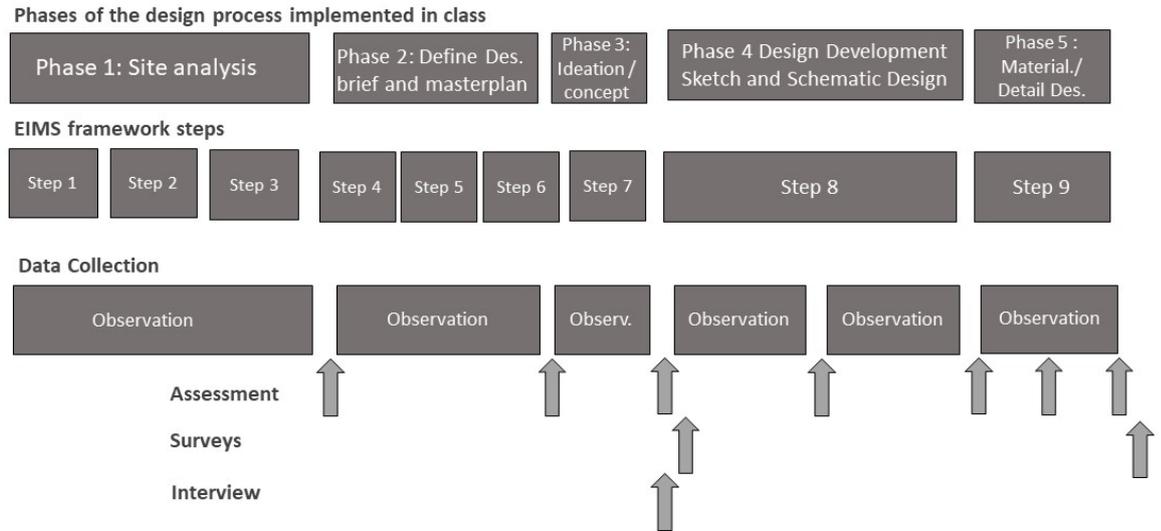


Figure 42: Interrelation between design process, EIMS framework and data collection

Research methods

The use of assessment criteria and outcomes as research data

At the start of the semester, participants were introduced to the subject brief (Appendix 5) which defines the learning outcomes of each subject and to the assessment criteria sheets which defines specific criteria and standards of achievement in each of the design phases of the project work. Summative assessments took place after each design phase, which were translated into the assessment milestones defined above: *Site Analysis*, *Design Brief*, *Ideation*, *Sketch Design*, *Schematic Design*, *Detail Design* and *Final Design*. The intention of giving the assessment criteria and design brief at the beginning of the semester is to provide the participants with an overview of their expected leaning in relation to the design process. The assessment criteria can therefore be used by the students for self-assessment and to monitor their own progress throughout the development of the project. Assessment criteria sheets were created to assess students' performance in each EIMS framework step and in relation to a design process phase. In other words, the assessment criteria defined the learning outcomes of each step as well as the level of development of the thinking process in each phase of the design process. The assessment criteria ensured the consistency of the students' assessment as well as the objectivity of the data collected in Study 4. These criteria allowed for both a quantitative and a qualitative evaluation of the students' performance in each phase of the process. The aim of the assessment criteria was to define the depth and quality of the work according to the different grades. Grades varied between A (Excellent), B (Good), C (Satisfactory), D (Fair) and F (Poor). In addition, the assessment criteria enabled both participants and tutors to identify strengths and weaknesses across different aspects of each submission (Appendix 6).

Field observations in a studio setting

Observations in a studio setting can occur in different circumstances, namely:

Desk critique or consultations:

These sessions can either happen between the tutor and a group of participants or individually. These were strictly formative feedback sessions. These informal sessions normally lasted ten minutes per consultation and they were conducted at the students' working areas.

Design reviews/critique sessions

These were formal sessions that required participants to present their work after all stages of the design process. These summative sessions still included formative feedback. Participants were graded according to the assessment criteria which was presented to them at the beginning of the subject (Appendix 6). During these sessions, a panel of two or three tutors was present not only to give more holistic feedback but also to assure the validity of the assessment. These sessions were about 15 minutes per student over two days. These learning and teaching methods and specific interactions with participants form the backbone of design pedagogy are what distinguish studio learning from other teaching methodologies.

Case Study 4. Part 1:

Application of the EIMS framework in the context of *Sustainable Design 2 and Integrated Studio 2*

Implementation of the EIMS framework in the classroom

The EIMS framework was translated into a step-by-step approach and adapted to the subjects' briefs. The petals of the EIMS diagram were translated in the form of layers to make the information collected more visual and easier to interpret by the students. This adaptation of the EIMS framework was named "The Layer Analysis Methodology".

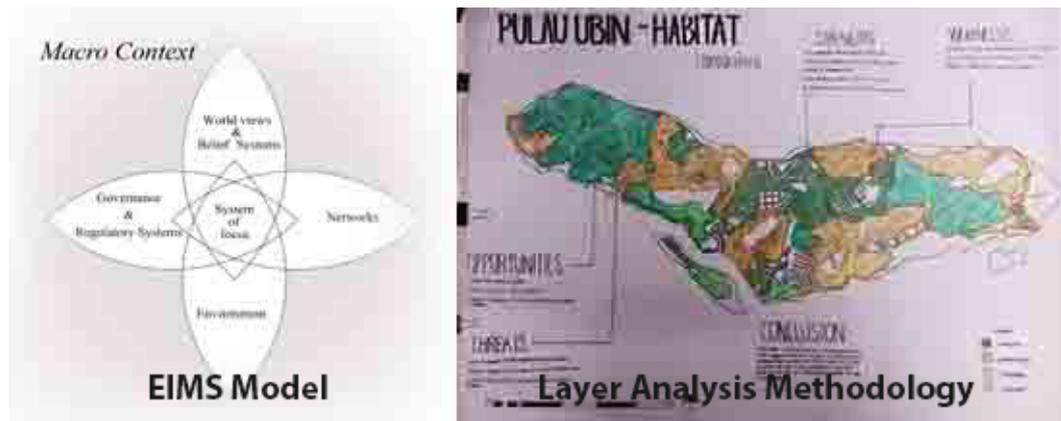


Figure 43: EIMS basic model translated into layers

The step-by-step methodology suggested by the EIMS framework implies first of all the definition of the relevant parts or perspectives that compose the system, second the analysis of the parts independently, third the analysis of two or more combined parts of the system, fourth the suggestion of strategies in one or more of the system's parts, and finally the analysis of these strategies in relation to the whole and to possible future scenarios. This methodology was translated in the class through a sequence of assignments and class activities which were introduced to the participants verbally and through subject briefs (Appendix 5).

First phase: Define the system of study at the present moment

Understanding and creating an empathy with the site

Assignment 1 invited participants to reflect on the question of whether Pulau Ubin is a sustainable community from four different perspectives/themes. Participants were divided into groups and asked to study these different perspectives of the Pulau Ubin urban system separately; in this case, the aspects or perspectives defined for analysis were the people, biodiversity and biosecurity, history and character of the place, and the physical environment. Participants were required to reflect on the question of whether Pulau Ubin is a sustainable community from the perspective of their theme. (Appendix 5: Sustainable Design 2-Assignment 1)

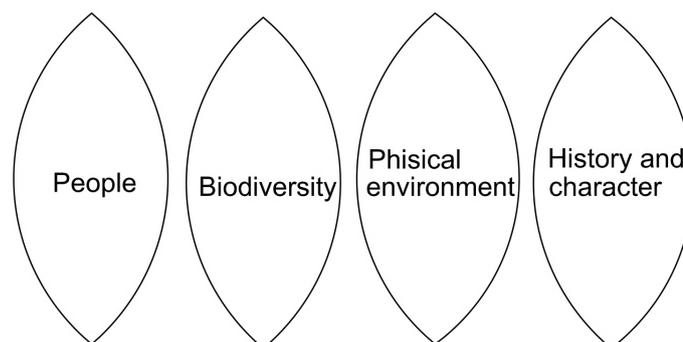


Figure 44: Diagram representing the aspects of analysis suggested in Assignment 1



Figure 45: Example of layers suggested for analysis

To support their reflection, participants visited the site several times to collect data and were required to illustrate and translate the acquired information into relevant layers to understand the site better.



Figures 46 and 47: participants collecting data during the site visit to Pulau Ubin

As it was the first time for the participants to make a site analysis of this scale and the first time using the EIMS framework, tutors facilitated not only relevant areas of research but also the distribution of layers and sublayers, so that participants could achieve a comprehensive study of the site.

For example, in the theme of physical environment, relevant layers of analysis consisted of the composition of the soil, topography, greens and blues, coastline erosion, climate, sun path, etc.

At this point participants felt the need to develop layers which would focus on more specific areas of knowledge and new possible areas of research emerged, such as soil type, types of water bodies, kinds of birds present in different parts of the island, animal migrations to mainland Singapore, maritime traffic, etc.

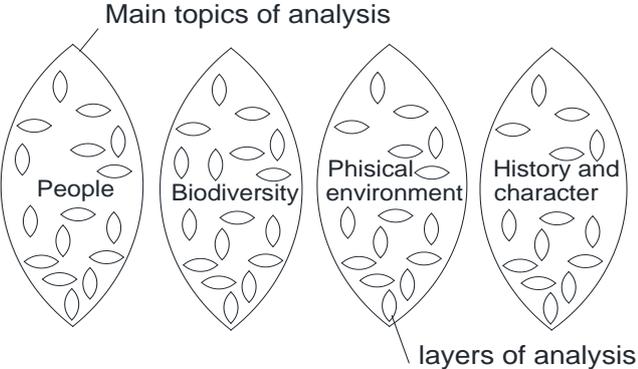
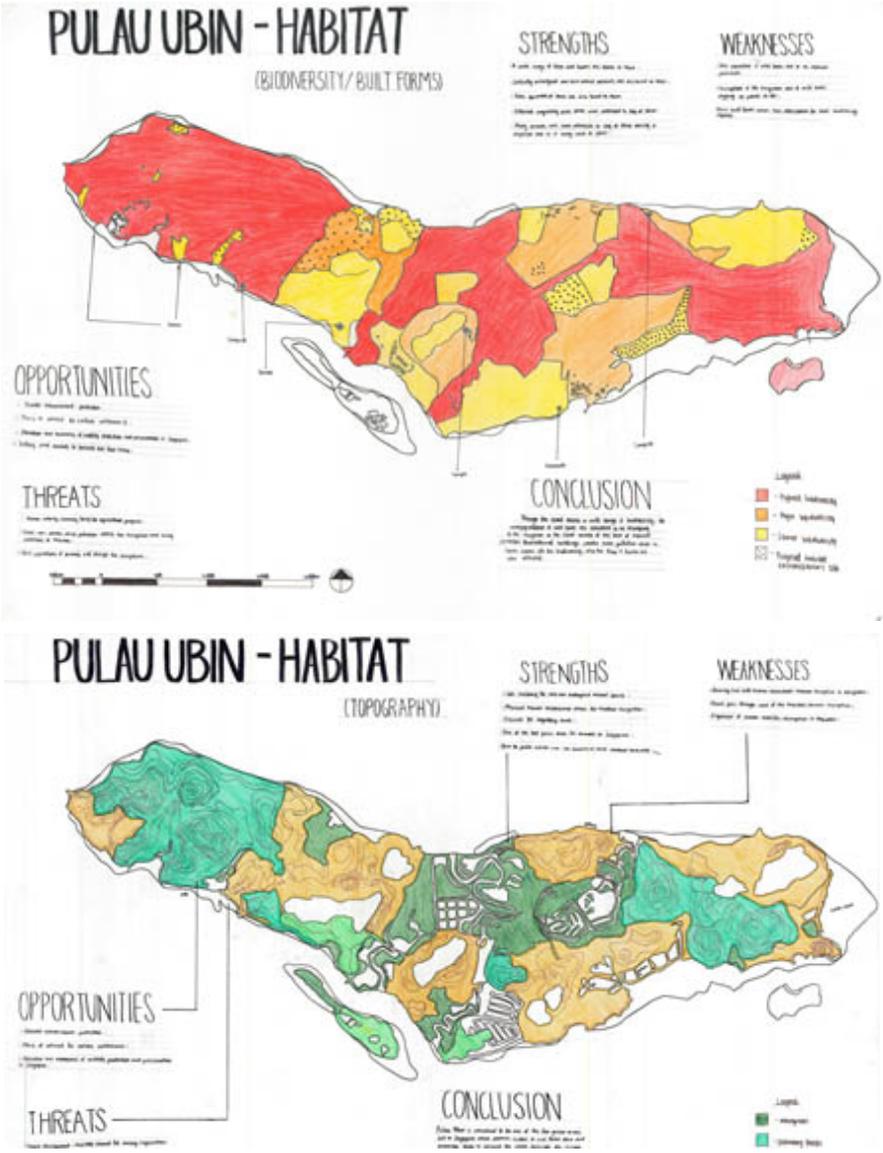


Figure 48: Diagram representing the layers of analysis within each research topic



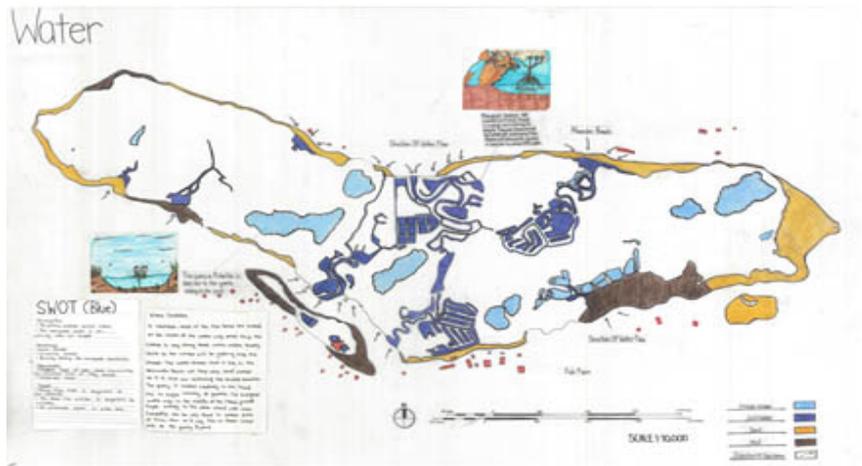


Figure 49: Examples of layers analysed

After the individual analysis of each main topic and its layers, participants were asked to overlay different layers and analyse how one layer related or impacted the other within their theme of analysis. Participants were asked to look at inconsistencies or patterns that might emerge from the analysis of the intersections of layers. They were asked to derive issues or threats and highlight the opportunities from both individual layers and the analysis of two, three, four or more layers combined.

During the study of this subject, participants were required to analyse the superposition of layers within each topic of research as well as across different research areas. We concluded that the depth of analysis and the meaning of the conclusions taken were deeper than before the introduction of the EIMS framework and therefore the team will proceed accordingly in the future.

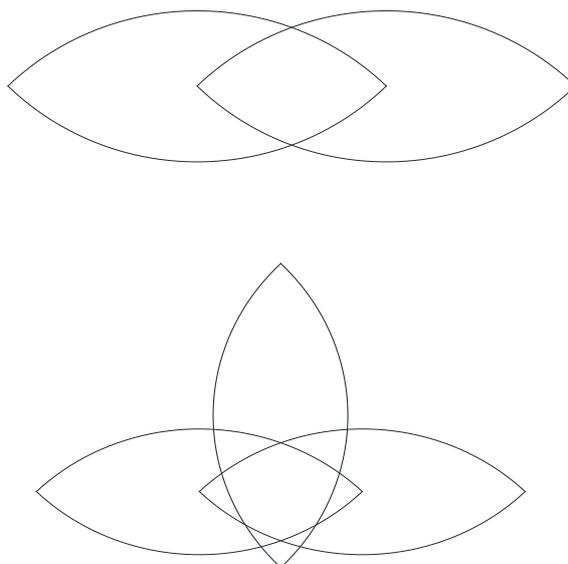


Figure 50: Diagram representing the intersections of two and three layers

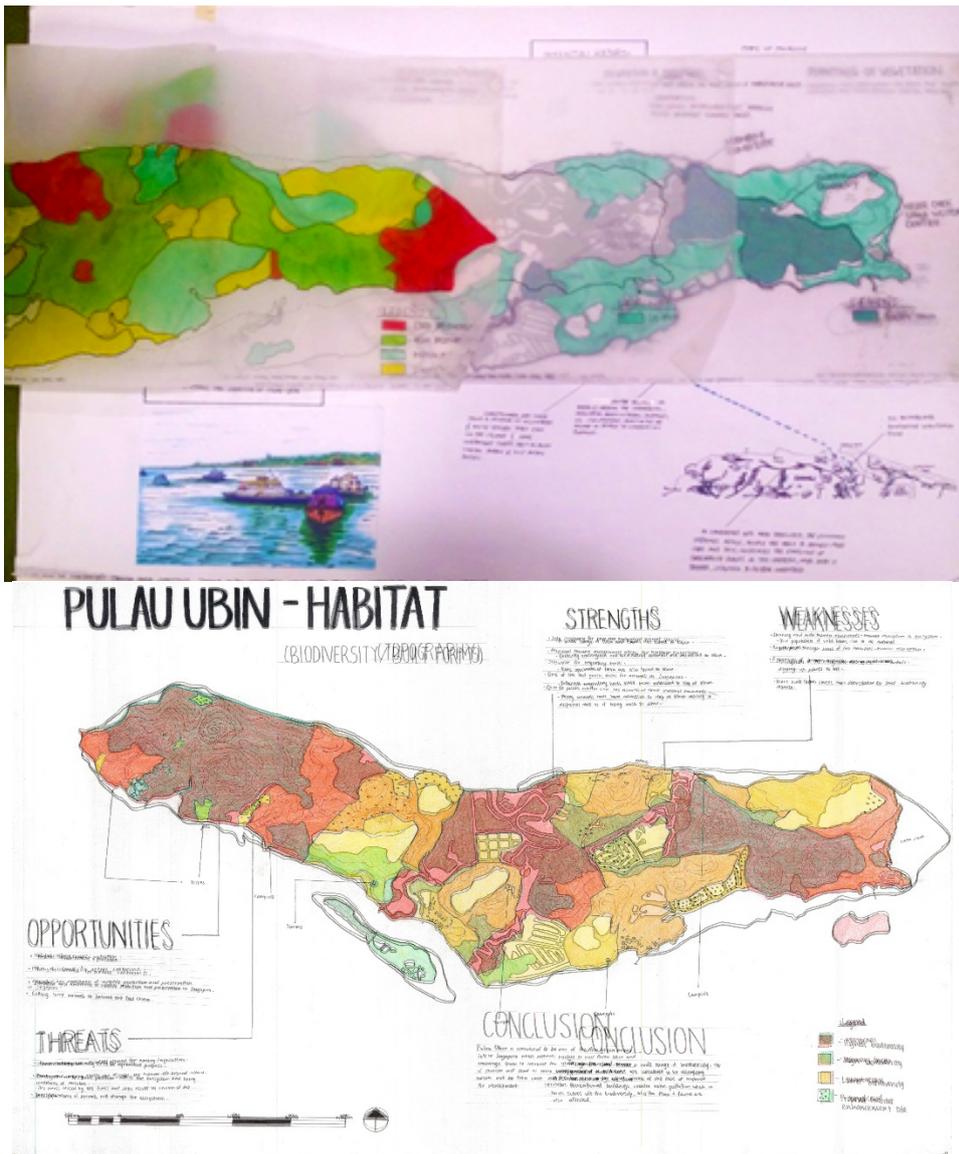


Figure 51: Examples of the intersection of more than two layers

Assignment 1 concluded with each group presenting the findings of each individual topic to their peers. This submission was integrated with Integrated Studio 2’s submission and it represented 30% of their overall mark. At this point in time, participants had a deep understanding of the individual topics of research and therefore were able to respond to the question of whether Pulau Ubin is a sustainable community from the perspective of their research topic.

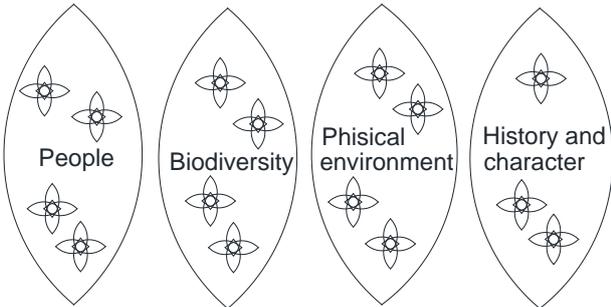


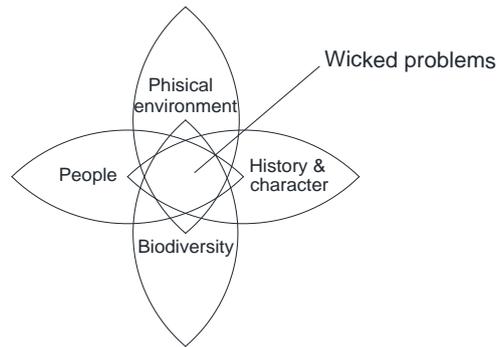
Figure 52: Diagram representing the analysis of multiple layers within each research topic



Figure 53 and 54: Group presentation of site analysis- Phase 1 of EIMS framework

Defining the problems to solve

A “jigsaw puzzle” activity was used to help participants integrate the different aspects of analysis and formulate a holistic view of the island (Muijs and Reynolds, 2018). Participants were asked to regroup in such a way that each member of the group is an expert of different topics of analysis. In these new groups, the participants were asked to debate on the question posed earlier, *Is Pulau Ubin a sustainable community?* and suggest how the island can become a more sustainable and resilient community in the future. Each expert should answer the question from the perspective of his own research theme. This exercise guided participants to deal with different approaches that may even be contradictory depending on the varying perspectives of analyses. This discussion served as a platform for participants to share knowledge and develop a holistic understanding of the site as well as to define the systems’ focus and the wicked problems they aimed to address.



These activities in class were also meant to enhance students' critical thinking skills and give them confidence to share their ideas freely (Appendix 5).

Figure 55: The holistic understanding of the system of focus/site



Figure 56: Group activity. Jigsaw puzzle layout: Groups are discussing Pulau Ubin's future and how to make it a more sustainable island



Figure 57: Examples of outcome of Jigsaw puzzle activity: Annotations of strategies on a map of Pulau Ubin. These strategies are a product of negotiations among participants and respond to a common vision of the site.

Second phase: Reflect on strategies and interventions that can produce effective change in the system of analysis

Masterplan- Brainstorming about strategies to enhance the site

In the next session, participants were invited to reflect individually on the lessons learnt in the previous sessions. This led to the next phase which focused on developing their own vision for a sustainable Pulau Ubin. The participants were then asked to define strategies to achieve their vision. The proposed strategies had to work in cohesion to make the island sustainable and should be designed to enhance either the natural habitat of the island or human wellbeing of its inhabitants (Hodgson,

2011:13). Participants were asked to write each strategy on a postcard and categorise them according to a variety of groupings, such as type of intervention, sequence of implantation, impact on the island, resources, need for implementation, etc. This activity was inspired in the EIMS dynamic model and allowed participants to reflect on the deeper understanding of the site and the implications of each strategy suggested for the future development of the place. This activity also gave participants an opportunity to develop a pool of ideas to kickstart their individual assignments (Appendix 5- Activity 1).



Figure 58: System thinking activity (part 1)

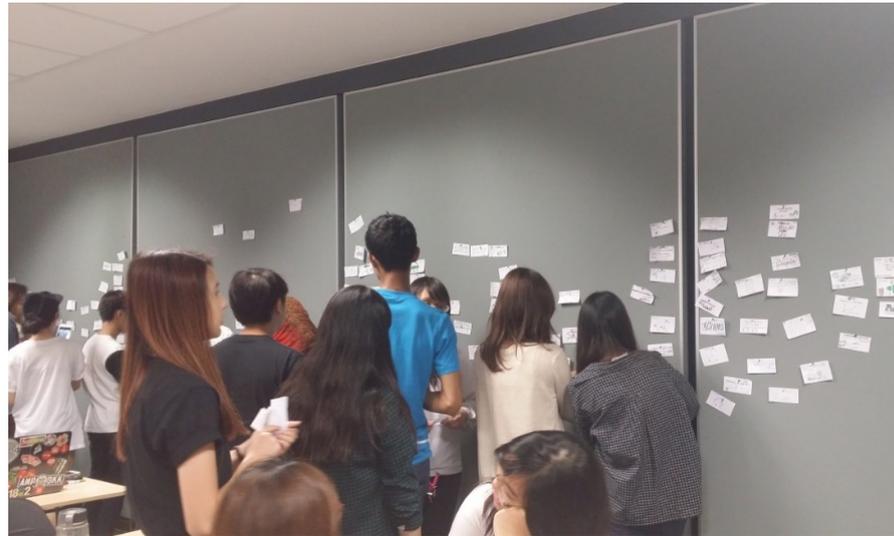


Figure 59: System thinking activity (part 2)

Assignment 2 focused on the individual application of the information gathered so far. In Assignment 2, participants were asked to implement the abstract strategies on the site. This exercise served as an introduction to the meaning and conceptualisation of a masterplan. The strategies were now situated on a map of the island. This exercise required the synthesis of all the research and conclusions gathered in assignments 1 and 2. It required participants to think in terms of systems and to translate abstract thoughts into a real-life context (Appendix 5- Activity 2).

Concurrently in the context of *Integrated Studio 2*, participants were requested to develop their design brief. This exercise required them to relate the macro understanding of Pulau Ubin to the specific requirements of the site. Participants were now asked to define specific information that could serve as a basis to develop the design project, such as program, areas, target audience, etc.

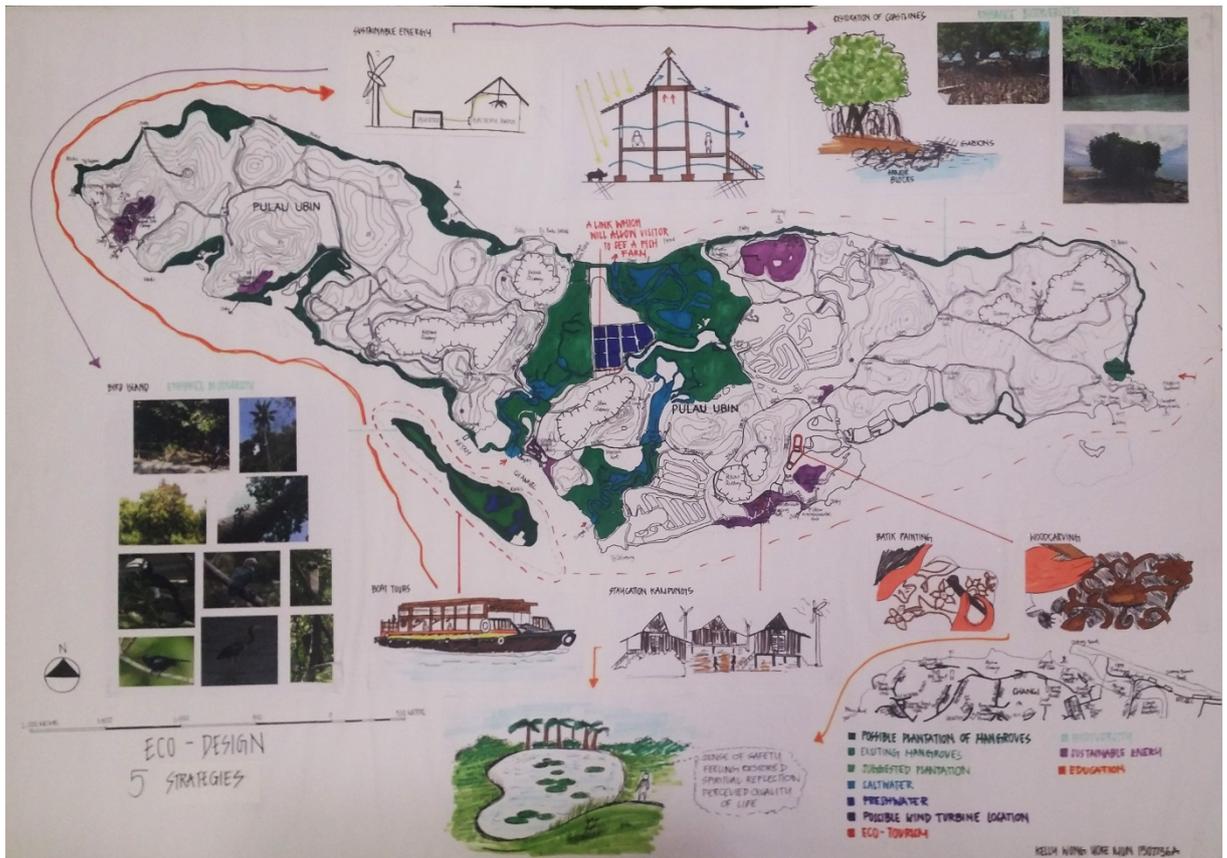


Figure 60: Student's work: Strategies proposed for Pulau Ubin

Third phase: Translating intentions into realities; designing the selected strategies

Ideation on the micro scale: the architectural object

In the design brief participants were asked to contextualise their site in relation to the macro analysis developed so far. They were also asked to define the program for their project and a focus user as part of the system of strategies suggested for the masterplan.

Once participants had a clear idea of the design brief they had drafted for themselves, they started their exploration of form and entered the prototyping phase of the design process. During this phase of the design process tutors made reference during consultations and presentations to a deeper meaning of the form in relation to the site analysis. By the end of the prototyping phase tutors focused on the knowledge and skills needed to develop the architectural form and its materialisation. During the final presentation participants were asked to explain the project holistically; the decisions related to program, form and design concept had to be based on the conclusions taken from the site analysis and the strategies suggested for the masterplan

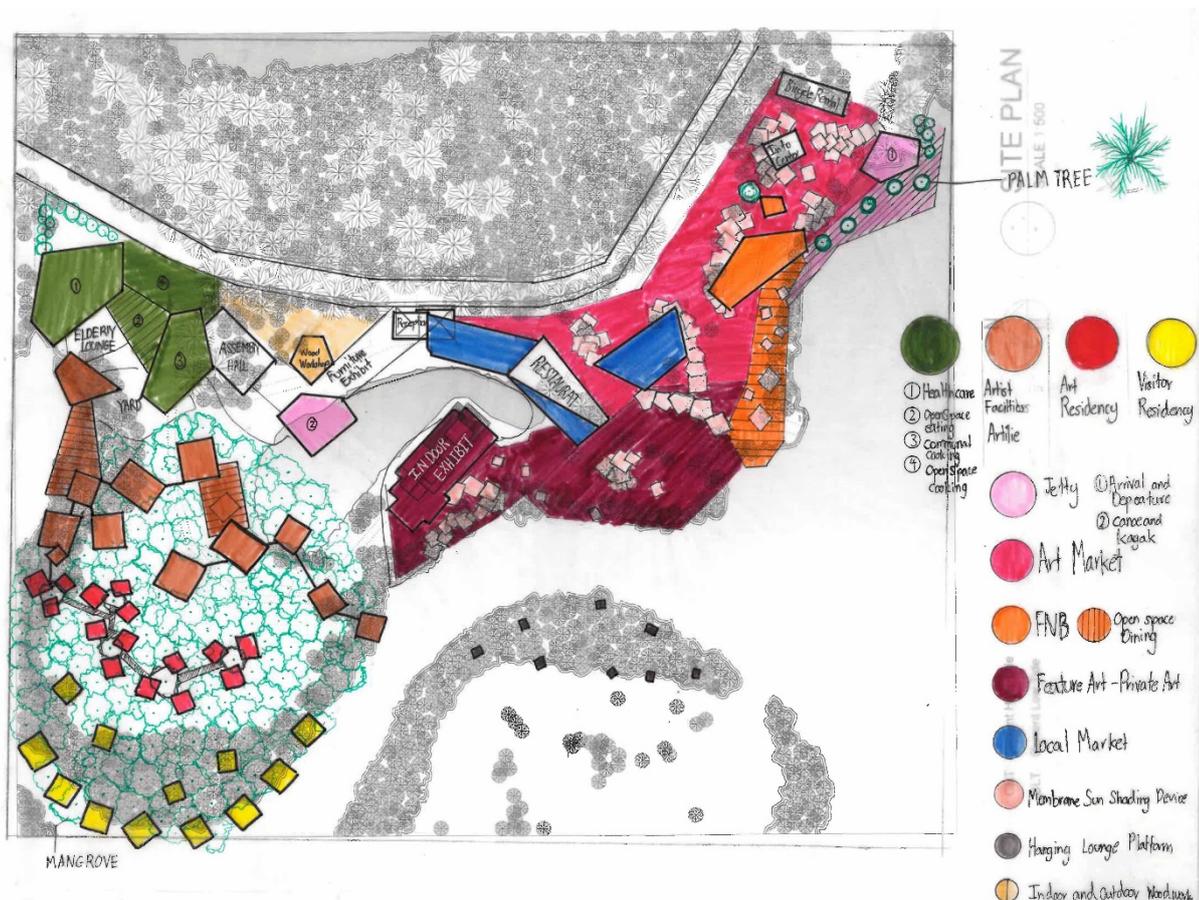


Figure 61: Student's work: Strategies and program proposed for the site

Data analysis

In this section, the information extracted from the data collection is studied, interpreted, codified and collated to generate results that represent the research findings. The methods used to collect data were: the observations made in class during activities, consultations and presentations, feedback given by the participants in the form of surveys, the assessment of students' work as the product of the research, and the design process.

To extract meaning from the research's conclusions we compared the different kinds of data collected during this case study. The comparison of the conclusions taken from the tutors' observations, survey/questionnaires, assessment of assignments, focus group and interviews allowed us to:

- * identify which of the EIMS framework steps had more impact in students' performance and in the design process
- * identify in what way the EIMS framework shaped the design thinking process
- * Identify how EIMS influenced the design vision, strategies, program, concept and form
- * Identify any inconsistencies in the data collection

Research findings

Field Observations

Participants were engaged in all classes. They were enthusiastic and participative in all class activities. The class activities and discussions were particularly meaningful as they confronted participants with new topics and contradicting perspectives which led them to question facts that were for them, until that point, considered as absolute truth.

The first lessons of the semester were used to introduce the framework. During the first week participants were trying to define information to collect and their roles within the groups. After one week of clarifications and guidance by the tutors, participants started to translate information into layers. During the first weeks, participants focused on immediate observations from the site and the information collected was quantitative in nature; participants focused on hard facts such as numbers of people on site, transportation networks, time of visits by tourists, etc.

It was only by the end of the third week that participants started to unfold inconsistencies and patterns in the layers. These observations led them to ask more complex questions which, in return, led them to search for more qualitative information about the site, such as: cultural values of the different ethnic groups present on the site, historical memories, what gives the character of the place, etc. Layers started to be more specific and richer in terms of depth of understanding of the place. Participants used the EIMS framework to manage time and distribute work. Even if groups had collected information of different aspects of the site, the fact that the analysis of facts emerged from the intersection of different layers guided participants to develop a holistic understanding of the place.

The information and analysis presented by the participants in the *Site Analysis* presentation could have more depth but it showed the participants' ability to relate and extract meaning from the intersection of different kinds of data and to relate information across different urban scales. Moreover, the participants collected and analysed an immense amount of information in a short period of time which was received as a surprise by the tutors, especially having had considered that this was the first time participants had engaged with the analysis of such complex systems.

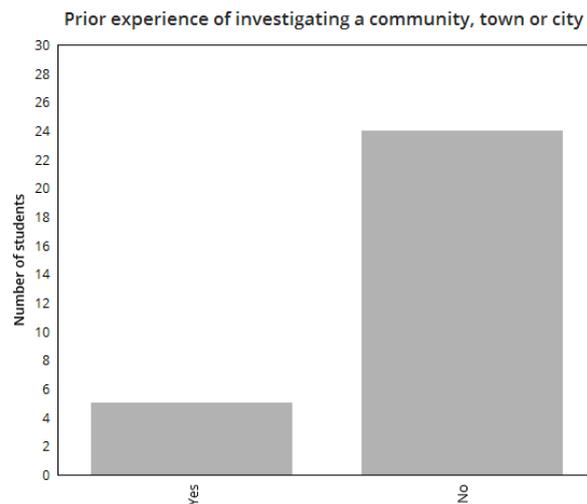
Weaker participants took longer to analyse the interrelation but all participants achieved results above average, as can be seen in Graph 3.

In addition, participants used the EIMS framework to articulate the verbal presentation and to articulate their thinking process.

Survey 1

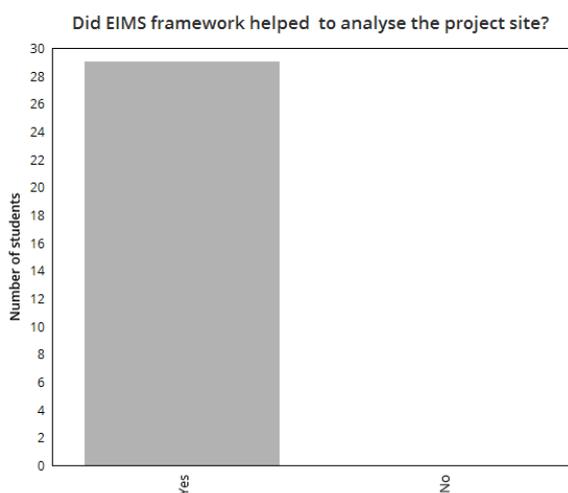
Survey 1 focused on gathering information on how the EIMS framework supported students' learning and performance during phases 1, 2 and 3 of the design process (Appendix 7- Survey 1- Part1). From the analysis of the students' statements we could conclude the following:

Most participants had no prior experience of the analysis of complex systems. The participants that stated they had previous experience referred to small and defined systems whose complexity is not comparable to the systems analysed in this study.

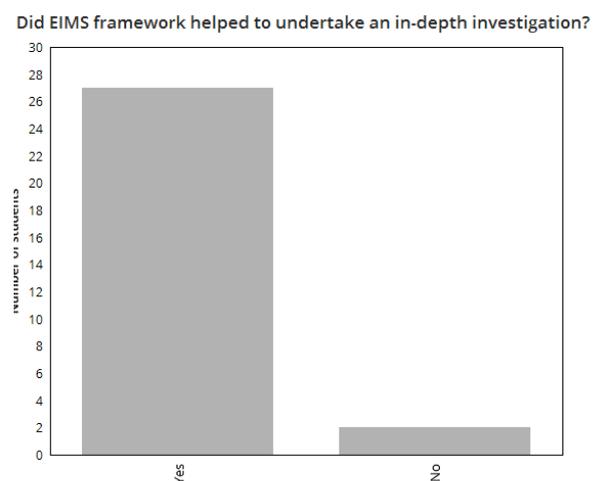


Graph 1: Prior experience investigating a community, town or city

All participants stated that the *Layer Analysis Methodology* helped to analyse the project site. Most of them replied that it helped them to develop an in-depth investigation into different topics and all of them stated that the methodology helped them to make connections across different topics and therefore develop a more holistic understanding of the place.



Graph 2: Did the EIMS framework help to analyse the site?



Graph 3: Did the EIMS framework help to undertake in-depth investigation?

“Yes, every site analysis should be done with this methodology as it helps us understand the site even deeper. I can also use this methodology when i want to find out the types of places each bio diversity are found specifically (urban etc).”

“it help me to see clearer.”

“Individual themes of research and overall understanding of site. we got to go into detail with each layer and analysis them deeply. when we combine the layers together, we then get an overall knowledge of the site.”

“It was helpful in terms of understanding the overall site as i am able to link the connections between each layers together.”

“the creation of each individual layer allows for a surface data understanding of the topic, however when the layers are put together more information and conclusions are made, allowing for a more accurate representation of the site of study.”

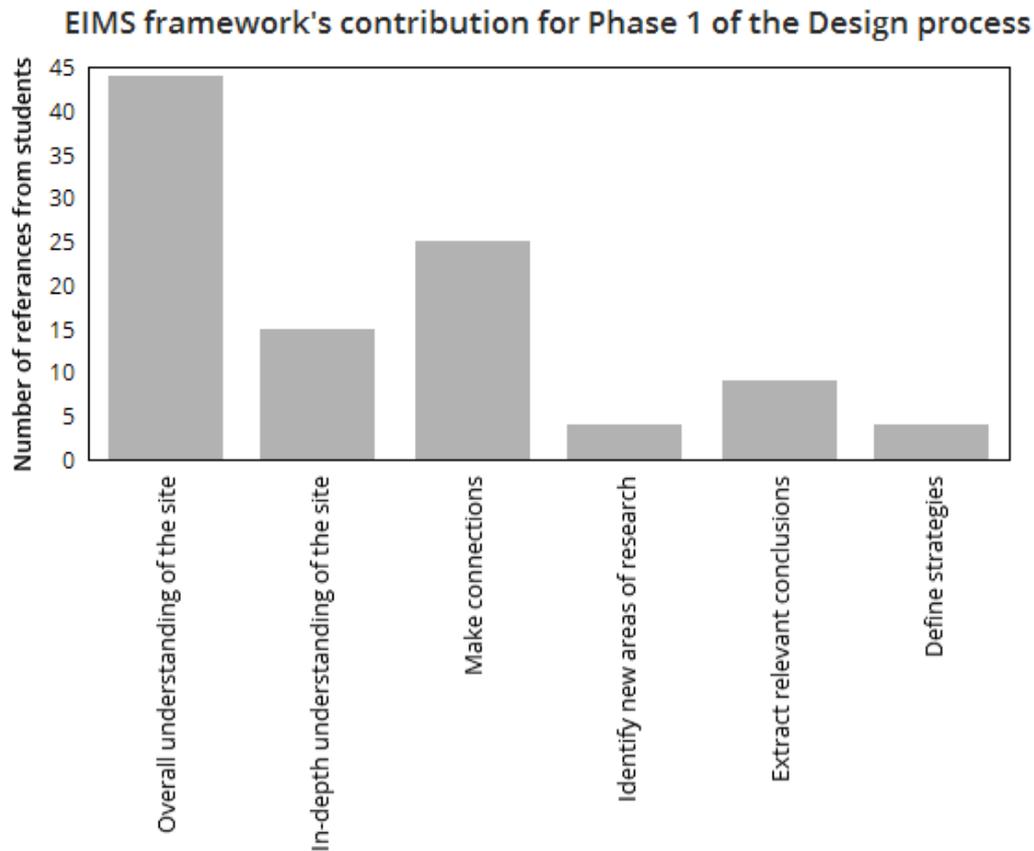
In addition, several participants referred to the fact that the methodology helped them to synthesise information, draw clear conclusions from the data gathered and translate these into strategies to improve the system in analysis.

“If used properly it can efficiently allow one to draw conclusions and back them up whenever necessary. It can foretell the future implications and also identify any existing issues that may affect the conclusions made from the layer itself. This can allow for one to make a sound proposal of how to solve issues, tackling the main issues instead of making more issues to solve (making baseless conclusions of the site).”

“... able to plan out my strategy well for my p2.”

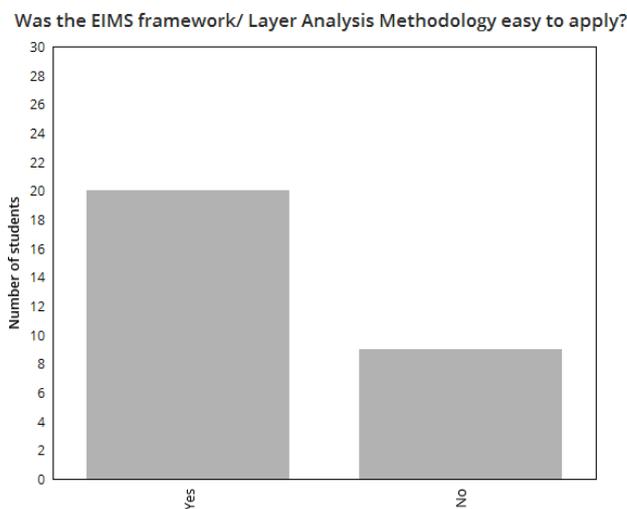
“... For example, if I wanted to build a structure that needed a lot of human activity, I would see the biodiversity layer and choose a location that has the lowest biodiversity so that my design will not harm the habitat.”

The table below summarises the responses of participants regarding the EIMS framework contribution during phases 1 and 2 of the design topic.



Graph 4: EIMS framework contribution for Phase 1 of the design process

Most of the participants argued that the methodology was easy to apply. Some noticed that the use of the methodology required precision of facts otherwise inconsistencies emerged when information was overlapped. Participants acknowledged the fact that the framework guided them to think deeper and be more critical about facts. This point is important, especially as the study was conducted in Singapore where people are not used to question things – a context where both cultural and political factors offer pressure in terms of freedom of thought and expression.



Graph 5: Was the EIMS framework/Layer Analysis Methodology easy to apply?

“it is systematic and useful.”

“Each layer had to be accurate to prove the hypothesis and conclusions made about the site, if not the information backing our baseless conclusions will never form an accurate representation of the site on paper for us.”

“... it is just like asking yourself why until you can no longer ask yourself why and get the core problem and from there you can get the solution to solve the problem.”

“This is a very good methodology as it involves more critical thinking rather than just going to the site and do our research on what we can only see there.”

Finally, all participants agreed that the methodology could be applied in other contexts and they assumed that they would use it in the future.

Survey 2

Survey 2 questions focused on gathering information about students' perception of the translation of the EIMS framework into the teaching methods applied in class (Appendix 7- Survey 2- Part1). Participants were asked to give an opinion about the class activities and the experiential learning that was implemented in the classroom. They were asked what they liked the most and what their challenges were. From the analysis of all their replies, we can group their statements to support four general findings:

Participants believe that this method enhanced their learning in a variety of ways:

1- Lessons were engaging and participants actively participated in discussions.

The following were extracted from the student survey of the subject:

“I believe by actually practising while learning something, that we absorb the most!”

“I prefer the format, it make us more Interest in studies.”

“I understood more through class activities, as I was being guided while working on my ideas and models.”

“... We had multiple discussions in class which challenged the thoughts of one group from another.”

“The lecturers tried to have engaging activities that help us to understand sustainability better like splitting the group and form another group with various people to help us understand Pulau Ubin better and how an implemetation [implementation] is sustainable.”

- 1- This teaching methodology facilitated participants to be critical thinkers and to engage in deeper thinking processes.
- “To be critical, you need a lot of research to back you up and I don't really like it.”*
- “The lecturers always gives [gives] us critical questions that requires us to think deeper.”*
- “Often in class activities, i just want to provide answers that i think is right in the eyes of the lecturers. i don't explore or learn much. so explain clearly that textbook answers and info from the web are not what eco is looking for, right at the start of the module. that way, we really know we need to use our brain and think deep.”*
- “It allow me to be critical with my research down to smallest detail.”*
- “I like that the subjects requires me to be critical towards the topic.”*
- 2- The methodology requires the real-life application of abstract concepts and ideas. This helps participants to see the relevance of their learning and understand how the framework can be applied in real-life scenarios.
- “The fact that we were applying our strategies we did research on real places (Pulau Ubin & Gardens by The Bay).”*
- 3- This method leads participants to understand the complexity of their environment and address future challenges. It empowers them to be lifelong learners and to actively contribute to create a more positive, healthy and ethical world.
- “I get to learn new methods to create a sustainable environment and also using natural elements to form a cycle of a technique.”*
- “I like that in eco, more analysation [analysis] was done in comparison to other modules. instead of just accepting and absorbing info, eco teaches us to really question on whether solutions are working and if its not, how we can better improve it.”*
- “I like how i like design strategies that help me further promote green design and sustainability.”*
- “Learning things that are always around us which can be applied into projects.”*
- “I get to learn more about environmentally-friendly approaches that can be implemented to my design.”*
- “Relating P2 with eco design and how our work from eco can relate with our major project.”*

Note: Participants wrote the above quotes in a vernacular, local parlance.

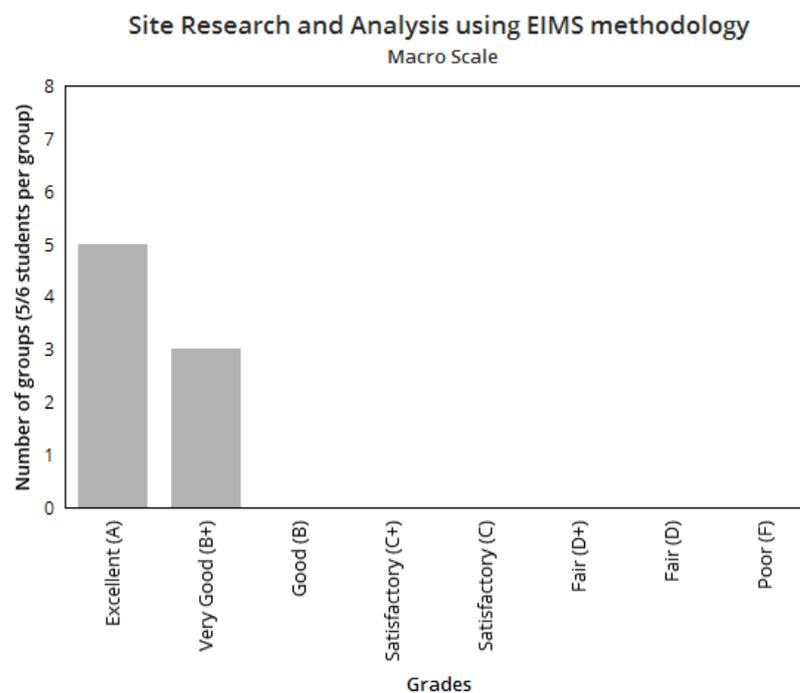
Assessment criteria

The following graphs show a synthesis of the information collected from the assessment of phases 1 and 2 of the design process. The assessment focused on the application of EIMS framework on the understanding of big-scale systems and the work developed in the context of the subject of Sustainable Design and Integrated Studio 2. Two tutors were asked to assess both the verbal and graphical presentation of students' work. The grades presented were moderated and agreed by both tutors.

Phase 1: Site analysis

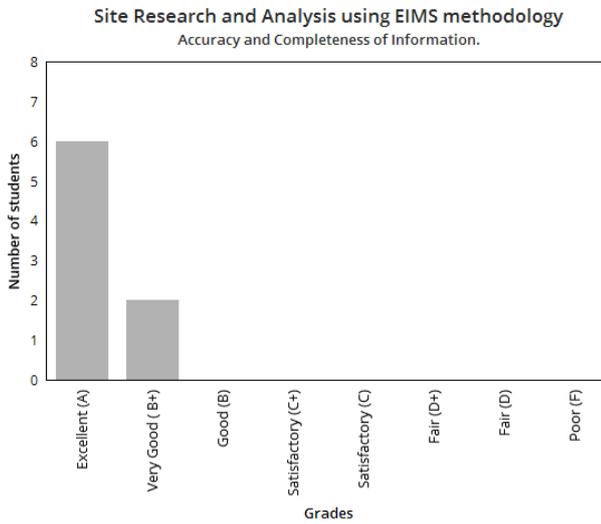
Site analysis is developed in groups of an average of five participants, therefore the grades reflect the efforts of the group rather than individuals. The assessment for the site analysis focuses on the quality and depth of the analysis made on the scale of the island of Pulau Ubin. Given the fact that it was the first time that participants were performing the collection of data, the assessment also focused on the accuracy of facts and the ability of participants to interpret information. The assessment also took into consideration innovative ways of collecting and interpreting information and the ability of participants to relate the information collected with the sustainability of the system in analysis.

According to the grades given to the groups, participants performed above average, especially when taking into consideration that it was the first time participants had to deal with such complexity of information.

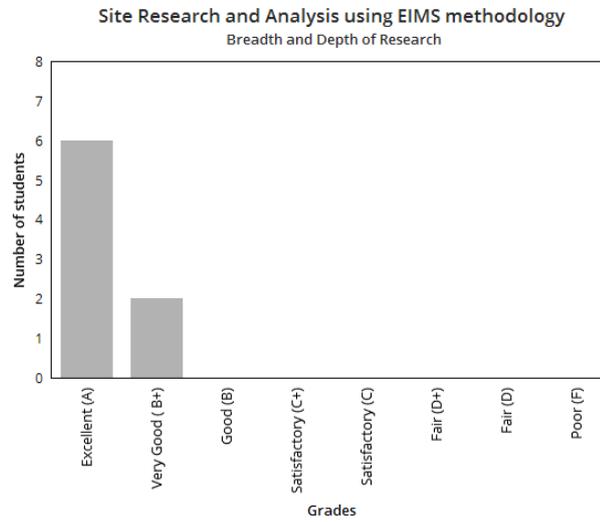


Graph 6: Participants' grades. Site research and analysis using the EIMS operational methodology

Information collected was comprehensive and complete and was beyond what was expected from the students. Participants were able to identify new areas of research that were able to bring interesting perspectives to the understanding of the site.

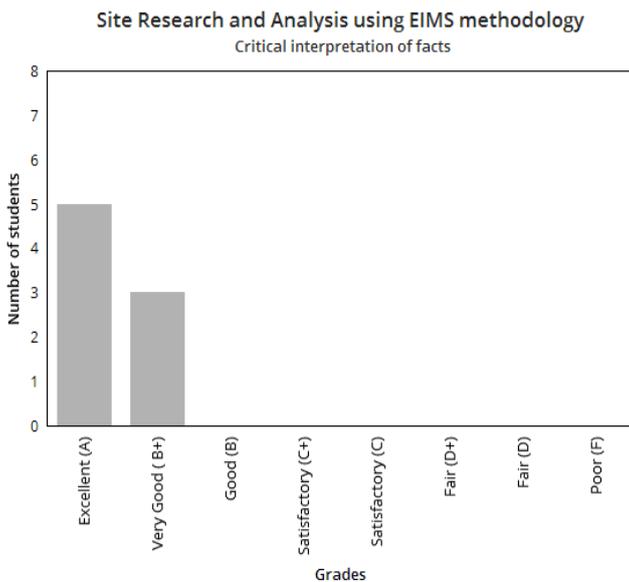


Graph 7: Participants’ grades. Accuracy of information

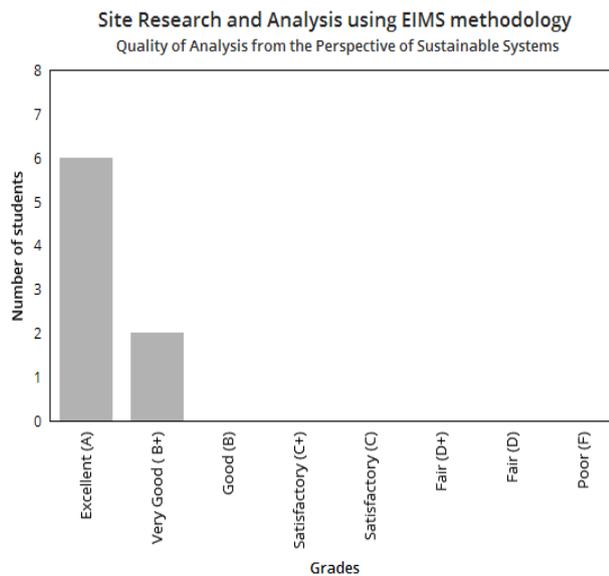


Graph 8: Participants’ grades. Breadth and depth of research

Taking into consideration that participants were just introduced to the methodology and the complexity of urban systems, they performed well in terms of critical interpretation of facts and the ability to relate the findings to the sustainability of the system in analysis. Finally, the data also shows that there were traces of innovative ways to collect and interpret information.



Graph 9: Participants’ grades. Critical interpretation of facts

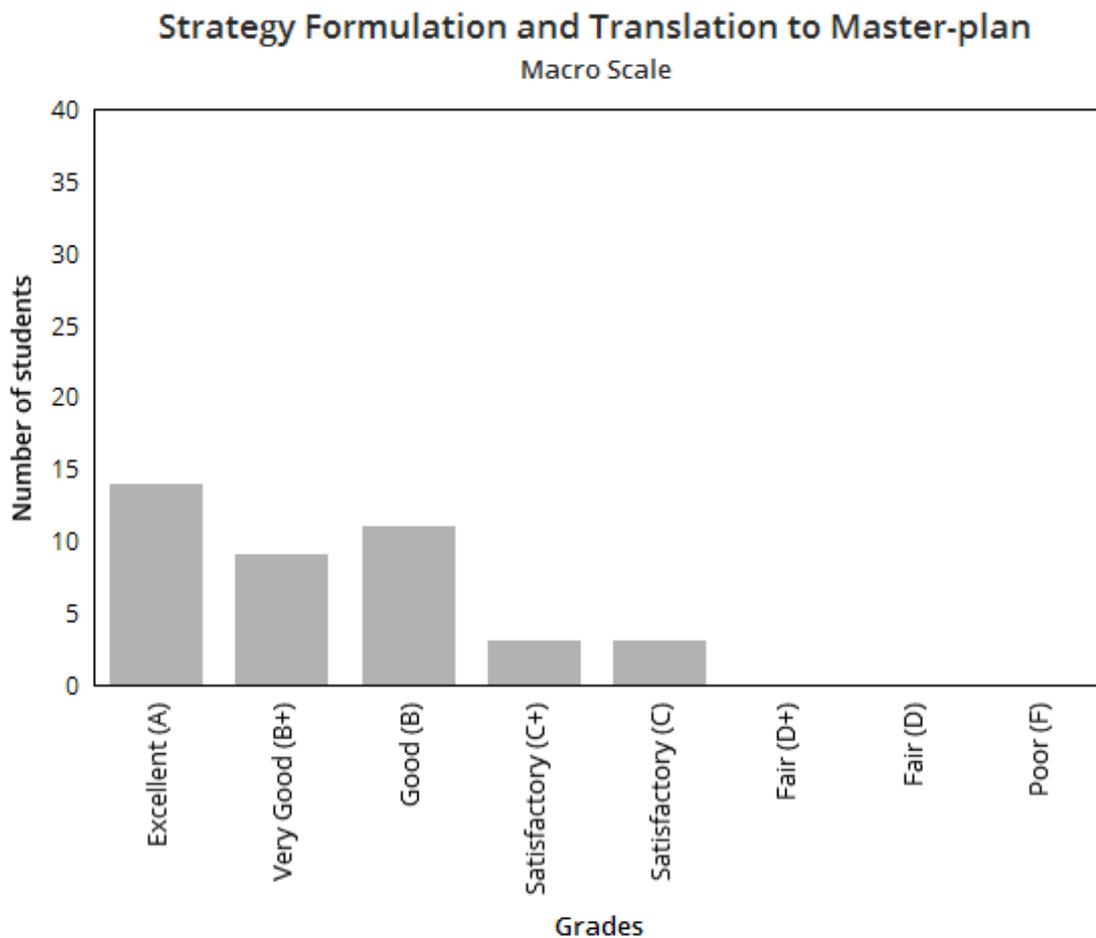


Graph 10: Participants’ grades. Quality of analysis from the perspective of sustainable systems

Phase 2: Define strategies and masterplan

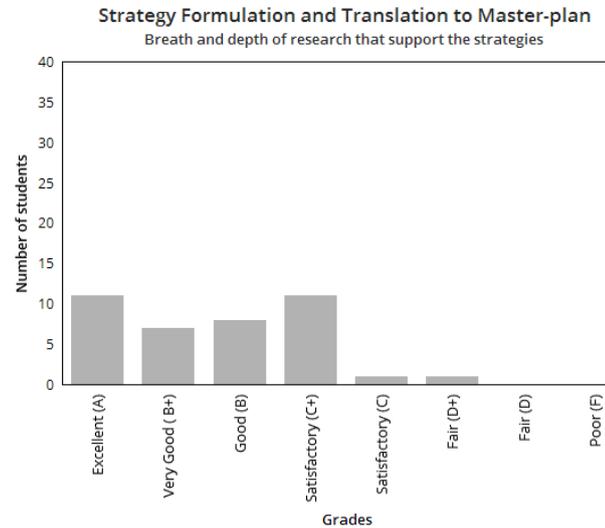
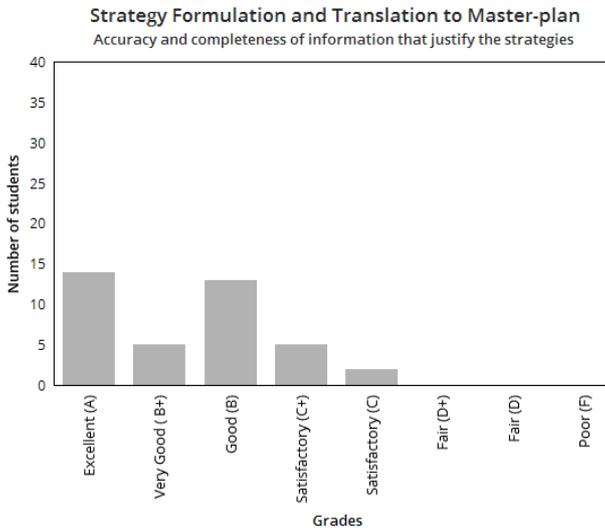
Phase 2 of the design process was developed independently by each student. The assessment criteria focused on the ability of participants to establish their views and understanding of the site based on the facts gathered previously; it assessed the ability of participants to assume an informed position. It assessed students' ability to translate information into considerations and considerations into a system of strategies to manipulate the system of analysis. Finally, it assessed the ability of participants to translate abstract strategies into concrete solutions that compose a comprehensive concept masterplan.

The majority of participants did either good or exceptional work to translate the information gathered in groups into concrete individual design solutions proposed for the site. This observation was inspiring for the research because it marked the transition from group to individual work. It supported the observations and survey findings that argued that the EIMS framework gives both an in-depth and holistic understanding of the site to all students, regardless of what aspect they focused on and of their general academic performance.



Graph 11: Participants' grades. Strategy formulation and translation to masterplan

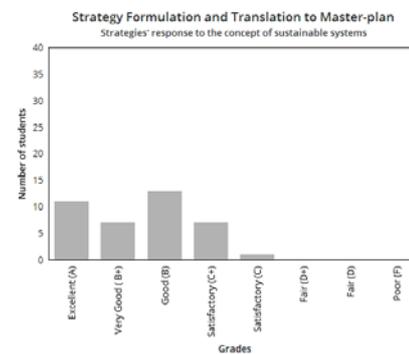
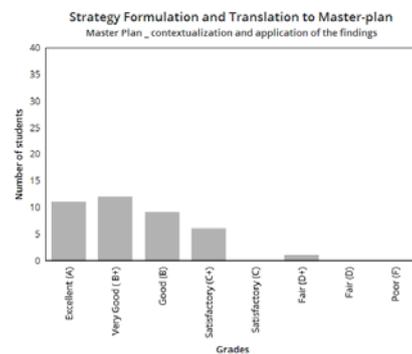
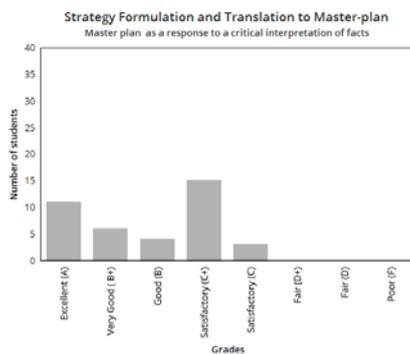
The following graphs also show that the participants were able to support their strategies with relevant and accurate data and therefore had a solid ground supporting the next phases of the design process.



Graph 12: Students’ grades. Accuracy and completeness of information used to justify the strategies proposed

Graph 13: Students’ grades. Breadth and depth of research that supports the strategies proposed

Participants presented proposals that show a critical interpretation of facts and were deeply rooted on the context responding to very specific constraints of the site. The majority of participants suggested strategies based on research that shows the understanding of related sustainable solutions and adaptations to suit specific site conditions.



Graph 14: Students’ grades. Quality of the masterplan as a response to a critical interpretation of facts

Graph 15: Students’ grades. Quality of the masterplan as a response to the context

Graph 16: Students’ grades. Relevance of the strategies suggested in relation to the understanding of the urban change

In 2018, the following run of this subject was done in collaboration with The National Parks Board (NPARKS).

NPARKS is a statutory board of the government of Singapore responsible for providing and enhancing the greenery of the country and is held responsible for the preservation of Pulau Ubin island. NPARKS suggested for EVD participants a real-life project and a comprehensive masterplan to develop. It is interesting to note that participants performed even better in the 2018 run of this subject, bringing the depth of analysis and the maturity of the strategies and masterplans presented to a completely new level (see Appendix 12, pp. 424).

NPARKS collected design ideas and conceptual strategies from the participants' work and integrated them in the national masterplan proposed for the future development of Pulau Ubin.

Case Study 4. Part 2:

Application of the EIMS framework in the context of *Urban Design Studies* and *Integrated Studio 3*

Urban Design Studies focused on the analysis of a complex system at an urban scale, therefore the systems analysed were bigger and more complex by nature. The EIMS framework was implemented in the *Urban Design Studies* class in a similar way to how it was implemented in the *Sustainable Design 2* class, but the participants were not as guided as previously. Briefs were also drafted to guide participants through the process but they were more open and there were fewer guided class activities (Appendix 5). The aim was to test the comfort level of participants using the framework and observe how it improved the quality and efficiency of their work. It also aimed to test their autonomy and their critical thinking skills.

As previously referred, *Urban Design Studies* was delivered in integration with *Integrated Studio 3*, therefore the framework was applied across the two subjects. The *Integrated Studio 3* brief requested an analysis of the specific building site. The *Urban Design Studies* brief requested participants to analyse the macro context of that site and its relation to the site itself. As during *Sustainable Design 2*, the subject briefs requested participants to analyse relevant urban systems, take conclusions from the analysis and define strategies to address the issues that emerged from the

findings. Participants were also requested to submit a concept masterplan for the area, synthesising their strategies on specific locations on the map, and a Design Brief. This time, instead of two months, participants had two weeks to complete the site analysis phase. Tutors were not actively guiding the research process; instead they were acting as advisors and used questions to nudge participants in meaningful directions when needed.

During the third and fourth weeks of class, in the Urban Design Studies class, participants analysed in depth the historical aspect of the site, while in Studio 3 they entered the ideation phase and were trying to relate the macro analysis findings with a concept and a program for their project. In the following weeks participants explored volumes and produced prototypes to test their ideas. During final submission they were asked to reflect on their proposal from the perspective of the EIMS framework and explain how the project was responding to all parts of the diagram.

Data collection

Data was collected during the five phases of the study. The methods used to collect data were: the observations made in class during activities, consultations and presentations, feedback given by the participants in the form of surveys, the assessment criteria used to assessment students' work as the product of the research and design process, and a focus group meeting.

The diagram below shows how the methods of data collection were articulated with the design process and the implementation of the EIMS framework in class.

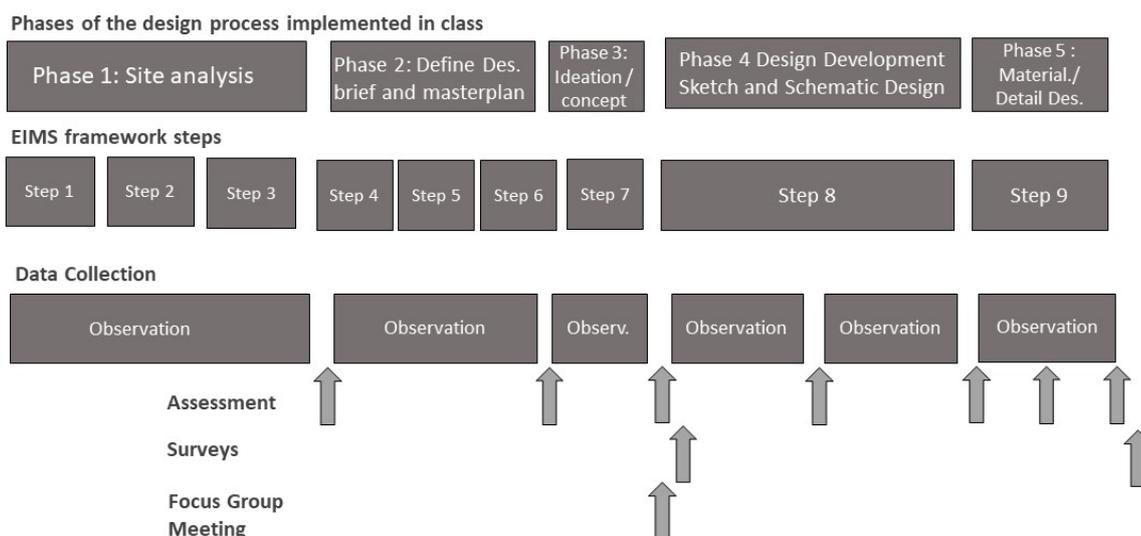


Figure 62: Interrelation between Design Process, EIMS framework and assessment

Research findings

Observations in class:

From the observations conducted in the class, the following findings emerged:

One week after participants were introduced to *Integrated Studio 3* and *Urban Design Studies* briefs, they attempted to translate the information they gathered from the internet, the interviews developed on the site and their observations during the site visit into layers of information synthesised on maps of Singapore.

Similarly, in the observations in the context of *Sustainable Design 2*, during the first lessons participants produced basic layers and focused on quantitative information about the area. Participants were still exploring how to synthesise information in layers effectively as some layers produced had too much and diverse information.

Even if participants were still only focusing on measurable facts, they had already started to identify opportunities for interventions in the urban system and therefore relevant subsystems to analyse.

One week after the exercise started, communication was not efficient within and across groups. The work was produced by each member of the group independently, therefore sometimes there were overlaps of information and gaps in the research. The consistency required by the layers led participants to talk about better ways to work as a team.

Following this, participants defined not two scales of analysis as defined in the subject brief but three scales of analysis. Defining three standard scales to synthesise information proved to be very relevant when translating their macro level research to the scale of the project's site. This decision simplified the translation of the information across scales and supported participants to keep an overview of the project site. Participants also used the EIMS framework to divide the work so that there were no repeated layers and therefore created a coherent platform to exchange knowledge and ideas efficiently. These decisions were supported by all 45 participants of the cohort, showing the ability of the framework to support collaboration among big groups of people. In general, soon after being introduced to the sequence of the EIMS framework steps, participants took the lead and used the EIMS framework to address the following aspects of the research process:

- Distribute the workload amongst all of the cohort
- Identify general relevant systems/layers of analysis
- Identify specific layers relevant to the specific site
- Define common scales for the analysis across all groups
- Define which layers to intersect and get extra information from

- Collaborate across groups to work more efficiently and share information to support more relevant conclusions
- Debate about the problems as well as the strategies suggested for the site



Figure 63: Application of the *layer analysis methodology* on two different scales

By the end of the second week of work, all participants presented the layers they had produced so far in the classroom, therefore everyone had an overall understanding of the site. They could also identify key layers that still needed to be produced and divided the work accordingly. Tutors explained how the opportunities and issues identified in the analysis could lead to design strategies both on the macro and micro scale. The layers presented were clearer and the information more detailed. Relevant sub layers emerged from students' observations and they started to focus on a softer understanding of the site. Participants started to focus more on qualitative aspects of the site and this shift in focus led to the identification of other sub layers relevant for a holistic understanding of the area, e.g. food, ethnic and religious distribution.



Figure 64: Class presentation 2.11.2018

Students also started to look at the intersection of different layers meaning that interesting connections between different aspects of the site started to emerge. The conclusions taken from the intersection of the layers led students to identify key aspects relevant to improve the place, e.g. connectivity through the Green and the park connectors, possible relation with the future waterfront, relation between old and new aspects of Singapore’s character and culture, etc.

This deeper understanding of the site led to the identification of new, very specific layers relevant for the study, such as the ferry and water taxi networks, nightlife areas, the historical railway corridor, public and private property, different kinds of commerce, and traditional shops.

Strategies and concepts for the masterplan started to emerge but were still very focused on the connectivity and transportation networks.

Within and across groups, students used the layers as a platform to exchange opinions, visions and concerns about the analysis process and about the site itself. Students had long conversations and debated about:

- a) Ways of using the EIMS framework to conduct the analysis.
“Shell we combine all layers? Shell we concentrate on one layer?”
- b) Their understanding of the place and possible approaches to address its issues.
“What do we want?”; “Another HDB will not make this a better place!”; “On who will we focus?”; “Are we going to connect with this?” (The park); “This is not safe!”; “Shell we go underground?”
- c) The relevance of their masterplan proposals.

Students compared their masterplan strategies across groups. They concluded that there were basic common strategies to improve the site. This conclusion supports the idea that the information gathered was consistent and therefore led to consistent strategies to approach the problems that emerged from the site analysis. After identifying these basic common strategies to improve the site, students focused on identifying the aspects that would make each proposal unique, e.g. gastronomic experiences, park connectors, heritage, relation between land and the sea. This was the point when students were trying to identify their system of focus and define the specific layers that were relevant for their understanding of the site and to support their masterplan decisions and their project’s proposal.



Figure 65 and 66: Students using the layers as a framework to debate and exchange of ideas

On the first day of the second week participants had to present their site analysis findings as well as their masterplan proposal.



Figure 67: Class presentation 6.11.2018

Participants improved significantly their macro and micro understanding of the site. The masterplans were in general more developed and framed different aspects of the site analysis. The strategies suggested were working in a system and were coherently translated on a map. The outcome was a relevant tool to support the individual design process.



Figure 68: Conversation about the integration of information across different scales

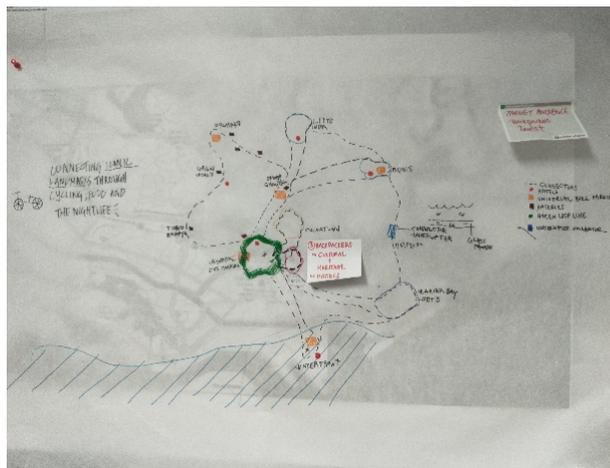


Figure 69: Draft of urban strategies on the map of Singapore

In conclusion, by the end of the second week participants touched phases 1 and 2 of the design process, even if Phase 2 was only related to the definition of a vision and strategies at a macro-scale

level and on the level of masterplanning. In comparison with the observations conducted in the context of *Sustainable Design 2*, participants were able to draft and communicate a concept masterplan in a much shorter period of time. Participants did not refer to details in the masterplan, keeping it quite general, and focused essentially on connectivity issues across Singapore's islands. Both the SWOT analysis and the masterplans could have captured more soft aspects of the site. Nevertheless, the research suggests that if participants were given more time, they would have been able to develop their findings in greater depth.

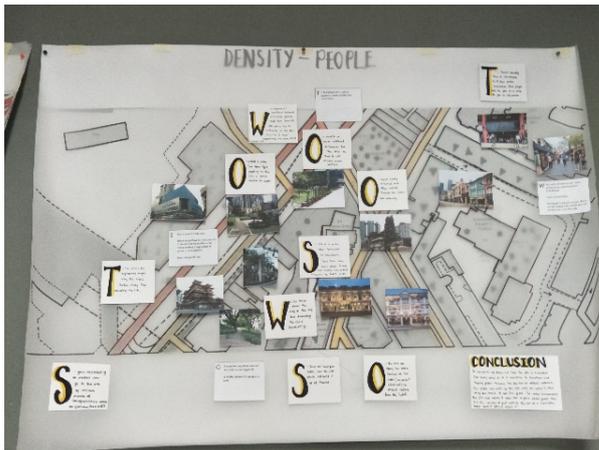


Figure 70: SWOT analysis on a micro scale translated into a site plan



Figure 71: Site analysis presentation using layers to represent information on different urban scales

The second phase of the design process at the scale of the site started during the third week of lessons. This was the phase where the idea of time and change was introduced to the students.

In *Integrated Studio 3* classes, participants started to define their project briefs and with it the design concept, the program, the target user, exact implementation site, etc. During this week, participants started to think about how the system would change in time. In *Integrated Studio 3* participants started speculating about the future of the site and during *Urban Design Studies* class they used the EIMS framework to investigate the past of the site in more depth. At this point, the EIMS dynamic model was introduced to the students.

By the fifth week, participants entered Phase 3 of the design process and were developing their program and concept in relation to a form. Good participants achieved the desired depth of thought. They were able to integrate the macro strategies with design intentions for the site. They started to explore meaningful forms and had a clear vision for the future of the place. Weaker participants reached this level of thought two weeks after.

The table below articulates the Design Process phases – with the lesson plan of *Urban Design Studies* and *Integrated Studio 3* – with the EIMS framework step-by-step methodology and students' progress/achievement throughout time. It also situates research methods, such as assessment, surveys and focus group meetings on a chronological timeline.

Design process	EIMS' steps	Students' Progress and Achievements
Date	Lesson Topic & activities	
Site analysis 23.10	Intro. to the project site	
24.10	Preliminary research	
25.10	Site visit	
26.10	Phase 1 EIMS Step 1: Intro to EIMS/Layer Analysis Defining areas of analysis/Layers	
-	Collection of information	Communication was not efficient; Work was produced by each member of the group independently
30.10	EIMS Step 2: Defining the system of analyses Translation of the information collected in layers Exploration of relevant subsystems	<u>The majority of students:</u> - focused on quantitative information - focused on the analysis of individual layers <u>Some participants started to:</u> - identify opportunities for interventions - identify relevant subsystems to analyse - identify three different scales of analysis - collaborate more efficiently
31.10	EIMS Step 3: Analysis of the system Analysis of one layer or the intersection of several layers	<u>The majority of students:</u> - presented the layers more clearly and the information was more detailed. - identified more relevant subsystems - were able to collaborate and divide the workload efficiently <u>More students:</u> - started to inquire about qualitative aspect of the site <u>Some participants started to:</u> - made connections between different aspects of the site started to emerge. - analyse the intersection of different layers
01.11 02.11	EIMS Step 4: Redefining the system of analysis SWOT Analyses	Participants start to synthesise information and redefine their system of focus and the design issues. They start to define a vision for the site.
06.11	Assessment	In general, participants articulate well the relation between analysis and vision for the site. They are still not able to translate that information into strategies to improve the area.
Concept Design 08.11 09.11.	Design Brief Workshop Phase 2 EIMS Step 5: Think of the system as a complex ever-changing entity Phase 3 EIMS Step 6: Translate abstract strategies into specific actions	In different levels of depth participants are able to relate analysis with site issues and translate them into a vision for the site. They are able to translate the vision into specific strategies and strategies into a specific program. Better participants elaborate each argument in more depth. Weaker participants stay on a more superficial level of synthesis of information but they are able link coherently all the steps of the EIMS thinking process and therefore justify their intentions for the site.

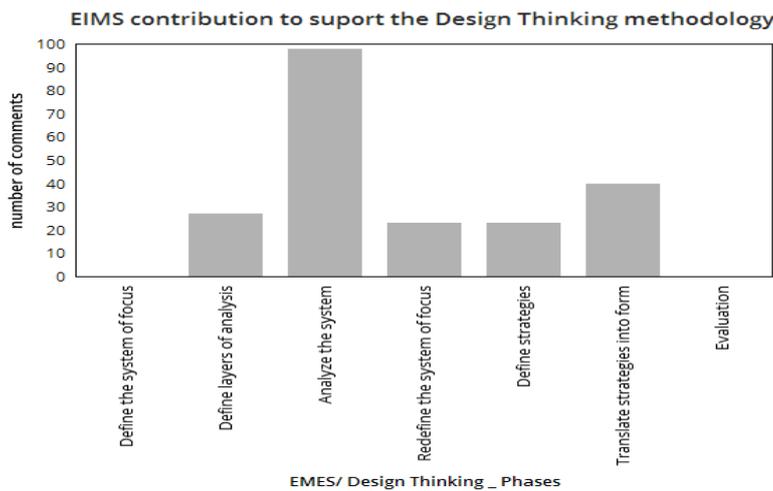
13.11	Form Exploration Workshop Phase 4 EIMS Step 7: Materialisation of the strategies	Participants start to explore forms that translate their design concept and intentions for the place.
From 14.11 Until 16.11	Exploration of form	Participants translate different ideas into form and test how they relate to the design brief
20.11		Many prototypes are produced and presented to peers
21.11		Participants are required to look for references and case studies
22.11		Participants are required to make the link between form, program and context
From 23.11 Until 28.11	Design Development	
29.11	Formative Assessment	Many prototypes are produced. Participants have selected the best idea to address their design brief and have established a location and orientation of the design object on the site. Better participants respond easily to the design brief initially proposed.
Schematic Design From 30.11 Until 11.12	Design Development	
12.12 13.12 14.12	Assessment	Presentations: Participants have developed their selected prototype. They have solved issues related to the program, scale, circulation and accessibility. They have addressed the integration between hardscapes and softscapes. Better participants start to think of the materiality of the building. Weaker participants are still in a developmental phase.
	Survey 1: Urban Design Studies Survey 2: Layer Analysis methodology	DES VACATION (16th Dec 17 to 31st Dec 17)
Materialisation and Detail 8.1 10.1		Weaker participants are able to articulate a coherent programme and concept but continue to explore form in relation to program and design brief. Better participants start to work of the detail design and the materialisation of the project.
15.1 26-1		All participants work on the materialisation of the projects and its detailing.
2.2	Assessment	Final Submission
20.2 20.2 20.2	Assessment	Final Presentation: All participants are able to articulate verbally and visually all the steps of the design process. They are able to articulate the data collected from the site with the analysis and synthesis of the information collects, the issues and relevant characteristics of the place, strategies to address these issues, masterplan ideas, design brief, program and concept for specific site. Better participants are able to articulate these relations in more depth and explain the form in relation to the vision for the site.
	Survey Integrated Studio Focus group meeting	DES VACATION

Table 21: Chronological relation between the design process, EIMS framework operational steps, lesson activities and students' progression

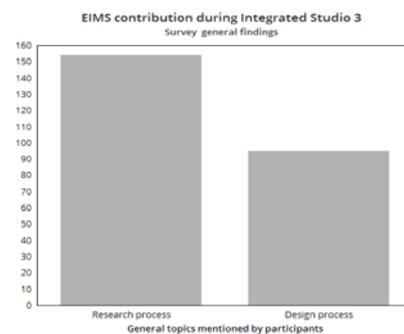
Survey 1:

From a total number of 41 students, 28 responded to the online survey conducted when the Urban Design Studies subject ended (Appendix 7- Survey 1- Part2). From the analysis of the responses to the survey we could conclude that the methodology supported students all through the design process with emphasis on the analysis of the site. From the responses it was evident that participants based their site research on the layer analysis methodology and that the methodology had a significant impact on the translation of their findings to the design concept, program and form.

“... it gave me a solid path to follow and work on...”

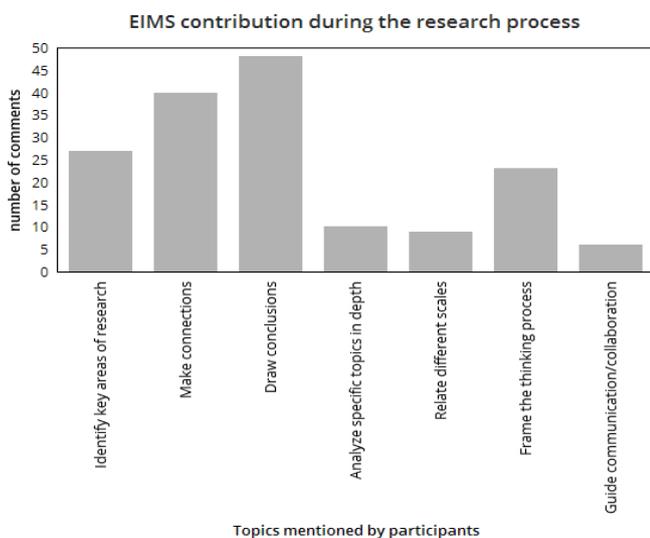


Graph 17: EIMS framework contribution to support the design thinking methodology

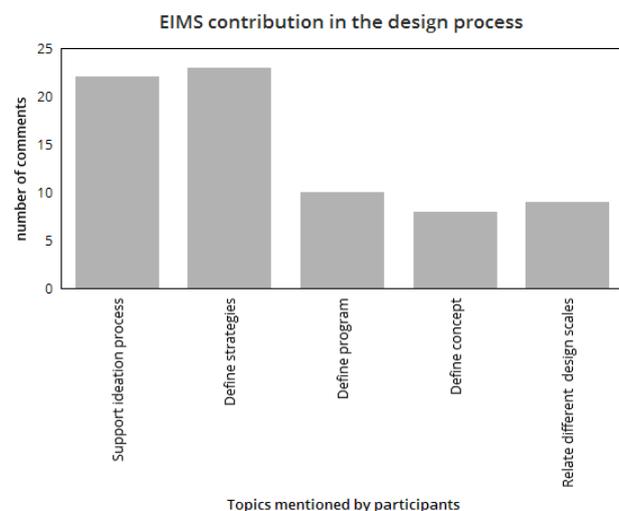


Graph 18: EIMS framework contribution in relation to the research and design processes

A more detailed analysis of the students’ responses was able to identify specific contribution during both the research and the design process.



Graph 19: EIMS framework contribution during the research process



Graph 20: EIMS framework contribution during the design process

Research process:

Participants acknowledged the methodology for supporting them to identify relevant areas of research and make connections between apparently different aspects of the urban system. The methodology guided their thinking process and help them to analyse vast amounts of information in a very short period of time. Even if most of the participants refer to the methodology as a tool to study urban systems in a holistic manner, some mention its relevance in allowing one to investigate in-depth specific aspects of the system. They mentioned that the methodology helped them to relate information across different urban scales, thereby enabling them to relate their project site with the needs of the overall neighbourhood and even the city. Finally, participants mentioned that they used the methodology to communicate and exchange information within and across groups.

“EIMS model helped me a lot in relating the categories relevant to understand the site...”

“It has helped me to identify which area am I focusing... but at the same time not neglecting the other areas.”

“The layer Analysis Methodology answered the questions we had.”

“It actually helped me to identify problems that maybe no seem affecting (may not seem to affect) the site but actually it is affecting in some ways.”

“... each layer is interconnected to one another...”

“... coming up with conclusions that required critical thinking.”

“... It help to scope down what I should do.”

“It helped working in groups.”

“It helped to split the research in more digestible parts...”

Design process:

Participants mentioned that the methodology was of key importance during the ideation phase where they had to define how to respond to the site. It enhanced their creativity and the relevance of their proposals. They mentioned that the information analysed was easily translated into strategies to improve the specific urban system which was analysed. These strategies were then translated into specific programs and design concepts. Once more they mentioned that the methodology helped them to navigate through different urban scales, thereby giving them a more robust ground to support their intentions for the project site.

“... helped us to think more and outside the box.”

“Defining strategies that could enhance every petal of the EIMS diagram.”

“... we can understand what is lacking or the strength of the site (or what) requires improvements...”

“... the master plan...”

“... it allowed us to clearly identify a program which will follow us along through the design process.”

“... if we know all these (research findings) we can have a better idea for our project and program.”

“... It helped me think on the surrounding site context to match mine (project site).” Darian

“It helped to link the site to the master plan.”

In addition, participants mentioned that the methodology was easy to apply and made the research and design process more efficient.

“... It can save time...” Jun Hao

“... easy to apply...” Muqsith

“It is straight forward.” Yong Jun

Some also realised that the methodology could be applied to other complex systems.

“... It applies to everyday lives...” Dianah

“It could be used to annualize social/racial issues” Farhan

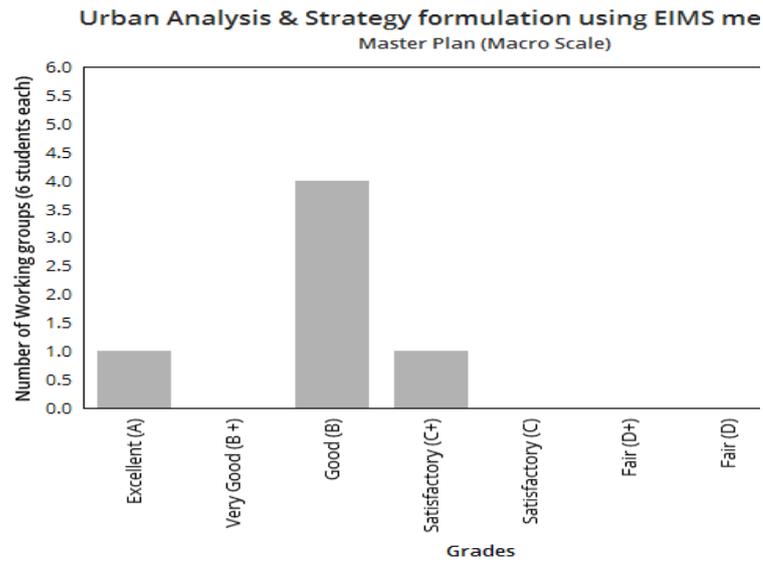
Assessment criteria

From the analysis, the assessment criteria of both Urban Design Studies and Studio 3 across the whole design process, we could extract the following findings:

Phase 1 of the design process:

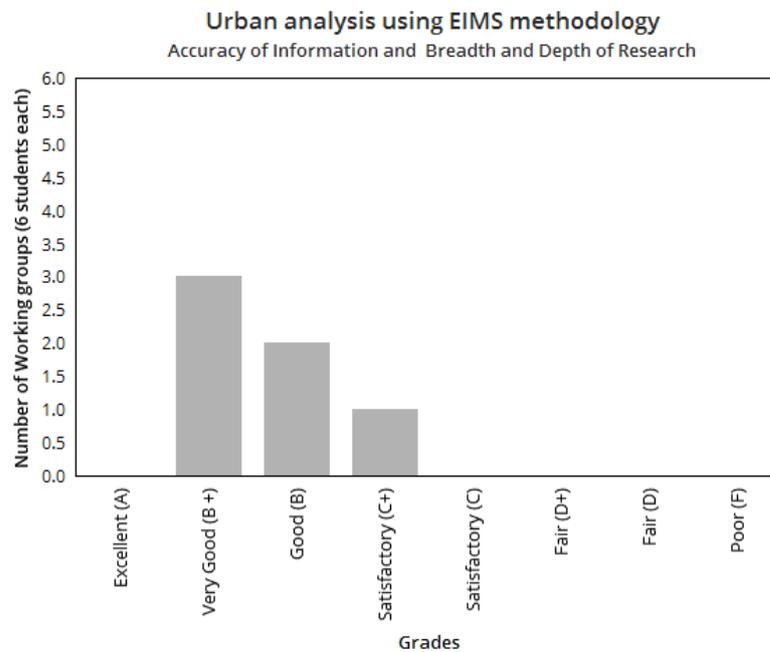
Urban Design Studies – Site analysis (macro analysis)

The assessment of the first phase of the process focuses on the quality of the site analysis and the relevance and academic maturity of the concept masterplan. This first assignment was developed in groups of six participants each. The overall grading of the participants was above average, therefore we can conclude that EIMS methodology guided participants to analyse and interpret vast amounts of information and produce a coherent masterplan in a two-week working period.



Graph 21: EIMS framework contribution to define urban strategies – Masterplan

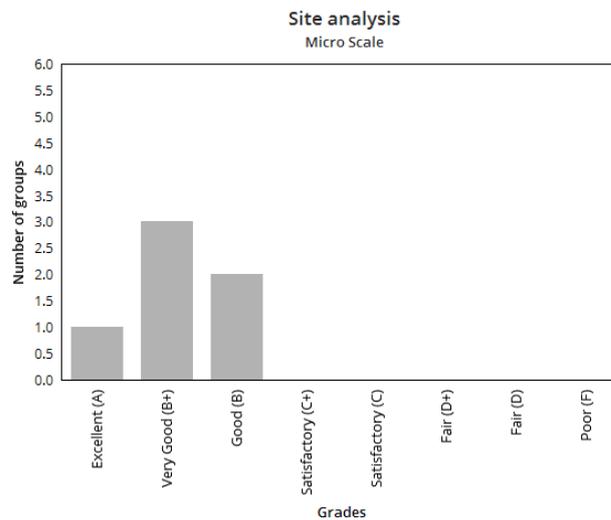
A more detailed analysis of the assessment criteria shows that the participants were able not only to gather vast amounts of information but they were also able to interpret it and analyse in a constructive manner, ask relevant questions and perform a SWOT analysis which was able to inform both the masterplan and the project site.



Graph 22: Students’ grades. Urban analysis using the EIMS framework- Macro Scale

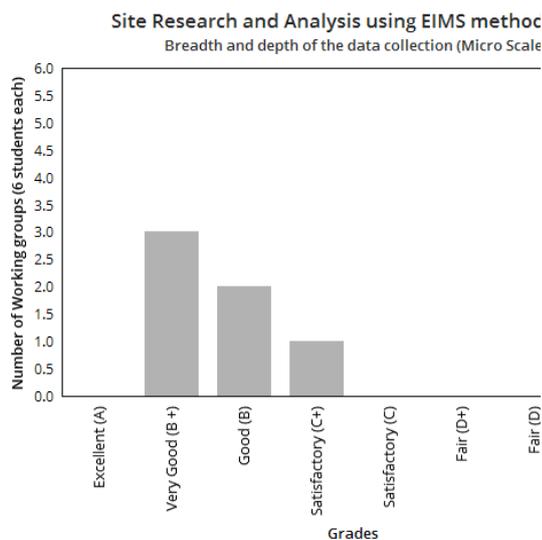
Integrated Studio 3 – Site analysis (micro analysis)

While Urban Design Studies used the Layer Analysis methodology to analyse the macro context of the project site and develop a concept masterplan, Integrated Studio 3 used the layer analysis methodology to analyse the site itself and its direct context. The grades in Integrated Studio 3 were consistent with the ones in Urban Design Studies, indicating that the methodology can be efficiently applied across urban scales.

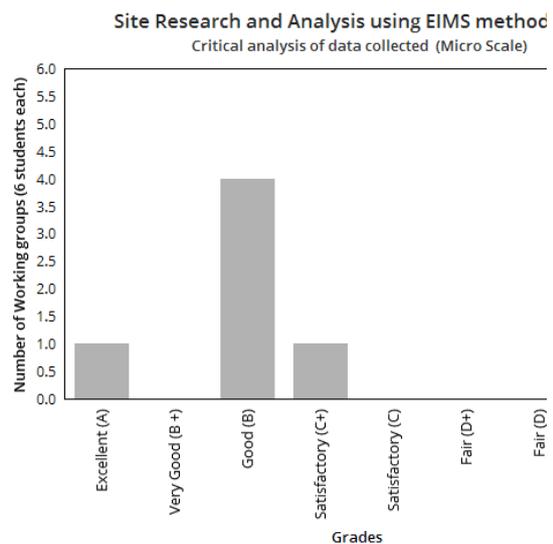


Graph 23: Students’ grades. Urban analysis using the EIMS framework - Micro Scale

The findings extracted from a more detailed analysis of the assessment criteria proved again to be identical across scales. Also, on a smaller and more detailed scale of the project site, the methodology was able to efficiently support participants to extract relevant information and interpret it meaningfully in a very short period of time.

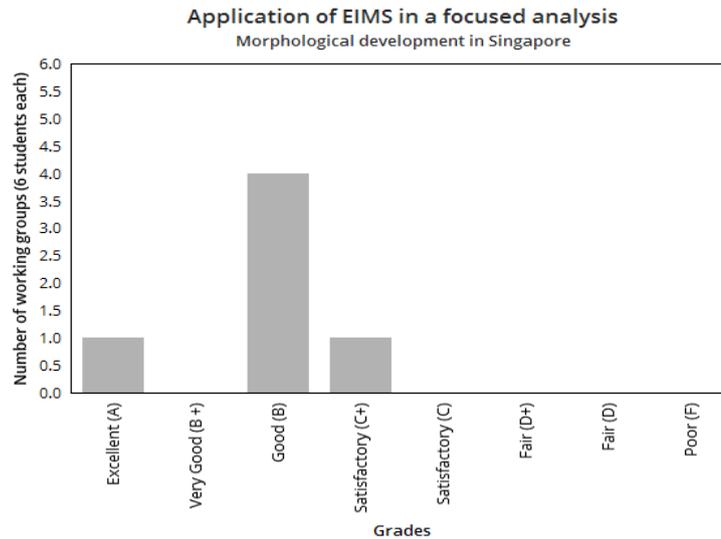


Graph 24: Students’ grades. Breadth and depth of the data collection – Micro Scale



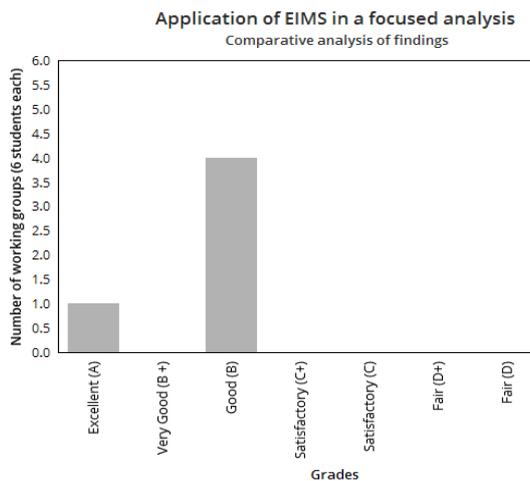
Graph 25: Students’ grades. Critical analysis of data collected – Micro Scale

The second Urban Design Studies assignment was developed in groups and focused on the in-depth analyses of one particular layer: history from the perspective of urban morphology. The aim of this exercise was not only to respond to the content of the particular subject but also to guide participants to understand urban systems on a more qualitative approach. Identically to the previous assignment, participants performed above average, producing a great amount of work within two weeks.

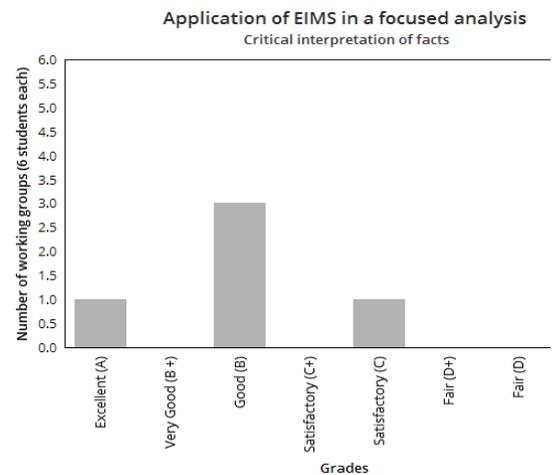


Graph 26: Students’ grades. Application of EIMS in a focused analysis. Morphological development in Singapore

A more detailed analysis of the assessment criteria shows that participants performed well in terms of gathering relevant information, interpreting it and translating the findings into relevant knowledge, able to inform the project requirements. Participants were also able to compare Singapore’s urban morphology with the morphology of other urban contexts and extract conclusions regarding the relation between urban morphology and the character of the streets and public spaces.



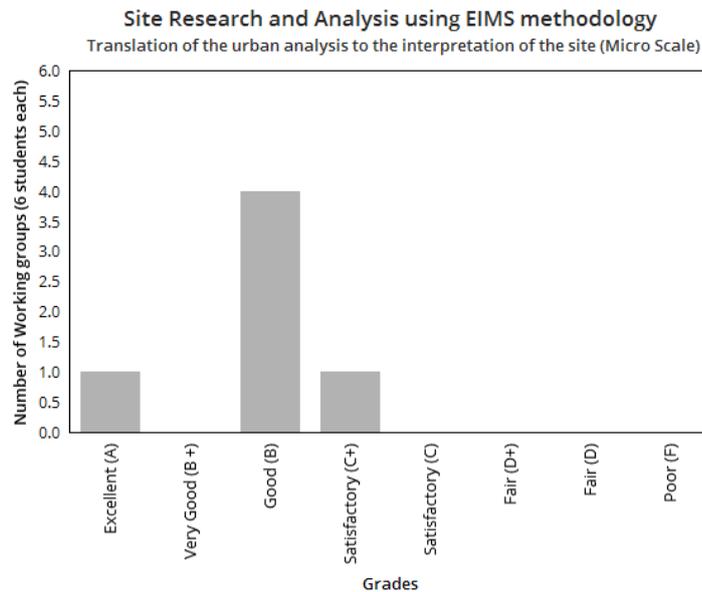
Graph 27: Students’ grades. Application of EIMS in a focused analysis. Comparative analysis of findings



Graph 28: Students’ grades. Application of EIMS in a focused analysis. Critical interpretation of facts

Giving more time for participants to study one of the aspects of research in depth enabled them to form more solid connections and see the site from a more experiential perspective.

The analysis of the assessment criteria shows that the methodology supported participants to efficiently translate the findings on a macro scale of the island to the scale of the site.

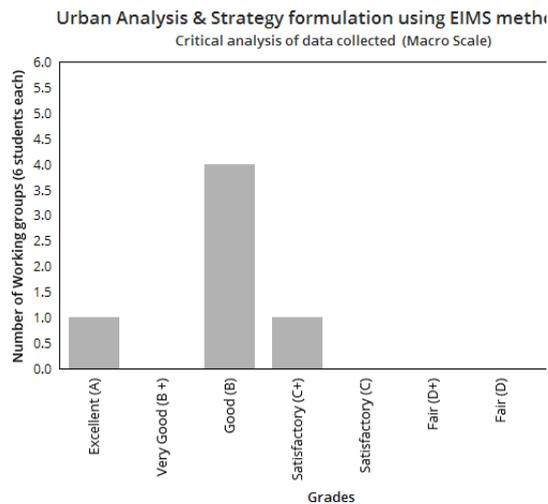


Graph 29: Students' grades. Translations of the findings from a macroscale to a micro scale

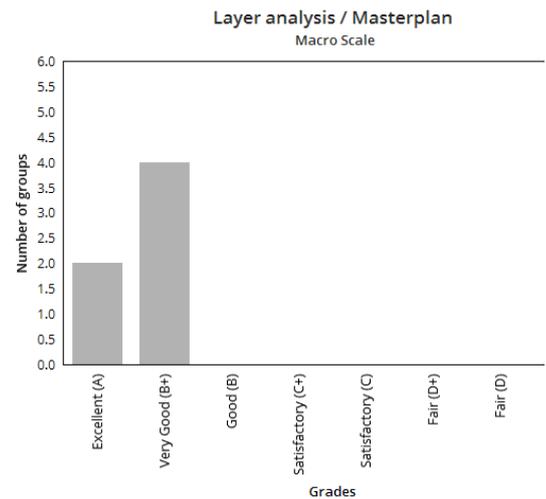
Phase 2 of the design process:

Urban Design Studies – Define strategies/masterplan (macro analysis)

Analysis of the assessment criteria also shows that participants were able to translate the issues identified during site analysis into actions or strategies to nudge the site towards a more sustainable development. Participants produced relevant and academically matured masterplans that were able to support their design process. This is particularly interesting if one takes into account that these participants are between 17 and 18 years' old and did not have any prior knowledge of urban planning and design.



Graph 30: Students' grades. Application of EIMS in a focused analysis. Comparative analysis of findings



Graph 31: Students' grades. Application of EIMS in a focused analysis. Critical interpretation of facts

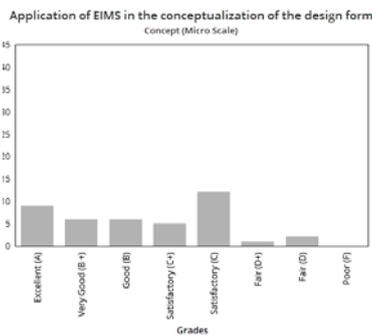
Phase 3 of the design process:

Integrated Studio 3 - Schematic Design

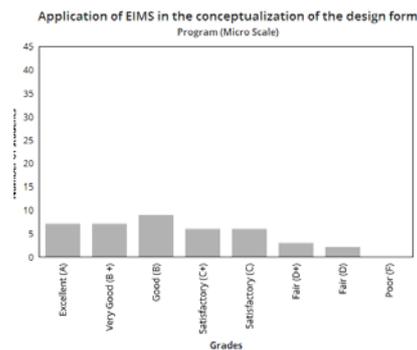
The assessment of the schematic design proposal focused on the relevance of the design concept and the program proposed for the site, in contrast to the assessment in *Integrated studios 2*, which focused exclusively on the design brief; the schematic design assessment in *Integrated Studio 3* also assessed the exploration of the design form. The assessment criteria assessed how the EIMS framework was able to support the translation of the information gathered and interpreted in Phase 1 into a clear program, concept and form.

This phase of the project was developed individually, therefore it can be observed in the graphs below that the marks are more spread out. This expresses the degree of development of each student at a specific time. As it can be observed, participants performed well but not as clearly above average as in the previous design phase. This observation aligns with the information collected from the survey which emphasises the support of the methodology during the research process. The analysis of the students' marks indicates that participants performed average in terms of the translation of the research findings into a program and concept. In reverse of what was extracted from the survey, the students' marks express that the methodology was more useful in supporting the translation of the findings into a design form. The information given by the students' marks should be considered in relation to the survey, focus groups findings and the conclusions extracted from the class observations. In the survey and during the focus group meeting, participants argued that the methodology guided them towards linking urban strategies to specific design decisions for the site. They also argued that the methodology supported them in defining a concept and the program for the project.

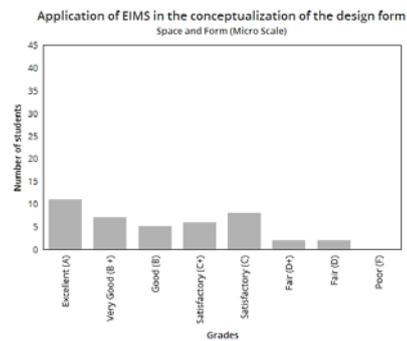
Nevertheless, the results of the analysis of the students' marks support the conclusions taken from the observations in class, whereby it is noticed that weaker participants took on average two additional weeks to meet the expected outcomes of this particular design phase. According to these observations (see Table 21, pp. 289), if the assessment was conducted two weeks later, the marks would have been significantly better. This shows that different participants need different lengths of time to mature the expectations of each design phase. That does not mean that they do not reach more meaningful and deeper results by using the EIMS methodology to support their design process.



Graph 32: Students' grades. Application of EIMS in the conceptualisation of the design form. Concept



Graph 33: Students' grades. Application of EIMS in the conceptualisation of the design form. Program



Graph 34: Students' grades. Application of EIMS in the conceptualisation of the design form. Space and form

Focus group meeting with students

The focus group meeting took place on 21st February, the last day of the semester. Participants' memories of the semester were still fresh; therefore students' statements were quite vivid at that time. The date was also chosen because participants could reflect on the implementation of the EIMS methodology both in Sustainable Design 2, as an introduction, and in Urban Design Studies and a consolidation of the framework imbedded in the design process. There were nine participants (out of 45). The participants volunteered to participate and they represented the whole spectrum of grades given to students. The group included two participants that scored A, two that scored B, three that scored C, one was graded a D, and finally one an F, which was a fail. Both the best and the worse performing students were present in the meeting. There were also representatives from different ethnic groups represented in class, especially Singapore Chinese and Singapore Malay students. The recording of the interview involved audio recording because it was imperative to observe the nonverbal expression of participants when responding to the questions asked. Participants were informed that the interview would be used as data collection for this research.

The meeting took one hour. For the first part of the meeting, participants were informed about the research and the studies developed so far. During the second part, semi-structured interviews were

conducted (Appendix 8). The semi-structured approach towards the interview and the use of both open and closed questions allowed me, as the interviewer, to adapt and react to the conversation quite easily, making participants feel comfortable about being part of a group conversation. The open questions posed to the participants aimed to confirm the findings gathered from other sources of data and explore possible emergent findings. Namely: how the EIMS framework and the Layer Analysis methodology helped with the site analysis research, identifying problems on site, relating the macro analysis to the micro scale, developing a design brief, and developing the architectural form. Participants were also asked if the framework helped in terms of holistic or in-depth understanding of the site; they were asked how it helped to facilitate collaboration and time management. They were also asked if and in what way it supported their thinking process and if they felt more autonomy during the design process.

The findings collected from the focus meeting generally confirmed the findings collected from the observations in class, surveys, assessment criteria, presentations and submissions.

Research findings

Before the interview started, participants were requested to be as honest as possible. They were asked to be critical about the methodology and the way it was implemented in class. They were told that their critical input would serve to improve the EIMS framework and its operational methodology.

All participants expressed the opinion that EIMS and the *Layer Analysis Methodology* helped to support the site analysis and ideation phases of the design process by offering step-by-step guidance to the students. This methodology was helpful when they felt “stuck” in the design process because it offered them alternative views of the problems as well as of possible solutions.

Participants mentioned that the methodology helped them to have a more holistic perspective of the site, guiding them to look at aspects that they would otherwise neglect. Participants mentioned that the methodology helped in understanding the core problems of the site and therefore gave them the opportunity to think about ways to react to them on a deeper level.

“... we were able to understand the site from different perspectives, like from the greens to humans and how these interrelate with each other.”

“... it makes us think of other factors that we never thought of ...”

“It help you to see the bigger picture of the whole site rather than just the place you see when you go there.”

All participants argued that the EIMS and the *Layer Analysis Methodology* helped them to justify the project by guiding them to form a strong concept and define a relevant program for the site. When asked how the methodology influenced their design form, participants referred to their influence in an indirect way; according to them, the methodology influenced the concept, program and their social and cultural awareness of the site, which in return influenced the architectural form.

“... it helps you when you analyze the site and then when you make your program ... and then it helps to find out what is more applicable for the site.”

“... The methodology kinds of allows you to see what is missing or lacking on the site. I mean, as designers we are asked to build something that tackles most of the problems just with one design solution ...”

“... like all the existing information from the government sectors and finding out some of the observations by ourselves, using this model we can combine all this information and then, kind of predict what can happen to the site and allows us to avoid a lot of errors in the future rather than just being narrow-minded and the picture only from the governmental side of things. We can see it from more perspectives ...”

Participants commented that the methodology helped them to relate different scales of things, namely the site with the bigger picture of the city. It also gave them the flexibility to zoom in depth into certain aspects of analysis while still understanding the system as a whole.

“... so it helps when you put all the layers together to see the big picture, but ... if you look at each layer individually it gives you an in-depth perspective of each section and then if you combine it you can have the whole picture ...”

The methodology helped the participants to be more efficient and distribute work without losing a holistic understanding of the site. They mentioned that without using the methodology they wouldn't have gathered the amount of information they did and they would not have had time to analyse it in such a short period of time.

“... it's easier workload for getting the same amount of information at the same time ... we actually check information, so we gathered information (individually) and we collaborated on all layers together to see how the layers affect each other. It was actually quiet efficient to communicate that way.”

“... it's like you put all these little pictures together and it forms that whole big picture together that informs you about the site better.”

Participants also commented on the fact that the methodology makes them more independent and more self-critical and therefore prepares them to be lifelong learners.

EIMS framework award winning in the Educational Innovation Awards 2017

The methodology and observations outlined in this chapter were presented in the context of the Educational Innovation Awards 2017 attributed annually in the seminar developed by Temasek Polytechnic (TP), which aims to share innovative pedagogical practices. EIMS methodology was attributed with the winning prize.

Every year the Learning Academy department organises a conference to debate about pedagogy and innovative teaching methods applied internationally and across the school. International and local speakers are invited to share approaches and teaching methodologies that have proven to improve teaching and students' learning. The conference includes talks and workshops spread across one week.

In the context of this yearly conference, awards are given to the best teaching practices in school. All schools and diplomas are invited to submit proposals and compete for the Educational Innovation Award. The selection among the different proposals submitted is made upon a submission of a description of the methodology, according to a template in Appendix 10, including proof of the relevance of the methodology, a presentation to a panel of four juries, class observations and the written testimonies of colleagues and superiors stating the validity and benefits of the approach.

The evaluation criteria for the selection of the winning prize was aligned with the school's mission: to prepare school leavers and working adults for a future of dynamic change, with relevant knowledge, lifelong skills, character, and a thirst for continuous improvement. In light of this, the assessment focused on the methodology's ability to equip participants to be critical thinkers and lifelong learners (Appendix 9).

- a) Enhancement of participants' learning: The proposal must show evidence that improves the curriculum and methods of teaching and learning. It must support and enhance students' achievements and progress as learners. It must actively engage participants in making strong connections within and across subjects or research topics.
- b) Replicability: It must show clear evidence that it is easily transferable and adaptable to other contexts, other subjects or diplomas.
- c) Support the achievement of the diploma/school aims and objectives: The proposal must show objective evidence that prepares participants for a future of dynamic change, equips them with relevant knowledge and prepares them for lifelong learning skills.
- d) Novelty: The product or its idea must be new to TP, and unique or novel.

The 2017 Educational Innovation Award was attributed to the *Layer Analysis Methodology* with an application of the Exploratory Intervention Management Systems (EIMS) (Miguel, 2015) in the area of urban analysis. Adaptations were made to the EIMS methodology to address the curriculum requirements of Environment Design and content included in its most relevant subjects. Adaptations were also made to support active student participation in class, as it enhances students' learning. The case study presented in the context of the 2017 Educational Innovation Award was the subject of Sustainable Design 2, as described in Part 1 of Study 4 of this thesis.

Focus group meeting with lectures

The EIMS methodology can be used to study any complex system; therefore it can be applied as a learning and teaching tool in a variety of areas, such as engineering and innovation, sociology, psychology, entrepreneurship, etc. In the context of the annual conference, a workshop was developed to introduce the academic staff to the EIMS framework and the ways in which it can improve students' learning and guide them in analysing and addressing with confidence any complex problem.

The objectives of the workshop were:

- a) Describe the EIMS and the Layer Analysis Methodology
- b) Explore how EIMS and the Layer Analysis Methodology could support deeper learning in other domains of expertise

A total of 11 teaching staff represented the Diploma of Interior Architecture, Environment Design, Business, Law, Learning Academy (which deals with pedagogy), student and staff development, International Relations and the leadership program. The workshop was divided into three parts. First there was a presentation where the framework and its application in the context of the subject of *Sustainable Design 2* were presented. During the second part of the workshop, participants were asked if they could see the EIMS framework applied in their field of work and conversations emerged regarding the necessary adaptations. At the end of the workshop, participants were encouraged to fill in a survey (Appendix 11).

Research findings

All participants agreed that the methodology could be applied not only as a teaching methodology but also in their field of work to enhance both their working methods and outcomes. They all agreed that it would effectively guide its users to have more ideas and make connections which otherwise could be disregarded. They all thought that it was relevant to recommend the

methodology across schools and identified key points of possible future applications, namely in the context of psychology and student development, innovation and development, public engagement and design. They suggested using the methodology to:

- support problem solving in general by guiding users to make more informed decisions
- teach all subjects that deal with complex systems regardless of their nature and scale.

Participants acknowledged the fact that the methodology guides users to consider more aspects of complex systems. Law could be an area where the methodology could improve the analysis of information and legislation and guide users through the decision-making process

- support the design process not only in an academic context but also in a professional one. It can also support users in explaining and communicating decisions and projects to clients and guiding public engagement

- guide people to connect to themselves and to others. It can support leadership programs and the integration of participants in school or any other social group. It can also be used to teach topics such as professional development

Summary

When one compares the findings of studies 2, 3 and 4, one concludes that indeed the EIMS framework guides users towards a deeper analysis of complex systems. It allows them to intersect different areas of information and the understanding of the system across different scales of analysis. From the studies, one can conclude that the methodology does not add complexity to the process of site analysis and the design process. It rather adds relevance and meaning to design proposals. The framework can be used to justify architectural forms and programs which emerge from a coherent and in-depth analysis of the system. Users create innovative and aesthetic forms but the use of EIMS as a framework to guide the thinking process adds a deeper meaning to the design form. EIMS models are more valuable when they are used actively through longer periods of time. After using the framework for one complete round of the design process, participants were able to instinctively apply again and with very limited supervision. Participants were able to analyse the urban system critically, which in the context of Singapore's traditional education system is a relevant breakthrough. In addition, the EIMS framework proves to be an effective tool to support communication and cooperation across its users.

Study 4	Aims	Findings	Literature
Findings	Test and validate the EIMS framework to facilitate the analysis of complex systems	<p>EIMS framework supported the in-depth investigation about different areas of a complex system and it helped to make connections across them. By crossing information over different areas of research, participants developed a more holistic understanding of the system in analysis.</p> <p>The framework helped participants to identify gaps in the data initially collected and find new, alternative and relevant topics of analysis.</p> <p>The framework helped participants to synthesise information and draw clear conclusions from the data gathered which led them to finding core issues and problems in the system. Subsequently the framework led to translating these into strategies to improve the system in analysis.</p>	On the understanding of the design problems: (Simon, 1973; Tong, S., 1992)
	Test and validate the EIMS models as a framework that supports the design of more informed human actions/ interventions	<p>The EIMS methodology supported the translation of the information gathered during the site analysis into concrete individual design solutions. It had a significant impact in the translation of the findings to the design concept, program and form.</p> <p>The interventions suggested for the site were based on research that shows the understanding of related sustainable solutions and adaptations to suit specific site conditions. Participants were able to support their strategies with relevant and accurate data and therefore had a solid ground for supporting the next phases of the design process.</p>	<p>On the human aspects of the urban form: (Rapoport, 1977)</p> <p>On the gap between the abstraction and human reality (Stringer and Mikellides, 1980)</p>
	Analyse to what extent the EIMS models influenced the design concept, the design process and the design object.	The EIMS framework guided participants through a deep understanding of the context and induced in them a social and cultural awareness of the site. This knowledge and awareness shaped students' design concept, defined the program suggested for the site, which in return influenced the architectural form.	<p>On the way schools are transmitting knowledge on aesthetics and design to the students: (Read, 2002)</p> <p>On cognition of space and in what way that shapes emotions and performances: (Kuller, 1980)</p> <p>On the translation of concepts</p>

	<p>The design form had a deeper ethical relevance than just the exploration of ascetical pleasing architectural shapes.</p> <p>The framework guided students' thinking processes throughout the design process, keeping them focused and showing them an alternative path when they felt "stuck".</p>	<p>into possible solutions: (Cross 2008)</p> <p>On the designers' values and the way one accesses the quality of designs: (Lera, 1981)</p>
<p>Test potential of the models to self-educate users and stimulate people to think in complex systems from a holistic perspective.</p>	<p>The framework led participants to understand the complexity of their environment and address future challenges. It empowered them to be lifelong learners and to actively contribute in creating a more positive, healthy and ethical world.</p> <p>The framework guided them to think more critically about facts and engage with a deeper evaluation of the social and human aspects of design.</p>	<p>On the topic of lifelong learning: (Candy et al., 1994)</p> <p>On the re-evaluation of the social and ethical dimension of aesthetics and design: (Humphrey, 1980; Smith, 1980) and (Alexander, 2003; Ehrenfeld, 2008)</p> <p>On how to enhance critical thinking in a studio-based learning setting (Bose et al., 2006)</p>
<p>Test the applicability in a real-life situation of the EIMS framework</p>	<p>Both participants and peers agreed that the EIMS framework could be applied in other contexts that deal with complex systems in general, such as law, sociology, innovation and technology, leadership as well as all design fields.</p> <p>Both participants and peers assumed that they would use the EIMS framework again in the future.</p>	
<p>Test the ability of the framework to support communication and cooperation across different participants</p>	<p>The EIMS framework was used to articulate verbal presentation and describe students' thinking process.</p> <p>The framework was effectively used as a ground for debate and discussion about complex issues. It served as a coherent platform to exchange knowledge and ideas, efficiently supporting collaboration among a big group of people.</p> <p>Participants used the EIMS framework to divide the workload and make sure that there were no repeated areas of analysis. Even if groups had collected information on different aspects of the site, the fact that the analysis of facts emerged from the intersection of different</p>	<p>On relation and cooperation in a studio-based setting. (Shreeve et al., 2012)</p>

		layers guided participants to develop a holistic understanding of the place. The analysis of information across different research areas was effective due to the EIMS framework's ability to enhance and guide communication across participants.	
Emergent Findings		The framework supported students' thinking processes effectively, keeping them focused and guiding them efficiently through the design process. The EIMS framework guided participants to effectively gather and analyse vast amounts of information in a very short period of time.	On the ways in which design thinking can trigger innovations in human dynamics and society: (Sennett, 2008; Lawson and Dorst, 2009; Cross, 2011; Dorst, 2011) On factors that shape Design Thinking: (Gray, 2013)
		The EIMS framework guided participants to relate information across different urban scales and therefore enabled them to relate their project site with the needs of the overall neighbourhood and even the city. It also gave them the flexibility to zoom in depth into certain aspects of analysis while still understanding the system as a whole.	

Table 22: Summary of the findings which emerged from Study 4

Chapter 10: Research's conclusions and discussion

At the outset, we introduced the research hypothesis and three associated aims:

- To investigate urban change from the perspective of human actions.
- To explore the possibilities of a kind of urban planning focused on the selection and design of human actions rather than on the management of the urban space.
- To develop and test a framework that facilitates the analysis of complex systems and supports the design and selection of more informed human actions.

These were directed towards investigating urban change from the perspective of human actions and to explore the possibilities of a kind of urban planning focused on the management of human actions rather than on the management of the urban space. The research focused on the relationship between urban complexity, human interventions and urban dynamic change. The knowledge which emerged from this study has been used to suggest ways to use human actions strategically to manipulate the process of urban development intentionally.

The thesis investigated the research questions in the following way:

In Chapter 2, the research sets the context of the research and elaborates on the topic of cities. To describe and define types of cities it links urban management, top-down, bottom-up, and all nuances in between, with the way cities change and their morphology.

Chapter 3 focuses in more detail on urban change. It uses urban complexity to define the morphological building blocks of a city and speculate how the manipulation of these building blocks can generate urban change in an intentional manner. It refers to evolutionary theory to explain the uniqueness of cities despite their common building blocks. It frames design and human actions in general as a kind of artificial selection that provides tools to guide and speed up human and urban evolution and provide ways and strategies to better adapt to the environment.

Chapter 4 focuses on defining a kind of urban management that is able to deal with the unpredictable and continuous changes of urban complex systems, and offers the means to effectively guide them in a sustainable way.

Chapter 5 categorises human interventions as a pool of actions or happenings that have the ability to redirect urban development. It serves as the ground to contextualise architecture and urban design as a powerful tool to manipulate change. It builds on the literature review to categorise interventions in the field of architecture and urban design that have the potential to influence deeply the way people live and therefore have the ability to efficiently nudge urban development. Chapter 5 highlights the relationship between the physical scale of interventions in the built environment with

the scale of the change they can potentially produce. It brings forward the relevance of micro interventions as a delicate yet efficient way of manipulating urban development.

Chapter 5 elaborates on what the possible key design generators for urban change are. Chapter 6 focuses on how to define appropriate generators of change in a pragmatic and effective manner. Chapter 6 builds on the literature review to define a framework (EIMS) that guides users through a step-by-step process to analyse urban complex systems holistically, identify the route triggers of their unbalances and identify appropriate interventions to enhance them.

Chapter 7 describes the methodology used to develop the research studies. Chapter 8 describes the studies that together with the literature served to test the research hypothesis and develop the EIMS framework. Chapter 9 describes the application of the EIMS framework in an academic context and highlights the study's major findings.

From the research journey described above we extracted the following conclusions and findings:

How to relate the city, its complexity and its dynamic character with human interventions

In Chapter 2 we focused on the following two research objectives to answer the first research question:

- 1) To investigate how cities emerge from the perspective of human actions. Establish a relationship between urban evolution and urban character.
- 2) To establish the role of top-down and bottom-up actions in relation to urban and social development. Establish their risks and their potentials.

From Chapter 2 we concluded that all urban organisations are a combination of both bottom-up and top-down interventions. Different kinds of interventions play different roles in the urban development. Besides the nature of urban development, urban character is also deeply related to the nature of interventions in the urban environment. The combination of different interventions gives the cities their unique character, their potential and their challenges.

To understand better the role of top-down and bottom-up interventions in relation to urban morphology and urban change, cities were distinguished into two main categories: the natural city and the planned city. We have concluded that the *natural city* emerges from the merging of small individual interventions or actions. These interventions are normally focused on individual interests;

they emerge from everyday needs such as the need for work, food, shelter, entertainment, education ... and are translated in everyday life choices.

Bottom-up interventions in the built environment are by nature of a small scale due to the type of interest behind them as well as the restricted resources available. Bottom-up interventions in the urban environment are typically the construction of a family house, of a place to work, decoration of the front door area, etc. The natural city is therefore characterised by small buildings and more narrow and organic streets. It emerges slowly from the continued addition of small parts which merge together to form the city as a whole. The natural city is normally more complex; it hosts more diversity of urban functions and human relation (Jacobs, 1970). This kind of city tends to have a more human scale and give people a sense of belonging (Alexander, 1966).

In contrast, we have concluded that the artificial or planned city emerges from larger scale interventions, normally originating from the top-down. These interventions normally address the needs of a community. Typical top-down interventions in the city are schools, hospitals, water and sewage networks, etc. This shift in focus is translated into the scale and nature of the buildings implemented in the city.

Top-down actors normally do not build one house, they build an apartment block; they don't build a workshop, they build office areas; they do not build a tent in a market, they build a shopping mall. Top-down interventions are normally meticulously planned and designed. Due to the complexity and scale of some top-down interventions, they normally require more logistics and resources. In addition, they change the city more dramatically and influence the lives of a larger number of people. In contrast to the natural city, the artificial city emerges quite quickly. The artificial city is therefore characterised by bigger scale buildings and broader and straighter streets; streets which are normally designed to serve not only pedestrians but the increasing demand for motorised vehicles. In many examples, the city becomes more sectarian and less complex (Alexander, 1966). In other words, when the city is thought of from the top down, it is automatically simplified by the human mind which does not have the capacity to imagine the complexity of human relations that emerge naturally in the public space (Bortoft, 2010). The top-down city tends to be perceived as more hostile and less human friendly (Jacobs, 1961; Alexander, 1966).

The risks and potential of bottom-up and top-down interventions in relation to the urban character and urban development can be addressed from two different perspectives:

From the perspective of the intervention's nature, we have concluded that bottom-up interventions, due to their small scale, merge quite easily with the city as a whole (Marshall, 2009). In contrast to large-scale interventions, even if they don't work as expected, the side effects are not very relevant in relation to the bigger picture. In addition, due to their normally small scale, the resources lost, in case of the failure, are much less significant compared to larger scale, top-down actions (Coleman, 1985; Panerai et al., 2004; Pearson, 2006).

From the perspective of urban organisation, urban character and urban development, we can conclude that bottom-up interventions give continuity to urban change (Alexander, 1966) and top-down interventions have the capacity to shift the direction of urban change quite dramatically (Lane, Maxfield et al., 2009). Both kinds of intervention have advantages and a role to play in urban management but both can also lead to urban problems. On the one hand, continuity gives a sense of place to people and stimulates more in-depth and complex human relations. However, intentionally altering urban development can prove to be vital in addressing urban and social challenges. The self-organising city can lead to urban sprawl and social segregation (Batty, 2005). And the planned city can lead to isolation and depression among other things (Jacobs, 1961).

In light of these conclusions, we argue that some kind of top-down management is needed. Our findings in Chapter 2 suggest the need to be cautious when intervening in the urban environment. In addition, the findings in the literature review establish a clear role for top-down and bottom-up interventions in relation to the urban development. Consequently, this research suggests considering the potential of top-down and bottom-up interventions as a tool to support a new kind of management. In other words, from the conclusion taken in Chapter 2 we suggest a management that values the benefits of urban self-organising systems but that recognises that adjustments have to be made to address urban problems which will inevitably emerge (Thaler and Sunstein, 2008).

In Chapter 3, we used complexity theory applied to the study of cities and evolutionary theory to investigate further the assumptions made in Chapter 2 (Allen, 1997; Spencer, 2009).

Complexity and evolutionary theories helped justify the research hypothesis and the kind of management it suggests: a management based on the process of development and on the gentle nudging of the natural emergent change of complex urban systems. In other words, in Chapter 3 we used complexity theory to emphasise the argument that self-organising systems do not always develop in positive ways (Prigogine and Nicolis, 1977; Portugali, 2000). This argument led to the assumption that a certain kind of top-down management is needed to monitor the development of urban complex systems (Portugali and Alfasi, 2007; Marshall, 2012; Portugali, 2012). From the analysis of the city as a complex system we could extract the basic building blocks which define the spatial syntax of each city. The proportion and interrelation between buildings, plots and streets define and can be used to manipulate the way people use, perceive and live in the city.

The evolutionary perspective on the study of cities contributed firstly to justify the relevance of urban continuity for human quality of life (Wilson, 2011); it reinforces the need to nurture the self-organisation of urban systems and their emergent character (Allen, 2012). Evolution frames the inter-relationship between humans and the environment as forms of adaptation (Mayr, 1977; Ramírez, 2000; Ridley, 2004). Certain aspects of adaptation need time; therefore continuity is the basis for human adaptation and identification with the environment (Futuyma, 2005; Douglas, 2006). This

conclusion is the foundation of the research hypothesis which suggests acting on the urban natural development of the city only when necessary (Portugali, 2004; 2008; Thaler and Sunstein, 2008). In addition, this conclusion justifies the relevance of small-scale actions and the danger of large-scale interventions. It justifies the argument that large-scale interventions can easily disturb existing relations and symbioses between people and the physical and social environment around them (Marshall, 2009).

Evolutionary theory explains design as a tool to reproduce in a selective manner efficient ways to adapt to the environment and therefore it defines design as a great tool to accelerate and manipulate change.

In addition, evolutionary theory explains why actions focused on the self can lead to social imbalances (Strickberger, 2000; Gibbons and Sherratt, 2007). We used the work of Miller (1978) to justify the relevance of some kind of social and political hierarchical organisation to address the common good and the needs of a community. We used the work of Wilson (2011) and Elionor Ostrom (1990) to suggest the need for top-down regulations to induce social cooperation and give a direction for social and urban development. In other words, evolutionary theory applied to the study of social systems justifies the need for top-down management based on the notion of nested hierarchies (Miller, 1978); the top-down control suggested by the research findings is based on the idea that the wellbeing of a given social hierarchy is dependent on the wellbeing of lower hierarchies and is vital for the wellbeing of the higher ones.

Based on the literature available on complexity theory, we argue that the unpredictable nature of cities makes it humanly impossible to predict change and to prepare for all emergent social organisations and challenges (Portugali, 2008). Therefore, we suggest a management which addresses human needs as they emerge and guides the city to develop according to a general vision for the future. The research findings suggest that urban planning and urban management should happen in constant dialogue with the natural self-organisation of the city. We should assume the fact that we cannot control or predict change and that leads us to a new approach towards planning (Portugali and Alfasi, 2007; Marshall, 2012; Portugali, 2012).

In short, chapters 2 and 3 demonstrate the need for a kind of top-down management that respects and nurtures the self-organisation of the urban system and re-adjusts it accordingly. The findings suggest a kind of management that changes with the city; a management as a process parallel to the overall change of the urban system. We have concluded that bottom-up interventions have the potential to give the city a human scale and therefore give people a sense of belonging. Top-down interventions and design have the ability to speed up and influence the directions of urban change. The conclusions gathered in chapters 2 and 3 establish the ground to suggest a management based on the continuous and endless process of design and selection of *intentional strategic actions* to address emergent problems or re-direct urban change.

In other words, the conclusions which emerged from chapters 2 and 3 suggest the hypothesis of using top-down strategic interventions as a tool to nudge change and address urban problems within the modern complex urban environment.

How can we use “urban interventions” to nudge urban and social change intentionally?

Chapter 3, besides reinforcing the arguments made in Chapter 2, investigated in more depth the meaning of *human strategic intervention in the built environment* and how it relates to urban systems. This theme was further explored in Chapter 4 where we exclusively focused on the notion and categorisation of interventions within the context of urban change.

Chapters 3 and 4 focused on the following research objectives to address the second research question:

- 3) Explore the meaning of *strategic interventions* in relation to the composition and structure of urban complex systems. Are strategic interventions a synonym of *catalyst interventions*? What are the components of a complex system that can influence the system as a whole?
- 4) Investigate the relationship between the scale of intervention in cities, and the scale of their effect. Can small and discreet interventions induce great changes in urban complex systems?
- 5) Explore the relationships between short-term actions and long-term visions.
- 6) Explore the role of design as a strategic intervention.

Both the complexity and the evolutionary theory suggested that interventions made in the basic elements from which a complex system emerges have the capacity to change that system as a whole (Miller, 1978; Allen, 1997; Marshall, 2009; Spencer, 2009). This conclusion supports not only the hypothesis of using interventions to nudge urban change but also raises the relevance of *micro interventions* as a tool to nudge change in complex systems (Portugali, 2008; 2012). The findings in Chapter 3 suggested that when we plan an intervention as a finished whole, we consider the urban environment as we know it or as we imagine it. The interventions we design are therefore a result of that image. If the environment changes in ways that we could not predict, the intervention becomes automatically obsolete or it has to have the capacity to adapt to new circumstances (Marshall, 2009).

In contrast, if we intervene on the elements which make the system, the system as a whole transforms with it. In other words, from an emergent perspective, when the components which compose the city change, the shape of the city changes automatically accordingly. In light of this, and having taken into consideration the unpredictable character of complex systems, we argued that strategic interventions, and in particular micro interventions, can be used to open barriers and create

possibilities for the system to improve naturally. The management strategy suggested by this research can also be seen as a way to test urban tendencies and therefore avoid unnecessary top-down mistakes.

In light of the conclusions taken from Chapter 3, we suggested that *strategic interventions* are not necessarily micro interventions, but they are preferably small. A *strategic intervention* acts on the elements from which the complex systems emerge and has the intention to manipulate the system as a whole. *Strategic interventions* are not necessarily originated from the top down but it is the responsibility of top-down organisations to focus on the common good rather than on the self (Smith, 1776; Keller, 2007). *Strategic interventions* emerge from a holistic awareness of the complexity of an urban and social system.

The research suggested that the awareness of the complexity of the urban system and its unpredictability will lead humans to be more cautious when intervening in the city (Loorbach, 2007). Furthermore, it suggested that not only top-down interventions, but all interventions in the built environment can be intentionally and strategically used as catalysts for change. With time, all interventions, strategic and others, merge together. They form the city as a whole and establish the direction for urban development (Batty, 2005).

Due to the extent of the meaning of *interventions* there was the need to contextualise *strategic interventions* and more specifically *strategic interventions in the built environment*, this research study's interventions of focus. Following this, Chapter 4 categorised interventions and related them to the potential influence they could have in the urban environment and urban development.

It used notions of nested hierarchies to establish the relationships between scales of complex systems (Miller, 1978) and scales of interventions (Alexander, 1977) and established the relevance of micro interventions as tools to nudge urban change as a whole.

To answer the question of how to use strategic interventions to nudge urban change we focused on the role of design and selection as a short-term action in relation to intentions as a long-term vision for the future. Following Marshall's (2009) arguments and the evolutionary perspective, *design* was framed as both a form of adaptation and of reproduction. As a form of adaptation humans use design to manipulate or change the environment to better serve their needs (Hansell, 2007). As a reproduction process *design* has the capacity to adapt existing models to new situations (Stedman, 1979; Marshall, 2009). It has the capacity to select the elements which already proved to be efficient and invent new alternatives to solve emergent problems. In other words, design has the capacity to create variation based on inheritance.

In addition, the design process is based on rational decisions and choices and the design object is a consequence of these rational choices. Artificial selection, in the context of design or not, has the capacity to speed up and direct change (Lane et al., 2009). In light of this, we concluded that both design and artificial selection can be seen as means for short-term change or as a single step further into the evolutionary process. Nevertheless, we argued that each step of the evolutionary process can be used as the step to change the evolutionary path. In other words, we argued that even if design and

selection are short-term actions they can relate the present with the future; they can relate short-term actions with long-term intentions (Loorbach, 2007).

Evolutionary theory suggests that long-term common intentions play an important role in the human and urban evolutionary process. They help focus the reason behind human actions in one direction. This increases the cooperation for a common good (Ostrom, 1990; Wilson, 2011), and optimises and speeds up development in a given direction.

From the perspective of complexity theory, a clear intention or a long-term vision enables individuals to find their own position in relation to the system as a whole. The combination of complexity theory and the evolutionary approach suggested that a common vision gives individuals the freedom to self-organise within hierarchical levels of social organisation and intervene in the urban environment, knowing that ultimately, regardless of the nature of the intervention, they are contributing to the common good (Wilson, 2011).

Bortoft (2010) framed the notion of long-term intention as the meaning behind human actions, as the *active absence* that gives coherence to the parts in relation to the whole and links short-term intervention and long-term changes.

For Loorbach (2007), long-term intentions define the methodology needed to bring an action forward across all levels of social and political organisation.

Following the literature review findings, long-term intentions should be based on concepts of sustainability and resilience. They should open up ways to explore interventions which facilitate humans to flourish on the planet rather than exclusively fight for their survival (Ehrenfeld, 2008).

It is important to address human intentions as ideas in evolution; concepts that change with people and the ways they perceive the world around them (Richerson et al., 2001; Read, 2005; Mindell, 2006). Humans are the basic elements of society and the creators of the urban environment. They are parts of a whole and therefore reflect on the environment around them (Ponty, 1962). As the environment changes, humans change with it, as well as human actions and intentions (Mindell, 2006). In other words, *intentions* will change with human and urban development, but despite that fact, they serve as an objective that focuses on resources and actions.

Chapter 6 explored models that translate in the visual form the conclusion taken from the literature review. A summary of the conclusions taken from the literature review were translated in the form of explorative research tools which worked as a framework for the studies' explorations.

In other words, the research studies and the qualitative research approach developed and tested the EIMS models and the acceptance of the management approach suggested by the MIS project.

The models developed and tested by the research methodology addressed the last two research objectives:

- 7) To explore how we can design human interventions more efficiently, so that they can improve the urban environment.
- 8) To postulate and test an operational framework based on the research's theoretical approach that would lead to the design and selection of more innovative and sustainable interventions and strategies.

Following the findings which emerged from the research's literature review, we developed two research tools or frameworks which were used as the basis for the research methodology.

On the one hand, we developed two explorative models to support professionals such as designers and decision makers to intervene in the city more adequately. We called these models *The Exploratory Intervention Management Systems* – the EIMS.

The EIMS models are pragmatic and a simple visual representation of complex concepts which emerged from the study of complexity sciences and evolutionary theory applied to social and urban systems. The aim of the models was to improve the design and selection of interventions in the urban environment and contribute in this way to facilitate the kind of management suggested by this research. The intention behind the EIMS models was to support urban actors to reflect on the consequence of their actions and on the interrelations between different aspects of society. With this we expect to make people feel more responsible for their acts and more aware of the unpredictable reactions of the city.

On the other hand, we translated in plans and drawings the management strategy suggested by the literature review and we used that as a basis to test its acceptance.

The management approach this research suggested relies on the self-organisation of the systems and therefore nourishes and improves bottom-up initiatives. In this approach, top-down interventions are only applied in the system to gently redirect its development in case it is needed or previously forecasted. Such an approach suggests delicate and gentle interventions, what we named in Chapter 4 as *micro-interventions*.

In light of this, we developed a system of micro interventions to trigger change in the overall dynamics of Aberdeen city. In other words, we represented in the form of an urban proposal an urban strategy which mirrored the research findings. This project was supported by the *Princess Foundation* and suggested to the Lord Provost as adequate to improve Aberdeen's dynamics and development. We called this project *The Micro-Intervention System* (MIS).

Chapter 7 presented a generic introduction on qualitative research and case studies as the basis for the research methodology. Chapters 8 and 9 described the research's studies. Chapter 8 focused on studies conducted in Aberdeen, designed to adjust and improve the models as a framework that can be used in the design process. Chapter 9 described a comprehensive study developed in Singapore which

was designed to test the validity of EIMS models as a tool to support the design process within the academic context.

Chapter 8 described the testing of the EIMS models both in the academic context and in a real-life situation where political discussions occurred regarding the selection of interventions in the built environment. The response of the participants suggested that:

- The models were indeed a relevant tool to consider in the design and decision-making context. In general, the models were well accepted. The conclusions taken from the studies reveal that such models can indeed lead people to reflect on urban organisation in more depth. They can be used as a basis for communication and exchange of knowledge as well as a tool to justify intentions and actions. In other words, they can be used as a tool to relate short-term action with long-term intentions for the city.
- The models were inefficient in influencing people's pre-established opinions; therefore, they were inefficient as a selection tool.
- The models could influence design and designers. The models influenced the design concepts and many argued that they did not add complexity to the design process.

In addition, all three studies opened new research areas in this and contributed to adjusting the initial models and redefining the methodology to operate them.

Besides testing EIMS models, we used case studies 1 and 2 to investigate the acceptance of the kind of management suggested by this thesis. To support this investigation, we used *The Micro-Intervention System* (MIS) as a research framework.

From the case studies, we have concluded that the use of strategic micro interventions in the built environment as a tool to nudge urban change was welcomed in the academic environment and by the people defending the maintenance of the intervention site. Organisations and top-down protagonists did not take the relevance of micro interventions in the urban environment seriously. Instead, they focused on larger scale interventions, arguing that they had greater potential to improve the system as a whole and the risks involved in the process were worth taking.

In other words, the case studies suggest the kind of management suggested by the research was not easily accepted by top-down protagonists. This does not necessarily contradict the validity of the research hypothesis. It rather raises questions related to:

- The relationship between power and scale of interventions in the built environment.
- The influence of the self and pre-established convictions in the decision-making process.
- The use of 3D renderings and images as tools to manipulate human cognition and therefore influence selection.

Even if the MIS was not well accepted among top-down protagonists and the EIMS models were not helpful in changing people's minds, the studies suggest that the EIMS models were a relevant

tool to improve communication and in-depth thinking of complex systems. The models helped people to think of the urban system in a holistic manner, it helped them to relate short-term action with intentions and it suggested other areas of interventions to manipulate the system as a whole.

In addition, the studies suggested the EIMS models could be relevant to redirect the focus of design. Study 3 left open questions regarding the influence of lecturers and university philosophies and methodologies in the shaping of architectural professionals. It also raised questions about the relationship between the quality of design and its appropriateness to improve the character of the system and its dynamics.

Chapter 9 described Study 4 which aimed to investigate the influence of the EIMS models in the field of architecture and urban design and tested how the EIMS models influenced students' concepts, the design process and the design product. The study tested the ability of the framework to give depth to the urban analysis and a deeper meaning to the design proposals suggested. Study 4 had a longer implementation period. Students had the opportunity to familiarise themselves with the models, test the step-by-step methodology with guidance from tutors and apply the framework in a different context on their own. The models that were tested were the result of continuous improvements suggested by the previous studies and the step-by-step methodology intertwined with the design process. From the analysis of the data collected we could conclude the following:

The models were pragmatic and accessible to young and unexperienced users, bringing depth to their reasoning and guiding them effectively throughout the design process. This finding validates the pragmatic character of the models and this opens the possibilities for broader applications in other fields of work that deal with complex systems. It also opens up the possibility to translate the framework into a digital tool that can be linked with relevant software in the field.

The models were particularly useful in supporting the analysis of urban systems. They guided students to articulate a holistic understanding of the urban fabric that they analysed to establish relations across different urban scales as well as different areas of research. The models were useful in extracting relevant information about the intervention area which led to the formulation of meaningful strategies and relevant programs.

The models also supported communication within and across groups and enhanced the efficiency of the teams. Students used the models to articulate their thinking processes and justify their design decisions. Relevant emergent findings refer to the fact that the models made the teams more efficient and supported the exchange of knowledge, reinforcing in this way a meaningful collaboration within and across groups and a holistic understanding of the topics across the different group members.

The research suggested interesting findings which in our opinion are worth exploring further in different environments, under different theoretical backgrounds and eventually adjusting the research methodology. The EIMS framework is a methodology of thinking in the relationship between parts and the complex whole. As it is contextual, its parts change according to the object of analysis but the

methodology stays invariable. The methodology can be easily adapted to the analysis of any complex system regardless of its nature or scale. It can be used to study a person, a group of people, a company, a business, an investment, the implications of a scientific discovery, etc. EIMS can be particularly useful in subjects like Humanities, Design, Sciences and Business Studies. In general, this framework aligns well with subjects that involve research and innovation.

In conclusion, in this thesis we used management theory to discuss the research's findings and we explored the research hypothesis under the umbrella of complexity sciences and evolutionary theory. One could argue that it would make sense to use the same theoretical background to discuss the research conclusions. As a matter of fact, we can relate the findings of Study 1 to the literature review on evolutionary theory to inform the fact that people representing positions of power preferred iconic interventions rather than discreet ones, with other examples of species which use icons to be recognised as leaders (Hansell, 2007). We could have related the coalitions made during Study 1 with notions of cooperation and related that to human evolution (Strickberger, 2000; Richerson et al., 2001; Ridley, 2004; Futuyma, 2005).

Studies 2 and 3 responded to the literature as the testing of the models that synthesise the research findings. Studies 2 and 3 focused on the development of EIMS models as a pragmatic framework. Both studies evolved as a consequence of a dialogue between literature and the testing of the framework. The findings suggested by Study 4 can be examined under the umbrella of complexity and evolutionary theory. The discussions in class and students' argumentation during presentations focus greatly on the relationship between the space syntax and its building blocks and the way people use space (Batty and Marshall, 2012). Academic discussions and design proposals in both the field of architecture and urban design, were articulated in terms of Alexander's conceptualisation of components of form: "patters" (Alexander, 1964: 153) and in terms of how the design proposal addresses transitions and change (Loorbach, 2007). Program and form were debated according to the way they interrelate with the elements which compose the system and its nested hierarchy (Alexander, 1964; Miller, 1978; Salingaros, 2000; 2005; 2006). They were debated in terms of how they translate human needs (the heart of the system) into spatial solutions (Hodgson, 2011). The contents expressed in this thesis is in essence the basis for the development of the design proposals conducted in Study 4 and it also defines the assessment criteria that generated great part of the data collected.

The fact that we choose to discuss the findings under several scientific umbrellas aimed to help open doors between scientific fields. It aimed to help see a greater perspective of the relationship between facts. It aimed to explore a truly interdisciplinary approach to investigate a given subject which was synthesised in the form of the framework proposed by this research framework (EIMS). We are not experts in management theory, complexity theory or evolutionary theory. Nevertheless, the contribution of this research is the connection between disciplines rather than their in-depth knowledge. Hopefully, this research helps to open doors between disciplines and offers grounds for a truly interdisciplinary approach to the study of cities and urban development. Hopefully, we were able

to establish some kind of link between disciplines such as urban theory, complexity sciences, evolutionary theory, management, design and architecture. Above all, it is hoped that the research can inspire people to explore further a similar approach towards scientific research.

Particularities of the research and the research findings

The objectivity and relevance of the conclusions taken from the use of the EIMS models

The methodology to characterise the EIMS models and the methods used to analyse them reflect the perspective of its user. Nevertheless, we argue that an analytical analysis of such a system is extremely complex and not necessarily less subjective.

The complexity of an analytical analysis of a complex system is related to the infinite number of subsystems and their intersections and the fact that all different hierarchies of the system influence all the others (Portugali, 2000; Batty, 2005). An everyday user of the EIMS system probably won't be able to clearly define all the subsystems that characterise an urban settlement in a scientific, methodological way. Nor they will be able to relate systematically the different hierarchies in a component of the system with the different hierarchies of the other system components. Nevertheless, would more profound analytic research of a complex system be efficient in terms of operability and time of research? Would it be pragmatic in terms of the complexity of the findings in order to efficiently support the creations and selections of everyday human actions?

We suggested that perhaps a more pragmatic and simpler model which relies on the human innate capacity to deal with complexity would prove to be more efficient. In other words, we suggested a model that trusts the human capacity to deal with the complexity of everyday life. The model is used as a guide to bring that innate knowledge to light and support people in drawing conclusions from their own analysis of the system. We argued that such an approach can prove to be more efficient in informing and guiding professionals' everyday actions.

Another issue one might raise is related to the subjectivity imbedded in the characterisation and interpretation of EIMS models. On the one hand, it is a fact that the conclusions one takes from the use of the model are related to the perspective from which one analyses the system. This perspective is one view of the world; it is related to personal beliefs and world views (Grosskurth and Rotmans, 2005). On the other hand, one can never take into consideration all the aspects or elements of a complex system and all the dynamics between them. In other words, there are infinite perspectives from which one system can be analysed and they are all valid aspects of reality (Bortoft, 2010).

The methodology used to operate the EIMS models depends on the perspective taken to analyse a given system. That perspective will influence the selection of relevant subsystems of analyses and the perspective the analysis will take. Consequently, the analyses of these subsystems give a certain image of a social reality. The combination of different perspectives or the combination of the analysis of different subsystems allows one to have a more integrated image of that system. In other words, the different pictures of society or the intersection of the conclusions drawn from the analysis of different subsystems will help to characterise a specific reality. Regardless of the specificity of the perspectives one might take from the analysis of a complex system based on the EIMS models, the conclusions drawn are always regarded in relation to the system as a whole. This allows one to change perspective, add information and compare ideas and points of view based on the same diagram.

Put another way, the EIMS models allow one to define and identify personal choices and world views and relate them to both the process and the methodology needed to use the model as well as to the conclusions taken from it. The conclusions taken from the use of the EIMS models emerge from the priorities and choices of its user. Nevertheless, the choices made to analyse a system are taken into consideration in the specific context of that analysis and not as a general truth. The fact that the EIMS models situate the users' choices within the framework of analysis opens the door to sharing information, comparing findings and using them in other circumstances.

Relationship between the relevance of informed interventions and the unpredictable character of complex systems

We can try to estimate the long-term consequences of an action but we cannot really predict them. This unpredictability grows with the increase of time we aim to foresee. External conditions and the non-linear character of complex systems make all provisions mere expectations in a world of unpredictability (Portugali, 1997; Batty, 2005). The unpredictability of the consequence of human actions might raise questions for the relevance of analysing our actions in relation to any social system.

We argued that having a holistic awareness of complex systems and being induced to formulate both the problems and the solutions from different perspectives might lead to taking into consideration factors that otherwise would be forgotten (Hammond et al., 2006). The methodology suggested by the research can also bring forward things that, because of personal preconceptions or other reasons, would not be given enough relevance (Bazerman and Chugh, 2006). We argued that from a short-term perspective this increase of awareness might improve the adequacy of interventions in the urban environment and therefore increase human quality of life.

We are aware of the fact that ultimately, in the long term, one can just hope for the best, as reality can unfold in surprising ways. Therefore, we argued that the sustainable management of human

development has to be a process parallel to that of human evolution. In order to manage human development towards a sustainable path one has to monitor the events and happenings which emerged as a consequence of a given intervention and readjust things when necessary. Following this, there are issues related to the size of human interventions in the built environment that should also be taken into consideration.

The use of micro interventions as explorations to find more appropriate permanent interventions

This research focused on interventions in the built environment. These kinds of interventions, depending on their scale and nature, can involve many participants and large investments. These constraints make it difficult to formulate a context where the EIMS models can be applied as an operational tool because the relevance and efficiency of interventions to manipulate change intentionally can only be tested after the interventions are actually implemented in the urban fabric. This fact also puts more pressure on the model as a framework to efficiently conceptualise, design and plan sustainable interventions.

EIMS models support the design and selection of strategic interventions regardless of their scale. In other words, the models are mainly conceptualised to relate design objects with their context and to offer the grounds to explore optimal solutions. Nevertheless, the theoretical arguments which emerged from this research suggested that small-scale interventions have key attributes able to operate from within complex systems. This argument suggests that micro interventions are extremely relevant tools to consider in manipulating urban change without disturbing the continuity of the system's change, therefore avoiding unnecessary risks.

Loorbach (2007), in the context of *transition management*, suggests the need for the formulation of different strategies to achieve similar goals. This approach builds on the unpredictability of the system and its uncertainty factor. This research argues that by leaving several options open or by implementing a variety of small interventions we are testing the best possibilities, the best strategies and the best combination of interventions. In other words, we are letting the system select the best strategy to achieve a certain goal.

The *micro-intervention* management strategy was not sufficiently tested in the context of this research, but there are findings that are worth mentioning.

In the context of *transition management*, the different strategies used to manipulate change are related to the diversity of strategic actors which are involved in the process of change and the coalitions they form (Loorbach, 2007). Following this, the research acknowledges the need to test and implement a variety of strategies to nudge urban systems. The EIMS models serve as a framework to empower not only top-down actors, such as decision makers and architects, to create and implement more informed intervention in the urban system, but also bottom-up ones. The research's studies also

aimed to test the ability of the EIMS models to help single individuals, regardless of their background to self-develop their awareness of complex systems. The EIMS models can be shaped by personal perspectives and individual analyses of a context. Consequently, this individual characterisation of the EIMS models shape individual views for the future of the social organisation in analysis, which, in turn, leads to the development of unique but well-rooted intentions in the system. As argued in Chapter 2, bottom-up interventions are normally small in scale and they merge easily with the existing urban fabric; they naturally become part of the city whose emergent character will naturally select the interventions that thrive and the ones that fail (Alexander, 1966; Jacobs, 1970; Akkerman, 2007). In other words, the evolution of the emergent city is the perfect testing ground for an infinite variety of small interventions giving top-down actors the time and the evidence of sustainable paths of growth (Marshall, 2009). The EIMS models can be used as a tool to empower individuals to make more informed choices and act in complex systems with more awareness, eventually creating the opportunity to test more interesting and innovative solutions to influence the natural growth of cities.

Strategic micro interventions can also be used more actively by top-down actors to test the direction of urban growth. In studies 1 and 2 we explored ways to test a variety of alternative interventions to induce a specific urban change; we designed an intervention strategy based on a system of micro interventions (MIS). Each intervention was conceptualised to revitalise the character and the use of Union Terrace Gardens in Aberdeen, both as independent elements and as part of a system. The *micro-intervention* strategy approach would also allow testing several options and letting the system select by itself the best solution or the best combination of solutions.

The *micro-intervention* strategy was tested against two larger scale alternatives. Due to their scale, the alternatives were automatically more expensive, more permanent and therefore more rigid. We can therefore suggest that the *micro-system* alternative offers the possibility to try things and explore new possibilities in the urban environment. This argument opens the door to the need to further test the approach and find more conclusive findings that relate to:

- a) The scale and kind of intervention with the changes they produce.
- b) The relationship between the exploratory interventions to which the system reacts desirably and more permanent solutions designed as a consolidation of the system's tendency.

Defining, selecting and designing an intervention based on the conclusions taken from the EIMS models both as an individual and as a group

The process of defining, selecting and designing an intervention in the built environment should happen smoothly if both the analysis and the intervention are a product of a single individual's efforts. In other words, if the models were built by one single person, the intention behind the interventions

and the focus of the system would be directly related to this person's world views. This would influence the knowledge obtained by the use of the models which would guide design concepts from which future projects would emerge. In this context, the EIMS models can help to design and conceptualise more contextualised and eventually more relevant strategies, but they will not be used to mediate common ideals.

Things get a bit more difficult when different actors need to agree on a shared vision of a situation and on the strategies that follow. At this point, disagreements and different interpretations of the conclusions taken might emerge. As concluded in Study 1, actors might even agree on the conclusions extracted from the EIMS models, but they can disagree on the strategies to address the problems. Moreover, they might even agree on the strategy and disagree with the character of the interventions. Tuning ideas might not be easy due to the fact that both the model and the consequences of their analyses operate in the context of uncertainty (Rosenhead, 1998). Furthermore, as we have concluded from the studies, the personal imagery of an apparent shared idea can vary drastically (Ponty, 1962).

Nevertheless, from the conclusions we took from our studies, we can say that even if participants did not agree on a common strategy, at least a discussion was triggered by considering relevant concepts related to the EIMS model, such as whole systems, complexity, unpredictability, human and urban evolution. In addition, each urban actor used the philosophy behind the models to justify and further develop their arguments. From this research's perspective, this in itself is already an achievement because it helps its user to sharpen their proposals and test them according to variables which would not be considered otherwise.

Recommendations for further research

The EIMS models have already been applied in contexts beyond this thesis (see Appendix 12). This helped to further validate the models as well as open doors for further research.

Future research should be undertaken to further test the validity of the EIMS models not only within the context of urban management, but in a professional context or in other fields of work that deal with complex systems. There is the need to:

1- Test the relevance of EIMS models to support design thinking in a professional context. The framework should be tested as a tool to guide the design process and support collaboration and communication across all participants involved in it. The framework has been already applied in a professional context but further research needs to be conducted to validate it. (See appendix 12 pg. 430)

2- Test the relevance of EIMS models to support different kinds of users and different thinking processes. Possible applications could be to deepen the findings of Study 1 and support decision

makers or investigate how the framework would perform in areas such as management, public engagement, sociology and others.

In both cases it would be important to establish a clear relationship between the methodology to operate the models and human thinking processes, such as the design thinking approach investigated in Study 4. It would also be relevant to test the capacity of the models to help users to detach from personal beliefs and base their decisions on rational analyses. Areas of focus could include:

- The influence of the self in the decision-making process.
- The way human individual imaginary gives a new meaning and shape to an external object.
- The influence of the visualisation in changing human preconceptions.
- Establishing objectively how the EIMS models lead the user to think about society and about notions such as complexity, sustainability, dynamic change, short and long-time actions, intention, nested hierarchies and so on.

3- Investigate the possibility of translating the EIMS framework into a digital tool to empower users to reflect and act to complex systems more efficiently.

4- Investigate further the micro-intervention system approach in the context of urban management. Tests should be carried out in real-life scenarios to test the influence strategic micro interventions can have on a complex system. The EIMS models should be tested to identify to what extent they can support the identification and selection of micro interventions that trigger a reasonably controlled change in complex systems. The models should also be tested according to their adequacy in the facilitation of the implementation of these interventions and the monitoring of the impact and change they trigger in the system.

Endnotes

Personal statement and motivation for the research

1. For a description of the city and urban change from the perspective of emergence see: Marshall (2009:185, 209); Portugali (1997: 353,380), (2000); Batty (1994). For a description of the city and urban design in the context of complexity sciences see: Salingoros (1998; 2005; 2006); Alexander (1965). For a description of the city from a sociological perspective see: Jacobs (1970) ;(1972). For a description of the city from an evolutionary perspective see: Geddes (1915); Wilson (2011). For a multidisciplinary analysis of the city from the perspective of sustainable ecological systems see *PermaCity*, edited by Rosemann (2007).
2. See: Cruz, T. (2013). How architectural innovations migrate across borders, TEDGlobal: 13:14.

Chapter 1: Introduction

- 1 On the global city from the perspective of the relation between information society, communication and globalization see: Sassen (2000: 143,159; 2001; 2011), Castells (1989; 1996; 2000) or Harvey (1989). From the perspective of global migrations see: Castells (1998); Sassen (1988; 2001); Storper & Manville (2006). On technology and the city see: Ihde (1990) or Marc Augé (1995).
- 2 On explorations of new kinds of urbanism see: Sandercock (2010). See also: Friedmann (1997); Font (2002-2003); Portugali and Alfasi (2007); Marshall (2012); Portugali (2012); Roo and Rauws (2012)
- 3 Communicative and strategic planning for example emerged from the urge to manage the postmodern city. Actually, the work of Harvey (1989) *The Condition o Post modernity* and of Castells (1996) *The Rise of the Network Society* inspired several responses that dominate contemporary urban planning approaches today; namely the communicative approach (Hearley, 2007), strategic urban planning/ governance and New Urbanism. (Portugali, 2012)
- 4 On how technology shapes urban life, urban dynamics and consequently the urban form see: Duarte and Firmino (2009); Ihde (1990) and Augé (2008) ; On a view of the future society as a consequence of globalization and technology Chareonwongsak (2002). On a new form of self-organisation in urban neighbourhoods see: (Kotus and Hlawka 2010); On the influence internet has in city centres Weltevreden and Mindali (2009); Weltevreden (2007); On the influence of phatic technologies in modern society Wang et al. (2012). From a sociological perspective see: Sassen (2001). For a view from the perspective of urban management see: Sandercock (1998)
- 5 On criticism towards traditional planning practices see Marshall (2009) or Koolhaas and Mau (1995: 961, 971) , Friedmann (2011); Sandercock (1998; 2010); Allmendinger (2001)
- 6 For critical perspectives of the modernist movement see: Alex Marshall (2000); Coleman (1985) - Coleman, A.M. (1985), *Utopia on trial: Vision and reality in planned housing*. London: Hilary Shipman; Panerai et al. (2004:116,118,156) and Sandercock and Lyssiotis (2003). For specific examples of modernist failures see: Alex Marshall (2000) for the example of Norfolk Verginia; Jodison and Kieran (2003) make a list of what they entitle as “crap towns”; Pearson (2006) describes Cumbernauld as a ‘horrible place’.
- 7 For a better understanding of the morphology of cities from an historical perspective see the example of Mediterranean cities from in the work of Braudel (2002); For an interpretation of an urban unit from the perspective of urban morphology and space syntax see: Marshall (2009: 59,88).
- 8 For a sociological critique on top-down designed cities see: Jacobs (1970; 1972). For a critique from the perspective of design see: Alexander (1966); For a critique from the

- perspective of Complexity theory see: Portugali and Alfasi (2007; Portugali (2012); For a critique from the perspective of Evolutionary theory see: Marshall (2009)
- 9 For a theoretical critique on modernism and planning see: Campell and Marshall (2002:22); Friedmann (2003); Sandercock (1998, 2003); Allmendinger (2001)
 - 10 We focus our argument on New Urbanism because it is focused on interventions in the built environment rather than on planning policies.
 - 11 Neo-traditional (n.d.) is defined as:
 “*reviving traditional methods; combining tradition with newer elements*”. Retrieved November 11, 2013, from Dictionary.com
 website: <http://dictionary.reference.com/browse/neo-traditional>
 On the influence of traditional cities in the ‘neo-traditionalist’ movement as a reaction to the modernist one see: Rowe and Koetter (1978); Jencks (1981, 1987); Hanson and Younes, (2001); Banai (1996); Campell and Cowan (2002)
 New urbanism is an urban design movement which started in the United States around the 1980s. It promotes walkable cities and mixed urban functions. It has ecological concerns and addresses problems related to urban sprawl.
 The terms of *neo-traditional* planning and *new urbanism* movement are normally associated see: Kreiger and Lennertz (1991); Calthorpe (1993); Katz (1994); Leccese and Mc Cormick (2000).
 On the neo-traditional awareness for the need of eco-friendly places see: Barton et al. (1995; 2003); on sustainable new towns see Battle and McCarthy (1994); Frey, (1999). For details on New Urbanism’s projects see www.cnu.org. The reaction to modernism is happening in many parts of the world and is not only becoming increasingly influential but it is also completing successfully numerous projects of all scales. Herbert (2005a); Southworth (2003)
 - 12 See also: Dutton (2000).
 - 13 For a critique on the relation between the planning process and urban change see also: Marshall (2009) and Peraneraï et al. (2004:179). Post modern planners such as (Kreiger and Lennertz 1991; Katz 1994; Herbbert 2003; Marshall 2009) researched for other and more interactive and sensible planning.
 - 14 See also: Rowe and Koetter (1978); Jencks (1981, 1987); Hanson and Younes (2001) ; Banai (1996); Campell and Cowan (2002); (Portugali 2004; Portugali and Alfasi 2007; Portugali 2012)
 - 15 On the death of a certain kind of planning see: Turner (1996). On the death of a planning based on an overview of the city see: Allmendinger (2001: 116)
 - 16 See also: Batty (2005: 18), Koolhaas (2005), Batty (2008 a); Davis (2006)
 - 17 Some authors relate the urban sprawl with the developments in transportation and communication networks. For more details on this approach see: Salingaros (2013); Marshall (2003;2005;2006b); Banister (2002); Brandon (2002) About the logic of public transport: Marshall (2005). About the logic of accessibility (2006b), Marshall (2009:209)
 See: Sassen (2000) on the relation between global economy and new centralities. For the example of Africa see: Parnell et al. (2009)
 - 18 Ihde (1990) elaborates on the relationship between technology, the city and humankind.
 - 19 We will explore this argument in chapter 3 in the light of evolutionary theory
 - 20 See: Alexander (2003) for an approach on the relevance of architecture in the understanding and manipulation of the urban environment. For a view on interventions in the urban environment as a tool to trigger change see: Lerner (2003); Alexander (2006); Batty (2005); Marshall (2009); Portugali (2004).
 - 21 For more information on unpredictability in complex systems. See: Johnson (2012) for a perspective based on complex multilevel systems. See: Portugali (1997; 2004; 2008; 2012) for a perspective of urban planning paradoxes. See: Dixon (2001) for a perspective of management and problem solving.
 - 22 See: Geddes (1915/1949) for the first explanation of human evolution from a biological perspective. See: Alexander (2003) to read about the relation between human interventions in the built environment, namely architecture and human evolution. See: Marshall (2009) to read about emergence of cities from the perspective of space syntax, complexity and evolutionary

- theory. See: Portugali (2011) for a relation between human actions, urban change and human cognition.
- 23 This argument opposes what was defended earlier by Simpson in his book *The Science of the Artificial* (1981). In addition, Alexander (Alexander, 2003) and Simpson (1981) suggests that the study of human artefacts should become a science. The problem is precisely the fact that the product of human artefacts are other human artefacts and artefacts are out of the scientific domain (Portugali, 2003).
 - 24 See also: Portugali and Alfasi (2007) chapter 1.
 - 25 Stafford Beer explores this subject further in a talk available on You-Tube (<https://www.youtube.com/watch?v=JJ6orMfmorg>). The film belongs to John Moore University's Stafford Beer collection.
 - 26 See: <http://www.socialresearchmethods.net/kb/dedind.php>
 - 27 In chapter 4 we will define strategic interventions. In addition, we will argue that every human action can be intentionally designed to become a strategic intervention. Nevertheless, it is the responsibility of top-down management to design and select strategic interventions.
 - 28 In addition, even if large scale-top-down interventions can be seen as a proactive way of 'taking care about the future' they carry the risk of stifling creativity. Imposed top-down interventions can damage the emergent order that gave life to a place, therefore they should be used delicately and only when necessary. In chapter 4 we will use evolutionary theory to argue that humans normally need time to adapt their daily habits and to new urban structures.
 - 29 Two examples of how our daily lives and our cities reconfigure around new technical-cultural interventions are the social and urban changes that emerged from the increase in use of the car and internet.
 - 30 *Strategic Interventions* is the name we give to human intentional actions applied in the urban system. Strategic top-down interventions should emerge as a response to the system imbalances and should be used to nudge the emergent development of urban change. In other words, we address as *strategic interventions* intentional actions used as catalysts to improve the urban system and to direct urban change.
 - 31 In cybernetics the systems which are capable of having an independent existence are called viable systems (Beer, 1983) . For an introduction on Synergetic see: Haken 1996; (Haken et al., 1995). For its application to urban planning see: Portugali (2002; 2003).

Chapter 2: The city

- 1 This argument expresses a preferable tendency not a rule. Each context is unique and large-scale top-down interventions might prove to be the best *Intentional Strategic Action* to re-direct urban development towards a sustainable path. The argument made here also depends significantly on whether we are intervening in a well established urban structure or we are creating one.
- 2 Benevolo (1980: 60, 72) describes the city as a united social and political entity.
- 3 See also: Alexander et al. (1977: 940-945,469)
- 4 In an interview in 2008, Byrne, a fellow Portuguese architect, named the public spaces of the city such as the street and the squares "the empty spaces". This way of addressing the public spaces is from the built environment perspective. It relates to the empty spaces which connect all the built volumes.
- 5 On how technology shapes urban life, urban dynamics and consequently the urban form see: Ihde (1990); Duarte and Firmino (2009) and Augé (2008) ; For a view of the future society as a consequence of globalization and technology Chareonwongsak (2002). For a new form of self-organisation in urban neighbourhoods see: Kotus and Hlawka (2010); On the influence internet has in city centres Weltevreden (2007); Weltevreden and Mindali (2009) ; On the influence of Phatic technologies in modern society Wang et al. (2012). From a sociological perspective see: Sassen (2001; 2005). For a view from the perspective of urban management see: Sandercock (1998).

- 6 Paper presented at ARI's conference - *Intercity Networks and Urban governance in Asia* 8-9 March 2012- by Teddy G. McGee, *The Role of Translocal and Intercity Networks in the Development process: Resolving the contradictions of Mega-Urban Development in Southeast Asia*.
- 7 The kind of city that emerges from the bottom-up is addressed by some authors as the organic city. The term organic city is used to define a vast number of perspectives and theoretical considerations about the urban form. Therefore, to avoid miss interpretations, we have decided to follow the terminology used by Batty (Batty, 1994) in his book *Fractal Cities* coined by Alexander (Alexander, 1966) in his famous article *A city is not a tree*. In light of this we'll refer to the organic city as natural city.
- 8 Wilson calls this the human capacity to escape a path dependence "*Cultural Evolution, like biological evolution, is path dependent. You can't always get there from here.*" (Wilson, 2011)p 124 ; Alexander (1965); Jane Jacobs (1970); (1972); Marshall (2009)
- 9 '*Hopeful monsters*' was a term coined by Goldschmidt and it refers to large mutation in organisms (Dennett, 1996). The same term was used by Marshall (2009) to explain the risk of breaking the continuity of the evolutionary process.
- 10 Both Modernism and Neo-traditionalist movements are an example of this top-down urban design approach.
- 11 He explored this idea further in his book *Pattern Language* (Alexander, 1977)
- 12 On the human need to simplify reality in order to perceive it see: Alexander (1966; 2003). See also: Ehrenfeld (2008) or Bortoft (2010). On the relevance of studying emergent human interventions in the built environment to the understanding of the quality of life in the city see: Alexander (2003-2004); About public realm policies (Which are mostly related to health and safety) see: Lang (2005).
- 13 For a description of the city and urban design in the context of complexity sciences see: Salingeros (1998; 2005; 2006).

Chapter 3: Human and urban change

Introduction:

- 1 This theoretical background was the basis for our *Explorative Intervention Management System (EIMS)*; a framework to design, analyse and select interventions in the context of complex and dynamic urban system. To learn more about EIMS (the exploratory intervention management system) see chapter 5 p. 154.

What is common to all cities?

- 2 Haken was the founder of the theory of Synergetic (Haken et al., 1995) and of a new domain of complexity and self-organisation theories.
- 3 Cited in Marshall (2009: 129) and in Kostof (1991: 86);
- 4 On the relevance of the use of micro-interventions to nudge urban change see chapter 4 p.134.
- 5 Cited by Marshall (2009: 129).
- 6 See: Jacobs (1965).
- 7 As we have seen in chapter 2, in his article *The City is not a Tree* (Alexander, 1966), Alexander argues that most problems in planned cities are related to the simplistic character of design. He suggests that natural cities have a deeper order which echoes the human relations and the urban functions which compose it.
- 8 This notion is very closely related to the biological notion of nested hierarchies. See: Miller (1978); Alexander (1979 and Marshall (2009).
- 9 See also: Portugali (2012) and Read (2012); The gap between theory and practice is an aspect we want to avoid. Complexity theory was used as the background body of knowledge to

- design the exploratory framework which will support the research's methodology and eventually serve as a tool to support design and selection of urban interventions. To learn more about EIMS (the exploratory intervention management system) see chapter 5 p. 154.
- 10 For an analogy between complexity theory in the study of cities and social senses see: Portugali (2012)
 - 11 For examples of computer models to study the city based on fractal geometry and complexity theory see <http://www.complexcity.info/media/software>. PSS is an example of a tool to support urban design and management based on 3 components: Simulation models based on complexity theories, GIS (Geographic information system) and visualisation models such as VR (virtual reality). This tool allows us to test future scenarios for the city and try different strategies. It is reasonably easy to operate and its application in real-life scenarios is slowly increasing. See: Geertmana and Stillwellb (2004) for inventory of the use of PSS among urban planners. See <http://www.whatifinc.biz/> for an introduction to a planning support system named What if. See <http://www.whatifinc.biz/publications.php> for publication on the subject. See also <http://www.complexcity.info/media/software/>
 - 12 Portugali highlights the fact that users of PSS models which in theory should approach the city as an open unpredictable and self-organising system often treat it according to the classical approach (Portugali, 2012:232).
 - 13 See the example of Tel Aviv balconies in Portugali (2012).
 - 14 The word fractal was coin by Benoit Mandelbrot (1982). In the book *The Fractal Geometry of Nature*, Mandelbrot (1982) argues that apparent random mathematical shapes actually follow a pattern if they are seen from the perspective of a single repeating unit. To know more about fractal analyses in social complex systems see: (Falconer (1990) and Brown and Liebovich (2010).
 - 15 For a description of a fractal from the urban perspective see: Marshall (2009); From a design's perspective see: Mitchell (1990: 103-104); From the perspective of whole systems see: Bortoft (2010).
 - 16 For a description of humanity and the natural world from the perspective of *emergence* see: Gribbin (2005). For a description of *emergence* from the perspective of human behaviour or, more specifically, from the perspective of market behaviour see: Smith (1776).
 - 17 See: Ramírez (2000) for an analogy between the beehive and the city from the perspective of *emergence*.
 - 18 Bottom-up actions emergent from individual needs. They are focused on the self. Top-down decisions consider time, budget and cost in relation to overall urban dynamics, such as closeness to 'workplace or workforce, market or customers, civic facilities or constituents'. About the logic of public transport see: Marshall (2005).
 - 19 Lynch (1981) mentions how it is difficult for us to conceive forms-in-progress. Perhaps this has to do with planners' speciality on a targeted kind of design that is typically fixed in form.
 - 20 Modernist city planning is an example of such analysis of the city form, see projects such as: Ville Radieuse by Le Corbusier; The garden city Ebenezer Howard ; Ciudade Lineal by Arturo Soria's and others.
 - 21 Marshall (2009:187) demonstrates how urban forms such as *concentric settlements*, which happen spontaneously according to logical individual choices, served later as a model of how a city should be. He shows how something organic becomes rigid by the means of planning and design. Modern and Neo-modern planned towns are examples of that; they are a consequence of focusing on the overall shape rather than on the rules that it originated from.

Why are cities unique?

- 22 Dawkins (1976; 1997:13) makes a similar remark about wasps.
- 23 See: Strickberger (2000); Ridley (2004); Futuyma (2005); Lynch (2007).
- 24 See for example *Oxford Dictionary* on line <http://oxforddictionaries.com>
- 25 Cited also in Marshall (2009:161).
- 26 See: Thaler and Sunstein (2008); Ariely (2008) and Akerlof and Shiller (2009).

- 27 See <http://www.centrodeoperacoes.rio.gov.br/>
- 28 See the example of the parable of the immune system in Wilson (2011:125-137).
- 29 See chapter 5 p.160 for more information about EIMS' models.
- 30 The scope of (Geddes, 1915/1949) *Cities in Evolution* is best summed up by its subtitle: *An Introduction to the town planning movement and to the study of civics*.
- 31 Ernst Mayr (1977) called *population thinking* to refer to a society which emerged from individuals. Lane (Lane et al., 2009) refers to *organizational thinking* as a society which emerges from groups of people.
By *organizations* Lane refers to physical, biological and human *socio-cultural* groups.
- 32 This description relates to the biological concept of *nested hierarchies* Miller (1978) and to Wilson's (2011) ideas of a possible hierarchical organisation of society.
- 33 Wilson (2011:318), Vermeij (2004) and Dawkins (1976) look at complex human adaptations such as culture and religion as complex systems like organisms. Both culture and religion receive information from the environment, interpret it and react accordingly. Furthermore, they have to be sophisticated enough to survive and reproduce in the world. Both authors explain cultural and religious diversity in detail from an evolutionary perspective and make constant analogies with biology. Their opinions differ however in relation to the benefits religion can bring to humankind, but this is not relevant for the argument we are trying to make.
Culture and religions evolution however differ from biological evolution in several aspects such as the way they reproduce. In contrast to what is generally known in biological evolution (even if there are new understandings on this matter since there are more knowledge on the movement of genes across taxonomic boundaries (Zhaxybayeva and Gogarten 2004; Ge et al., 2005) cultures can derivate from different ancestral species. "A given religion can borrow elements from many other religions and nonreligious traditions, but the fate of each element in competition with other elements is still a matter of cultural Evolution." (Wilson, 2011: 319)
The rules of cultural selection are not known to people. They can either be invented or inherited like genes. People have the capacity to decide their own selection rules which will guide them through the path of development they aim for themselves. But it is not said that those guide lines will work. Especially because they have to interact with guidelines of other people and relate to the motion of the whole. The outcome of such complex systems is impossible to predict. As we have seen before *change* and therefore *evolution* is unpredictable and the future is unforeseen.
"Life is complex, and our understanding is severely limited. At the end of the day, we need to try out multiple solutions, designing them as best as we can, and select the ones that work based on a careful evaluation of their consequences. We need to manage the process of cultural Evolution." (Wilson, 2011: 354)
- 34 Wilson (2011) took samples of DNA of a vast number of individuals as part of the data collection made for the studies presented in the book *The neighbourhood project*. Previously he made a study on elderly people based on DNA samples and interviews.
- 35 On the idea of 'hopeful monsters' see: Dennett (1996) and Marshall (2009).
- 36 On social and cultural evolution see also: Dawkins (2004: 133). On the evolution of religion see: Hopkins (1999) or Mindell (2006).
- 37 See also: Dawkins (1976:13).
- 38 Lane et al. (2009:28-36). Note: By *artefact* Lane implies something produced by humans for their own use. By *agents* Lane implies 'an organization of human beings and artefacts, in the name of which social action is initiated and executed'. With *attributes* is implied the characteristics which specify the identity of the agents and of the artefacts.
- 39 Because of the deep symbioses between the organisms and their environment, Marshall suggests referring to *evolution* as *adaptive emergence* (Marshall, 2009).

Chapter 4: Managing complexity, unpredictability and dynamic change

- 1 See <http://nymag.com/arts/art/features/51163/> and <http://www.allvisualarts.org/artists/hilary-berseth.aspx>
- 2 The idea of nested hierarchies is described here as a world view. In chapter 4 we will relate this world view with different scales of interventions and emergent reactions from the urban environment see p. 129
- 3 It is a fact that cities are not in equilibrium and they don't emerge necessarily to that state but it is inherent to complex system to self-organise in an attempt to achieve a certain kind of balance even if that balance does not necessarily favours the good of the system as a whole (Portugali, 2000; Batty, 2005). See: Banathy (1996) for a perspective of systems theory.
- 4 See: Valerie and Allen (1996) and Lane (2006).
- 5 Just as Wilson (2011) implies when establishing the *Evolutionary Paradigm* as a common language across all scientific fields.
- 6 This argument informed the research methodology where participants are asked to define their system of analyses as well as its most relevant subsystems.
- 7 *Inter-level generalization* is “the assumption that each of the levels of life, from cell to society, is composed of systems of the previous lower level.” All living systems “are composed of comparable carbon-hydrogen-nitrogen constituents, most importantly a score of amino acids organized into similar proteins, they all need water and oxygen to survive. They all decent from a common evolutionary rout. These are important uniformities that enable certain generalisation across levels and even across kinds of living system.” (Miller, 1978) These generalisations can help us to make predictions and identify problems even before they occur. See also <http://www.panarchy.org/miller/livingsystems.html>
- 8 Like the water striders (Wilson, 2011).
- 9 Mike Mesterton-Gibbons (Gibbons and Sherratt, 2007), attempted to shed light on the conditions in which cooperation will emerge as well as to the conditions under which individuals might form fighting coalitions.
- 10 Adam Smith (1723- 1790) when he observed the self-organising character of human organisations did not imply that humans were particularly selfish and self interested. He rather emphasised the natural human concern for others as part of human nature. Still, as we will see this empathy is related to the scale of the group where individuals operate.
- 11 Politics and Religion for example have the capacity to give a greater meaning to the lives of individuals and make them part of something larger then themselves. Nevertheless, Religion has both the power to make people cooperate and increase human segregation and aggression (Dennett, (1996); Dawkins, (2006); Dennett, (2006). Even in a rigidly structured and ethical orientated believe system such as religion, there is space for individualism and for exploitation.
- 12 Wilson suggests the following Norms:
 - “*To defy the authority of empirical evidence is to disqualify one-self as someone worthy of critical engagement in a dialog*”
(Dalai Lama, 2005: 76)
 - “*If you're undermining the commons, then you're degrading your soul*”
(Wilson, 2011: 376)

He names these norms as *ant commandment*. The first *ant commandment* is broadly used in science but is now used in politics and among people engaged with the management of public good. Furthermore, is more used in some contexts then others “the norm is more solidly established in Denmark then in America”. This commandment would establish the grounds for discussion and for scientific knowledge to engage it's know-how with actually solving real problems.

The second commandment is important once, as we have seen with the example of the world economy, emergence does not necessarily promote a common good. Self-interest can develop

in dangerous and even auto-destructive forms. Furthermore, the second commandment is important to regulate choices and stop personal interests overcome the common good.

“When we are attempting actively to make a decision, however, our decisions become the winnowing process. If we are not making decisions on behalf of the common good, then we will be generating conflict, neglect, and decay at some level of the multitier hierarchy”

(Wilson, 2012: 377)

- 13 According to Wilson, this database should include not only the genetic information of the citizens, but also their economical and social background, profession and previous professions, address and previous addresses... everything that would help build an image of each individual and his surroundings. Of course this could bring ethical problems and there would also be problems associated with the mis-use of the information, but those issues are left for others to study further. The point we would like to make is that both the city and that kind of database would work as an input of information. This information could then be processed either to monitor the city's development or support a new direction of growth. As the immune system parable suggested us, to address any problem or even to avoid it in the first place we need to understand it in order to make the appropriate decisions. To understand a situation or a context we need as much information as possible.
- 14 See chapter 5 p.160 for more information about EIMS' models.
- 15 See Chapter 4
- 16 Legal and social control, for example, has to exist even if it is to avoid stealing and the destruction of the neighbour's front door. Furthermore, top-down social control can deal with issues like segregation, poverty, crime, urban sprawl, etc.
- 17 These aspects of city planning shaped our exploratory models which were used as the research methodology. See chapter 5 p.160
- 18 Adaptive management is based on the feedback learning from the environment. It aims to respond adequately to the feedback of the environment rather than blocking it. It relates uncertainty and unpredictability with ecosystems. Therefore, it emphasises the relevance of a management system as a process parallel to ecological cycles. It is designed to improve based on a trial and error approach. Relating adaptive management with the kind of management suggested in this research could be an interesting topic for further research a future paper. For a better understanding on adaptive management see: Berkes et al., (2000).
- 19 Ijburg islands, in Amsterdam can be seen as an example of such approach of planning. See <http://globalsiteplans.com/environmental-design/ijburg-amsterdam-innovative-neighborhood-on-artificial-islands/>
- 20 See the Italian example. <http://mostlyeconomics.wordpress.com/2013/02/27/decentralisation-gone-wrong-in-italy/>

Chapter 5: Categorising Interventions

1. Stafford Beer (1983) in his article *The will of the people* applies cybernetics to the understanding of social systems. In this article he shows how feedback reactions of the system can take over the system but not always in desirable ways.
2. To read more about adaptive governance in relation to *the intervention management system* see chapter 3, p.100.
3. To read more about what we consider being genuine public participation see chapter 3 p. 108 *Dissolve decision-making*.
4. See: Morgan (2008: 18). The letter written in February 1804 by the provost Thomas Leys was a key intervention responsible for the fine character of Union Street today.
5. We used this example because Aberdeen is the urban context of these studies. The example is only used to make a point on the connection between contextual action and emergent contextual reactions.
6. See page 96 of this thesis.
7. Interventions design and selected with an intention to trigger or direct change
8. See: <http://www.britannica.com>

9. See also: Ihde (1990).
10. See table 4, p.178.
11. The Natural and artificial city were the theme of chapter 2. "Urban emergence" is explored in chapter 3 from the perspective of complexity and evolutionary theory.
12. Associations such as EDRA (The Environmental Design Research Association) and IAPS (International association People-Environment Studies) are of key importance in this topic. For both associations the symbiotic relationship between humans and their environment is central to research efforts. See <http://www.edra.org/> and <http://www.iaps-association.org/>
13. See chapter 3, p.85 for *Design* and p. For *Artificial Selection* see p.84
14. Loorbach (2007) studies change from the perspective of *Transition Management*. The models used in his work were valuable for the design of this research's explorative models.
15. The word *Insurgencies* has a wide meaning. Some writers mean just protests or movements against the state. Others, like John Friedmann (2011), would include projects for alternative life-spaces that go against prevailing structures of power. In light of this emerged the idea of *insurgent planning* such approach privileges bottom-up interventions such as e.g., occupying abandoned land to grow food for social rather than market consumption. This was the theme of the conference organised by the Asian Research institute (ARI) on the 3rd and 4th of May 2012 (Global Insurgencies. Remaking the public city in Asia). There is key literature on this theme which was not included in the literature review presented in this thesis. Relevant books on the theme of insurgent planning and insurgencies are: Castells (1983); Lefebvre (1991); Holston (1998); Purcell (2002); Mitchell (2003); Purcell (2003); Harvey (2008); Marcuse (2009); Miraftab (2009); Sweet and Chakars (2010); Harvey (2012).
16. One problem arises when top-down visions focused on the self. In light of this Marshall (2009) suggests that planning also should have the responsibility of identifying the decision making protagonists and taking into account the influence they can have in the decision-making process. In other words, urban management should have the responsibility to reveal if the urban vision is social based or individual based. '*It is not just a matter of having a vision, but taking care with who's vision, and for whose benefit.*' As we will see from study 1 findings, this is possibly the most challenging aspect of the decision makers' and planners' roles, once as individuals they cannot be detached from a personal perspective of the world and personal relations. Therefore, their appreciations are always subjective. The influence of decision-makers and practitioners is merged with the process of planning and should be regarded as such.
17. As argued in chapter 3, in the context of the research exploration for a new kind of planning (see p. p. 92), we suggest nurturing the self by nurturing and encourage bottom-up interventions in the city. In other words, we argue that the self should be nurtured by the respect for the emergent character of the system.
18. Interventions such as war can also be considered top-down intentional interventions. Such interventions imply destructive actions and from the perspective of the higher levels of the system they emerge from competition rather than cooperation. In addition, there are obvious questions regarding the both the good of both the higher and lower levels of the system. In light of this, in general terms, they should not be considered as appropriate options, regardless of the fact that they sure make part of humankind's evolutionary process. Such interventions should also be considered under a contextual and ethical analysis of the subject. This would require a vast literature review which was not the focus of this thesis.
19. For more information on *insurgent planning* and *insurgencies* see note 15. To illustrate examples of insurgent action from the perspective of the tension between top-up and bottom-down forces, see the case of the UTG in Aberdeen <http://www.youtube.com/watch?v=G4OzzPwFFDQ> and of Ha Noi: <http://www.youtube.com/watch?v=-lvnXU3Epp0>. Both cases illustrate the tension between private top-down forces allied with governmental ones against the civil bottom-up aims and needs.
20. There are several explorations on new strategies to empower bottom-up interventions and give them more protagonism in the urban evolutionary path. Namely the ones suggested by Portugali (2012) and by Marshall (2012), both following the findings which emerged from complexity theory in the study of cities. There are also relevant studies on insurgent planning,

which open doors for the consideration of alternative bottom-up kinds of urban planning (Friedmann, 1997; 2011). See note 15 of this chapter.

21. Figure 9 diagram was presented at a conference on held on the 8th and 9th of March 2012 at ARI - Singapore. The paper presented by Terry G. McGee was entitled as *The role of Translocal and Intercity Networks in the Development process: Resolving the contradictions of Mega-Urban Development in Southeast Asia*
22. Such a diagram could inform the models explored in chapter 5.
23. In chapter 5 p.154 we will use an exploratory model to relate interventions in the urban environment with the other areas of interventions which are relevant to describe social complex systems.
24. See chapter 3 p. 59
25. The generative elements or the self-similar aspects of a complex system are those which repeat themselves over and over again through long periods of time. These are the elements from which a complex system emerges and self-organises (Batty, 1994; Portugali, 1997; Portugali, 2000; Batty, 2005).
26. Marshall (2009:194) refers to the notion of probability in emergent cities to demonstrate how and why certain outcomes in urban morphology or some urban patterns are more probable than others. *'That is, although a situation may be random, this does not mean that all outcomes are equal likely – a natural level playing field of probability. Rather, there is a varying landscape probability, in which some outcomes are more likely than others.'* For example, Marshall demonstrates that the emergent city is likely to be more irregular and heterogeneous rather than regular as the 'planned city. *'What makes a given structure unlikely is that only a few paths lead to it... A regular structure is unlikely not because it is regular as such, but because to create the regularity one must not deviate from a given path, or limited set of paths.'* According to Marshall, the unlikeliness of a given structure is also related to how tightly it is defined. E.g. it is more likely that a city pattern is based on an orthogonal grid rather than a hexagonal pattern. Still, if the units which generated the pattern are hexagonal, the hexagonal urban pattern would be likely Marshall (2009:200, 207) ; (Stedman, 2006). Those considerations on probability are important to justify the application of complexity sciences and cellular automata programs to the study of cities and as a tool to support urban planning and urban management. Computer models, regardless of how accurate then can be, they cannot replace reality nor dictate the path of development of a city, but they can be of great importance to acknowledge the range of probable urban development paths and to analyse the most probable consequences of an action in the urban structure.
27. Just like the example of Aberdeen (Morgan, 2008).
28. See chapter 3, p. 60.
29. See chapter 3, p. 60.
30. On the relation between the complexity of human perception in relation to the ways we organise to optimise human development, see: Lane et al. (2009); On human perceptions in relation to human condition and to the environment see: Ponty (1962).
31. See chapter 3. Human actions as adaptations to the environment p.66
32. We used Alexander's work to define the concept of artificial and natural city see chapter 2; we used his vision of the world to reinforce the relevance for a holistic study of things and the need for a serious study of human actions. In addition, in chapter 4 we used his work to define interventions of events and of space.
33. IAF will be the heart of our *Exploratory Intervention Management System (EIMS)*. See chapter 5, p.160.
34. There are explorations on how to translate these basic elements in software designs to support the design of more appropriate interventions. See: Salingaros (2000; 2005).
35. Examples of man who change the way we see and act on the environment are people such as Nelson Mandela, Winston Churchill, Bill Gates, Elvis Presley, Charles Darwin, Sir Isaac Newton and so many others; Examples of buildings which influence the dynamics of a country and the ways we build are the pyramids in Egypt, Eiffel Tower in Paris, the Guggenheim Museum in new York or in Bilbao and so many others.
36. For Alexander, human survival depends on the research and good application of insides from generative methodologies which need further study in all fields of science (Alexander, 2006).

37. Exxon, Shell, Microsoft, BP or Philips as the majority of global private companies have a great influence in countries as well as in the world economy.
38. The example of this intervention was suggested by one of the participants in study 2 (Sue Keating) . See also <http://www.hsme.co.uk/>
39. More studies based on such a framework can help to inform us about the relationship between kinds and scales of intervention, areas of intervention and the scale and nature of their impact on urban systems. In other words, the categorisation of interventions establishes a framework to study them and to address the questions such as: How can we design and select strategic interventions more efficiently? And how can an adequate management of interventions be reflected on a more efficient management of urban change?
This research explored and tested a framework to address this first question. Nevertheless, further tests must be done to relate our finding with innovative management systems, with institutionalised kinds of governance (Termeer et al., 2010) and with our explorations made in Chapter 3.

Chapter 6: The Exploratory Intervention management system (The EIMS)

- 1 There are several models that attempt to represent the different levels of complexity of a system in relation to the environment. These models were developed to address different kinds of complex systems (Jacobson and Wilensky, 2006; Leiba et al., 2012) and emerged from different research's needs. Previous research detected several difficulties or challenges in using some of these models as a tool to understand complex system's behaviour (Jacobson, 2001; Hmelo-Silver and Pfeffer, 2004; Assaraf and N 2005). Following the findings above, several models have been explored and combined in an attempt to understand urban system's dynamics and development from the perspective of human actions.
 - SPCity models emerged from a view of the city similar to the EIMS models and aimed to address similar problems (Portugali, 2012). Because of this the SPCity models helped give validity and structure to the EIMS models. Nevertheless, their objectives are rather different; among other things SPCity models were designed as a tool to support organisations of institutionalised systems and we focused on the individual as the basic element of society and organisations.
 - Geels and Kemp (2000; 2005) use a multilevel model to study transitions (which they defined as system innovations) from one socio-technical system to another. One reason to compare the multilevel model with the EIMS basic model is the fact that the multilevel model was largely used in studies on sustainability; a key concern in our research (Ehrenfeld, 2008). Geels and Kemp's multilevel model is particularly relevant for this research because it can summarise concepts of holism (Bortoft, 2010) as well as the idea of nested hierarchies as the structural organisation of social complex system (Alexander, 1977; Miller, 1978). Geels and Kemp's multilevel model inspired the methodology to operate the EIMS models.
 - One challenge transition management studies faced when using the multilevel model is related to the fact that transitions are a very complex and non-linear process. Change does not happen necessarily as the sequence of the steps represented by the multilevel model. Change comes back and forward and it continuously shapes all different levels of the system. Another key challenge transition management studies faced when using Geels and Kemp's multilevel model was the fact that it did not consider factors outside the system (The Macro System). In light of these two arguments Loorbach (2007) introduced the Multi Layer Perceptions model or the MPL model which is also based on nested hierarchies, yet is arguably more flexible and dynamic. The MPL model was of key importance to trigger the need to search for a model as a standard framework still adaptable to all context, needs and circumstances.

- The SCENE-model was used within transition management (Loorbach, 2007) to characterise the systems in analysis. The main relevance of this model is the fact that it gives space to characterise complex systems and sustainable development both from an objective and subjective perspective; both from qualitative and quantitative qualities of a system. Furthermore, the structure of SCENE model gives it flexibility to be applied in every context even if the representation of the model stays the same. This is relevant to compare and cross information. In addition, SCENE model can easily be used as a tool for participatory use.
 - Hodgson (2011) used the The World System Model to frame a complex and holistic perspective of social systems in a simple and pragmatic way. As EIMS models The World System Model aim to be used by everyone who aims to explore whole complex systems. As with EIMS models it was used as a framework and the methodology in a relevant study named as The IFF World Game. The World System Model helped design and contextualise the heart and focus of the EIMS models.
- 2 The most significant studies for this research's theoretical background, research methods and methodology were:
- The neighbourhood project (Wilson, 2011), namely the Design Your Own Park Competition, which used evolutionary theory to link space which human adaptations. In this study a broad spectrum of people were asked to suggest designs for a neighbourhood park. The facilitation process and the selection criteria were inspired in Lin Ostrom's work (1990). This experiment was effective in providing the structure and the necessary ingredients for people to self-organise and manage their commons effectively. In addition, this study proved that when we change an environment we change human behaviour.
 - The City Games is a case study based on complexity science's urban theory and was inspired on Portugali's City Game SIRM (Portugali, 1996). With this study, Tan (2012) aimed to find out when, how and what kind of different design orders and design rules emerge spontaneously from the interaction of a small group of people. The participants were asked to brainstorm for innovative strategies and interventions in the built environment around a 3D model of their city. The study aimed to test the applicability of the city-games as a design tool. We argue that the projects which emerge from the city games' workshops, due to their complex and emergent nature have probably more potential to serve adequately human life than one the ones which emerge from a single mind. Nevertheless, the basic problem remains; when such large scale projects are implemented as one single urban intervention there is a risk of posing problems for human adaptation.
 - Hodgson's (2011) game is significant for this research in three ways.
 - a) It contributed for the contextualisation of EIMS models in the context of whole systems adapted for an everyday life use.
 - b) It confirmed the relevance of a shared vision to stimulate people to work towards a common good.
 - c) It encouraged the use of EIMS as a framework used in the research's methodology. These issues are relevant for this research because they help justifying the research methodology and they echo the findings of the research's literature review. In addition, the model used in the studies was relevant for the design of the EIMS models.
 - There is expansive literature on the relevance of whole systems theory to support design. The most relevant theories, principles and practices were magnificently synthesised in the work of Blizzard and Klotz (2012). This work took the form of a methodological review of the literature available on the subject and was synthesised in the shape of a framework. This framework is composed of 20 elements, categories and processes principles and methods. As the norms suggested by Elionor Ostrom (1990) on how to facilitate cooperative human behaviour, Blizzard and Klotz's syntheses of processes, principals and methods can facilitate sustainable designs to emerge. Such a framework could be used to guide design process and conceptualisation towards the creations of meaningful and efficient top-down interventions; it might represent a way

for humans to break through what Wilson (2009) call the rigid flexibility and help us imagine the imaginable.

The whole system's framework was relevant for this research because it informed the design of EIMS models as well as the methodology to use them. In addition, it helped identify general characteristics sustainable designs and therefore it helped defining sustainable interventions. Finally, it played a vital role defining the methodology used in study 3.

- Transition management (Loorbach, 2007) focused on nursing the transition of organisations and institution from the “old way of doing things” to a more innovative and sustainable way of thinking and performing. The research on Transition Management is based on case studies and it is continuously being tested and developed. Still it is an inspiring work which shares relevant common purposes with this research, such as:
 - a) To address problems of complexity from their basis.
 - b) To link theory with practice.
 - c) To explore the connection between short-term action and long-term intentions.
 - d) To explore the conceptualisation of a vision as a framework to select and design intervention.
 - e) To explore the relation between long-term intentions or visions with notions of sustainable development.
 - f) To explore the relevance of micro-interventions in the process of nudging dynamic change.

The studies on transition management were relevant because they helped to position this thesis in a broader research context of management of change. Furthermore, transition management's findings reinforced key concepts and ideas that emerged from the literature review and from our pilot studies; namely the idea of manipulating change in complex systems by using small-scale interventions.

- 3 See analogy between Hodgson's model and EIMS in note 4.
- 4 See chapter 3 p. 93 for a notion of nested hierarchies from a perspective of social organisation. See chapter 4 p. 135 for a notion of nested hierarchies from a perspective of interventions.
- 5 The EIMS were designed to help defining cross levels and hierarchies of governance relevant to address a given problem (Termeer et al., 2010).
- 6 See chapter 4 p.113 for a more in-depth description of interventions as actions and as reactions of the emergent nature of complex urban systems.
- 7 For a better understanding of the kind of management suggested by this research see chapter 3 p. 92- 110.
- 8 Such as suggested by study's 3 findings.
- 9 As suggested by study 1's findings.

Chapter 7: Research methodology

- 1 See: Packer (2010: 164-166).
- 2 On *radical realism* see: Packer (2010: 203) and table on p.206.

Chapter 8: Studies 1, 2 and 3

- 1 For more information about the EIMS' models see chapter 5 p.160.
- 2 For more information about the *micro intervention system* (MIS) see chapter 6 p.192.
- 3 For an historical description of Aberdeen, from the perspective of Union Street and therefore from the perspective of interventions in the built environment, see: Morgan (2008). See also:

http://www.andyweightman.com/docs/UTG_AWreport_FINAL.pdf

<http://mcjazz.f2s.com/RailwayHistory.htm>

<http://en.wikipedia.org/wiki/Aberdeen>

<http://www.aberdeencity.gov.uk/home/home.asp>

- 4 Today, Union Terrace Gardens are a one-hectare public park which is open all year long; they are much smaller than when they were open in 1879. The gardens are situated half way along Union Street right in the heart of Aberdeen. Actually, we can say that the Union Terrace Gardens are the heart of Aberdeen. Normally the heart of a city is marked by a square, a church, or the civic building of the city. In contrast, Aberdeen's centre is not a place of encounter, a place to stop, a place to connect with the spirituality or with civic duties. The city centre of Aberdeen is *Union Street*³; a place to walk, to move. The buildings related to it are mostly retail and housing. Besides the graveyard of Saint Nicolas church, *Union Terrace Gardens* are the only place to “stay” or to stop related to *Union Street*.

Today the garden is surrounded by some of the most relevant architectonic buildings of Aberdeen city centre; His Majesty's Theatre, St Mark's Church and the Library on Rosemount Viaduct to the north, and the Triple Kirks to the east.

Union Terrace Garden is limited to the north by Rosemount Viaduct, to the south by Union Street, Aberdeen's main thoroughfare, to the east by the railway and Denburn Road, and to the west by Union Terrace.

On the west side the gardens are characterised by the arches situated under Union Terrace. The arches were design by James Matthews' with the intention to turn the park into a pleasure area. They were placed along the length of the gardens and are one of the special features that define the character of the whole site.

Contrary to popular belief, the north side of the garden is in fact not a natural the amphitheatre. It is the covered remains Denburn Terrace which was reduced to rubble when the Victorian Viaduct was built in 1888.

This slope is the elected place for people to sit. It has no trees blocking the sun and it is protected by the wind. Besides that, it gives one a beautiful view over the length of the gardens.

The north side of the gardens are limited by the viaduct which substituted the pedestrian bridge which was part of the original design of the gardens. Denburn Viaduct (1867) became the Rosemount Viaduct in 1886 and it is the north end of the gardens today.

On the east side, as a background to the rail way, are the back facades of Belmont Street's buildings.



Figure 72: Image of Denburn Road taken from the Union Bridge.

The back sides of the houses of Belmont Street emerge from the ground. These constructions step down the slope of the Denburn; they connect the difference in level between the front and the back side of Belmont Street. In other words, the volumes are displaced and shaped in such a way that they stretch in height and relate both to where the railway was built and the bottom level of the gardens as well as to the much higher level of Belmont Street, which smoothly relates to Union Street through a gentle slope. These houses are reasonably small scale and picturesque constructions. They do not form a continuous and compact facade. They are, in fact, rather permeable and offer several narrow alleys that physically connect the back and the front sides of Belmont Street.

A key feature of the east “facade” of the gardens is The Triple Kirks which was a church designed by Archibald Simpson in 1843 to commemorate the conflict between church government and Spiritual independence. Today some of these constructions are abandoned and others are bars or restaurants mostly related to Belmont Street. This gives the east facade of the gardens a rather nostalgic and abandoned character.

The railway is still functioning but it is rather discreet when compared with the impact of the oversized Denburn Road.

The south side of Union Terrace Gardens is characterised by Union Street and Union Bridge (1801).

- 5 See <http://www.friendsofutg.co.uk/>
- 6 See the study made by RGU in 2006 entitled Urban Connections (Aberdeen City Growth)
- 7 See <http://www.thecitygardenproject.co.uk/>
- 8 See <http://www.brisacgonzalez.com/projects/pva/pva01.html> and <http://www.peacockvisualarts.com/files/NEW%20BUILDING/InformationLeaflet.pdf>
- 9 There are other topics of discussion, which emerged from crossing information gathered in study 1 and 2. In light of this, topics such as the relation between power and big scale interventions will be addressed further in the text, when the reader is familiar with study’s 2 findings.
- 10 See the questionnaire used to collect data in appendix 3.
- 11 See the assignment used to collect data in appendix 4.
- 12 Acuto (2010) explains how Dubai was built on the basis of such objective.
- 13 Using the UTG to bring in people in the city contradicts political strategies such as the creation of out skirt business centres and new university campus.
- 14 See, chapter 3 for an evolutionary perspective on the subject.
- 15 Emile Durkheim (1984) refers to the fact that global icons are significant only when they are recognised as such by the symbolic meaning understood by as many people as possible; they should relate to what Gregory (1994) addresses as imaginative geographies. King (2004) explored common signs and functions related to global icons of modernity. Bourdieu (1991) explored the relation between Language & Symbolic Power.
- 16 See note 4 and 5 from chapter 5.
- 17 To see more about the relevance of architecture and design in urban development see: http://livabilitylaw.com/archives/7887_
http://www.metropolismag.com/pov/20111129/frontiers-of-design-science-biophilia_
<http://www.metropolismag.com/pov/20120330/science-for-designers-the-meaning-of-complexity>
- 18 We have related the themes of focus of the students with the detailed description of the tutors’ remarks given just before the final presentation (This report was used as the student’s basis for the completion of the project). Based on this comparison we can suggest that tutors influence directly the students’ priorities. Nevertheless, more research should be done to support this statement.

Chapter 9: Study 4

- 1 After the second world war, Singapore became part of Malaysia. In 9th August 1965 Singapore became independent due to large political, economic and ethnical differences between the two countries, especially the fact that the large Chinese population prove too daunting for the Malaysian government to establish its National identity. In 1950 Singapore had a population of over one million people from which 75.4% were Chinese, 13.6% were Malay and 8.6% were Indian. Today, Singapore is a developed country with a population over 5.6 million people. With no natural resources, it was discipline and a strong political power that led Singapore to develop and grow the city state it is today. Lee Kuan Yew was the father of modern Singapore who's vision of political and economic state, education and national security prevail until today (Lew. 2000).

The education system in Singapore is known for its reputation of excellence. For some it represents an education model for the world. Others question how the system advances and supports the country's founding principles of meritocracy and equality of opportunity. There are also questions about academic freedom and the focus on academic results rather than on innovation, creativity and the qualitative process of learning (King. 2016).

Chapter 10: Research's conclusion and discussion

- 1 See: <https://www.mauromoro.net/mydesignprocess>

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Appendices

Appendix 1

Categorisation of interventions according to their size (Table)

Examples of interventions in the building environment according to their size. Relating hierarchies of <i>Patterns of Space</i> with hierarchies of <i>social organization</i> and hierarchies of <i>interventions in the building environment</i> .										
Hierarchy of organisational levels of urban and social systems. E.g. The research study's environment.	<u>Level 1:</u> World	<u>Level 2</u> Continent E.g. Europe	<u>Level 3</u> Country E.g. UK	<u>Level 4</u> Region E.g. Scotland	<u>Level 5</u> Province E.g. Aberdeenshire	<u>Level 6</u> City E.g. Aberdeen	<u>Level 7</u> Neighbourhood E.g. city centre	<u>Level 8</u> A place E.g. UTG	<u>Level 9:</u> Object E.g. The arcade system	<u>Level 10:</u> The unit/ The element. E.g. The public benches
Patterns organised as intervention areas of focus. (IAF)	<u>Macro Systems of Interventions</u>				<u>Macro Interventions</u> <u>Urban planning and urban design.</u>			<u>Architecture</u>	<u>Micro Interventions</u> <u>Design</u>	
IAF 1 - Access to water, food, energy, learning, health, a house, work and nature.	Interventions in the urban environment from the scale of the world, the continent, the country and even the region tend to be interventions of a lower level applied in a system. They can also be architectural icons such as the Eiffel Tower or the opera house in Sydney.				IAF 1 - Access to: - Water: a dam - Food: farm for agriculture, cattle farming - Energy: a nuclear station, Wind farm, a dam. - Learning: centres of exchange of good and knowledge between the urban areas and the countryside. - Health: hospitals - A place to live: housing areas. - A place to work: office areas, factories, a harbour, land	IAF 1 - Access to: - Water: a lack - Food: urban plantations - Energy: a power station. - Learning: cultural centres, university centres, research centres. - Health: hospitals. - A place to live: housing areas. - A place to work: office areas, factories, a harbour	IAF 1 - Access to: - Water: a lack - Food: shopping areas - Energy: local sources of energy - Learning: museums, schools, universities. - Health: hospitals. - A place to live: house. - A place to work: office buildings, a factory, shops	AF 1 - Access to: - Water: a public swimming pool - Food: one shopping street - Energy: local sources of energy - Learning: one museum, one university - Health: one hospital -- a place to live: housing buildings - A place to work: the office buildings, shops	AF 1 - Access to: - Water: a water tower - Food: one market, a supermarket - Energy: a wind mill, - Learning: a school. - Health: a health centre - A place to live: a house. - A place to work: an office	AF 1 - Access to: - Water: a fountain - Food: one market tent. - Energy: a solar panel - Learning: one information board. - Health: one emergency office. - A place to live: a room, a bed - A place to work: a desk
IAF 2 - Relationship between nature and urban environment.					IAF 2 - Access to: - Nature: natural reserves, preserved natural areas	IAF 2 - Access to: - Nature: a city park	IAF 2 - Access to: - Nature: a garden	IAF 2 - Access to: - Nature: a garden; an urban open space	IAF 2 - Access to: - Nature: an area in a garden	IAF 2 - Access to: - Nature: a tree

<p>IAF 3 - Relations within and between the same and different levels of social organization, in terms of trade, knowledge and culture.</p>				<p>IAF 3, 4 and 5: - A place to trade: local markets and "urban markets", shopping areas. - A place to meet and have fun: Sports complexes, entertainment areas - A place to pray: sacred areas. - A place for every age group: community centres</p>	<p>IAF 3, 4 and 5: - A place to trade: markets, shopping areas - A place to meet and have fun: sports complexes, entertainment areas - A place to pray: sacred areas. -A place for every age group: squares, community centres</p>	<p>IAF 3, 4 and 5: - A place to trade: markets, big supermarkets. - A place to meet and have fun: stadium, a public swimming-pool, café, restaurant, bar disco. - A place to pray: a church. - A place for every age group: squares, community centres</p>	<p>IAF 3, 4 and 5: - A place to trade: a market, a supermarket. - A place to meet and have fun: stadium, a public swimming-pool, - A place to pray: a church - A place for every age group: squares, community centres</p>	<p>IAF 3, 4 and 5: - A place to trade: a shop, market, a supermarket - A place to meet and have fun: a restaurant, a disco, a bar - A place to pray: a church. - A place for every age group: a square</p>	<p>IAF 3, 4 and 5: - A place to trade: market a stand. - A place to meet and have fun: a public bench, a door step, the pedestrian sidewalk - A place to pray: an alter in a church - A place for every age group: a playground, a table to play cards</p>
<p>IAF 4 - Distribution of wealth and kinds of goods; the balance between developed and undeveloped levels of social organisation (E.g. countries) within and across natural, political, economical or social boundaries (E.g. continents)</p>									
<p>IAF 5 - Distribution of cultures and religions within and across levels of social organisation.</p>									
<p>IAF 6 - Communication and transportation Networks within and across levels of social organisation.</p>				<p>IAF 6 - Access to: -Networks: roads, public transport</p>	<p>IAF 6 - Access to: -Networks: roads, public transport</p>	<p>IAF 6 - Access to: -Networks: roads, public transport, bicycle paths</p>	<p>IAF 6 - Access to: - Networks: a street, bicycle paths</p>	<p>IAF 6 - Access to: - Networks: a street, bicycle paths</p>	<p>IAF 6 - Access to: - Networks: the street with comfortable pedestrian sidewalks</p>
<p>IAF 7 - The magic and the character of each place;</p>	<p>IAF 7: Relates to what is unique; to the unique way</p>	<p>Relates to the unique way people perceive and enjoy the</p>	<p>Relates to culture and tradition and to the way that is</p>						

within each levels of social organisation.	people express themselves in relation to one another and the environment.	world around them	expressed in human actions of all levels and kinds.							
IAF 8 - Relationship between the place one lives and the place one works.	IAF 8: Relates to the global markets and the use of plains	Related to human quality of life and with ecological behaviour	IAF 8: Relates to the organisation of the overall urban structure.	Relates to the use of car and public transport	Relates to the place of one function in relation to the other as well as in relation to the whole.	IAF 8: Working within walking distance from one's home. Optimal distance	IAF 8: Working across the street from where one lives. Optimal distance	IAF 8: Living and working in the same building Optimal distance	N.A	
Examples of patterns in: <i>A Pattern Language</i> (Alexander 1977)					Pattern 1 until Pattern 20 (p.10,p.112)	Pattern 3 until Pattern 74 (p.21,p.374)	Pattern 8 until Pattern 94 (p.41,p.466)	Pattern 21 until Pattern 94 (p.114,p.466)	Pattern 75 until Pattern 253 (p.114,p.466)	Pattern 75 until Pattern 253 (p.114,p.466)

Table 4: Categorisation of interventions according to their size. This categorisation is based on the theory of nested hierarchies and relates interventions with Alexander's patterns of space (Alexander 1977) and levels of social organisation.

Notes:

- Each pattern must be considered both in relation to one another within the same hierarchical level as well as across all hierarchical levels.
- Each of the examples given can be placed under different IAF's: a harbour can be either seen as a place to work or as a place of trade. Appropriate Interventions are contextual. The way we look at them has to reflect the unique needs and character of the place.

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Appendix 2

Table of the interventions suggested by the *micro-interventions* system project for the *Union Terrace Gardens* in Aberdeen

Interventions	Problems to address			
	1) Urban connectivity		2) Bringing human life to the UTG	
Description	Establish continuity within the different urban levels	Connect the two urban levels.	Promote seasonal social activity	Promote everyday life activity
<p>1- Open the gates:</p> <p>a) Open the existing gates on Belmont Street.</p> <p>b) Build a generous staircase connecting Schoohill with the lower areas of Denburn Road.</p> <p>Facilitate the public access to the back side of Belmont street.</p>		*		*
<p>2- Make the empty spaces liveable:</p> <p>Recover the empty areas facing the Denburn valley. Those areas have a wonderful view over the gardens, they have sun until late afternoon and they are protected from the winds. They are the perfect place for a drink after work. Even in winter.</p>		*		*

<p>These empty areas can be easily connected with the amenities of Belmont Street such as bars and shops. One option would be to stimulate the owners of Belmont Street to recover and use those areas.</p> <p>The terraces will themselves connect Belmont Street with Denburn Road.</p>				
<p>3- Use ground-floors to bring life to the street.</p> <p>The ground floors facing the Denburn Road should be used with public functions. If they are private property and their owners are not interested in exploring their use, they should be sold or made public. These ground-floors should be occupied with functions such as small scale shops, artist galleries and workshops, small cafés, small music schools, restaurants... They could be related with the functions on Belmont Street or not. In any case they would always relate to Denburn valley and the gardens.</p>		*		*
<p>4- Redraw the section of Denburn Road.</p> <p>Denburn Road is over dimensioned taking into consideration the traffic that uses it and the fact that this four-lane fast road ends in a round-about. Transforming these four lanes into two would allow the pedestrian sidewalk related to Denburn ground floors to be made wider. The pedestrian sidewalk should not only be made wider, but should also be populated with trees and public benches. This intervention would stimulate the pedestrian use of the lower city and would bring life to the abandoned and neglected “Old</p>	*	*		*

Aberdeen”.				
<p>5- Make a bridge.</p> <p>Make a pedestrian bridge from one of these new small squares to the gardens. This intervention would help to connect higher and lower Aberdeen not only stimulating people to go to the gardens but also to the amenities placed there (Intervention 5). It would make the gardens an extension of the new squares facing Belmont valley. One could have lunch on a terrace watching their children playing on the other side of the bridge.</p>		*		*
<p>6- Support everyday life at the UTG:</p> <p>Populate the gardens with two or three small kiosks. One could sell newspapers and others could sell coffee, beer or ice cream. One could be the tourist and culture information centre of the city. This intervention connected with the bridge could invite people to populate the gardens as part of their everyday life. Furthermore, these kiosks could be used to support other kinds of seasonal events.</p>		*	*	*
<p>7- Use the arcades.</p> <p>The space under the arcades should be used to support life at the gardens.</p> <p>The use of this space could be a challenge due to the fact that it is relatively narrow to support a lot of functions, still there are plenty of things we can imagine happening under the arcades which would stimulate life at the</p>		*	*	*

<p>gardens. This would be an interesting assignment to give to architectural students which would generate several new suggestions.</p> <p>In any case this area could be used in connection with the functions situated in Union Terrace or independently.</p> <p>It could just be a nicer place to sit and have a coffee or read a book or it could be a place one could by a coffee or a souvenir or could even serve to exhibit art or goods...</p>				
<p>8- Break the walls.</p> <p>Segments of the wall which define the “natural amphitheatre” of the garden should be open. This intervention should be made together with intervention 9, and 10. Their main purpose would be to connect the library and the <i>His Majesty’s Theatre</i> with the gardens.</p>		*		*
<p>9- Erase a road.</p> <p>Erase the small road which connects Union Terrace to the Rosemont Viaduct and School Hill and make it part of Union Terrace Gardens.</p>		*	*	*
<p>10- Reduce traffic.</p> <p>Slightly elevate Rosemont Road from the crossing of the library onwards. This would reduce the speed of the traffic and would give a much more human character to the city centre as a whole.</p>		*	*	*

<p>Furthermore, along with intervention 8 and 9 this would relate the library and the <i>His Majesty's Theatre</i> with the gardens. These strategies would make the garden the open space of these key buildings in Aberdeen city. People would use them while waiting for a concert or reading a book.</p>				
<p>11- Connect the green.</p> <p>Redesign the back side of the extension of the <i>His Majesty's Theatre</i> and connect it with the gate under Rosemont Viaduct and the UTG. Make it an extension of the green.</p> <p>This would help connecting the lower city and bring people from health care facilities such as the <i>Denburn</i> clinic and the <i>Woolmanhill</i> hospital to experience the healing effects of Nature.</p>	*	*		*
<p>12- Redesign the amphitheatre.</p> <p>This is the sunniest place of the gardens and it is related to an open field in front of it. Let people sit and enjoy the sun and the events happening in the valley. Build granite benches such as in the Greek amphitheatres. People would use them both as a place to sit as well as generous stairs inviting one to the valley. This intervention will reinforce interventions 8, 9 and 10</p>		*	*	*
<p>13- Make it ready for everything.</p>				

<p>Implement a <u>discreet</u> modular structure on the grass-field adjacent to the amphitheatre. Such a structure would be able to support light constructions which could be used to make a stage, a market, a covered open space for any kind of special event such as a concert or skating rink, a public gathering...</p>		*	*	*
<p>14- Recover the existing public toilets.</p>			*	*
<p>15- Make a lift. A lift on the crossing between Union Street and the Union Terraces would be of key relevance to connect all segregated parts of the city centre.</p>		*	*	*
<p>16- New bus stops. Create new bus stops on Dunburn Road. This would help populate the street and connect the two urban levels.</p>		*		*

Table 10: Table of interventions suggested by the MIS project and the intentions behind them.

Appendix 3

Questionnaire- Study 2

Two strategies for the Union Terrace Gardens in Aberdeen: *The micro-project system (MIS) / The city square (CS):*

Possible interventions:

- a) (MIS) Several micro urban interventions.
- b) (US) One big scale urban intervention.

General questions: Answers should be a), b) or “I don’t know”

- 1- Which would be more expensive?
- 2- Which would be faster to implement?
- 3- Which would be more difficult to implement?
 - Regarding the management of private and public property.
 - Regarding building complexity.
- 4- Which would attract more people to the centre/gardens?
- 5- Which would give more character to the city?
- 6- Which would be easier to replace/modify in the event of failure?

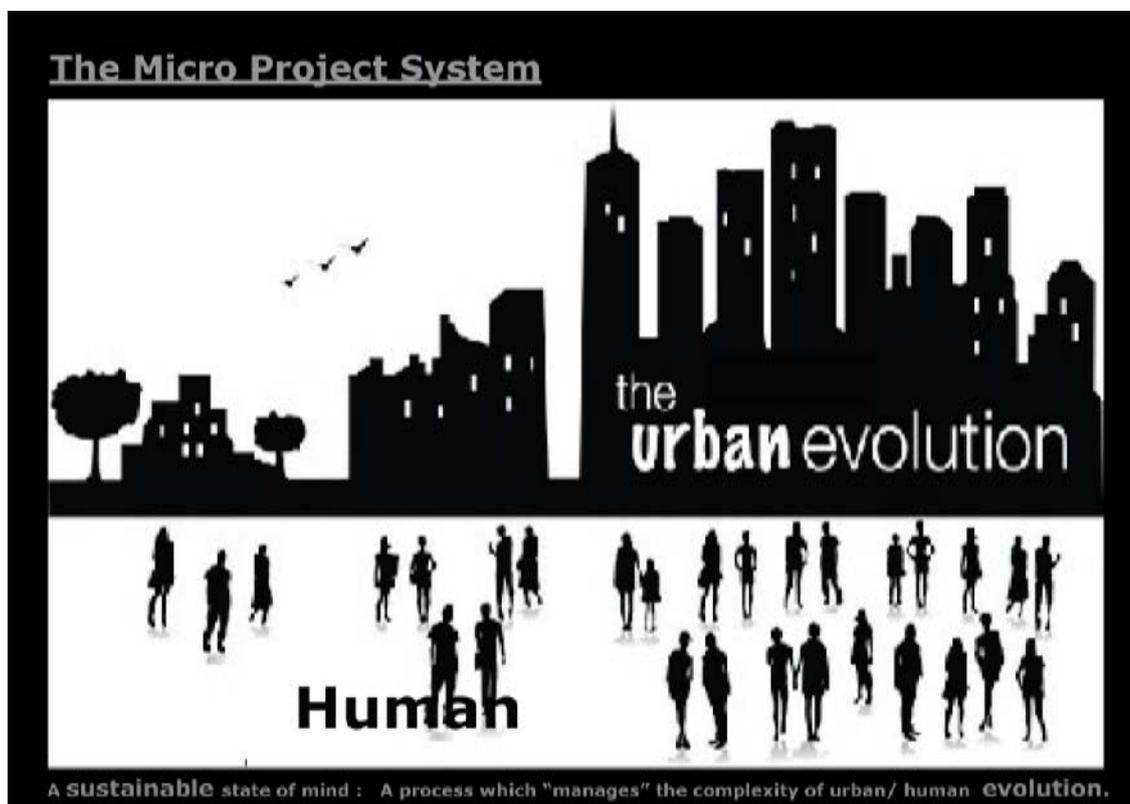
Specific questions for a) and b): Write down the main points.

- 1- What are the possible consequences for society?
- 2- What are the possible consequences for the city?

Members of the group: Names, year and field of study, previous study.

Appendix 4

Written assignment - Study 2



The Micro Project System

Micro versus Macro. Activity

Do this on your own or, if you can, in discussion with another.

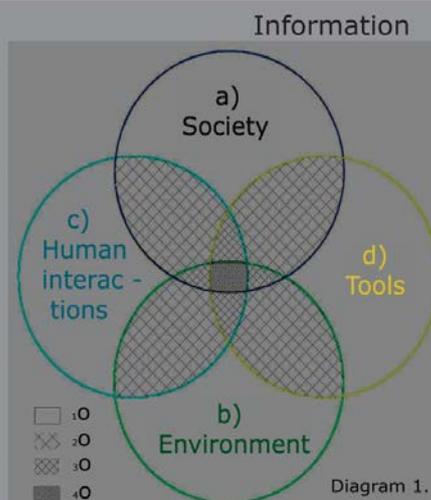
What are the implications of what you have learned in this exercise?

A sustainable state of mind : A process which "manages" the complexity of urban/ human evolution.

The Micro Project System

The micro project system defines "Urbanity" as an open system based on 4 interactive components:

- a) The individual and the different groups of individuals. (Society)
- b) Their environment. (Natural and Artificial)
- c) The way individuals deal with each other and with the environment. (Politics, culture, religion, and economy/ /Architecture, urban planning and engineering)
- d) The "tools" individuals use to deal with each other and with the environment. (Technology // Communication and transportation networks)



A sustainable state of mind : A process which "manages" the complexity of urban/ human evolution.

The Micro Project System

Activity – Part 1

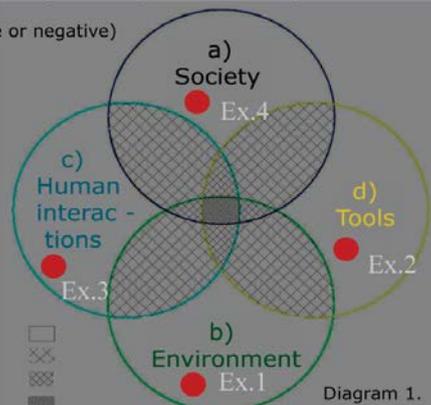
Identify an intervention made in society or in the city:

Identify one small human action which had greater implications for a city or for a society after a certain period of time. (The implications can be either positive or negative)

- 1- Describe the intervention as well as its social and urban context.
- 2- Place the intervention, with a red point, in diagram 1.

- Example 1 : The act of planting a tree.
- Example 2 : The act of creating a new television channel.
- Example 3 : The act of changing the legislation regarding emigrants.
- Example 4 : The act of creating an association for Muslim people.

NOTE: Choose an action related to your field of interest.

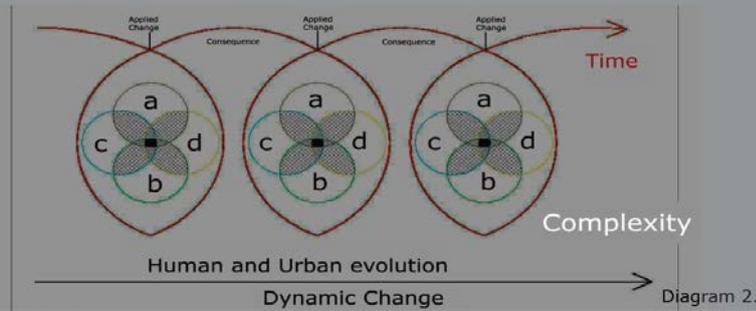


A sustainable state of mind : A process which "manages" the complexity of urban/ human evolution.

The Micro Project System

Activity – Part 2

- 1 - Describe the chain of events after the original intervention was made. Mention the social and urban implication of each event.
- 2 - Place the events in a chronological sequence in diagram 2. (You can eventually mention the dates of the events or how much time passed between them.)
- 3 - Write a small conclusion.

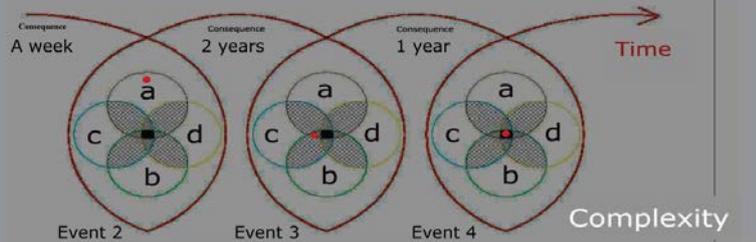
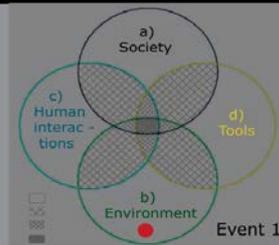


A sustainable state of mind : A process which "manages" the complexity of urban/ human evolution.

The Micro Project System

Example:

- Event 1- The act of planting a tree.
- Event 2- People start to gather under the tree.
- Event 3- Economy and culture start to flourish.
- Event 4- A new road was build.



A sustainable state of mind : A process which "manages" the complexity of urban/ human evolution.

The Micro Project System

Please note that there is no wright or wrong answer when placing the events in the diagrams.

We are testing this complex and dynamic system together!

Thank you and Good luck!

Above all... enjoy!!!!

Marta & Genevieve

A sustainable state of mind : A process which "manages" the complexity of urban/ human evolution.

Appendix 5

Subject Briefs - Study 4

Study 4 – Part 1

- Introductory brief for Integrated Studio2
- Introductory brief for Sustainable Design 2
- Sustainable Design 2 - Assignment 1
- Sustainable Design 2 - Assignment 2
- Class activity 1
- Class activity 2

Study 4 – Part 2

- Introductory brief for Integrated Studio3
- Introductory brief for Urban Design Studies
- Urban Design Studies. Assignment 2
- Urban Design Studies. Assignment 3

Study 4 – Part 1

Integrated Studio 2_Introductory brief

<p>Subject (code) Credit Units : 9</p> <p>EVD Project 2 (DED 2827)</p> <p>Semester Apr 2016</p>	<p>EVD PROJECT 2</p> <p>Project Brief</p> <p>Pulau Ubin: Singapore's green "back garden". A sustainable, informative and fun place to be.</p>
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1.0 Objective

Synopsis

This project focuses on understanding of site analysis and allows students to be confronted with the physical site condition issues of topography, air, vegetation, drainage; incorporation of universal design, social and culture, identity, biodiversity and landscape sustainability. Students are encouraged to think-out of the box while incorporating basic and real issues. **You are required to be sensitive to the environs and consider how to thoughtfully design within nature by integrating built-form and the environment.**

The aim of this subject is to equip students with knowledge of the processes of site analysis, site contextual issues, social and cultural factors, interpolation of contours and terrains impacting design, universal design requirements and awareness of drainage and biodiversity and thereafter the ability to incorporate site analysis to formulate and rationalize design. **In other words, your careful analysis of the site is to going to help you decide on your intervention (not intrusion).**

The existing vegetation, structures, paths and way of living in the island have great significance and must be respected and retained as much as possible as part of your proposed design. The incorporation of EECon, Eco-Design and having a sustainable design is imperative.

<p>EVD Project 2 (DED 2827)</p> <p>Type of subject Credit Units : 9</p> <p>Subject Introduction Diploma Core</p> <p>April Semester 2016</p>	<p>Learning Objectives</p> <p>Students should be able to:</p> <ul style="list-style-type: none"> • Conduct site analysis and survey and approaches by exercising analytical skills, interpretation and translation. • Analyse issues related to the physical, culture, social and history of the site, as well as landscape sustainability. • Propose appropriate design concept based on site analysis and concept. • Apply site analysis modes and final design synthesis (through integration of built-form and nature and landscape)
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2.0 Background

Pulau Ubin: Singapore's green back garden

Pulau Ubin, which literally means "Granite Island" in Malay, is a small island (10.2 km²) situated in the north east of Singapore. Rubber plantations and granite quarrying supported a few thousand settlers on Pulau Ubin historically, but only about a handful of villagers live there today, supporting the mainly **eco-tourism industry**. It is one of the last rural areas to be found in Singapore, with an abundance of natural flora and fauna.

The island is one of the last areas in Singapore that has been preserved from urban development. It's wooden house villages and wooden jetties, relaxed inhabitants, rich and preserved wildlife, abandoned quarries and plantations, and untouched nature make it the last witness of the old "kampong" Singapore that existed before modern industrial times and large-scale urban development.

Currently designated a nature area, but can be developed if the need arises. The government stated that the island will be kept in its rustic state as long as possible. Currently authorities and various stakeholders and community groups are making a collective effort in developing a vision for the island that would **address nature and heritage conservation and provide for education and nature-based recreation.**



<p>Prepared by: Malcolm Tan</p> <p>Property of Diploma in Environment Design ©</p>
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2.0 Background

Pulau Ubin: Singapore's green back garden

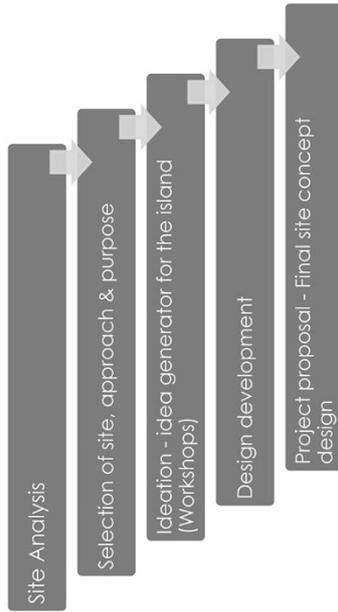
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4.0 ASSESSMENT SCHEME

INCEPTION	30%	Site Analysis (Group) – 20% (10x10) Ideation Review (Indiv.) – 10% * peer assessment
DESIGN DEVELOPMENT	40%	Sketch Design Review – 10% Scheme Design Review – 20% Journal & Design Dossier – 10%
PROJECT PROPOSAL	30%	Final Model – 10% Final Storyboard – 10% Final Presentation – 10%
Group Component (Site Analysis)		20%
Individual Component		80%

3.0 Challenge

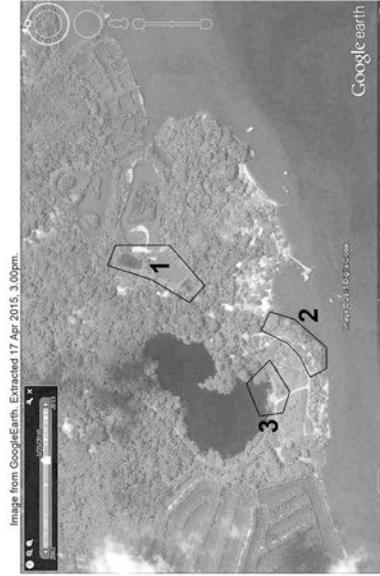
From Ministry of National Development's Friends of Ubin Network website:

"Efforts to enhance Ubin's wildlife habitats are underway. What more can we do?
 Do you hope to see more nature and wildlife on the island?
 What ideas do you have to enhance the island's sense of discovery and adventures?
 How can we tap into what the island has to offer and enhance the recreational options?
 Do you have suggestions that can help to revive the kampung life and its activities?
 Do you see Ubin as a green living educational laboratory?"

EVD Project 2 shall be conducted jointly with the subject **EcoDesign** to analyse Pulau Ubin and to explore design ideas to enhance Ubin as a rustic sanctuary that is sustainable, charming and unique.

From a macro level analysis of the entire island, students will then pick one (1) specific site out of three possible areas, which have already been identified earlier by Nparks & EVD as possible areas, to develop their ideas further into a site concept design (see GoogleEarth map showing the 3 areas). The areas are:

1. Jalan Ubin "Four Ponds" area
2. Jelutong Campsite
3. Pekan Quarry



Late work will **not be accepted**. Work is due on the **due date** and time in whatever stage of completion has been attained. Under extenuating circumstances such as illness or a death in the family, the due date might be extended. Please make every effort to notify your lecturer(s) of the pending circumstances as they occurred.

Work that has not been developed sequentially in the classroom under the supervision of the lecturer(s) **WILL NOT BE ACCEPTED**.

Students are to attend all consultation and review sessions as part of the design developmental process, with the necessary documentation required by the lecturer. Progressive work such as design processes to be carried out during tutorials is mandatory and must be presented to lecturer at all time.

5.0 Schedule of work

Objective	Monday	Tuesday	Wednesday	Thursday	Friday
Inception: Project Brief/ Site Analysis	25/04 Year Two Team Building Activity	26/04 Make-up lesson @ 9am: Project intro & briefing	27/04 Site Visit Pulau Ubin (Meet at Changi Point at 9am) Submission of consent forms	28/04 Site Visit: Pulau Ubin (Meet at Changi Point at 9am) (Ferry @ \$3 per person)	29/04
B1-Wk1	0	1	2	3	
Inception: Site Analysis	02/05 Public Holiday: Labour Day	03/05	04/05	05/05	06/05
B1-Wk2					
Inception: Ideation	09/05 Site analysis Existing site model	10/05	11/05	12/05	13/05
B1-Wk3	6	7	8	9	
Inception: Ideation	16/05 Ideation: Studio consultation – Design Brief & Concept formulation	17/05	18/05	19/05	20/05
B1-Wk4	9	10	11	12	
Design Development : Individual Development	23/05 Ideation interview: Design brief & concept formulation (formative assessment)	24/05	25/05	26/05	27/05
B2-Wk1	12	13	14		

EVD Project 2 (DED 2827)		Subject Introduction : Diploma Core		April Semester 2016	
Type of subject Credit Units		: 9			
Design Development : Individual Development B3-Wk3	18/07 Scheme Design Proposal: Studio consultation 28	19/07	20/07 Scheme design review Day 1 (20%: Indiv) 29	21/07 Scheme design review Day 2 (20%: Indiv) 30	22/07
Design Development : Individual Development B3-Wk4	25/07 Detail design Proposal: Studio consultation 31	26/07	27/07 Detail Design Proposal: Studio consultation 32	28/07 Detail Design Proposal: Studio consultation 33	29/07
Final Proposal: Production B4-Wk1	01/08 Final Design: Studio consultation & Production 34	02/08	03/08 Final Design: Studio consultation & Production 35	04/08 Final Design: Studio consultation & Production 36	05/08
Final Project Proposal: Production B4-Wk2	08/08 Final Design: Studio consultation & Production 37	09/08	10/08 Final Design: Studio consultation & Production 38	11/08 Final Design: Studio consultation & Production 39	12/08
Project Proposal: Presentation B4-Wk3	15/08 Final Design submission of models (10%) 40	16/08	17/08 Final Design: Studio consultation & Production 41	18/08 Final Design: Studio consultation & Production 42	19/08
Project Proposal: Presentation B4-Wk4	22/08 Final Design submissions: Storyboard (10%) & reflective journals (10%) 43	23/08	24/08 Final individual presentations (10%) Day 1 44	25/08 Final individual presentations (10%) Day 2 45	26/08

EVD Project 2 (DED 2827)		Subject Introduction : Diploma Core		April Semester 2016	
Type of subject Credit Units		: 9			
Design Development : Individual Development B2-Wk2	30/05 Concept design Proposal: Studio consultation 15	31/05	01/06 Ideation review Day 1: Concept development (10%: Indiv) 16	02/06 Ideation review Day 2: Concept development (10%: Indiv) & Debrief 17	03/06
Design Development : Individual Development B2-Wk3	06/06 Public holiday: Vesak Day 18	07/06	08/06 Sketch design Proposal: Studio consultation 19	09/06 Sketch design Proposal: Studio consultation 20	10/06 Independent
Design Development : Individual Development B2-Wk4	13/06 Sketch design Proposal: Studio consultation 20	14/06	15/06 Sketch design review Day 1 (10%: Indiv) 21	16/06 Sketch design review Day 2 (10%: Indiv) 22	17/06 Independent
DES VACATION		20/06	22/06	23/06	24/06
DES VACATION		27/06	29/06	30/06	01/07
Design Development : Individual Development B3-Wk1	04/07 Scheme Design Proposal: Studio consultation 23	05/07	06/07 Public holiday: Hari Raya Pusa 24	07/07 Scheme Design Proposal: Studio consultation 24	08/07
Design Development : Individual Development B3-Wk2	11/07 Scheme Design Proposal: Studio consultation 25	12/07	13/07 Scheme Design Proposal: Studio consultation 26	14/07 Scheme Design Proposal: Studio consultation 27	15/07

Prevention of Plagiarism Policy

- Academic integrity is expected of all students at Temasek Polytechnic. The Polytechnic requires all students to be assessed for their own work only.
- Plagiarism is a serious academic offence. Disciplinary action taken for students caught for plagiarism will depend on the severity and includes the failing the subject, suspension and removal from course.
- All students are required to **give proper acknowledgement** of all original sources of work used in assignments.

7.0 A summary of previous modules

Design skills	Detailing and materials	Environmental definition	Presentation technique	Understanding the environment	Communication Skills
EVD Project 1	Sustainable Materials	Landscape Design Studies	Drawing Essentials	Environmental Elements & Control	ComDI
Form Exploration		Planting Design Principles	Architectural & Landscape Drawings	Design Fundamentals	Marketing in Design
		EcoDesign	Architectural & Landscape Drawings	Architectural Design Theory	Professional Communication for Design
			Computer-aided Design Drawings	Introduction to Architectural Principles	
			Digital & Visual Presentation		

EVD PROJECT 2

6.0 Notes and Resources

General Notes

- Attendance is mandatory for all sessions in the above schedule. Students who are absent without valid documentation or official leave of absence (LOA) form would be penalized.
- Days marked in white or bold text in the schedule are extremely important as presentation days.
- The lecturer has the right to deny students of consultation, if they fail to produce what is required by the lecturer or if the design progress is inconsistent or insubstantial.
- Attendance would be marked for all review, submission and presentation sessions. Late comers would be penalized. As all reviews, submissions and presentation sessions are assessed and part of the examination, students who are absent without any valid reason, will be considered as absent for examination and work will not be reviewed.
- All consultations are rescheduled. Students are to adhere to the consultation schedule.
- Individual students are strictly to adhere in the documentation of the specific requirements of each started session and tasks.
- Submissions that do not fulfil the requirements stated in the project brief and other relevant documents would be penalized. Students are to refer to the assessment criteria for each stage of their proposal.

Specific Notes on Late Submission Policy

- The observance of deadlines is an important academic requirement. Submissions that breach stipulated deadlines without any valid reasons (eg. MC or LOA etc.) shall be taken seriously and has grave consequences. Please avoid being late for any reason.
- Late work will not be accepted. Work is due on the due date and time in whatever stage of completion attained or achieved. Under extenuating circumstances, such as death in the family, or verifiable illness, the due date might be extended.
- Late submissions without valid reasons that meet the minimum assessment criteria will be awarded at the maximum only 50 marks (Pass) or even less. This applies to assignments/projects submitted by the next working day or within a 24 hour time frame. Assignments/projects submitted later than the stipulated time frame would be deemed to have failed (zero mark).
- Students with valid MCs must send to tutors a digital format of their work within the deadline through email in whatever degree of finish the submission is.**
- Please make every effort to notify your lecturer(s) of the pending circumstances as they occur and please seek further understanding of the course through scheduled consultations with your respective lecturers.
- Works and or assignments that have not delivered sequentially under the supervision of your lecturer(s) will not be accepted.

Study 4 – Part 1

Sustainable Design 2_Introductory brief

<p>Subject (code) : EVD Sustainable Design 2 (DED2829) Credit Units : 3</p> <p>Semester Apr 2018</p> <p>Learning Objectives:</p> <p>The subject aims to equip students with the skills and knowledge of sustainable design concepts with the understanding of the green and blue natural systems in the environment, as in biodiversity, habitat and hydrological systems. The subject will enable students to carry out site analysis to propose ecological design strategies to address environment sustainability issues with consideration for the community.</p> <p>2.0 Mode of Instruction</p> <p>Method:</p> <p>The subject will introduce students to a studio-based learning approach of learning by-doing in a studio environment.</p> <p>The subject centres around the conception of learning as an active engagement. The aim is to encourage students to drive their own learning. In this process, the students will extensively engage in collaborative learning activities in a studio setting. 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Temasek
POLYTECHNIC

Sustainable Design 2

1.0 Subject Introduction

Introduction:

Today more than ever before there is the realization that we cannot manage our communities and our resources as we have done until now.

To become more sustainable we should reflect on wicked problems such as poverty, climate change, worldwide insecurity, lack of drinking water and food supplies in some regions of the planet and many more.

In *Sustainable Design 2* subject we aim to reflect on some of these issues from the perspective of human comfort and quality of life. In other words in this subject we aim to reflect on the ways we relate with each other and the environment around us.

In *Sustainable Design 2* subject we encourage students to reflect on the meaning of **"sustainable and resilient communities"** and reflect on questions such as:

- Can we imagine a *sustainable way of living without compromising modern human needs and demands?*
- How can we build more *resilient communities?*

The aim is not to achieve reductive conclusions or statements on these complex problems. This subject rather aims to explore further the deeper meaning of words such as *sustainability, community and resilience*. The aim is to challenge students to reflect on the complexity of the communities they will deal with in the future as architects and designers.

The aim is to raise awareness and criticism towards the way things have been done in the past and open doors to innovative ideas to deal with the future.

Subject Synopsis:

This subject introduces students to the meaning of sustainability in the context of environment design. The subject will identify the blue and the green natural systems and their relationship with habitats (natural and human communities). The subject will cover how to perform comprehensive site analysis, leading to the application of sustainable design strategies.

5.0 General Rules

General Rules:

- TP email official students' accounts shall be used for all communication and class submission. Other personal addresses such as Yahoo and Hotmail will not be accepted. Depth of analysis demonstrated and application of concepts would be awarded.

Attendance Policy:

- Students are required to attend classes regularly and punctually as per timetable schedule.
- If you are unwell and absent for a crit / presentation or submission, the medical certificate submitted must indicate clearly that the:
 - a) student is unfit to sit for the test/exam
 - b) date/period which the student is unfit

Note: Students are required to attend not less than 85% attendance.

Plagiarism Policy and Copyright Issues:

- Academic integrity is expected of all students at Temasek Polytechnic. The Polytechnic requires all students to be assessed for their own work only.
- All students are required to give proper acknowledgement of all original sources of work used in their assignments, projects or other assessed work.
- Plagiarism is a serious academic offence. Disciplinary action taken for students caught for plagiarism will depend on the severity and includes failing the subject, suspension and removal from course.

Late Work and MC Policy:

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- Student arriving late for presentation (or crit) or on submission days without any valid reason(s) will not be eligible to present or submit the work.
- Late submission without valid reasons that meet the minimum assessment criteria will be awarded the maximum of D Grade (Pass). This applies to assignment/project submitted by next working day within 24 hours timeframe.
- Those submitting later than the stipulated time frame would be deemed failed.
- Students applying for MC must submit their applications to Design General Office within 3 working days from the last day of the MC.
- Works and or assignments that have not developed sequentially under the supervision of your lecturer(s) will not be accepted.

The following assessment methods will be employed:

1. A series of individual and group assignments, incorporating presentations, is designed to test the students' integration and application of learning outcomes
2. Peer evaluation will be deployed to evaluate group member's contribution for group work
3. Reflective journal serves as a means to record reflections and allow the learners to be more aware of his/her learning progress, and also enables him/her to take active steps with his/her learning.

The continuous assessment scheme for the subject is made up of the following weightage:

Group Component:	Weightage	Submission dates
- Assignment 1	30%	3 rd of May 2018
Individual Component:		
- Peer evaluation	10%	3 rd of May 2018
- Assignment 2	50%	6 th and 7 th of Jun 2018
- Reflective journal	10%	6 th of Jun 2018

Students will be advised accordingly on the respective datelines of the assessment.

Evaluation Criteria:

The criteria for evaluation of each assignment will be advised in detail according to the assignment brief.
The evaluation of group assignments will have in consideration the peer evaluation conducted within each group.
Participation and engagement in the class is assessed as discussion is essential for the subject's delivery.

Semester Apr 2018

Subject (code) : EVD Sustainable Design 2 (DED2329)
Credit Units : 3

Design Development	14/05	15/05	16/05	17/05	18/05
Individual Development	Interpretation and design application of the findings.	Interpretation and design application of the findings.	Master Plan Individual	Master Plan Individual consultation -	
B2-WK1	Lecture 3: Relating the findings with the global context	Master Plan Individual	Pin-up Formative	Design Brief	9
	Master Plan Individual				8
Design Development	21/05	22/05	23/05	24/05	25/05
Individual Development	Ideation: Studio consultation -	Concept design Proposal: Studio consultation	Concept design Proposal: Studio consultation	Concept design Proposal: Studio consultation	
B2-WK2	Case Studies Form exploration model				11
Design Development	28/05	29/05	30/05	31/05	1/06
Individual Development	Ideation review	Public holiday: Vesak Day	Concept design Proposal: Studio consultation	Sketch design Proposal: Studio consultation	
B2-WK3	Design Brief and development (10%: Indiv)		Master plan Individual Project work	Cad Drawings Model	
	Concept design Proposal: Studio consultation				13
Design Development	4/06	5/06	6/06	7/06	17/06
Individual Development	Interpretation and design application of the findings.	Sketch design Proposal: Studio consultation	Sketch design review Day 1 (10%: Indiv)	Sketch design review Day 2 (10%: Indiv)	
B2-WK4	Master Plan Individual	Cad Drawings Model	Submission of Assignment 2 (50% Indiv)	Submission of Assignment 2 (50% Indiv)	15
	Workshop Essay writing				14

Prepared by: Marta Miguel and Ronnie Tan. Page 5 of 8

Semester Apr 2018

Subject (code) : EVD Sustainable Design 2 (DED2329)
Credit Units : 3

6.0 Schedule

Objective	Monday	Tuesday	Wednesday	Thursday	Friday
Inception: Project Brief/ Site Analysis	16/04 SustDes2 Introduction & briefing. Formation of teams: briefing	17/04 IntStud2 Site analysis Studio consultations (macro/island)	18/04 SustDes2 Site analysis Studio consultations (macro/island)	19/04 IntStud2 Site Visit: Pulau Ubin (Meet at Changi Point at 9am) (Ferry \$6 per person)	20/04
B1-WK1	Intro Assign. 1: Define sustainability, community and resilience.	1	Project intro & briefing preparation for site visit.	Submission of consent forms	2
Inception: Site Analysis	23/04 SustDes2 Site analysis Studio consultations (macro/site)	24/04 IntStud2 Site analysis Studio consultations (macro/site)	25/04 SustDes2 Site analysis Studio consultations (micro/site)	26/04 IntStud2 Site analysis Studio consultations (micro/site)	27/04
B1-WK2	3	3	2/05 SustDes2 Site analysis Studio consultations (micro/site)	3/05 IntStud2 Site analysis review Students to define their individual site	4/05
Inception: Ideation	30/05 SustDes2 Site analysis Site model	1/05 IntStud2 Public holiday: Labour Day	2/05 SustDes2 Site analysis Studio consultations (micro/site)	3/05 IntStud2 Site analysis review Students to define their individual site	4/05
B1-WK3				Submission SustDes Ass 1 (50% Group + Peer Ass. 10%)	5
Inception: Ideation	7/05 SustDes2 Interpretation and design application of the findings	8/05 IntStud2 [S] Interpretation and design application of the findings	9/05 SustDes2 Interpretation and design application of the findings.	10/05 IntStud2 [S] Interpretation and design application of the findings.	11/05
B1-WK4	GAME 1 Discussion Synergize the learning and apply it to Pulau Ubin Context	GAME 2 Individualization of learnings gathered from Game 1	Lecture 1: Relating the findings with the global context	Lecture 2: Relating the findings with the global context	Master Plan Group
			Master Plan Group		7
					6

Prepared by: Marta Miguel and Ronnie Tan. Page 4 of 8

<http://www.inhabitat.com> - good online resource on green design
<http://www.treehugger.com/> - leading green news resource

6.0 References

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- http://www.bca.gov.sg/EnvSus/legislation/others/Env_Sus_Code.pdf
- http://www.pub.gov.sg/abc/ABCWaterMasterplan/Documents/PUB_integrate-1.pdf
- <http://www.greenmark.sg> - BCA Greenmark
- <http://www.sgbc.sg> - Green Building Products Listing
- <http://www.pub.gov.sg/ABCWATERS/Pages/default.aspx> - ABC Waters Programme
- <http://research.cugc.com.sg/> - Urban Greenery & Ecology - Skyrise Greenery

Study 4 – Part 1

Sustainable Design 2_Assignment 1

Subject (code) : Sustainable Design 2 (DED 2829)
Credit Units : 3
2018



Temasek
POLYTECHNIC

Group Assignment 1 (30%)

Is Pulau Ubin a sustainable community?

1.0 Objectives

Students will explore the complexity of social systems from the perspective of *culture and human diversity, biodiversity, legislation and politics and history and character* of places. Related to these, topics such as *waste and pollution, water drainage, alternative energy and recycling* will be addressed.

EVD sustainable Design 2 *Group assignment 1* shall be conducted jointly with the subject of Integrated Studio 2. The aim is to analyse Pulau Ubin community and reflect on complex issues related to the sustainability and resilience of the site.

2.0 Assignment

In groups of 6 students, reflect on the following question:
Is Pulau Ubin a sustainable and resilient community?

Reflect on the question conducting an analysis of Pulau Ubin Island (Project 2 site) from the following perspectives:

People - (Group 1 and 2)
Who visits the island, who lives there and why? Who works there? Where do all these different users come from? Why do they go there? At what times of the day? With whom else do they relate to? Could they go somewhere else? Why do they choose Pulau Ubin?
Study the site's users in relation to their: origin, health, wealth, sense of belonging, culture, religion, education
Research on what are the unique ways people do things on this particular site.
Research on what people need and what do they produce.
Define the island's user groups and their expectations.

Subject (code) : Sustainable Design 2 (DED 2829)
Credit Units : 3

Biodiversity & biosecurity - (Group 3 and 4)
How would you characterise this natural habitat? Which are its features? What puts it in danger? What makes it unique?
What species of flora and fauna are found on the site? What was lost? Which species are in danger? What could be preserved? What should be preserved? Which species could be introduced? What is unique? Compare the findings to Singapore's main land and South East Asia.

History and character of the place - (Group 5 and 6).
Define the kind of community Pulau Ubin is (urban, rural, forestal). Investigate how it was in the past, how is it in the present and do you expect it to be in the future. Relate your findings with other relevant communities, Singapore main land, South East Asia and the world. What makes the place unique? What characterises it? What makes it special? What relates it to other habitats?

Physical environment - (Group 7 and 8)
How is the topography and climate of the site? Reflect about the energy, food and clean water the community needs and their present supply and resources.
Reflect on transportation and connectivity networks that link Pulau Ubin with south East Asia and the world.
Are there any legislation protecting Pulau bin natural environment? What is the government envisioning for the future of Pulau Ubin.

Critical reflection/ conclusion: As a conclusion of the research analysis all groups should elaborate on the following two questions:

- 1- **Is Pulau Ubin a sustainable and resilient community?**
- 2- **What are the strategies that can improve the sustainability and resilience of the community?**

3.0 Deliverables:

- 1- **Short film on the theme of research**
Submission and presentation: 3rd of May 2018 together with Integrated Studio 2.
During your site visit, make a short film to capture the essence of the island from the perspective of your research theme. Make interviews, film people, places, environments animals, plants, colours, textures, sounds, movements... anything you need to express your vision on the theme of research
The film should include a narrative explaining the students' vision and reflections on the subject
- 2- **Layer analysis**
A compilation of the analysis of key systems relevant for a holistic understanding of the island at different scales
- 3- **Story board**
Submission: 3rd of May 2018 together with Integrated Studio 2
The Sustainable Design 2 story board should follow the same format and contextualise the Integrated Studio 2 presentation. It should include a resume of your findings and should be illustrated with visuals and diagrams.

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4.0 Assessment Criteria

This assignment forms 30% of your overall grade, in addition peer evaluation forms 10% of your overall grade.

Participation and engagement in the class is assessed as discussion is essential for the subject's delivery.

Assignments have to be submitted both as a hard and soft copy. Students are strictly advised to use hand drawn sketches & diagrammatic representations. All visual information should be interpreted by the students and submitted as original drawings.

- Submission will be assessed on the following criteria:
- Accuracy and completeness of information
- Breadth and Depth of research
- Quality of analysis
- Clarity of diagrams and sketches
- Critical interpretation of facts

5.0 General Rules

Plagiarism Policy and Copyright Issues:

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- Plagiarism is a serious academic offence. Disciplinary action taken for students caught for plagiarism will depend on the severity and includes failing the subject, suspension and removal from course.

Late Work and MC Policy:

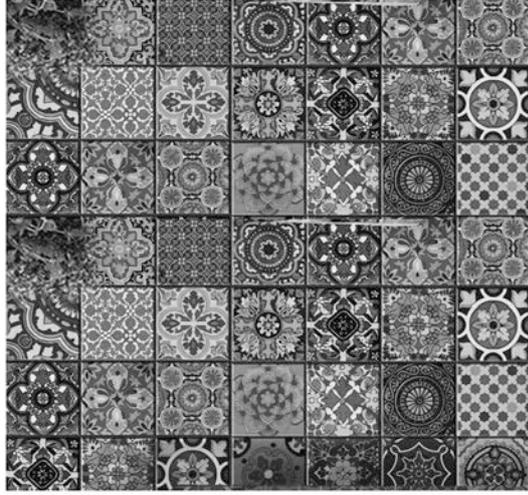
- Only medical certificates issued by medical practitioners registered with the Singapore Medical Council will be accepted.
- Student arriving late for presentation (or crit) or on submission days without any valid reason(s) will not be eligible to present or submit the work.
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- Those submitting later than the stipulated time frame would be deemed failed.
- Students applying for MC must submit their applications to Design General Office within 3 working days from the last day of the MC.
- Works and/or assignments that have not developed sequentially under the supervision of your lecturer(s) will not be accepted.

In addition, the story board should include:

a) Mosaic of relevant images for the theme of research

Collect relevant images of the site from the perspective of your theme of research and display them in a mosaic kind of format. This will serve as inspiration for Integrated Studio2.

NOTE: A scaled image of this mosaic should be included in your reflective journal



www.pinterest.com

b) A SWOT analysis of the site
Each group should submit short essay or a summarizing of the findings related to the research. The document should include a critical analysis of the findings and should elaborate on the questions:

Is Pulau Ubin a sustainable and resilient community?

NOTE: Both the SWOT and the essay should be included in the reflective journal

Study 4 – Part 1

Sustainable Design 2_Assignment 2

Subject (code) : EVD Sustainable Design 2 (DED2529)
 Credit Units : 3
 Semester Apr 2018



Individual Assignment (60%)

How can Pulau Ubin become a sustainable and resilient community??

1.0 Objectives

Assignment 1 explored the complexity of social systems from the perspective of culture and human diversity, biodiversity, history and character of places. Topics such as waste and pollution, water drainage, alternative energy and recycling were also addressed.
 The aim of group Assignment 1 was to analyse Pulau Ubin's community and reflect on complex issues related to the sustainability and resilience of the site. The aim of assignment 1 is to apply the knowledge that emerged from the themes debated previously in the studio to Integrated Studio 2. In addition, it invites students to reflect on the impact decision related to the built environment can have globally.

2.0 Assignment

Assignment 2 will be divided in 4 parts.
 Part 1: Define 5 strategies to implement on the site that would make the island more sustainable
 Part 2: Integrate key strategies and make them work as a system
 Part 3: Implement the system in Pulau Ubin and explain how your Integrated Studio 2 site relates to the system proposed. This exercise is an introduction to the meaning of a master plan. The implementation should be explored on a map of the island. The proposal should define protected areas; areas of development, key relevant facilities, housing, commercial areas, agriculture areas, water reservoir areas, different kinds of circulation in the island, etc. ...

EcoDesign (DED 3813)
 Type of subject : Diploma Core
 Credit Units : 3

Part 4: Relate your strategies to global wicked problems we are facing today and describe associated mitigating strategies to address them.

Highlight how the proposed strategies for Pulau Ubin contributes to the mitigation of one or more of the following global problems.

- Carbon footprint
- Climate change
- Reliance on fossil fuel
- Pollution
- Loss of biodiversity and habitats
- Waste management
- Water
- Food security

In other words students are required to address the following questions:
 - "What global issue/issues did I address during the last months? Why is it relevant?"
 - "How can it be solved? Is there anything being done?"
 - "How can the strategies I suggested on Pulau Ubin contribute to the bigger picture?"

This reflection should be based both on empirical knowledge and on the theoretical resources given to you. In addition you are required to search relevant literature to fundament your arguments.

The report should a mix of text and infographics (hand drawn sketches & diagrammatic representations) to help illustrate students' understanding. All sources of information should be referenced or credited appropriately.

NOTE: the report is to be included in your Reflective Journal.

3.0 Deliverables:

A1 story board illustrating the proposed master plan and how the proposed strategies work in a system. The story board is to be submitted and presented in combination with Integrated studio 2 on the 6th and 7th of June.
 The essay -Part 4 of this assignment - is to be submitted in the reflective journal which submission date is on the 6th of June

4.0 Assessment Criteria

This assignment forms 60% of your overall grade.
 Participation and engagement in the class is assessed as discussion is essential for the subject's delivery.
 Assignments have to be submitted both in as a soft copy and in standard A3 format. Students are strictly advised to use hand drawn sketches & diagrammatic representations. All visual information should be interpreted by the students and submitted as original drawings.

EcoDesign (DED 3813)
Type of subject
Credit Units

: Subject Introduction
: Diploma Core
: 3

The assessment criteria will be given to the students prior to submission and presentation

5.0 General Rules

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Study 4 – Part 1

Sustainable Design 2_Class activity 1 and 2

Subject (code) : EVD Sustainable Design 2 (DED2X22)
Credit Units : 3
Semester: Apr 2018



Class Activity

1.0 Objectives

Reflect critically on Eco and Sustainable Systems.
Study, appreciate and apply sustainable urban design ideas to project work.
Present the analysis in the form of diagrams and visual representations.

2.0 Task

Re-organize in groups of 6. The new groups should be composed of representatives of Assignment 1 groups.
Students should brainstorm around a map of the Pulau Ubin and use their knowledge to comment on the following questions:

Question 1: Is Pulau Ubin's community sustainable? Why? Why not?

Define a human group of focus. Reflect on the above question in terms of:

- Health and wellness
 - Economy
 - Food
 - Water
 - Security and sense of belonging
 - Shelter
 - Education
 - Energy
- Define relevant habitats. Reflect on the sustainability of the biodiversity in terms of:
- Indicator species
 - Size/ scale
 - Richness/diversity

Suggestion: Define the community you want to study and the challenges they face.

Question 2: How can we make Pulau Ubin a more sustainable and resilient place?

Each expert should answer the question from the perspective of its research field. In order each representative should comment on the suggestion of the previous one and suggest something himself.

Prepared by: Maria Miguel and Romie Tan
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Subject (code) : ECO Design Studies (DED 3813)
Credit Units : 3
AY: 2015_2016_May



Class Activity

1.0 Objectives

Reflect critically on the meaning of Sustainable Systems.
Study, appreciate and apply sustainable urban design ideas to project work.
Present the analysis in the form of diagrams and visual representations.

2.0 Task

Part 1: Define your vision for a sustainable Pulau Ubin. Define also a strategy to achieve your intention. The strategy should compose of five clear actions which may possibly work in a system. Use diagrams and sketches to illustrate the message you aim to convey. Pin up these sketch on the wall and group them according to their kind.

Part 2: Focus on one or more of these actions. Describe how to implement it and how it would benefit the island. Find a case study to defend your arguments and to illustrate the relevance of the intervention you suggested. Explain the methodology and the technology needed to implement it. Use diagrams and sketches to illustrate the message you aim to convey.

3.0 Deliverables

5 illustrations of the strategies you aim to explore and implement in Pulau Ubin.
These strategies should be coherent and strongly related to Pulau Ubin context.

A written reflection on the 2 parts of this exercise's task.

NOTE: All deliverables are to be included in your reflective journal

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Study 4 – Part 2

Integrated Studio 3_Introductory Brief

Subject [code]: Integrated Studio 3 (DED 2834)
 Credit Units: 6
 Subject [code]: DED 2834

Subject [code]: Integrated Studio 3 (DED 2834)
 Credit Units: 6
 Subject [code]: DED 2834

Oct AY2017/2018

Oct AY2017/2018



DED 2834 – Integrated Studio 3

Subject Introductory Sheet

Project Brief

'Life's most persistent and urgent question is, 'What are you doing for others?'. Martin Luther King, Jr



Prepared for Diploma in Environment Design
 By Derek Lo | 18 Oct 2016 adapted by Marta Miguel Oct 2017

Prepared for Diploma in Environment Design
 By Derek Lo adapted by Marta Miguel | 13 Oct 2017

The project site is located at one of the ends of Duxton Plain Park. It sits at the intersection of New Bridge Road and Kreta Ayer Road and is very much like a piece of an incomplete jigsaw puzzle within Singapore's city center. The site leads to Duxton Plain Park, which is characterized by the backs of shophouses and greenery lining the linear path connecting New Bridge Road and Yan Kif Road. Historically, Duxton Plain Park makes use of the land previously occupied by the Singapore-Kranji Railway Line. Although the noisy trains were unpopular among the residents then, falling defunct in 1914 and eventually being dismantled in 1925, the park now finds itself within close proximity to a variety of both old and new landmarks. Yet, its urban role as a node or connector does not seem fully realized.

With the site being one of the entrances into Duxton Plain Park, now both a shophouse back alley and a linear park, is it a vibrant and relevant node that promotes community interaction and the enjoyment of a green outdoor space? Is there even a greater role that it can realise?

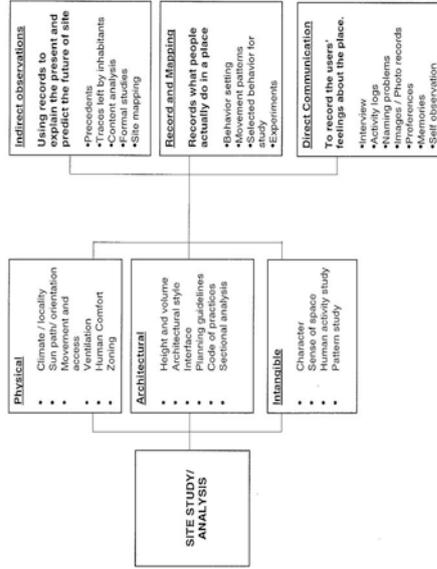
Synopsis

This project focuses on site analysis processes to explore your responses to the selected site. The project will introduce environmental and physical issues such as sustainability, recycling, conservation, human comfort zone in a tropical environment and technical issues of construction viability.

The aim of this subject is to equip you with knowledge and skills of advanced processes of site analysis, site contextual issues, building typology, social and cultural factors, construction methods, and thereafter the skills to incorporate these processes to **formulate, rationalize design issues/strategies**. You will also need to illustrate to some detail proposed construction layout and techniques.

Learning Objectives:

- Students should be able to:
- Identify factors relevant to design approach and process
- Formulate (urban) design strategies
- Propose appropriate design for construction
- Illustrate design ideas and construction details



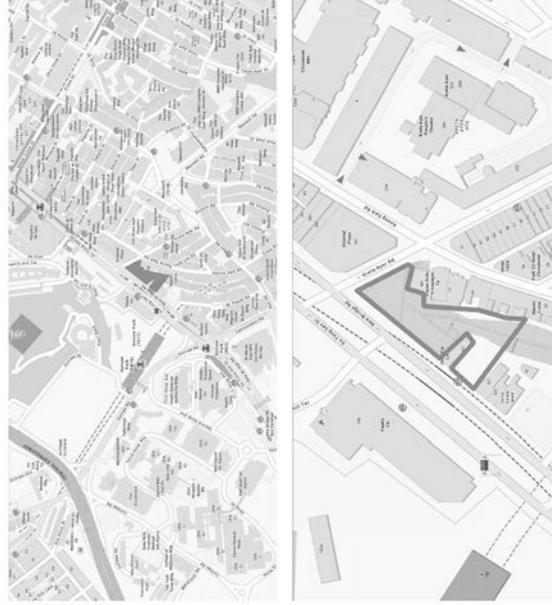
Task 1.: Observe, make basic measurements and map the relevant features of the site

Deliverables:

- Site plan with scaled site measurements and annotations. The site plan should have scale bar and North arrow and should illustrate the following contents:
Topography and water bodies: Contour lines illustrating the terrain on the plan.
Landscape: Indication of plant species and locations
Circulation: Indication of existing roads and pathways
Built forms: Indication of existing buildings, fences, structures, etc.
Public amenities: Indication of bus stops, pedestrian crossings ...
Etc...
- At least 2 scaled sections of the site
- Sketches and diagrams relevant to describe the site
- Mood board: A4 collection of images that characterize the place.
- Scaled site model.

Note: the scale of the drawings and model will be deliberated in class.

Location – Duxton Plain Park
 New bridge road



Part 1 (Group)

In groups of 5-6 students collate and analyse the site according to its physical and sensorial attributes:

The objectives of the group assignment are to gather relevant information on various aspects of the site and its surrounding areas and how people response to it.

Requirements:

- A) Contextual
 - The design should relate to the existing infrastructure/architectural elements present on site
- B) Informative
 - The design should allow the logical dissemination of information in any creative way/ methodology.
- C) Interact
 - The design should allow interaction of users with the space. Consideration is to be given to how the spaces complement the existing community
- D) Functional
 - The design should incorporate universal design and design for easy accessibility and friendly for all.
- F) Program
 - The design proposal and program should be appropriate and address issues and concerns identified by the group design strategy.

Constraints:

- No removal of existing trees
- No removal of existing amenities along the main roads i.e. Bus-stop, taxi bay, electrical over-ground boxes (OG box), manholes and inspection chambers, etc.
- No change of public material and form of the existing pathways unless necessary

Subject Introduction

EVD Project 3 content outline has the following stages, topics and activities:

1. Inception - Research, Analysis and Master Plan/ preliminary Design Proposal
2. Design Development – Concept / Sketch / Schematic / Detail and Construction
3. Project Proposal – Final Design Presentation / Portfolio Development

Duration

The duration of EVD Project 3 shall be from **23rd Oct 17 to 23rd Feb 18**
(Vacation: 16th Dec 16 – 31st Dec 17)

Studio session: 9am-12.00pm, Mon & Wed

Task 2: Interview 3/4 different profiles of people and ask their opinion about the site.

Note: you can use a time-based interview from morning, afternoon and evening. Different times of the day = different types of users.

Profiles of people to consider:

- People who worked near the site
- People who live near the site
- People who pass-by and/or use the place

Questions to consider:

- Where do these people come from?
- Why do they go the site?
- Where do they go after that?
- What do they like most about the place?
- What does this place mean to them?
- What do they don't like about the place?
- What would they like to see built at the place?

Deliverables:

Take a photo of the people you have interviewed and write a story of the place as seen thru their eyes.

Part 2 (Individual)

Individually you are to respond by designing an integrated architecture and landscape proposal to address the design strategy agreed by the group. This will need to take into consideration URA's conservation guidelines where appropriate.

Requirements and Constraints

The following requirements and constraints are to be integrated in the design/intervention. It is mandatory that the design/interventions are to adhere to the stated requirements and constraints below.

Subject (code): Integrated Studio 3 (DED 2834) Oct AY2017/ 2018
 Credit Units: 6
 Subject (code): DED 2834

Mode of Instruction

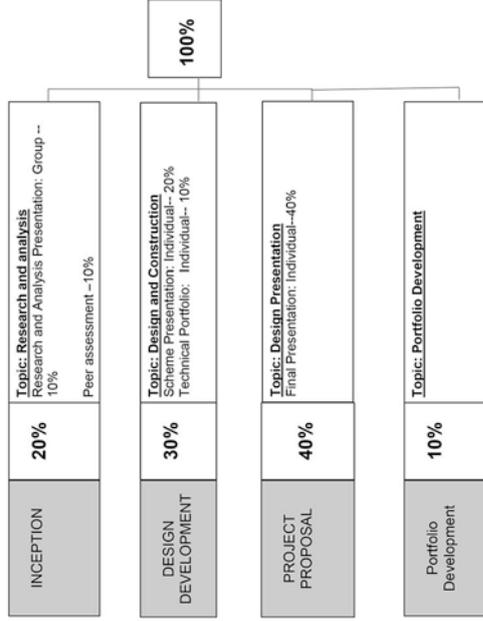
The subject is to be conducted in a studio-based environment with one or group discussions.

The learning and teaching method of this module, EVD Project 3 are as follows:

1. Studio 84 hours
2. Site visits 6 hours

ASSESSMENT

ASSESSMENT SCHEME



Prepared for Diploma in Environment Design
 By Derek Lo adapted by Marta Miguel | 13 Oct 2017

Subject (code): Integrated Studio 3 (DED 2834) Oct AY2017/ 2018
 Credit Units: 6
 Subject (code): DED 2834

Late work/submissions will **not be accepted**. Work must be submitted by the given **deadline**. If student is unable to submit by the due date with valid reason(s) such as illness, the lecturer will assess the circumstances and review their deadline in consultation with co-lecturers. Please notify your lecturer(s) of circumstances that may affect your submission. **Student will still need to submit digital copy via DROPBOX or equivalent, even if unable to attend class physically.**

Work must be methodically developed and systematically documented in the classroom under the supervision of the lecturer(s) for the Process Portfolio phase. Failure to do so may result in penalty. Students are to attend all consultations and review sessions as part of the Design Development process, together with the necessary documentation required by the lecturer.

A summary of previous and concurrent modules

Design skills	Detailing and materials	Environmental definition	Presentation technique	Understanding the environment	Communication Skills
Form and Space Exploration	Sustainable Materials	Landscape Design studies	Design Fundamentals	Introduction to architectural principles	ComDI
EVD Project 1	Building technology 1	Principles of Plant design	Architectural and landscape Drawings	Environmental Elements and control	Marketing in Design
EVD Project 2	Building technology 2	Sustainable Des 2	Computer Aided Design Drawings		
	Building technology 3	Urban Design Studies	Digital visualisation 3		
EVD PROJECT 3					

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 By Derek Lo adapted by Marta Miguel | 13 Oct 2017

M	13/11	Studio session - Ideation Workshop (Form exploration)	Individual responses to group design strategy – Concept statement / program
T	14/11	Urban studies- History	
W	15/11	Studio session - Ideation	Individual responses to group design strategy – Concept statement / program
T	16/11	Urban studies- History	
F	17/11		
M	20/11	Pin-up: Concept Presentation @ Tutorial Group level (Formative)	Individual responses to group design strategy – Concept statement; Program & drawings; Concept models; Sections (if applicable)
T	21/11	Urban studies- Case Studies	+ Urban Design Case Studies
W	22/11	Pin-up: Concept Presentation @ Tutorial Group level (Formative)	Individual responses to group design strategy – Concept statement; Program & drawings; Concept models; Sections (if applicable)
T	23/11	Urban studies- Case Studies	+ Urban Design Case Studies
F	24/11		
M	27/11	Studio session – Sketch design	Design development of sketch design – starting Cad Drawings
T	28/11	Urban studies- Application of CS	
W	29/11	Studio session – Sketch design	Design development of sketch design
T	30/11	Urban studies- Application of CS	
F	1/12		
M	4/12	Studio session – Sketch design	Design development of sketch design
T	5/12	Urban studies- Application of CS	

Schedule of Work

Day	Date	Topic	Lesson Plan	In-class activity
M	23/10	Inception- Site analysis	Subject introduction and tasks briefing	Explain assessment criteria and expectations
T	24/10		Introduction to Group Assignment (Site Analysis) Studio 1	Group brainstorming on site analysis requirements
W	25/10		Urban studies- Vocabulary Site Visit to Duxton Plain Park (3+3 hrs)	Work distribution to group members Meet at Duxton Plain Park at 9am for orientation
T	26/10		Studio 2	
F	27/10		Urban studies- Layer Analysis	
M	30/10		Studio session on Group assignment	Data collection and collation
T	31/10		Studio 3	
W	1/11		Urban studies- Layer Analysis Studio session on Group assignment	Data collection and collation
T	2/11		Studio 4	
F	3/11		Urban studies- Master plan	
M	6/11		P3 – Site analysis submission and presentation (20%) Studio 5	Note: UDSU Assignment 1 and Assignment 2 Part 1 submission/presentation
T	7/11		Urban studies	
W	8/11	Ideation and exploration	Studio session - Ideation	Individual responses to group design strategy – Concept statement / program
T	9/11		Studio 6	
F	10/11		Urban studies- History	

Subject (code): Integrated Studio 3 (DED 2834)
 Credit Units: 6
 Subject (code): DED 2834

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 Credit Units: 6
 Subject (code): DED 2834

W	6/12	Developing Design Proposals	Pin-Up Auto Cad Drawings (Formative)	Design development of schematic design
T	7/12	Schematic	Urban studies - Application of CS	Design development of schematic design with cad drawings (in preparation for BasCon) Note: UDSU Assignment 3
F	8/12			
M	11/12			
T	12/12		Schematic Design (Day 1) Presentation (Formative)	
W	13/12		Schematic Design (Day 2) Presentation (Formative)	
T	14/12		Schematic Design (Day 3) Presentation (Formative)	
F	15/12			
M	1/01			
T	2/01			
W	3/01			
T	4/01			
F	5/01			
M	8/01	Developing Design Proposals	Studio session – Detail design development	Design development of detail design
T	9/01	Final proposal	Studio session – Detail design development	Design development of detail design
W	10/01			
T	11/01			
F	12/01			
M	15/01			
T	16/01			

W	17/01	Studio session – Detail design development	Design development of detail design
T	18/01	Blech – Technical Portfolio	Design development of detail design
F	19/01		
M	22/01	Studio session – Detail design development	Design development of detail design
T	23/01	Blech – Technical Portfolio	Design development of detail design
W	24/01		
T	25/01	Blech – Technical Portfolio	Design development of detail design
F	26/01		
M	29/01	Final Submission (Part 1) – Models	Public Holiday for Chinese New Year 28 th and 29 th of Jan
Chinese New Year			
T	30/01	Blech – Technical Portfolio	Design development of detail design
W	31/01	Studio session – Final proposal	Design development of detail design
T	1/02	Blech – Technical Portfolio	Design development of detail design
F	2/02		
M	5/02	Portfolio development	Design development of detail design
T	6/02	Blech – Detail	Design development of detail design
W	7/02		
T	8/02	Blech – Detail	Design development of detail design
F	9/02		

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Subject (code): **Integrated Studio 3 (DED 2834)**
 Credit Units: 6
 Subject (code): DED 2834

Oct AY2017/2018

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Subject (code): **Integrated Studio 3 (DED 2834)**
 Credit Units: 6
 Subject (code): DED 2834

Oct AY2017/2018

M	12/02	Studio for Portfolio Development
T	13/02	Studio 28
W	14/02	Blech – Detail Studio for Portfolio Development
T	15/02	Studio 29
F	16/02	Blech – Detail
M	19/02	Submission Portfolio Development (10%)
T	20/02	Final Critique (Day 1- 40%)
W	21/02	Final Critique (Day 2- 40%)
T	22/02	Final Critique (Day 3- 40%)
F	23/02	Clean up!!!!

General Rules

1. Attendance is **mandatory** for all sessions on Mon, Wed and Thu between 9am and 12pm in the above schedule. Students who are absent without valid documents/reasons or official leave of absence form would be penalized. Please note that a minimum of 85% attendance is required or a non-graded pass (NGP) will be accorded.
2. Attendance would be marked for all review, submission and presentation sessions.
3. All students are to adhere to the scheduled consultation sessions as informed and the studio representative is to consolidate the list of students who would attend the day's consultation session with the lecturers before every session, if applicable.

Prepared for Diploma in Environment Design
 By Derek Lo adapted by Marta Miguel | 13 Oct 2017

Subject (code): Integrated Studio 3 (DED 2834) Oct AY2017/ 2018
 Credit Units: 6
 Subject (code): DED 2834

W	6/12	Developing Design Proposals	Pin-Up Auto Cad Drawings (Formative)	Design development of schematic design
T	7/12	Schematic	Urban studies - Application of CS	
F	8/12			
M	11/12			
T	12/12		Studio 14	Design development of schematic design with cad drawings (in preparation for BasCon) Note: UDSU Assignment 3
W	13/12		Studio 15	
T	14/12		Studio 16	
F	15/12		Studio 17	
M	1/01		DES VACATION (16 Dec 17th to 31st Dec 17)	
T	2/01		Blech - Intro	
W	3/01		Schematic Design (Pin Up – Silent review- 20%)	
T	4/01		Blech – Case study	
F	5/01			
M	8/01	Developing Design Proposals	Studio session – Detail design development	Design development of detail design
T	9/01	Final proposal	Studio 18	Design development of detail design
W	10/01			
T	11/01			
F	12/01		Studio 19	
M	15/01		Studio session – Detail design development	Design development of detail design
T	16/01		Studio 20	

Study 4 – Part 2

Urban Design Studies _ Introductory Brief

Subject (code) : Urban Design Studies (DED 2826)
 Credit Units : 3
 AY 2018/2019 Oct



DED2826 – Urban Design Studies

Subject Introduction

1.0 Subject Introduction

Subject Synopsis

The subject focuses on sustainability with emphasis on people. It covers basic urban vocabulary and fundamental urban systems. It introduces key urban design principles and trends relevant for the design of resilient and sustainable cities. It draws on Singapore's urban history and makes references to key urban design movements that have shaped cities of today. The subject also introduces local planning guidelines and strategies.

Learning Objectives

This subject aims to equip students with the knowledge and skills to:

- Appraise cities from the perspective of urban design
- Use urban vocabulary to describe public spaces
- Relate relevant urban design movements and sustainable urban design solutions to the local context
- Identify urban forms and suggest sustainable urban design solutions.

2.0 Duration

The duration of the subject is as follow.

Block 3 and 4: 15th October – 6th Dec 2018 (Mondays and Wednesdays)

Session: 9am – 12pm

Venue: DES Studio DG28-05-12/ DG28-05-16

Urban Design Studies (DED 2826)
 Type of subject : Subject Introduction
 Credit Units : 3
 Diploma Core

3.0 Mode of Instruction

The subject will introduce students to a studio-based learning approach of learning-by-doing in a studio environment. The subject caters around the conception of learning as an active engagement. The aim is to encourage students to drive their own learning.

Substantial group work is essential in the subject due to the scope and scale of the assignments which involve urban investigation of Singapore city. Group work will also encourage teamwork and collaboration and will serve as a platform for students to consolidate research materials, engage in urban analysis and propose design strategies. Furthermore each student in the team will be tasked to peer teach within the group setting. This will allow the sharing of knowledge and will help to assess individual contributions within the team. This is in alignment with the course curriculum that promises to develop students' creative acumen and skills like critical thinking, problem solving, communication and collaboration which are recognized as the key innovation and learning skills under the 21st century learning framework.

Teaching methods include short lectures, which are used sparingly to facilitate the understanding of new knowledge and assignments which are hands-on activities that encourage exploration. In addition verbal and graphic presentations will be required of students as a means to hone their communication skills and to gauge their understanding and application of the concepts. Field trip will be incorporated to broaden the students' exposure and experience of the various subject topics.

4.0 Assessment

Formative assessment shall be conducted during teaching sessions. These sessions will include design reviews and consultation sessions, a form of desk reviews which are conducted on one to one basis on draft of the assignments periodically. The lecturer will use the information obtained during these design reviews and consultations to gauge the student's learning progress and provide appropriate feedback to the students. Further opportunities will be provided to the students for them to act and improve based on the feedback. Similarly for group assignments, systematic check-ins over time before the final submission will be incorporated to check the progress of group work and gauge individual effort.

Urban Design Studies (DED 2626)
 : Subject Introduction
 : Diploma Core
 : 3
 Credit Units

Urban Design Studies (DED 2626)
 : Subject Introduction
 : Diploma Core
 : 3
 Credit Units

5.0 Scheme of Work

Wk	S N	Day	Date	Topic	Learning Teaching Mode	Hrs	Lesson Plan
1	1	Mon	15 th Oct	Urban design and character	Lecture	2	Introduction to: <ul style="list-style-type: none"> Subject Assignment 1: Vocabulary (urban sketches)
					Tutorial	1	Lecture 1: Vocabulary Lecture 2: Making Drawings and Diagrams Introductory assignment (Group): Paradigms: City/ forest; City/ Human body; City/car; City/ computer;
2	2	Wed	17 th Oct	Urban systems and policies	Tutorial Consultation	3	Site Visit
	3	Mon	22 nd Oct		Lecture	1	Pin-up: Sharing of Site Observations <ul style="list-style-type: none"> Picture Matching Defining vocabulary words
3	4	Wed	24 th Oct	Urban Design History	Tutorial Consultation	2	Introduction to Assignment 2
	5	Mon	28 th Oct		Lecture	1	Layer analysis of Singapore today, Green; Water; Networks; car, bicycles, public transport; Relevant infrastructures/ building; characteristic areas; Distribution of population Assignment 2 Introduction to Assignment 2 Part 2
3					Tutorial Consultation	2	Working on Assignment 2 Part 1 & 2

The following summative assessment methods will be employed:

1. A series of individual and group assignments, incorporating presentations will be designed to assess students' ability to apply and communicate the concepts learnt in the classroom. The assessment will take into account the design process and outcome.
2. To motivate individual students and discourage the free-rider phenomenon, both peer and self-assessment will form part of the final grade.

Assessment Scheme

Assessment	Weightages
Continuous Assessment - Assignments - Peer evaluation - Self evaluation	100%
Individual Component	60%
Group Component	40%

- Assignment 1 will be individual and will be marked as 10% of the overall mark
- Assignment 2 will be developed as group work and will be marked as 50% of the overall mark. 40 % will be assessed by tutors and 10% will be defined by peer and self-assessment.
- Assignment 3 will be individual and will be marked as 40% of the overall mark

Assessment will be carried out in relation to all works that is done in class in response to the assignment briefs provided. Students are to work during class sessions to explore and experiment with varied class activities and assignments.

Urban Design Studies (DED 2826)
 Type of subject : Subject Introduction
 : Diploma Core
 Credit Units : 3

6	Wed	31 st Oct	Urban Design History	Tutorial Consultation	3	Working on Assignment 2 Part 1 & 2 NOTE: Submission and presentation of Assignment 1 and 2, 11 of November during Integrated Studio 3 class
7	Mon	5 th Nov		Tutorial Consultation	3	Workshop 1 (Group): What is your vision for Singapore's future development? Look for references and case studies to support your vision Translate the strategies into a concept masterplan
8	Wed	8 th Nov		Lecture Tutorial Consultation	3	Workshop 2 (Group): Define strategies to address site issues. Translate the strategies into a concept masterplan
9	Mon	12 th Nov	Sustainable Urban Design	Lecture	2	Lecture 4: Sustainable cities
10	Wed	14 th Nov		Tutorial Consultation	1	
11	Mon	19 th Nov		Tutorial Consultation	3	Video 1 What did we learn? Assignment 3 Case study analysis Concept Master Plan Video 2 What did we learn? Assignment 3 Concept Master Plan

Urban Design Studies (DED 2826)
 Type of subject : Subject Introduction
 : Diploma Core
 Credit Units : 3

12	Wed	21 st Nov		Tutorial Consultation	3	Pin – up, Formative assessment
13	Mon	26 th Nov		Tutorial Consultation	3	Video 3 Assignment 3 Concept Master Plan
14	Wed	28 th Nov		Tutorial Consultation	3	Video 4 Assignment 3 Concept Master Plan
15	Wed	5 th Dec		Tutorial Critique	3	Submission Assignment 3 Presentation P3 + Urban Assignment 3

0.6 General Rules

- Attendance is **mandatory** for all sessions shaded in grey in the above schedule. Students who are absent without valid documents/reasons or official leave of absence form would be penalized.
- All students are to be **present** with their respective partners in Group Work phase together with all required progress and peer assessment for submission to lecturers. Group consultation sessions with partners who were absent would be rescheduled to a later time slot. Also, they are to state the reason for the partner's absence for the lecturer's information. Lecturers may bypass students of critique if they fail to produce substantial design progress for a constructive session. Thus it is imperative that students organize and prepare their work diligently for lecturers to fully comprehend their progress/problems and assist in their work.
- Attendance would be marked for all review, submission and presentation sessions. Late comers would be penalized.
- All students are to adhere to the scheduled consultation sessions as listed and the studio representative is to consolidate the list of students who would attend the day's consultation session with the lecturers before every session.
- Individual student is strictly to adhere in the documentation of the specific requirements of each stated session.
- Submissions that do not fulfil the requirements stated in the project brief and other relevant documents would be penalized. Please refer to the assessment criteria for the grading breakdown.

Urban Design Studies (DED 2826)
 Type of subject : Subject Introduction
 : Diploma Core
 Credit Units : 3

Jacobs, J. (1991). *The death and life of great American cities*. New York, NY: Random House.

Jenks, M. & Dempsey, N. (2005). *Future forms and design for sustainable cities*. Boston, MA: Architectural Press.

Kim, D. (2016). *Urban design thinking: A conceptual toolkit*. New York, NY: Bloomsbury Publishing.

Lang, J. (2015) *Urban design: A typology of procedures and products. Illustrated with over 50 case studies*. Oxford, England: Architectural Press.

Lynch, K. (1960). *The image of the city*. Cambridge, MA: The MIT Press.

Lynch, K. (1981). *Good city form*. Cambridge, MA: The MIT Press.

Marcus, C. & Francis, C. (1998). *People places: Design guidelines for urban open space*. New York, NY: J. Wiley.

Mehaffy, M. W. & Alexander, C. (2016). *A city is not a tree: 50th anniversary edition*. Portland, OR: Sustasis press in association with Centre for Environmental structures.

Mehaffy, M. W. & Salinger, N. A. (2015). *Design for a living planet: Settlement, science, and the human future*. Portland, OR: Sustasis press.

Montgomery, C. (2013). *Happy city: Transforming our lives through urban design*. Vancouver, Canada: Doubleday Canada.

Moughtin, J. C. (2003). *Urban design: street and square*. Oxford, England: Architectural Press.

Moughtin, J. C., (2005). *Urban design: Green dimensions*. Oxford, England: Architectural Press.

Ritchie, A. & Thomas, R. (2009). *Sustainable urban design: an environmental approach*. New York, NY: Taylor & Francis.

Sadik-Khan, J. & Solomonow, S. (2017). *Streetsight: Handbook for an urban revolution*. New York, NY: VIKING.

Sheppard, M. (2015). *Essentials of urban design*. Clayton South, Australia: CSIRO Publishing.

Urban Design Associates. (2003). *The urban design handbook: Techniques and working methods*. New York, NY: W.W. Norton & Company, Inc

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 : Diploma Core
 Credit Units : 3

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- Works and or assignments that have not developed sequentially under the supervision of your lecturer(s) will not be accepted.

0.7 References

- Alexander, C. et al. (1987). *New theory of urban design* (Center for environmental structure). Oxford, England: Oxford University Press.
- Ascher, K. (2005). *The works: Anatomy of a city*. New York, NY: Penguin Press.
- Farr, D. (2008). *Sustainable urbanism : urban design with nature*. Hoboken, NJ: John Wiley & Son.
- Fleming, L.R. (2007). *The arts of placemaking: Interpreting community through public art and urban design*. London, England: Merrell.
- Graham, W. (2016). *Dream cities: Seven urban ideas that shape the world*. New York, NY: HarperCollins.
- Florian, H. & Robert, T. (2006). *Temporary urban spaces: Concepts for use of city spaces*. Basel, Switzerland: Birkhauser.

Study 4 – Part 2

Urban Design Studies _Assignment 2

Subject (code) Credit Units : : 3	: Urban Design Studies (DED 2826) : 3 AY 2018_2019_Oct	 Temasek POLYTECHNIC
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Environment Design
URBAN DESIGN
S T U D I E S

Assignment 2 (50% - 40%Group work+ 10% peer evaluation)

Urban Design Studies (DED 2826) Type of subject Credit Units : : 3	: Subject Introduction : Diploma Core : 3 AY2017_2018_OCT
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2.0 Tasks

Part 1: Singapore Today

In groups of 6/7 students, analyse both the city of Singapore and your project site from the perspective of its urban morphology. Following this, students are required to conduct contextual studies about Changi Point area. Students are advised to apply the Layer Analysis Methodology introduced in Sustainable Design 2, as well as identify and present the corresponding national statutory boards' regulations/policies, in the following layers:

- Group 1 and 2 – Greenery and Water Bodies (NParks)
- Group 3 and 4 – Demographics, Code on Accessibility, Universal Design, Sustainability and GreenMark (Dept of Statistics/BCA)
- Group 5 and 6 – Morphology, Land Use, with reference to key building, public spaces and infrastructures related to the national economy, politics, history and culture, Density, Plot Ratio and GFA – (URA) (<http://www.citylab.com/housing/2015/02/mapping-the-urban-fingerprints-of-singapore/>)
- Group 7 and 8 – Transportation Networks, Pollution Control, Sewage and Drainage Systems – LTA, NEA

Part 2: Singapore in the past

All groups will conduct a historical analysis of Singapore from the perspective of its urban morphology. In other words, students are required to analyse the historical development of Singapore from the perspective of the morphological layers that define the city and its different characters. For that students are required to analyse the layers during produced in class according to key different historical periods: Before & During the implementation of the Jackson Plan, During Singapore's Independence till the 1980 Master Plan, From the 1980 Master Plan onwards.

Group 1, 5 and 8: Analyse Singapore's urban development before its independence.

- With focus on integrated Studio site, analyse Singapore's urban development before the Jackson Plan. The analysis should have in consideration Singapore's historical and political context at the time. It should account for the city's geographic context, climate and topography as well. In particular, it should be sensitive to the country's economic relations both in a local and international context.

1.0 Objectives

In **Part 1** of this assignment, students should be able to analyse urban systems with reference to local urban design strategies. Students will have the opportunity to:

- Analyze relevant urban systems such as transportation, urban densities, water bodies and landscape elements, ethnic diversities, etc. from the perspective of a city, a district and a street
- Relate relevant urban systems with local planning guidelines such as the master plan, conservation guidelines in relation to a site
- Interpret complex urban systems by working in teams
- Present orally and visually the research findings to explain an urban site

In **Part 2**, students should be able to outline Singapore's historic development with reference to relevant urban design movements. Students will have the opportunity to:

- Review the history of Singapore with a focus on urban systems and urban design
- Interpret how major urban design movements impacted the design of cities, in particular Singapore

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Define the problems and the potentials related to your project site through a SWOT analysis based on data collated in part 1 and 2. Following the methodologies used in the previous modules, namely in **Integrated Studio 2 and Sustainable Design 2**, identify issues related to the sustainability of the site with the focus on People.

3.0 Submission Requirements

Students should use key maps of Singapore as the lay-out for the submission of their layer analysis findings. The analysis should be presented in the form of diagrams and visual representations.
 Final submission should include a resume of what was learned and include critical conclusions from their findings.

Format and date of submission:

Part 1 and Part 2: Groups are required to present and submit assignment 2 together with Integrated Studio 3 site analyses. The format of the submission should align with Integrated Studio 3 requirements. Additional diagrams and sketches have to be submitted in standard A3 format.

Submission date: **1st November**

4.0 Assessment Criteria

This exercise forms 50% of your overall grade. 40% refers to the assignment and 10% to peer evaluation.
 Peer evaluation will be conducted to gauge the level of participation amongst students.

Submission will be assessed on the following criteria:

- Accuracy and completeness of information
- Quality of analysis/critique
- Breadth and Depth of research
- Quality of analysis of the urban design/ Urban morphology
- Clarity of diagrams and sketches
- Critical interpretation of facts
- Comparative analysis of findings
- Storyboarding and Presentation

Urban Design Studies (DED 2626)
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 Credit Units

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- With focus on Integrated Studio site, analyse Raffles' influence in Singapore's urban development. The groups will analyse the Jackson plan and its influence on what is Singapore's urban morphology today.
- Identify the inspiration and the rationale behind Jackson's plan. The students should analyse critically these models and identify their potentials and weaknesses in the Singaporean context.

Group 2 and 6: Analyse Singapore's urban development after its independence.

- With focus on Integrated Studio site, analyse Singapore's urban morphology from the perspective of urban renewal. Students are required to identify the problems Singapore was facing at the time of independence and relate those to the urban strategies applied to the city.
- Identify the inspiration and the rationale behind the garden city and the city in a garden. The students should analyse critically these models and identify their potentials and weaknesses in the Singaporean context.
- With focus on Integrated Studio site, analyse Singapore's urban morphology from the perspective of preservation and conversation. Students are required to relate preserved urban morphologies with specific cultures, ethnic groups and periods of time in history.

Group 3 and 7: Analyse Singapore urban fabric today.

- Investigate how Singapore adapted the urban models implemented after the independence to the local context and specific needs of the country.
- With focus on Integrated Studio site, analyse the development and differences between Singapore's 1980, 2003/2008 and 2014 Master Plans. Identify the key features of the policies and ideas that led to the Singapore we see and know of today.
- The key focus of the Master Plan 2014 was to build townships for all ages that are green, healthy, connected, strong in community interaction and spirit, and to bring quality jobs closer to home. Looking back at these aspirations, identify how URA has tried to realise them and whether they have been successful.

Note: Groups are to organise between themselves so that there is no repeated information being presented.

5.0 General Rules

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Study 4 – Part 2

Urban Design Studies _Assignment 3

Subject (code) : Urban Design Studies (DED 2826)
 Type of subject : 3
 Credit Units : 3

AY2015_2016_OCT

Major Assignment
 Diploma Core

Environment Design
URBAN DESIGN STUDIES



Urban Design Studies (DED 2826)
 Type of subject : 3
 Credit Units : 3

AY2015_2016_OCT

Major Assignment
 Diploma Core

Environment Design
URBAN DESIGN STUDIES



Assignment 3 (Individual 40%)

1.0 Objectives

Assignment 3 will request students to reflect on Singapore's future development and introduce them to the design of a concept masterplan.

Students should be able to:

- Define the meaning of sustainability in an urban context
- Determine major current design movements and strategies with reference to sustainable development using case-studies
- Apply relevant urban design strategies to solve urban problems in a local context
- Defend design strategies to address urban problems

This assignment provides avenues to assist students to further explore the links between Urban Design Studies and Integrated Design 3. This assignment directly supports the undertaking of the project with the intention to encourage students to develop a sustainable and healthy city model. There are three parts to the assignment:

2.0 Task

From the conclusions taken from the urban analysis (Assignment 2), formulate a holistic design strategy to address at least one relevant issue that might compromise the future development of the site. This strategy should be translated into a master plan concept for the site and its surrounding areas.

The analysis of Singapore's urban development should be evaluated critically. The analysis should be well supported by relevant reference materials and presented with the aid of texts, sketches, diagrams (use of

Part 1: Research

- Investigate about Singapore's intentions for future development, both from the perspective of sustainability and emerging new urban models.
- Identify the inspiration and the rationale these models. The students should analyse critically these models and identify their potentials and weaknesses in the Singaporean context.
- Suggest strategies to make Singapore a more sustainable and liveable city. Select one area of interest for you and look for a relevant case study:

- Walkability
- Cycleability
- People-centric/People Friendly
- Imageability
- Green City
- Healthy cities
- Water and the City
- Technology and the City.
- Emotions and city

The selection of the case study should be based on credibility and reputation of the project. Apart from that, ample library resources including key plan of the city/area, sections, visuals and other pertinent information and reading materials should be available to support your research & analysis.

Part 2- A concept masterplan for Changi Point area

Analyse Singapore city and more specifically integrated Studio 3 site from the perspective of the case study investigated previously. Identify strategies on how to implement the guideline studied in the Singapore's context. Look at current Integrated Studio 3 site that you are working on and provide visual evidences on how you would like to implement these ideas in the area. Provide relevant rationalisation and reasoning to support your ideas

4.0 Assessment Criteria

This assignment forms 40% of your overall grade. Submission will be assessed on the following criteria:

Assignment 3 Part 1

Accuracy and completeness of information
Breadth and Depth of research
Quality of analysis/critique of the urban design including argument coherence

Part 2

Degree of exploration of design ideas
Quality of proposal
(positive addition to the urban environment, relevance, coherence of argument in relationship to theories, alignment to case study)
Quality of diagrams, sketches and/or mock up model
Storyboarding and Presentation

Date of the final submission: 3rd of December 2017

5.0 General Rules

1. Attendance is **mandatory** for all sessions. Students who are absent without valid documents/reasons or official leave of absence form would be penalized. Please note that a minimum of 85% attendance is required or a non-graded pass (NGP) will be accorded.
2. Attendance would be marked for all review, submission and presentation sessions.
3. All students are to adhere to the scheduled consultation sessions as informed and the studio representative is to consolidate the list of students who would attend the day's consultation session with the lecturers before every session, if applicable.

3.0 Submission Requirements

The submission should cover the following:

Part 1: Overview/background of Singapore from the perspective of the guide line considered for analysis.

Rationale for selecting the case study
Critical analysis of the case study

The above should be presented in the form of series of sketches/renderings which should be backed up by urbanist theories and ideas.

Part 2: Drawing of the design strategies implemented in Integrated Studio 3 context. Justify how it benefits the community.

The above should be presented in the form of maps, series of sketches/renderings which should be backed up by urban theories and ideas.

Relevant links:

<http://ecobook.org/>
<http://www.urbandesign.org/sustainable.html>
<http://www.sustainablecitiescollective.com/>
<http://www.fastcoexist.com/3016816/the-10-cities-that-are-leading-the-way-in-urban-sustainability>

3.0 Submission Requirements

The scale and format of submission, including drawings and mappings should align with Integrated Studio 3 Schematic Design submission' requirements. You are strictly advised to use hand drawn sketches & diagrammatic representations. Use of images from other sources like books and internet is prohibited.

Urban Design Studies (DED 2826)
Type of subject
Credit Units

: Major Assignment
: Diploma Core
: 3

AY2015_2016_OCT

- Only valid MCs and LOAs are accepted.
- Students applying for MC must submit their applications to TPOSS within 2 working days.
- MCs submitted later than the stipulated period shall not be accepted.
- Only medical certificates issued by medical practitioners registered with the Singapore Medical Council will be accepted.
- Students are required to safe keep the original document for 6 months for audit purpose.
- Application of LOA at least one week in advance.
- Leave Of Absence (LOA) is also to be applied online via TP Online Student Services (TPOSS) (<https://jis2oss.tp.edu.sg/sasmc/loa>)
- A clear image of the supporting document is to be attached to each application.
- The original document need not be submitted.
- However, same like the medical certificate, you are required to safe keep the original document for 6 months.
- Students are required to produce the original document when called upon by the school.

Urban Design Studies (DED 2826)
Type of subject
Credit Units

: Major Assignment
: Diploma Core
: 3

AY2015_2016_OCT

Plagiarism Policy and Copyright Issues:

- Academic integrity is expected of all students at Temasek Polytechnic. The Polytechnic requires all students to be assessed for their own work only.
- All students are required to give proper acknowledgement of all original sources of work used in their assignments, projects or other assessed work.
- Plagiarism is a serious academic offence. Disciplinary action taken for students caught for plagiarism will depend on the severity and includes failing the subject, suspension and removal from course.

Late Work

- Only medical certificates issued by medical practitioners registered with the Singapore Medical Council will be accepted.
- Student arriving late for presentation (or crit) or on submission days without any valid reason(s) will not be eligible to present or submit the work.
- Late submission without valid reasons that meet the minimum assessment criteria will be awarded the maximum of D Grade (Pass). This applies to assignment/project submitted by next working day within 24 hours timeframe.
- Those submitting later than the stipulated time frame would be deemed failed.
- Works and or assignments that have not developed sequentially under the supervision of your lecturer(s) will not be accepted.

Attendance Policy

- Lessons will start promptly on time (unless specifically stated). Punctuality for lessons is mandatory and an essential attitude to cultivate.
- Your regular attendance is critical in your ability to complete the subject successfully.
- Students not meeting the attendance requirement of 85% will be on the Non-Graded Pass (NGP). Attendance is defined here as your participation in the scheduled class activities under the supervision of the lecturer.
- Please take note that students on the Non-Graded Pass (NGP) will only be awarded 'Pass' or 'Fail' for the module. The GPA for a 'Pass' is '1.00'; and a 'Fail' is '0.00'. NGP will have an impact on your cGPA. The results for NGP will be reflected in the transcript as a 'Pass' or 'Fail' only.

Appendix 6

Assessment Criteria - Study 4

Analysis

- Study 4 – Part 1
Sustainable Design 2 _ Site analysis (macro scale)
- Study 4 – Part 2
Urban Design Studies_ Site analysis (macro scale)
- Study 4 – Part 1 and 2
Integrated Studio 2 and 3 _ Site analysis (micro scale)

Defining Strategies

- Study 4 – Part 1
Sustainable Design 2_ Masterplan
Vision, Strategies and Programme (macro scale)
- Study 4 – Part 2
Urban Design Studies_ Masterplan
Vision, Strategies and Programme (macro scale)
- Study 4 – Part 1
Integrated Studio 2 and 3_ Design Brief
Vision, Strategies and Programme (micro scale)

Form exploration and project development

- Study 4 – Part 1 and 2
Integrated Studio 2 and 3 _ Sketch Design
Form exploration
- Study 4 – Part 1 and 2
Integrated Studio 2 and 3 _ Schematic Design
Project Development
- Study 4 – Part 1 and 2
Integrated Studio 2 and 3 _ Final Proposal

Study 4 – Part 1

Sustainable Design 2 _ Site analysis (macro scale)

Sustainable Design 2 (DED2829): STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
Sustainable Design 2 (DED2829)

ASSESSMENT CRITERIA: GROUP ASSIGNMENT 1

Name of Students :		
Assessor		
Date of submission		
Assignment	Group	Individual

Criteria	Standards				
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>
Accuracy and completeness of information	Excellent aptitude to source for accurate and relevant information	Good aptitude to source for accurate and relevant information	Satisfactory aptitude to source for accurate and relevant information	Fair aptitude to source for accurate and relevant information	Poor aptitude to source for accurate and relevant information
Breadth and Depth of research	Displays excellent breadth and depth of understanding	Displays good breadth and depth of understanding	Displays satisfactory breadth and depth of understanding	Displays fair breadth and depth of understanding	Displays poor breadth and depth of understanding
Critical Interpretation of facts	Excellent display of critical analysis	Good display of critical analysis	Satisfactory display of critical analysis	Fair display of critical analysis	Poor display of critical analysis
Quality of analysis from the perspective of eco-design, sustainable systems and the theme of research	Displays excellent analysis from the perspective of sustainable systems and the theme of research. The information is emphasised by effective use of diagrammatic representation thru sketches, diagrams, plans etc.	Displays good analysis from the perspective of sustainable systems and the theme of research. The information is emphasised by effective use of diagrammatic representation thru sketches, diagrams, plans etc.	Displays satisfactory analysis from the perspective of sustainable systems and the theme of research with reasonable use of diagrammatic representation thru sketches, diagrams, plans etc. . .	Displays fair analysis from the perspective of sustainable systems and the theme of research with fair use of diagrammatic representation with limited use of sketches or diagrams, plans.	Displays poor analysis from the perspective of sustainable systems and the theme of research with very limited use of diagrammatic representation.
Clarity of diagrams and sketches	Excellent graphic presentation with well-proportioned sketches and diagrams to illustrate design ideas	Good graphic presentation with well-proportioned sketches and diagrams to illustrate design ideas	Satisfactory graphic presentation with reasonably proportioned sketches and diagrams to illustrate design ideas	Fair graphic presentation which lacks appropriate use of scale and proportion in sketches and diagrams	Poor graphic presentation with inappropriately scaled sketches and diagrams
Exploration and innovation	Excellent level of exploration which was translated in innovative research approach and findings.	Good level of exploration which was translated in innovative research approach and findings.	Satisfactory level of exploration which was translated in fair innovative research approach and findings.	Fair level of exploration	Poor level of exploration
Comments					

Prepared by Marta Miguel Diploma In Environment Design
May 2015

Study 4 – Part 2

Urban Design Studies_ Site analysis (macro scale)

DED 2826 Urban Design Studies: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
Urban Design Studies (DED2826)

ASSESSMENT CRITERIA: Assignment 2 Part 1

Name of Student:		
Assessor	Marta	Luke Lim
Date of submission		
Assignment	Group	Individual

Criteria	Standards							
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>			
Accuracy and completion of information Breadth and depth of research	Information gathered is extremely thorough and accurate exceeding expectations	Good amount of Information gathered with minor issues in accuracy	Information gathered is adequate but leaving out some critical aspects or with some issues in accuracy	Information gathered is minimal with substantial aspects not covered or having issues in accuracy	Hardly any amount of information gathered or major inaccuracies			
Quality of analysis of urban design / urban morphology	Able to thoroughly analyze urban layers and contextualize them in different times in history	Able analyze well urban layers and contextualize them in different times in history	Satisfactory layer analysis. Satisfactory contextualization of the layers in different times in history	Fair layer analysis. Fair contextualization of the layers in different times in history	Poor layer analysis. Poor contextualization of the layers in different times in history			
Storyboarding and Presentation Clarity of diagrams	Excellent storyboarding with clear format and structure.	Storyboarding is good but some format and structure needs better organization for clarity	Satisfactory storyboarding with reasonable format and structure that needs some work on organization for clarity	Storyboarding requires a lot of work in terms of format and structure to organize the information	Poor storyboarding with little regard for organization of format and structure and offers little information			
Comments								
Overall Mark/Grade	A	B+	B	C+	C	D+	D	F
Signature & Date								

Study 4 – Part 1 and 2

Integrated Studio 2 and 3 _ Site analysis
(micro scale)

DED2634 Integrated Studio 3: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
Integrated Studio 2 (DED2833)

ASSESSMENT CRITERIA: SITE RESEARCH & ANALYSIS

Group Members									
Assessor		Marta Miguel			Varit				
Date of submission									
Assignment		Group				Individual			
Criteria		Standards							
		Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>			
Research Skills - Breadth and depth of data collection		Comprehensive data collection to inform all aspects site study	Data collection is good enough to inform most aspects of the site study	Data collection is adequate to inform some aspects of the site study	Limited data collection to inform aspects of the site study	Data collection is lacking and there is little information on the site study			
Critical thinking skills – Quality of analysis and accuracy and evaluation of information Critical Interpretation of facts		Analysis is comprehensive with extensive evaluation and understanding of the site Excellent and innovative interpretation of facts that align well to the research findings and analyses	Analysis is good with a good amount of evaluation and understanding of the site Good interpretation of facts that mostly aligns with research findings and analyses	Analysis is adequate with some evaluation and understanding of the site Interpretation of facts somewhat aligns with research findings and analyses	There is limited amount of analysis with little evaluation and understanding of the site Interpretation of facts are implied but not properly supported by research findings and analyses	There is a lack of analysis with hardly any evaluation and understanding of the site Interpretation of facts have little alignment or unsupported by research findings and analyses			
Presentation – Storyboarding and verbal Use of media and techniques Use of graphic presentation Completeness of submission		Excellent storyboard with clear informative format and structure Excellent persuasive communication in verbal presentation Full command of academic language with wide use of appropriate design vocabulary Comprehensive submission	Good storyboard with appropriate format and structure. Good persuasive communication in verbal presentation Good command of academic language with good enough use of appropriate design vocabulary Submission is generally complete	Storyboard is unclear in some aspects of format and structure Reasonable persuasive communication in verbal presentation Some command of academic language with some use of appropriate design vocabulary Submission is just about adequate to illustrate intent	Storyboard is not very informative with the lack of format and structure in most aspect Barely able to persuade with verbal presentation Limited command of academic language with barely any use of appropriate design vocabulary Submission is barely adequate to illustrate intent	Storyboard is not informative with little attention to format and structure Unable to communicate with verbal presentation Little or no command of academic language with hardly any use of appropriate design vocabulary Submission is incomplete			
(For assessors use only) Mark/ Grade		A	B+	B	C+	C	D+	D	F

Study 4 – Part 1

Sustainable Design 2_ Masterplan

Vision, Strategies and Programme (macro scale)

DED 2829 SusDes: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
Sustainable Design 2 (DED2829)

ASSESSMENT CRITERIA: Individual Assignment

Name of Students :		
Assessor	Marta Miguel	Varit
Date of submission		
Assignment	Group	Individual
<p>Part A: Define 5 strategies to make the island more sustainable (at least one of the strategies must relate to your IntStu2 site). Elaborate on your strategies, its effectiveness in the Pulau Ubin's context, challenges and case studies. Part B: Integrate key strategies and make them work as a system (show using an annotated a systems diagram) Part C: Implement the system in Pulau Ubin and explain how Project 2 relates to the system proposed. This exercise is an introduction to the meaning of a master plan. The implementation should be explored on a map of the island.</p>		

Criteria	Standards				
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>
Accuracy and completeness of information	Excellent aptitude to source for accurate and relevant information	Good aptitude to source for accurate and relevant information	Satisfactory aptitude to source for accurate and relevant information	Fair aptitude to source for accurate and relevant information	Poor aptitude to source for accurate and relevant information
Breadth and Depth of research	Displays excellent breadth and depth of understanding	Displays good breadth and depth of understanding	Displays satisfactory breadth and depth of understanding	Displays fair breadth and depth of understanding	Displays poor breadth and depth of understanding
Quality of analysis from the perspective of eco-design and sustainable systems.	Displays excellent analysis from the perspective of sustainable systems. The information is emphasised by effective use of diagrammatic representation thru sketches, diagrams, plans etc.	Displays good analysis from the perspective of sustainable systems. The information is emphasised by effective use of diagrammatic representation thru sketches, diagrams, plans etc.	Displays satisfactory analysis from the perspective of sustainable systems with reasonable use of diagrammatic representation thru sketches, diagrams, plans etc.	Displays fair analysis from the perspective of sustainable systems with fair use of diagrammatic representation with limited use of sketches or diagrams, plans.	Displays poor analysis from the perspective of sustainable systems with very limited use of diagrammatic representation.
Contextualization and application of the findings.	Excellent inter-relation of the findings and excellent application in the project assignment	Good inter-relation of the findings and good application in the project assignment	Satisfactory inter-relation of the findings and satisfactory application in the project assignment	Fair inter-relation of the findings and fair application in the project assignment	Poor inter-relation of the findings and poor application in the project assignment
Clarity of diagrams and sketches	Excellent graphic presentation with well-proportioned sketches and diagrams to illustrate design ideas	Good graphic presentation with well-proportioned sketches and diagrams to illustrate design ideas	Satisfactory graphic presentation with reasonably proportioned sketches and diagrams to illustrate design ideas	Fair graphic presentation which lacks appropriate use of scale and proportion in sketches and diagrams	Poor graphic presentation with inappropriately scaled sketches and diagrams
Critical Interpretation of facts	Excellent display of critical analysis	Good display of critical analysis	Satisfactory display of critical analysis	Fair display of critical analysis	Poor display of critical analysis
Comments					

Prepared by Marta Miguel Diploma In Environment Design
May 2015

Study 4 – Part 2

Urban Design Studies_ Masterplan

Vision, Strategies and Programme (macro scale)

DED 2826 Urban Design Studies: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
 Diploma in Environment Design
 Urban Design Studies (DED2826)

ASSESSMENT CRITERIA: Assignment 3

Name of Student:		
Assessor	Marta	Luke Lim
Date of submission		
Assignment	Group	Individual

Criteria	Standards							
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>			
Relevance of the case study.	The case study is very relevant to inform the student's project work	The case study is relevant to inform the student's project work	The case study can inform the student's project work	The case study can eventually inform the student's project work	The case study is not relevant to inform the student's project work			
Accuracy and completion of information. Breadth and depth of research	Information gathered is extremely thorough and accurate exceeding expectations	Good amount of information gathered with minor issues in accuracy	Information gathered is adequate but leaving out some critical aspects or with some issues in accuracy	Information gathered is minimal with substantial aspects not covered or having issues in accuracy	Hardly any amount of information gathered or major inaccuracies			
Interpretation of the findings	There is excellent and thoughtful interpretation of the findings.	There is a very good amount of interpretation of findings with minimal oversight	Interpretation of the findings is adequate with some oversight	There is some interpretation of the findings but incomplete	There is hardly any interpretation of the findings			
Quality and innovation / Application of the findings	Very creative application of the findings in project work	Creative application of the findings in project work	Appropriate application of the findings in project work	Limited application of the findings in project work	No application of the findings in project work			
A3 booklet Clarity of diagrams	Excellent booklet with clear format and structure.	Booklet is good but some format and structure needs better organization for clarity	Satisfactory booklet with reasonable format and structure that needs some work on organization for clarity	Booklet requires a lot of work in terms of format and structure to organize the information	Poor booklet with little regard for organization of format and structure and offers little information			
Comments								
Overall Mark/Grade	A	B+	B	C+	C	D+	D	F
Signature & Date								

Diploma in Environment Design
 November 2017

Study 4 – Part 1

Integrated Studio 2 and 3_ Design Brief

Vision, Strategies and Programme (micro scale)

DED 2826 EVD PROJECT 3: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
DED 2833 – EVD Integrated Studio 2

ASSESSMENT CRITERIA: Ideation

Name of Student:			
Assessment Panel* *Please circle where appropriate	Marta Miguel	Varit	
Date of assessment			

Criteria	Standards								
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>				
Ideation & Concept Development (10%) Individual work – Date:									
Relating to Site context	Made relevant and strong relationships to the site, comprehensive use of site analysis data	Attempted to make relevant relationships to the site, good use of site analysis data	Attempted to make basic relationships to the site, using adequate site analysis data	Attempted to make basic relationships to the site using little of the site analysis data	Little relevance to the site and did not use much of the site analysis data				
Depth and extent of examination	Issues identified went beyond the site analysis, are quite mature, sensible, with interesting and relevant observations	Issues identified are good and are quite sensible and highly relevant	Issues identified are predictable and basic but relevant	Issues identified are quite basic and literal with minimal interpretation of data collated	Identification of issue lacks critical thought with hardly any interpretation of data collated				
Clarity of rationale	Data collated is well articulated and coherent (logical) at all times	Data collated is articulated and mostly coherent most of the times	Data collated is sometimes clearly articulated and information is sometimes coherent	Data collated is fairly articulated and information is occasionally coherent (barely logical)	Data collated is not clearly articulated and information is mostly incoherent (lacks logic)				
Concept Exploration									
Extent of exploration	Very extensive exploration that addresses a wide range of possibilities	Good exploration that addresses a range of possibilities	Adequate exploration that addresses some possibilities	Minimal exploration that addresses a limited range of possibilities	Superficial exploration with very limited or absent of more than one possibility				
Derivation of Program/Activity/ Function	Program is very clear and rationale is well articulated and well supported with data/facts	Program is clear and rationale is articulated and supported with data/facts	Program and rationale are not totally clear with some support of data/facts	Program and rationale is barely supported with data/facts	Program is fuzzy and rationale is not articulated nor supported with data/facts				
Grade	A+	A	B+	B	C+	C	D+	D	F

Study 4 – Part 1 and 2

Integrated Studio 2 and 3 _ Sketch Design

Form exploration

DED 2828 EVD PROJECT 3: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
DED 2833 – EVD Integrated Studio 2

ASSESSMENT CRITERIA: Sketch Design

Name of Student:			
Assessment Panel* *Please circle where appropriate	Marta Miguel	Varit	
Date of assessment			

CRITERIA	STANDARDS												
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>								
Schematic proposal													
Sketch design development	Sketch proposal has been extensively developed & resolved from concept stage	Sketch proposal has been well developed but with minor areas unresolved from concept stage	Sketch proposal has been developed but leaving some areas unresolved from concept stage	Some areas developed from concept stage leaving many areas unresolved	Sketch proposal is under-developed with major areas unresolved								
	Shows very clear understanding of programming and functional relationships	Shows a good understanding of programming and functional relationships	Shows some understanding of programming and functional relationships	Shows minimal understanding of programming and functional relationships	Shows no understanding of space planning and functional relationships								
	Demonstrates creative skills in spatial exploration	Demonstrates good skills in spatial exploration	Demonstrates some skills in spatial exploration	Demonstrates little skill in spatial exploration	Does not demonstrate any attempt in spatial exploration								
	Well integrated between architecture and landscape elements	There is a good integration of architecture and landscape elements	Architecture and landscape elements are somewhat integrated	Architecture and landscape elements are barely integrated	No integration between architecture and landscape elements								
Presentation													
Presentation – <ul style="list-style-type: none"> • Organisation of storyboarding • Use of media and techniques • Use of graphic presentation • Completeness of submission 	Excellent storyboard with clear informative format and structure	Good storyboard with appropriate format and structure.	Storyboard is unclear in some aspects of format and structure	Storyboard is fairly informative lacking format & structure	Not informative with little attention to format and structure								
	Excellent use of media and techniques to communicate information	Good use of media and techniques to communicate information	Reasonable use of media and techniques to communicate information	Barely able to communicate with media and techniques	Unable to communicate with media and techniques								
	Full command of academic language with wide use of appropriate design vocabulary	Good command of academic language with good enough use of appropriate design vocabulary	Some command of academic language with some use of appropriate vocabulary	Limited command of academic language with barely any use of appropriate design vocabulary	Little or no command of academic language with hardly any use of appropriate design vocabulary								
	Comprehensive submission	Submission is generally complete	Submission is just about adequate to illustrate intent	Submission is barely adequate to illustrate intent	Submission is incomplete								
Overall Mark / Grade	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 30px; text-align: center;">A</td> <td style="width: 30px; height: 30px; text-align: center;">B+</td> <td style="width: 30px; height: 30px; text-align: center;">B</td> <td style="width: 30px; height: 30px; text-align: center;">C+</td> <td style="width: 30px; height: 30px; text-align: center;">C</td> <td style="width: 30px; height: 30px; text-align: center;">D+</td> <td style="width: 30px; height: 30px; text-align: center;">D</td> <td style="width: 30px; height: 30px; text-align: center;">F</td> </tr> </table>					A	B+	B	C+	C	D+	D	F
A	B+	B	C+	C	D+	D	F						
Signature/date													

Study 4 – Part 1 and 2

Integrated Studio 2 and 3 _ Schematic Design

Project Development

DED 2828 EVD PROJECT 3: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
DED 2833 – EVD Integrated Studio 2

ASSESSMENT CRITERIA: Schematic Design

Name of Student:			
Assessment Panel* <i>*Please circle where appropriate</i>	Marta Miguel	Varit	
Date of assessment	19 th July 2018		

CRITERIA	STANDARDS												
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>								
Schematic proposal													
Schematic design development	Schematic proposal has been extensively developed & resolved from concept stage Shows very clear understanding of programming and functional relationships Demonstrates creative skills in spatial exploration Well integrated between architecture and landscape elements	Schematic proposal has been well developed but with minor areas unresolved from concept stage Shows a good understanding of programming and functional relationships Demonstrates good skills in spatial exploration There is a good integration of architecture and landscape elements	Schematic proposal has been developed but leaving some areas unresolved from concept stage Shows some understanding of programming and functional relationships Demonstrates some skills in spatial exploration Architecture and landscape elements are somewhat integrated	Some areas developed from concept stage leaving many areas unresolved Shows minimal understanding of programming and functional relationships Demonstrates little skill in spatial exploration Architecture and landscape elements are barely integrated	Schematic proposal is under-developed with major areas unresolved Shows no understanding of space planning and functional relationships Does not demonstrate any attempt in spatial exploration No integration between architecture and landscape elements								
Presentation													
Presentation – • Organisation of storyboarding • Use of media and techniques • Use of graphic presentation • Completeness of submission	Excellent storyboard with clear informative format and structure Excellent use of media and techniques to communicate information Full command of academic language with wide use of appropriate design vocabulary Comprehensive submission	Good storyboard with appropriate format and structure. Good use of media and techniques to communicate information Good command of academic language with good enough use of appropriate design vocabulary Submission is generally complete	Storyboard is unclear in some aspects of format and structure Reasonable use of media and techniques to communicate information Some command of academic language with some use of appropriate vocabulary Submission is just about adequate to illustrate intent	Storyboard is fairly informative lacking format & structure Barely able to communicate with media and techniques Limited command of academic language with barely any use of appropriate design vocabulary Submission is barely adequate to illustrate intent	Not informative with little attention to format and structure Unable to communicate with media and techniques Little or no command of academic language with hardly any use of appropriate design vocabulary Submission is incomplete								
Overall Mark / Grade	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 5px;">A</td> <td style="padding: 5px;">B+</td> <td style="padding: 5px;">B</td> <td style="padding: 5px;">C+</td> <td style="padding: 5px;">C</td> <td style="padding: 5px;">D+</td> <td style="padding: 5px;">D</td> <td style="padding: 5px;">F</td> </tr> </table>					A	B+	B	C+	C	D+	D	F
A	B+	B	C+	C	D+	D	F						
Signature/date													

Study 4 – Part 1 and 2

Integrated Studio 2 and 3 _ Final Proposal

DED 2828 EVD PROJECT 3: STUDENT ASSESSMENT FORM

TEMASEK POLYTECHNIC, SCHOOL OF DESIGN
Diploma in Environment Design
 DED 2833 – EVD Integrated Studio 2

ASSESSMENT CRITERIA: FINAL CRITIQUE (40%)

Name of Student:			
Assessment Panel* <i>*Please circle where appropriate</i>	Marta Miguel	Varit	
Date of assessment	14 th , 15 th and 16 th of August 2018		

CRITERIA	STANDARDS				
	Excellent (A)80<	Good (B)70<	Satisfactory (C)60<	Fair (D)50<	Poor (F)50>
Design of Final Proposal	Excellent final design proposal achieving all the aims and objectives of the design brief Comprehensive integration of architecture and landscaping in the context of the site Very coherent submission that brings together the site analysis, masterplan, architecture, structure and detail	Final design proposal meets most of the aims and objectives of the design brief Good integration of architecture and landscaping in the context of the site Coherent submission that brings together the site analysis, masterplan, architecture, structure and detail	Final design proposal meets some of the aims and objectives of the design brief Adequate integration of architecture and landscaping in the context of the site Fairly coherent submission that brings together some of key mile stones of project development such as the site analysis, masterplan, architecture, structure and detail	Final design proposal barely meets the aims and objectives of the design brief Architecture and landscaping is somewhat integrated in the context of the site Submission is not very coherent. It brings together almost none of key mile stones of project development	Final proposal does not meet the aims and objectives of the design brief Little integration between architecture and landscaping in the context of the site Submission is not coherent. It doesn't bring together any of the key mile stones of project development
Image and Character	Comprehensive and appropriate use of plant design, materials and finishes to achieve ambience	Good use of plant design, materials and finishes to create desired effect	Shows adequate use of plant design, materials and finishes to achieve ambience	Shows little use of plant design, materials and finishes to create desired effect	Barely any thought to use of plant design, materials and finishes to create ambience
Use of media and CAD techniques	Demonstrates creative & effective skills in the use of media and techniques 2D Presentation materials are extremely clear, legible and highly informative Displays excellent skills in producing perspectives to illustrate design intent	Demonstrates good skills in the use of media and techniques. 2D Presentation materials are clear and legible and with good information Displays relatively good skills in producing perspectives to illustrate design intent	Demonstrates some skills in the use of media and techniques. 2D Presentation materials are satisfactorily clear and legible with enough information Displays satisfactory skills in producing perspectives with some room for improvement	Demonstrates little skill in the use of media and techniques. 2D Presentation materials are fairly clear and barely legible with little information Perspectives produced displays a lot of room for improvement	Does not demonstrate any attempt in the use of media and techniques. 2D Presentation materials are unclear and legible with little information Perspectives are of low quality displaying little skill in illustrating design intent
Storyboarding – Format, Layout and Clarity	Excellent format, layout with absolute clear representation and communication of the proposal	Presented with a good format and layout with a general clear representation and communication of the proposal	Presented with some format and layout but representation and communication of the proposal not very clear	Presented with limited format and layout and little clarity in representation and communication of the proposal	Format and layout is lacking and representation and communication of the proposal is unclear
Design Communication Skills	Verbal presentation was engaging and very effective with a well-articulated use of design vocabulary	Verbal presentation was effective with good articulation of design vocabulary	Verbal presentation sufficiently effective with some use of design vocabulary	Verbal presentation was fairly coherent with limited use of design vocabulary	Verbal presentation was not effective with absence or poor use of design vocabulary

Prepared by Derek Lo | 01/02/2017
 For Diploma in Environment Design

Oct AY2016_2017

Appendix 7

Survey 1_ Study 4 Part 1

Survey 2_ Study 4 Part 1

Survey 1_ Study 4 Part 2

Survey 1_ Study 4 Part 1

Preview / Submit Survey

Page 1 of 2



Survey: Layer Analysis Sust Des 2017

Pages [1]

**Purpose**

The purpose of the survey/registration ...

* denotes mandatory question

1* Have you had any prior experience of investigating a community, town or city in the ways demanded by the study? (YES/NO)

Please select

2* If YES, please explain what that experience involved

4000 characters left

3* Do you feel the Layer Analysis Methodology helped you to analyse the project site? (YES/NO)

Please select

4* If YES, please explain in what ways it was helpful.

4000 characters left

5* Did the Layer Analysis Methodology help you to undertake an In-depth Investigation? (YES/NO)

Please select

6* If YES, was this in terms of individual themes of research, or overall understanding of the site? Please elaborate.

4000 characters left

7* Was the Layer Analysis Methodology easy to apply? (YES/NO)

Please select

8* What were the challenges faced when applying this methodology?

4000 characters left

9* Do you feel this methodology could be applied to other contexts? Give examples

4000 characters left

10* Would you consider using it in the future?

4000 characters left



Survey: Sustainable Design 2 - 2018

[I have read and agreed to the Terms of Collection, Use and Disclosure](#)

Pages [1]

Introduction

The aim of this survey is to find out the effectiveness in the learning outcome for students in this subject.

Effective learning outcome is defined here as those students who are able to achieve positive learning experiences and portfolio. Participants will remain anonymous throughout this survey. All information given in this questionnaire survey is treated with strictest confidence.

Instructions

1. There are no right or wrong answers. The answers are based on your own experiences, which may be different from that of your friends'. 2. The results will be used to provide a basis for reviewing and improving the curriculum and instruction. 3. Please answer every item in the questionnaire.

* denotes mandatory question

1* What did you like MOST about the subject?

4000 characters left

2* What did you like LEAST about the subject?

4000 characters left

3* Unlike other subjects which are run in lecture-tutorial format, Sustainable Design 2 was planned to include more student based activities in the classroom. Do you prefer the format? Give reasons.

4000 characters left

4* Class activities engaged me to think and that resulted in deeper understanding of the subject. Comment on the statement.

4000 characters left

5* Subject assignments were engaging and challenging. Comment on the statement.

4000 characters left

6 Provide any other comments that you may have, such as general comments or feedback to your lecturer, to help you to make the learning process better.

4000 characters left

The content learned in Sustainable Design 2 was applied in Integrated studio 2. Please comment on the statement.

* denotes mandatory question

– End of Survey –

Pages [1]

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Survey 1_ Study 4 Part 2

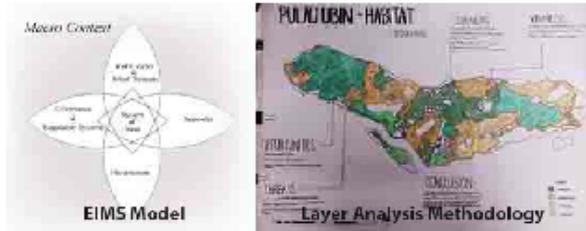
[Preview / Submit Survey](#)

Page 1 of 2



Survey: Layer Analysis Urban 2017

Pages [1]



Purpose

The purpose of the survey/registration ...

* denotes mandatory question

1* Were you able to identify the relation between the Layer Analysis Methodology (followed in class) and the EIMS model (introduced in class as a thinking tool)? (YES/NO)

Please select

2* If YES, please elaborate

4000 characters left

3* Did the EIMS model help you to identify or select relevant layers to study the site? (YES/NO)

Please select

4* If YES, please give examples

4000 characters left

5* Did you feel that the Layer Analysis Methodology help you to undertake an in-depth investigation of the project's site? (YES/NO)

Please select

6* If YES, was this in terms of individual themes of research, or overall understanding of the site? Please elaborate.

4000 characters left

7* If NO, please describe the challenges you faced

4000 characters left

8* Did the EIMS model and the Layer Analysis Methodology help you to identify urban strategies to inform your master plan? (YES/NO)

Please select

9* If YES, please give examples.

4000 characters left

10* If NO, please describe the challenges you faced

4000 characters left

11 * Did you find the Layer Analysis Methodology easy to apply? (YES/NO)
 ▼

12 * If YES, please elaborate

4000 characters left

13 * If NO, what were the challenges faced when applying this methodology?

4000 characters left

14 * Did the EIMS model and the conclusions taken from the Layer Analysis help you in defining a programme, or identifying design strategies, for your project site? (YES/NO)
 ▼

15 * If YES, please explain how.

4000 characters left

16 * If NO, please describe the challenges you faced

4000 characters left

17 * Did you feel the EIMS model was helpful in supporting your thinking during design process? (YES/NO)
 ▼

18 * If YES, please explain how.

4000 characters left

19 * If NO, please describe the challenges you faced

4000 characters left

20 * Do you feel this methodology could be applied to other contexts? Give examples

4000 characters left

21 * Would you consider using it in the future?

* denotes mandatory question

-- End --

Pages [1]

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Appendix 8

Focus Group meeting - Study 4 Part 2

Guiding questions:

- How did the EIMS framework and the layer analysis methodology help in your site analysis? Did it help?
- How did the EIMS framework and the layer analysis methodology influence your project?
- How did the EIMS framework and the layer analysis methodology influence the design process?
- In what other ways was the EIMS framework and the layer analysis methodology useful to you?
- Do you think that the EIMS framework and the layer analysis methodology can be applied in other contexts?

Appendix 9

Assessment criteria for the Educational Innovation Award

EDUCATIONAL INNOVATION AWARD - EVALUATION CRITERIA

Criteria	Each portfolio will be judged according to the extent to which it provides evidence of the following:
ENHANCES STUDENT LEARNING	<p>Clear evidence that the product achieves <u>all</u> of the following:</p> <ul style="list-style-type: none"> i elements of improvement to curriculum or methods of teaching/learning & assessment or learning environment or student achievement and progress or student support ii actively engages students in making strong connections <u>within</u> own subject iii actively engages students in making strong connections <u>outside</u> of own subject
REPLICABILITY (and potential for application in other Subjects, Diplomas or Schools)	<p>Clear evidence that the product can be easily transferred to other contexts, or clearly defined features allow for easy transfer and adaptation.</p>
ACHIEVEMENT OF AIMS of the course, school and TP in enhancing student learning, teaching and support practices	<p>Clearly contributes towards achieving <u>all</u> the aims of TP in terms of preparing students:</p> <ul style="list-style-type: none"> i for a future of dynamic change ii with relevant knowledge iii with life-long skills iv with character v with a thirst for continuous improvement
NOVELTY, originality/unique-ness within TP	<p>The product or its idea is new to TP, and is unique or novel.</p>

Appendix 10

Educational Innovation Award: Justification of the methodology

Project Title	Questions	Succinct inputs
Layer Analysis Exploratory Model	What are the steps/components of this framework that are applicable to EVD?	<p>The framework is a methodology of thinking in the relation between parts and complex whole. As it is contextual, its parts change according to the object of analysis but the methodology stays invariable.</p> <p>Because of the nature of EVD diploma and the need to teach students to decode and analyse urban complex systems, we use it in subjects such as ECO design (Sustainable Design 2), Urban Design, Sustainable Design 3 and during the site analysis of projects.</p> <p>We also can use it to reflect in our curriculum</p>
	How was this framework implemented in EcoDesign specifically?	<ul style="list-style-type: none"> • 1st students study each of the parts of a complex system separately • 2nd they are asked to bring different layers together and analyse how one relates to the other • 3rd students are ask to extract issues or threats and highlight the potentials from both individual layers and the analysis of 2,3,4... or more layers combined • 4th students are asked to define strategies to address the issues • 5th Students are asked to analyse these strategies in relation to each layer and all layers combined. In other words students are asked to explain how the strategies are able to influence the system as a whole by defining their position on individual layer and explain how they influence all the other layers studied. • 6th Depending on the result of the analysis of the strategies in relation to the layers students can explore improve or explore other strategies to nudge or influence the system as a whole.
	How could this be replicated to other diplomas in Design or other diplomas in the other Schools?	<p>This methodology it's more relevant to analyse complex systems. Systems that either are big in scale or include so many varieties that is difficult for the human mind to embrace it holistically without the risk of neglecting key relevant aspects of the system.</p> <p>The methodology can be adapted to the analysis of any complex system regardless its nature or scale. It can be used to study a person, a group of people, a company, a business, an investment, the implications of a scientific discovery, etc.</p> <p>The methodology suggested by EIMS implies 1st the definition of the relevant parts that compose the system, the analysis of the parts independently, the analysis of 2 or more combined parts, the suggestion of strategies in one or more of the parts and finally the analysis of these strategies in relation to the whole.</p>

Appendix 11

Educational Innovation Award: Survey to delivered lecturers participating in the workshop

Layer Analysis Methodology – Complexity Made Easy

Educational Innovation Award 2017 Recipient _ LA Fest 2017 _ Workshop: 28. 09. 2017

Name:

Department:

Diploma:

- 1- Do you think you can use the *Layer Analysis Methodology* in your field of work? (Yes/No)
- 2- Can you identify ways on how *The Layer Analysis Methodology* can improve/support your work?
- 3- Would you recommend the *Layer Analysis Methodology* to others? (Yes/No)
- 4- Would you use the *Layer Analysis Methodology* as a teaching tool? (Yes/No)
- 5- Do you think that the *Layer Analysis Methodology* can help you to develop ideas or identify connections which might not otherwise emerge? (Yes/No)
- 6- Other Comments

Note: The *Layer Analysis Methodology* is the application of the EIMS framework (Miguel, 2015) as a tool to conduct in-depth site analysis in the context of The Diploma in Environment Design – Temasek Polytechnic (Singapore)

Appendix 12

Application of the EIMS framework beyond this thesis

Since 2014, the EIMS framework has been applied successfully in several fields of work and in different academic contexts.

Collaboration between NParks, URA and Temasek Polytechnic

As described in Study 4, the EIMS framework was applied to support studio-based learning and teach sustainable design, urban design and architecture from 2014 until 2019.

The 2018/2019 batch of year 2 EVD students went through the same process as the one described in Chapter 4 (one year earlier) and they performed academically even better. The projects developed by this cohort, both in Integrated Studio 2 and 3, had the particularity of being supported by the industry and relevant governmental agencies (see Project briefs in Appendix 13). 2018 *Integrated Studio 2* was also developed in Pulau Ubin but in collaboration with the *National Parks Board*. NParks is a relevant governmental agency that manages the greenery and biodiversity in Singapore. This governmental agency is particularly relevant in the context of Singapore due to its worldwide image as the “Garden city”. The vision for the “Garden city” was introduced by the prime minister, Lee Kuan Yew, on 11th May 1967. 2018/2019 *Integrated Studio 3* was developed in collaboration with the *Urban Redevelopment Authority of Singapore*. URA is the governmental agency responsible for Singapore’s urban management and design and it is one of the most powerful governmental agencies in the country, whose main role is to define the country’s urban development. Following this, every five years URA launches a new masterplan for the country: a “statutory land use plan” which guides Singapore’s development in the medium term over the next 10 to 15 years. 2018’s *Integrated Studio 3* was developed in the context of the URA’s 2019 masterplan and will be exhibited alongside it, both in URA’s main quarters from 27th March 2019 until the end of May 2019 and at the *Civil Service Club*, a key location at the project’s site, on 30th and 31st March 2019. The work of students focused on the Changi Point area, the area on mainland Singapore that faces Pulau Ubin. This place evokes national historical memories and key cultural beliefs which the government aims to preserve.

The application of the EIMS framework and the layer analysis methodology in Integrated Studio 2 and 3 followed the processes described in Study 4. Students analysed the site according to scale of the place, the region and the city. They analysed each layer individually and intersected layers of different kinds of information and different scales of analysis. Students used the EIMS framework to propose strategies, programs and concepts and converted these into masterplan solutions. Finally,

they developed architectural forms as a catalyst to bring positive change to the Changi Point area and Singapore as a whole.

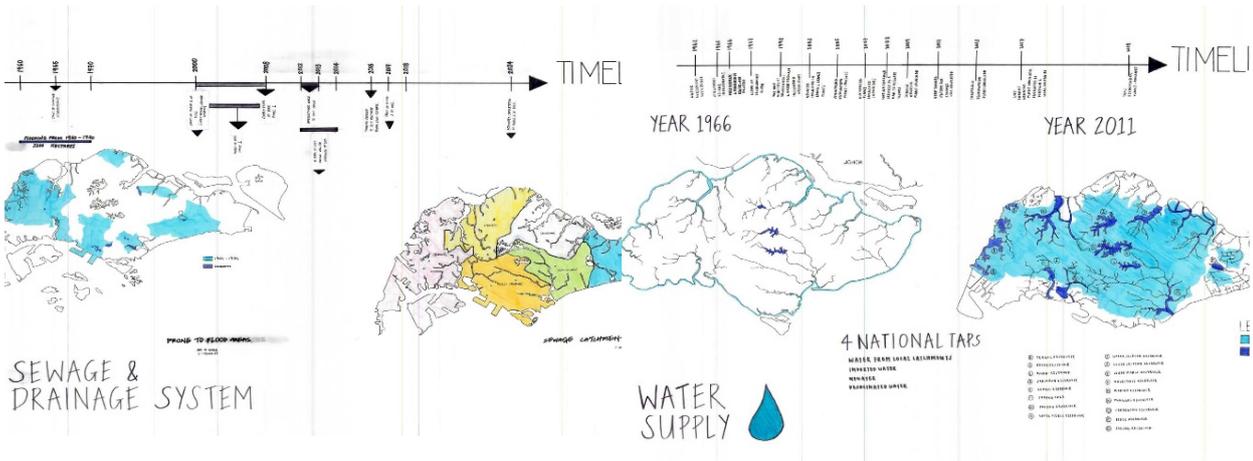


Figure 73 and 74: Layer analysis-scale of the country

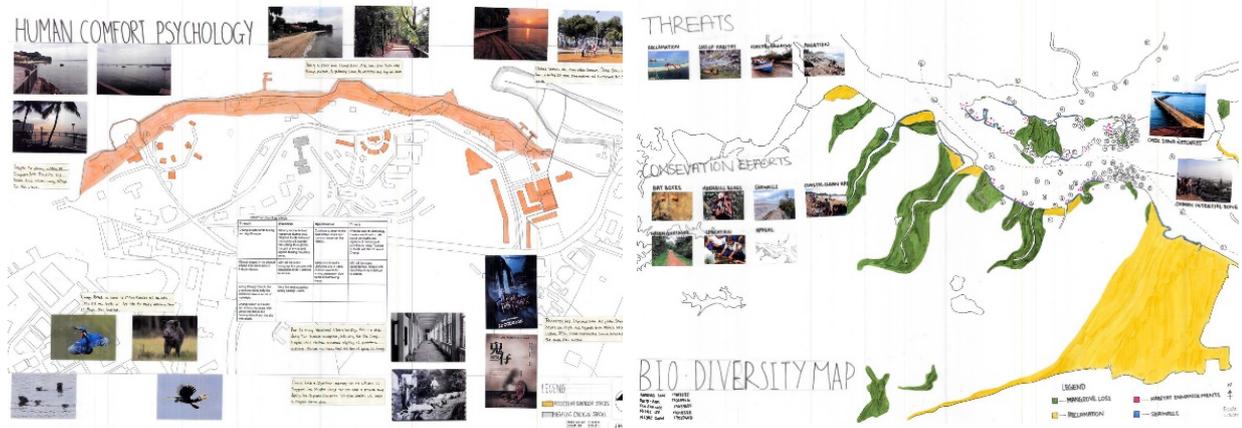


Figure 65 and 76: Layer analysis-scale of the region

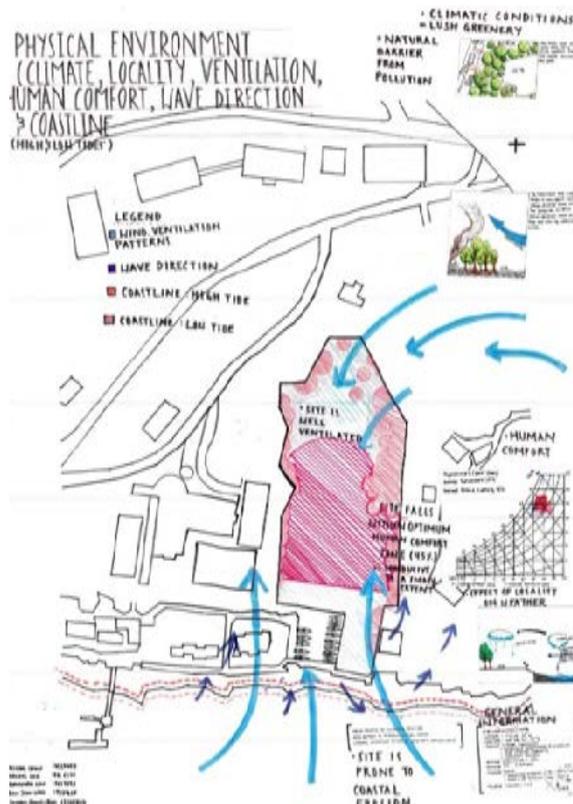


Figure 77: Layer analysis-scale of the site

The students' process was followed and supported by diversity-relevant governmental agencies and stakeholders which play a key role for the development of the area. The students' *Layer Analysis*, the masterplan and architectural proposals, served as valuable ground for public engagement. It brought people to talk about the site on a much deeper level than previously and it opened the minds of professionals working in the area to new perspectives and possibilities. Participants were engaged and students used the EIMS framework to defend their arguments and their proposals. There were two meetings between the governmental agencies, stakeholders and students: one at the concept design phase and the other when students submitted their final project.

Governmental agencies involved:

URA: Responsible for the Master Planning & Rejuvenation of Changi Point – activation of Cranwell open field as a public realm for public events/community events, enhancing accessibility, publicity of the area, working together with multi-stakeholders in rejuvenating Changi Point, adaptive uses of the heritage buildings. Representatives: Director - Physical Planning East, three Executive Planners and one Planner.

NParks: Responsible for the landscaping of Changi Point – rejuvenating heritage trees of Changi Point, refreshing a heritage trail that will increase public awareness of the heritage trees, increase public accessibility and awareness of the sandy beaches at Changi Point. Representatives: Deputy Director, Director of Park Planning and Manager of Park Planning East.

SLA: Responsible for the readapted uses of the heritage buildings for interim uses in Changi Point. The Singapore Land Authority is a stationary board under the Ministry of Law. It is responsible for the optimisation of land and resources for social and economic development of Singapore. Representatives: Head and Senior Executive, Interim Use Master Planning, In-house Leasing Manager and In-house Leasing Senior Executive.

NHB: Responsible for the heritage buildings of Changi Point and potential heritage trail and narrative for Changi in the future. National Heritage Board is a statutory board of Singapore's

government, under the Ministry of Culture, Community and Youth. Representatives: Deputy Director and Assistant Manager - Education & Community Outreach

Relevant stakeholders involved:

Civil Service Club: Major operator of chalets in Changi Point, programming of Changi Point and enhancing recreational offerings for guests staying at the chalets. Representatives: Chief Executive, Deputy Chief Executive and Director.

Changi Sailing Club: Promotes sailing activities in Changi Point and grooms sailing talents for Singapore. Representatives: General Manager.

Changi Point-Ubin Area Sub-Committee: Promotes the preservation and interrelation of both Pulau Ubin and Changi area. One representative.

People's association: Promotes the preservations of the community that lives in the old military barracks still present in Changi area. One representative.

The panel attributed eight awards to the projects, namely on the areas of innovations, networks, culture and heritage, biodiversity and landscape and the quality of the masterplan.



Figure 78: Representatives of government agencies and stakeholders engaging with the students and their work



Figure 79: Presentaion of the 1st prize winner, whose work will be exhibited in URA's headquarters in the context of Singapore's 2019 masterplan



Figure 80: 1st prize. Final submission to URA

To support Interior Design subjects

The methodology was also used to teach interior architecture subjects and several subjects with a focus on research, such as *Eco Design (2015-2017)* and *Issues and Trends (2018)*. The framework was used many times to guide students to challenge concepts and world views in a context where critical debate is not supported. EIMS methodology won Singapore’s Temasek Polytechnic 2017 Academic Innovation Award which became known across the school, and more lecturers started applying it in their own field of work. The methodology proved to be adaptable both across different topics and different kinds of users. The lecturers using the methodology as a teaching tool in other academic fields have addressed gaps and bridged differences in terms of content and kinds of data collected. Juniarto Hadiatmadja, an architect and lecturer in the Diploma of Interior Architecture, developed an innovative way to translate the EIMS framework and synthesise the step-by-step process in a visual form to facilitate his own understanding of the models and to share it with his students.

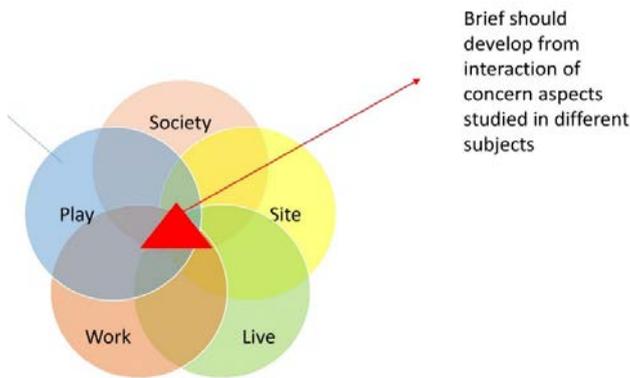


Figure 81: Lecturer’s suggestion for research areas



Figure 82: Lecturer’s suggestion for layers/subsystems of analysis

As in the context of study, the teacher supported students in identifying relevant sublayers to understand the system. The teacher also manipulated the way knowledge was exchanged by defining the main topics of research per group and then mixing the groups to analyse the site as a whole. In this manner, all participants could contribute with their specific knowledge to analyse. This jigsaw puzzle activity fosters students’ active learning (Muijs and Reynolds, 2017) and more meaningful conclusions from the intersection of layers, enabling students to extract core problems and imbalances of the system.

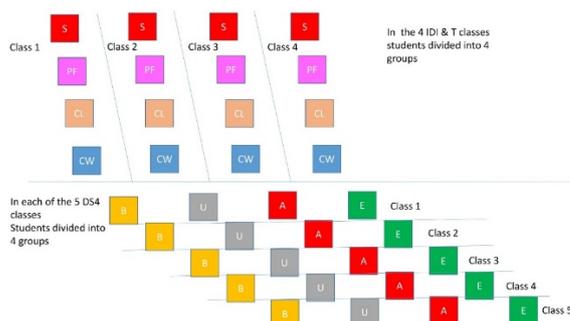


Figure 83: Class groups used to form the jigsaw puzzle organisation for class activity. The activity is used to guide students to analyse information holistically

As in Case Study 4, the definition of the core of the system and its translation into design strategies, a specific program and design concept for the site, is summarised in a document named “Design Brief”. This document serves as a guideline to support students’ entire design process.

In this case, the lecturer synthesised the content needed to inform the “Design Brief” as follows:

“Who/user” – what the research names as the *system of focus*

“What/vision” – the vision for the site and the program which might guide to it. In other words, the *What* refers to the strategic strategies that support the basic human needs and have the potential to trigger change in a specific direction

“Why” – a coherent reasoning that links the analyses of all aspects of the system with a proposal.

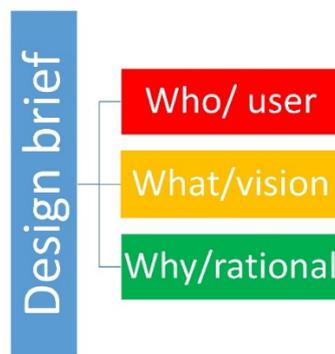


Figure 84: Design Brief content. Synthesis of the analysis, definition of vision and strategies.

Juniarto’s students’ method of synthesising and analysing information differed. Instead of translating the findings of each research topic in terms of maps, lecturers found it more useful to translate data into infographics. The infographics were then analysed in isolation and in relation to others. This other methodology of layering and analysing information in a more abstract way proved to be very efficient in terms of finding relevant patterns and helping students to situate themselves and their opinion within complex topics.

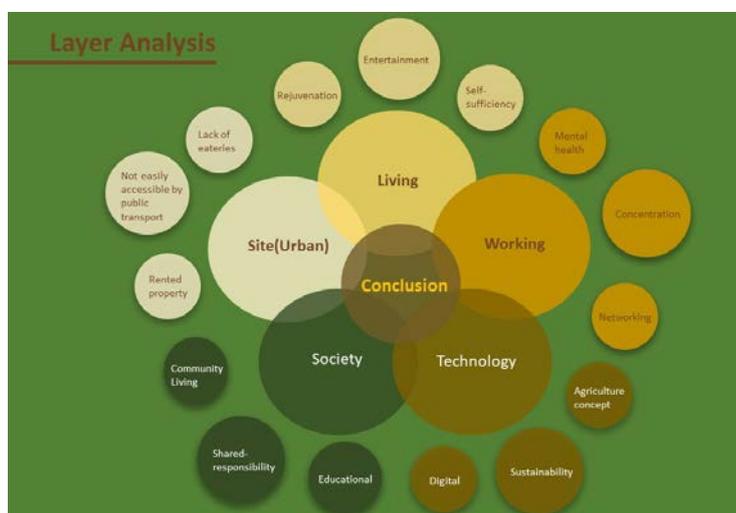


Figure 85: Students’ work. Synthesis of issues and considerations related to each area of analysis.

To support professional practice

Mauro Moro, senior architect and design leader with vast international experience in the field, is using the EIMS framework to articulate a design methodology able to bring depth and meaning to architectural and urban design proposals. He also uses the framework to exchange information and enhance collaboration across the team (Moro, 2019).¹

“WHY: The objective of this methodology is to manage a big amount of information (inputs) and to produce the correct interpretation of the results (outputs);

WHAT: By three phases: ANALYSIS – INTERPRETATION – PROJECT. These three phases are flexible and repeatable along the entire process;

HOW: The process must be oriented and focused on the final Goal or Purpose of the study.”

Mauro’s introduction of the EIMS framework to his peers (2018)

In 2018, Mauro Moro was introduced briefly to the EIMS basic model and explained how it should be operated. Recently, he has translated the EIMS framework into an operational methodology to guide design teams to collaborate and bring meaning to the design process and design object (See Table 23). Mauro’s ability to take ownership and interpret the models to formulate his own design process opens doors to assume that the EIMS framework can be useful to a broader number of design professionals. As in the academic approach described in Study 4, Mauro has also divided the framework into operational steps that align with the design process, but he framed the process in the context of the architectural design industry, where time to develop proposals is shorter and economic returns are of high importance. He argues that the EIMS framework offers a valid approach that guides and gives coherence to the design process. In addition, it brings depth and meaning to the design product. It is a way to step aside from the exploration of form without a deeper meaning: the exploration of form for the simple creation of form and space without the intent to improve the context of where things are built. Mauro supports the research idea that *Design* has the power to change lives and because of that it has an imbedded social responsibility, which deserves to be addressed both in a professional and academic context.

Mauro has applied the framework to develop a masterplan/sketch design proposal for a project in China/Beijiao. As we can see in Table 23, it is interesting to observe that the EIMS framework leads its users to a similar process and similar outcomes to extract and communicate information, regardless of if it is developed by professionals in the industry or by students. In both contexts, users used a SWOT analysis to synthesise information gathered. In addition, they both made use of maps to translate the findings and the proposals into a visual format to be analysed more easily and assimilated by all parties involved in the design process. The differences that emerged are related to the experience and maturity of the users. Mauro, as a professional, was able to analyse information and

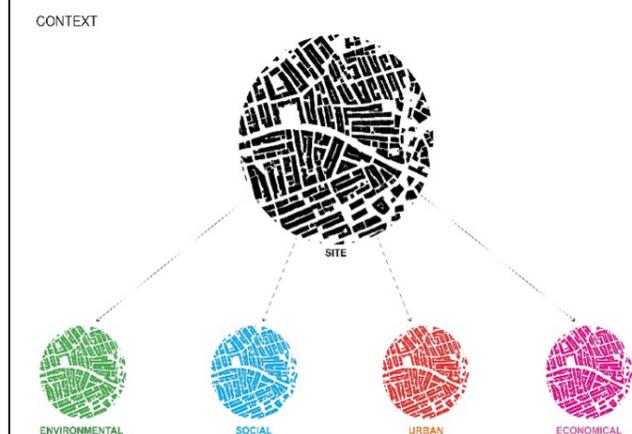
the intersection of layers in more depth. He was also able to take into more consideration softer aspects of the site. He was able to identify relevant areas of research faster, skipping some parts of the thinking process that had to take place in the academic context. As expected, he was able to synthesise and combine different sources of information faster and translate it into relevant maps which were used to defend proposals in presentations to clients. Mauro could articulate the process of analysis that guided to a form more clearly. These observations guide towards the conclusion that the EIMS framework is relevant both in an academic and professional context. The models are pragmatic and can be easily used. The models can bring coherence to the design process and a deeper meaning to the design form. The depth of research and meaning extracted from the framework is related to the user, his experiences and world views.

EIMS framework operational steps

The first step is to clearly define the model's core: The core of the model establishes a social system of analyses and/or hypothetical problems to be addressed.

This initial step normally emerges from the understanding of the design brief. The user defines a design context and the design problem which will be the bases to start the design process (Cross, 2008).

Graphic translation of the EIMS process by Mauro Moro



Examples of application in an academic context

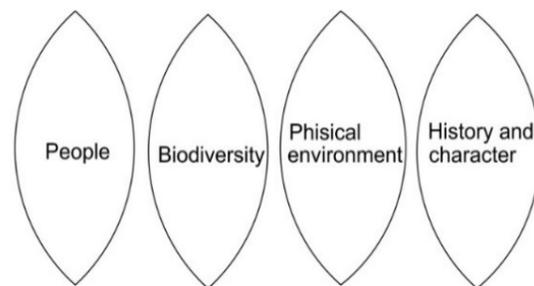


Examples of application in the architecture industry

BEIJIAO STRATEGIC OBJECTIVES
北涿战略目标

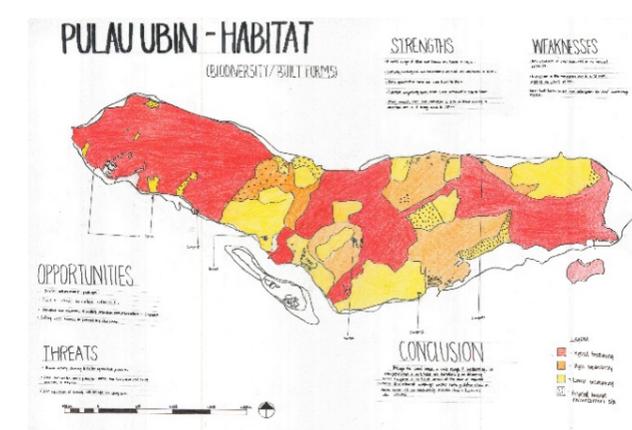
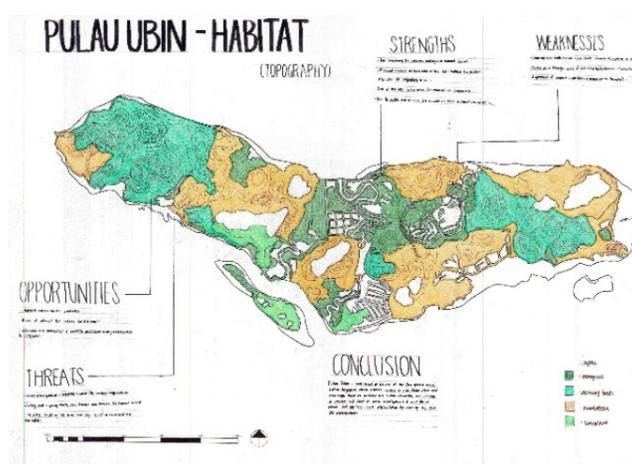
Attract Talents 吸引人才	Smart Transportation 智能交通
Reconvert Industrial Production "Smart" Business 智能产业升级	Natural & Built Assets 自然与建成资源
Regional Networking 区域联动	Beautiful People Happy Shunde 美丽北涿 幸福顺德

The second step is to characterise the system from the perspective of its key intervention areas.



As complex systems are organised in nested hierarchies (See pp.98), relevant sublayers of each main part of the system should also be analysed. For example, to understand people the topic needs to be subdivided in different layers, such as demographics, gender, age, religious background, etc.

Scale of the region



Scale of the region

CONTEXT _ ENVIRONMENT

项目背景-环境

Water Network

Beijiao is located in the Pearl River Delta, its water system plays an important role in forming the characteristic city image. Benefiting from its water network and outstanding nature environment, Guangdong Province has established 360 natural protection zones, including 11 national protection areas, 86 provincial areas and 283 municipal areas - thus being the province with the most protected areas in the country. These protected zones are particularly significant for migratory wetland birds.

水系网络

北涿地处珠三角地区，水系网络在塑造城市形象特色方面起着至关重要的作用。得益于发达的水网和优越的自然环境，广东省已建立了360个自然保护区，其中包括11个国家级保护区、86个省级保护区和283个市级保护区——使其成为中国拥有保护区最多的省份。这些保护区对候鸟迁徙具有重要意义。

CONTEXT _ ECONOMY

项目背景-经济

Industries

The Pearl River Delta is one of the most populated areas of China and the world. Sojiao manufacturing industries sit in a well-established industry network of the broader region. Great opportunities of industries upgrade and value chains are offered by the Pearl River Delta context.

产业

珠三角是中国乃至世界人口最为稠密的区域之一。北涿的制造业位于该成熟产业网络范围之内。珠三角的巨幅增长赋予了项目当地产业升级与价值链发展的重大机遇。

Main topics of analysis

People Biodiversity Physical environment History and character

layers of analysis

The system should be analysed not only in relation to its different parts but also across scales. Relevant scales of analysis might be the region, location and site.

Within each area of research relevant sublayers emerge

MAPPING

ENVIRONMENTAL SOCIAL URBAN ECONOMICAL

ENVIRONMENTAL: DIVERSITY, TOPOGRAPHY, GEOGRAPHY, GROUNDWATER POSITION, WATER CYCLE, WIND, NATURAL RESOURCES, POLLUTION

SOCIAL: ETHNIC CLASSES, LANGUAGE, RELIGION, HISTORY, TRADITIONS, MINDSET, VALUE, AGE

URBAN: HABITAT, PUBLIC SPACE, ACCESSIBILITY, PHYSICAL FORM, PUBLIC SPACE, SERVICES, REGULATIONS

ECONOMICAL: RESOURCES, INDUSTRIES, TRADE, MARKET, SPREAD

Scale of the site

PHYSICAL ENVIRONMENT (CLIMATE, LOCALITY, VENTILATION, HUMAN CONTEXT, LAKE DIRECTION, HUMAN CONTEXT, LAKE DIRECTION)

CLIMATE, LOCALITY, VENTILATION, HUMAN CONTEXT, LAKE DIRECTION

Scale of the site

EXISTING UNDEVELOPED LAND

现状未开发土地

Green areas and agriculture

The site benefits from an extensive amount of green areas which play a key role in the environmental quality of the space. Due to the presence of the water, the soil is rich with vitamins and other nutrients suitable for growing vegetables.

绿地与农业区

项目所在场地有大面积绿地，对空间环境质量有着重要的意义。由于水体的存在，土壤富含维生素和营养物质，适合种植蔬菜和农作物。

DATA 数据

existing green 现有绿地 64%

existing built areas 现有建成区 36%

WATER NETWORK

水系网络

Lingnan Water Villages

The site is characterized by the criss-cross pattern and interaction between large river, streams and ponds. There is a strong traditional relationship between villages and the water landscape. This has been a sustainable relationship created out of the low-lying nature of the land in this area of the Pearl River Delta. The fish ponds act as a natural detention across the site in high rainfall events.

岭南水乡

项目基地的一大特点是大小河流、溪流与池塘众多，形成了纵横交错的水网格局。村落与水景之间有着传统的紧密联系。这种可持续发展的产生主要是由于该区域位于珠江三角洲，地势低洼。众多鱼塘也成为基地范围内天然的滞洪区域。

The third step is to look at the model again and try to see it from the perspective of the intersection of relevant parts and as a whole. Users are invited to intersect the information regarding each aspect of the system and their subsystems and look for patterns, inconsistencies or opportunities that might emerge from the overlaying of information.

In a professional context, users already have a sense of the key aspects that are relevant for the site and for the client, therefore they can select that layers that are work intersecting.

GEOLOGY TOPOGRAPHY OROGRAPHY

GEOGRAPHY IDROLOGY WIND

NATURE SUSTAINABILITY POLLUTION

PULAU UBIN - HABITAT

CONTRAST & TENSION PATTERNS

STRENGTHS

WEAKNESSES

OPPORTUNITIES

THREATS

CONCLUSION

LEGEND

UNDEVELOPED VILLAGES 未开发村落

EXISTING VILLAGES 现有村落

In a professional context the superposition of layers happened both in terms of different aspects of analysis as well as in relation to the past, present and future developments.

EXISTING AND PLANNED VILLAGES

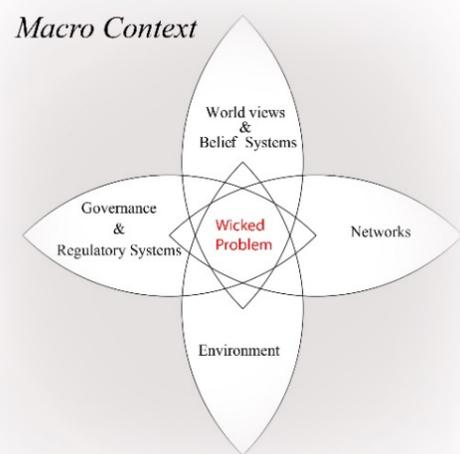
UNDEVELOPED VILLAGES 未开发村落

EXISTING VILLAGES 现有村落

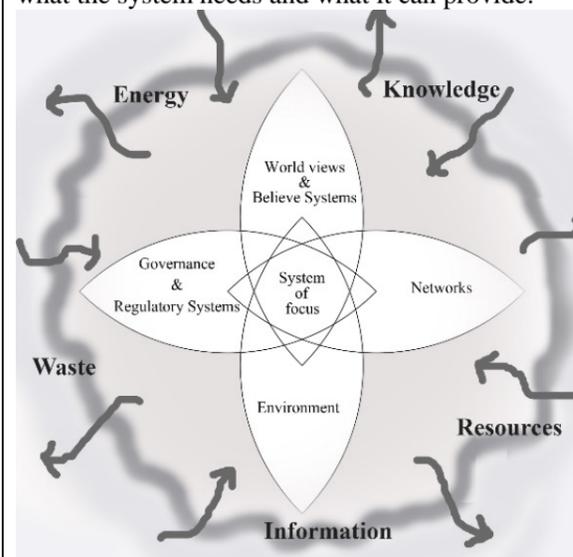
LEGEND

Analysis of the intersections of two or three layers

The user can select which layers to intersect and analyse each combination will guide to different issues of focus and different inter-relations between the parts of the system. Each conclusion taken from the models will lead to different concepts, different strategies, different programs and therefore different outcomes. This selection process is what makes each project unique, still responding to the urban system as a whole. It is important to establish what are the wicked problems of the system and understand how they relate to the system's parts



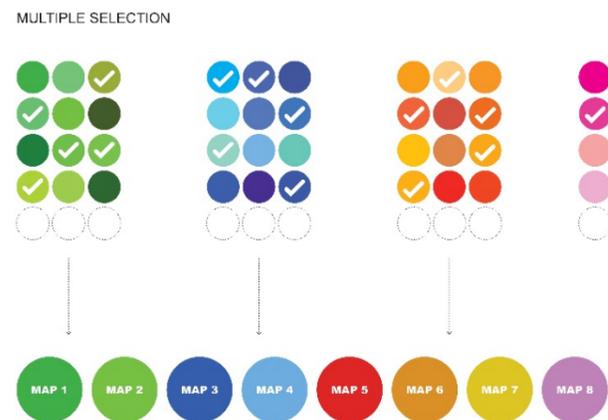
The aim of this analysis is also to understand what the system needs and what it can provide.



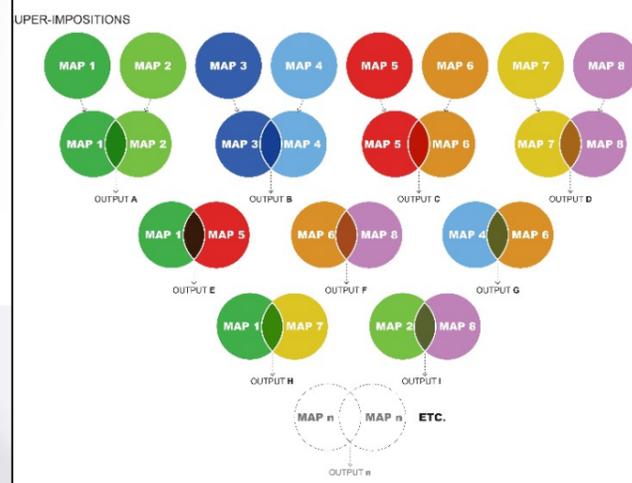
The depth of the analysis and of the conclusions taken is very much related to the user.

Users can select:

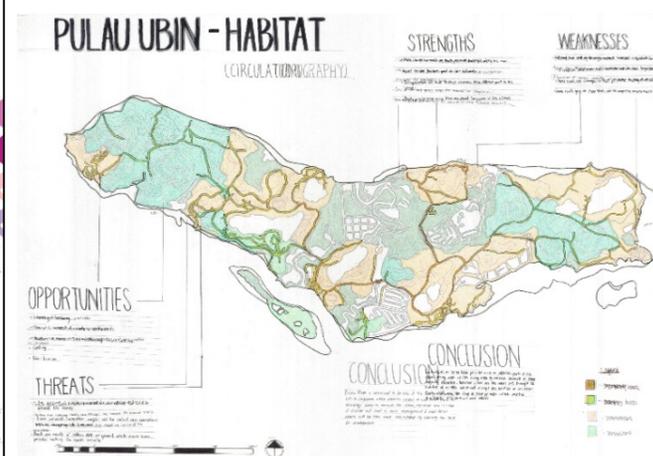
a) the relevant sublayers to analyse



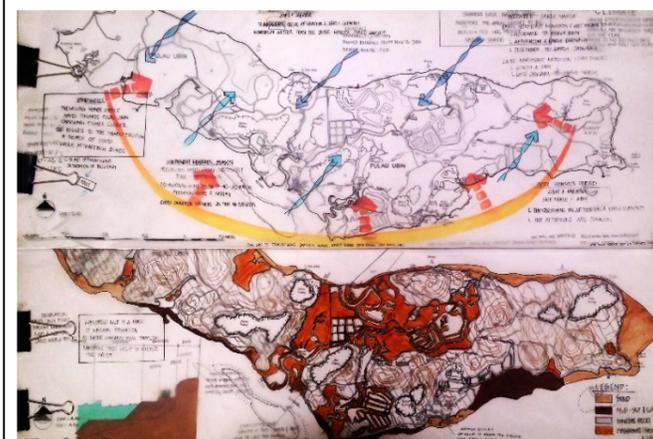
b) the variety of combinations of superposition of layers, each one leading to different conclusions about the site



Greens and temperature



Greens and networks



Topography, type of soil, coat erosion, prevailing winds

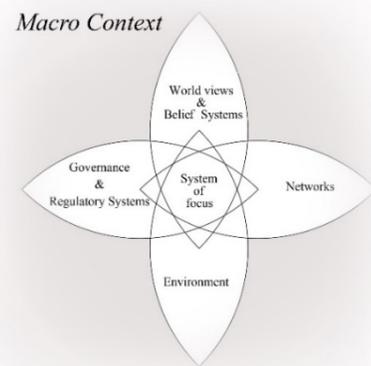
PLANNED SOIL CONSUMPTION PLAN 土壤消耗规划



VILLAGES AND RESIDENTIAL DEVELOPMENTS 村庄与住宅开发项目



The fourth step is to redefine the system of focus. As a consequence of the previous steps, misconceptions will be clarified and areas which were not initially considered will emerge from the analysis. The source of the problems is revealed rather than its side effects. Step 4 gives the opportunity to reflect and synthesise what was learned and to use these conclusions to redefine the system of focus. At this point a clear focus group should be identified as well as its relations with other subgroups. The key issues that need to be addressed should now be defined as well as the unique strength and opportunities the system in analysis has to offer. These conclusions are normally synthesised in the form of a SWOT, but they can also be marked on the models themselves.



STRENGTHS	WEAKNESS	OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> Keeping in rustic oasis without much urbanisation change High biodiversity on the island with many native species Little to no intervention from the government to urbanize the place in the near future 	<ul style="list-style-type: none"> Shrinking population in Pulau Ubin with almost 30 residents left, and demographics showing to live on it a man hard to recruit Technologically backwards (certain parts of the island not receiving tele-voice signals) Lack of economical activities for local, rely on the tourist for incomes (fish, wood fish, farm) Limited connectivity to the main land of Singapore with only one ferry available there 	<ul style="list-style-type: none"> Mangrove restoration works to help to strengthen the soil at the north side of the island, which helps to bring back the decreasing biodiversity Opening of a second jetty in the island to increase connectivity to the island Introduce more jobs for the local to leave the dependence from leaving a job reopening of the fish farm Introduce a new group of residents that will respect the heritage and culture of the island 	<ul style="list-style-type: none"> Soil erosion at the north side of the island leading to the collapse of islands branch With decreasing population many of the old buildings which are left behind will be lost The fear that with people leaving the place, it might lead to disaffection or abandonment of the place

TITLE: SENI MUSIK VILLAGESITE

STRENGTHS	WEAKNESS	OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> Former Celestial Ubin Beach Resort, marking the site where the previous building stood on could be rebuilt, since the adjacent is already there Site is located near the sea, with views of Pulau Ubin island and Singapore Site is within the dining and beaching zone, and Jalan Endak Street Road The site is near mangrove forest 	<ul style="list-style-type: none"> The site is a size which is not suitable for farming Low Biodiversity with certain parts of the site already being built-up and sandy areas Buildings are not to be built more than 2 story in height 	<ul style="list-style-type: none"> Placing coastal arts Allowing a new of residence on the island to promote the view to the sea Opening of the jetty Creating an art hub 	<ul style="list-style-type: none"> May cause huge influx of tourists to Pulau Ubin leading to the deterioration of biodiversity Introducing a new group of people living on the island might not be welcome by the locals Economic competition with the main jetty of Pulau Ubin

KEY ISSUES

- The shrinking of the population on Pulau Ubin with many older-dwells leaving to live in the main land, leading to the aging culture on Pulau Ubin
- In Singapore young are finding it hard to make a living with the increase living cost
- The handling of the cash from the island is currently have to be shipped back to Singapore

SWOT ANALYSIS _ STRENGTHS

SWOT分析-优势

Strong culture, well preserved heritage buildings and public open areas within villages

Unique natural assets of water canals and green fields

Well established manufacturing industry

Extensive landscape, bike lanes and pedestrian paths in new urban developments

Great location and infrastructure network to connect Beijing with the Region

Strategic developments for business, tourism and high-tech industries

现代城市拥有深厚的文化底蕴, 提供良好的历史建筑和文化开放空间

独特自然景观和绿色田野

成熟的制造业产业

新城市开发项目广泛拥有景观, 骑行与步行通道

优越的地理位置和基础设施网络让北京得以与周边城市实现互联互通

商业、旅游和高科技产业的协同发展

SWOT ANALYSIS _ THREATS

SWOT分析-挑战

Unable to attract talents and business to the area

Polluted, unattractive and under utilized water ways and canals

Supply of new developments exceeding current demand

Lack of vibrancy and access to opportunities

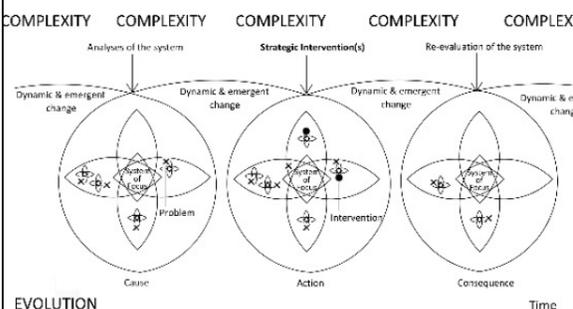
难以吸引人才和商家进入该区域

水体污染水体受到污染, 缺乏魅力, 利用率低下

新开发项目超过需求

缺乏活力与利用机遇的方式

The fifth step is to think of the system as a complex ever-changing entity. It is the time to engage with the notion of time and unpredictable change in relation to the interventions suggested for the system. Now it's the time to apply the EIMS dynamic model.



ISSUES

RESIDENTS ARE APPROXIMATELY AGING RESULTING TO LITTLE OF THE BEACHES

MINIMAL INTERACTION BETWEEN IDEAS AND VISITORS OTHER THAN TOUR AND VISITORS

VISITORS RATHER COME TO VISIT VISITORS

SHIPPING IS THE MAIN SOURCE OF INCOME FOR VISITORS

CHURCH AND ART OF UBIN IS NOT LOCATED TO VISITORS

LANDSCAPE IS NOT LOCATED TO VISITORS

EXTENSIVE OF LANDSCAPE AND BEACHES CAN BE USED TO VISITORS

NO BEACHES AT THE WATER ON THE ISLAND

THERE IS NO PLACE FOR VISITORS TO STAY OVERNIGHT IN PULAU UBIN OTHER THAN THE CAMP SITE

WALKING ON THE ISLAND IS NOT PLEASANT

COLLABORATION TO VISITORS NOT PLEASANT

VISION

WE VISION TO REUNITE AND STRENGTHEN THE COMMUNITY OF PULAU UBIN THROUGH ART AND CULTURE AS WELL AS CREATING A HIGHER LEVEL OF INTERACTION BETWEEN THE RESIDENTS OF PULAU UBIN AND THE VISITORS CREATE A PLACE FOR VISITORS TO STAY OVERNIGHT IN PULAU UBIN OTHER THAN THE CAMP SITE

WALKING ON THE ISLAND IS NOT PLEASANT

COLLABORATION TO VISITORS NOT PLEASANT

BEIJIAO: LIFESTYLE HUB FOR THE NEXT GENERATION

北涿: 未来的生活风尚中心

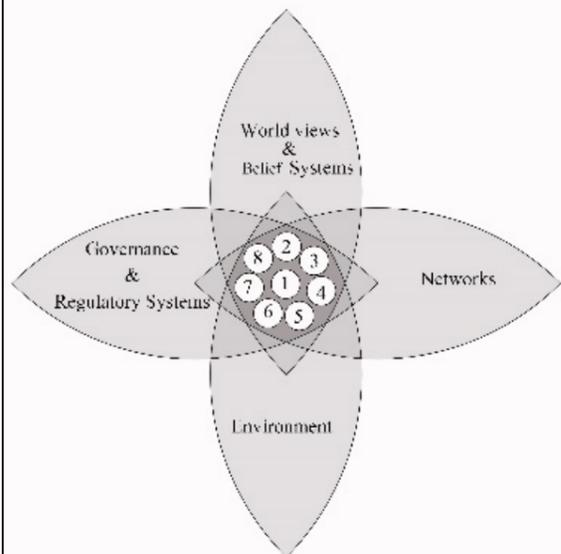
Proposed Vision

Beijiao is envisioned as the future LIFESTYLE HUB as it will be designed to cater to the trends and needs of the NEXT GENERATION. The next generation is seeking a lifestyle experience that is meaningful and fulfilling. A lifestyle experience is an important deciding factor to determine where to live, where to work and where to play. Job opportunities are no longer sufficient reasons to attract talent to cities. People are seeking a better lifestyle, a sense of belonging to a community, cultural identity and connection with nature.

规划愿景

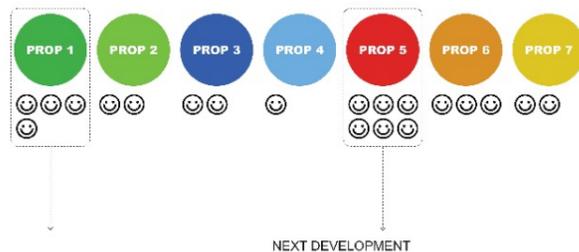
北涿被规划为未来的生活风尚中心, 其设计将着眼于迎合潮流趋势, 满足未来人群的生活需求。未来年轻一代追求高质量和有意义的生活体验。生活体验和品质是决定人们在哪里生活、工作和娱乐的关键因素。工作机会不再是吸引人才到某个城市的充分原因。人们想要的是更好的生活, 一种归属感、文化认同感以及亲近自然的机会。

At this stage the user should reflect on different scenarios and on the strategies that might lead to them. After selecting a direction, users are invited to translate it to a vision statement and clearly define strategies or a system of strategies that need to be implemented in the system to nudge change intentionally.



Strategic strategies are then translated into program. Relevant programs normally react to the heart of the system and relate to the human basic needs. (see pp.163 and pp.164)

PROPOSAL SELECTION



TESTING



VISION FOR PULAU UBIN

To revitalise the dying culture and heritage of Pulau Ubin through young local and foreign artists from all background.

VISION FOR SENI MUZIK VILLAGE (SITE)

To create an Artistic music community, that will attract young local and international artist and Singaporeans to experience art in Pulau Ubin.

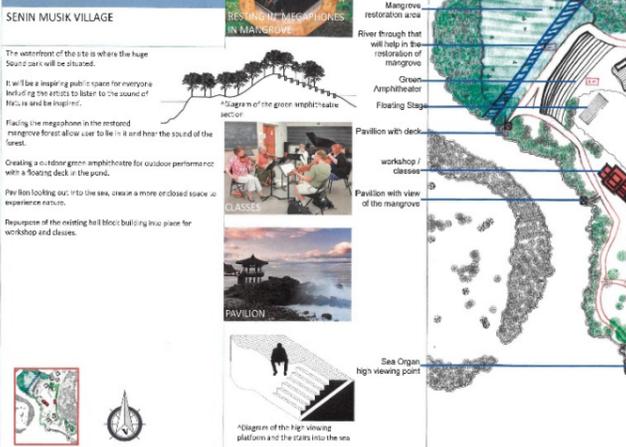
CLIENT: NPARKS SITE: PULAU UBIN LIVING LAB

REQUIREMENTS:

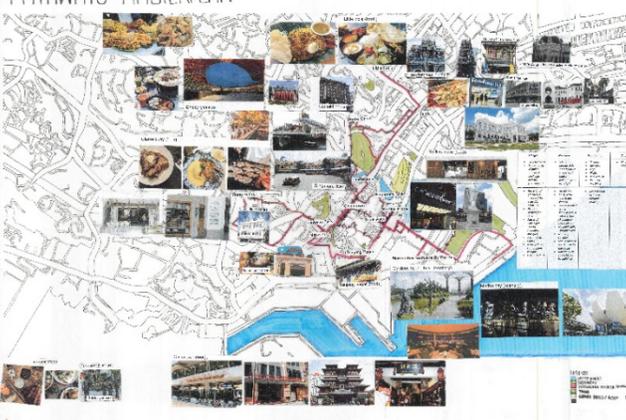
- To remain as a rustic getaway of the past
- Engage the community, try to remove the fence
- Celebrate the view of the sea
- Use of jetty as emergency exit point
- Preservation of the main building and hall block



PROGRAMS BY THE WATERFRONT



PATHWAYS-MASTERPLAN



VISION: UNIQUE BEIJIAO

项目愿景: 独特北漂

Our key design strategies will become the foundation of our proposal to guide the masterplan and to ensure that the vision and the objectives are consistent and incorporated into the design.

我们的主要设计策略将构成设计方案的基石, 并指导总体规划的制定, 确保项目愿景与目标在设计中得到充分一致的体现。

KEY STRATEGIES

主要设计策略

- | | |
|--|---|
| 1 CREATE VIBRANT COMMUNITIES
打造活力社区 | 3 ENHANCE CONNECTIVITY
提升互联互通 |
| 2 OPTIMISE EXISTING RESOURCES
优化现状资源 | 4 GENERATE OPPORTUNITIES
创造发展机遇 |
| A HOT SPOTS
热点 | B NETWORKS
网络 |

KEY STRETEGIES _ OPTIMISE RESOURCES

主要设计策略-优化资源利用

2.1 INCREASE DENSITY

提升密度

Optimize the land use and instead increase the density of built areas to accommodate additional Gross Floor Area (GFA). Increase the Floor Area Ratio (FAR) for selected areas to enable greater and optimization and to free up spaces for additional ground area for greenery and open spaces. Provide building density and building height guidelines for future development.

提高土地密度, 优化提升建成区的密度, 调整建筑密度, 提升土地集约利用率, 优化土地利用方式, 释放更多空间用于绿地和开放空间, 给出未来开发项目的建筑密度和高度设计指导。



2.2 RE-PURPOSE UNDERUTILIZED BUILDINGS

改造闲置建筑

Identify existing buildings that are underutilized or no longer in use that can be re-used or re-purposed to cater to different functions instead of being demolished. Especially buildings with architectural character and cultural significance.

确认可再利用或改造的闲置建筑, 保留建筑或建筑特色, 减少拆除, 重新改造, 满足不同的功能需求, 尤其是有特色和文化意义的建筑。



2.3 REDUCE, RECYCLE, REUSE

废弃物减少、回收与再利用

Encourage sustainable practices of energy and water efficiency. Explore non-polluting alternative energy sources and rain water harvesting as well as storm water management. Reduce waste and generate waste for recycling. Use of technology to support sustainable practices improve building systems efficiency. Support recycling and establish systems for collection and processing recyclables.

鼓励可持续能源和水资源利用, 探索可再生能源, 减少废弃物, 并循环利用资源, 雨水收集和雨水再利用, 提升建筑系统效率, 支持回收利用, 建立回收和废物处理系统。



2.4 ACTIVE AWARENESS

提升积极意识

Build social consciousness towards a sustainable lifestyle. Active awareness of the environment and gradual changes in attitudes and behaviors. Provide information to the public and promote sustainable practices in schools to educate the next generation.

建立可持续发展的社会意识, 树立积极的环保意识, 提高公众的环保意识, 在公立学校推广环保教育, 以此教育下一代。



KEY STRETEGIES _ ENHANCE CONNECTIVITY

主要设计策略-提升互联互通

3.1 PUBLIC TRANSPORTATION

公共交通

The public transportation to connect Beijing to Foshan and Guangzhou, will be greatly improved with the future extension of the high speed rail and additional train stations. In support of this, addition of public bus transportation to connect neighborhoods to transport modes will need to be planned. This is to enable a cohesive public transport system that can cater to the population of Beijing.

通过未来连接佛山和广州的高铁, 提升公共交通, 增加北京和周边地区的公共交通, 为公共交通系统提供必要的支持, 从而形成一个一体化的公共交通系统, 满足北京人口出行的需求。



3.2 ACTIVE MOBILITY

积极流动

Encourage active mobility by creating connected mobility corridors through the park connectors, along waterways as well as within the road right of way. Enable pedestrians, cyclists and users of personal mobility devices such as electric scooters to enjoy these mobility corridors for leisure or commuting. This will also supplement the public bus services to provide the 'last mile' connection.

通过公园走廊、水道和道路打通互联的交通网络, 促进步行、骑行和电动滑板车等个人交通工具的使用, 提升步行和骑行体验, 提升公共交通系统的最后一公里连接。



3.3 WATER NETWORKS

水系网络

Develop a network of canals, waterways, retention ponds and rivers to create a storm water management system that is resilient to flooding. Integrate the network of water with park connectors to create a holistic ecological system. Design waterways enable people to reconnect with the water.

发展由运河、水道、雨水滞留和河流组成的水网, 打造具有韧性的防洪排水系统, 整合水网与公园走廊, 形成一个完整的生态系统, 设计水道让人们重新与水建立联系。



3.4 PARK CONNECTORS

公园连接通道

Create a linked system of park connectors that enable all the major green open spaces and agricultural fields to be interconnected. Allow for active mobility corridors and location for public facilities to activate these open spaces.

打造互联的公园连接通道, 让所有主要开放空间和农业用地都能互联互通, 允许步行和骑行等主动交通, 设置公共设施, 激活这些开放空间。

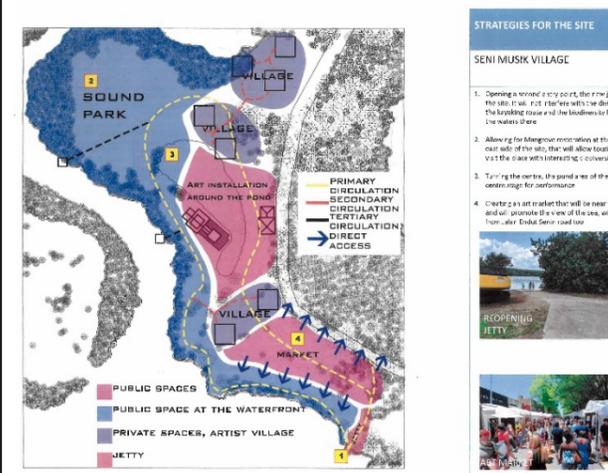
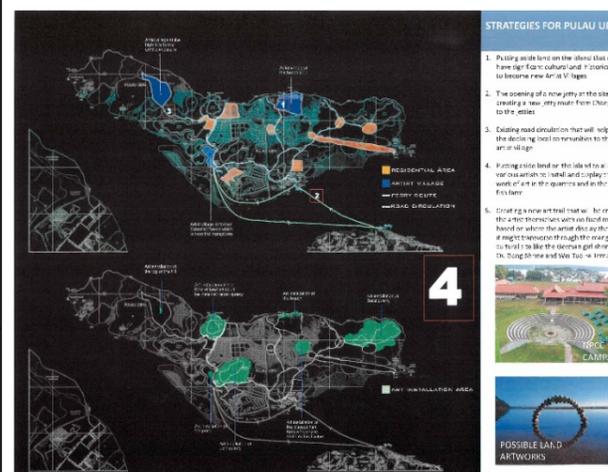
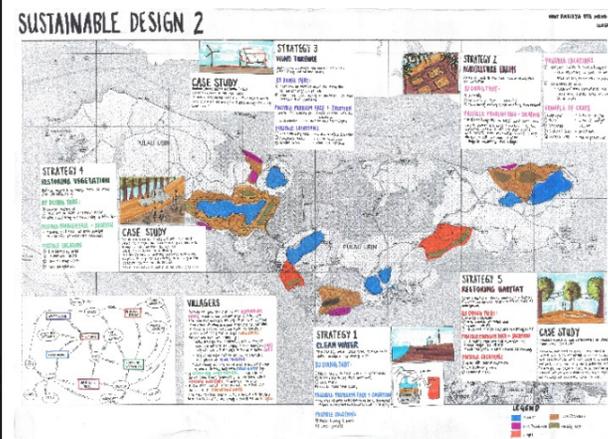
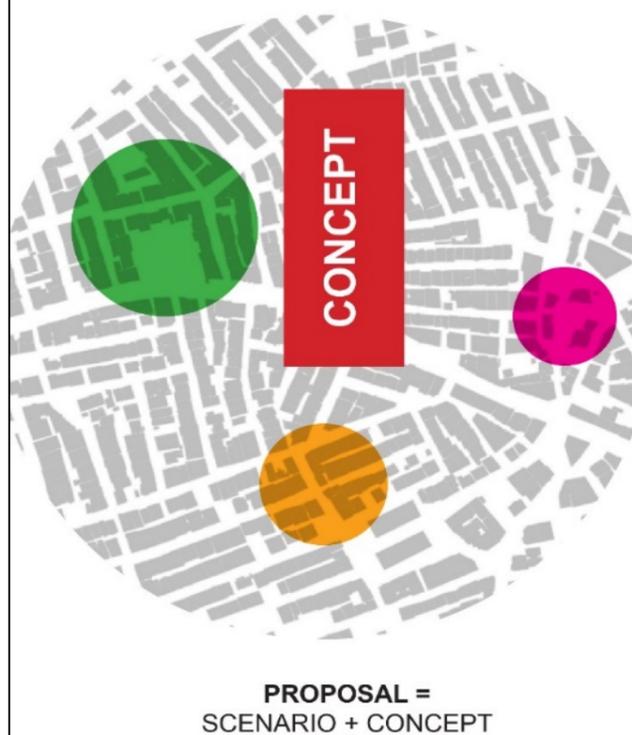


Step 6 is to translate abstract strategies suggested to improve a given system into specific actions defined within a specific time and place.

The strategies need to be translated into a concept and a clear program. The concept and the program evolve either into urban guidelines or architectural forms.

These translations should be tested through the building of prototypes/models or through debate, using the EIMS models as a framework to define more valid options.

Users should be able to use the models to justify the final products proposed.

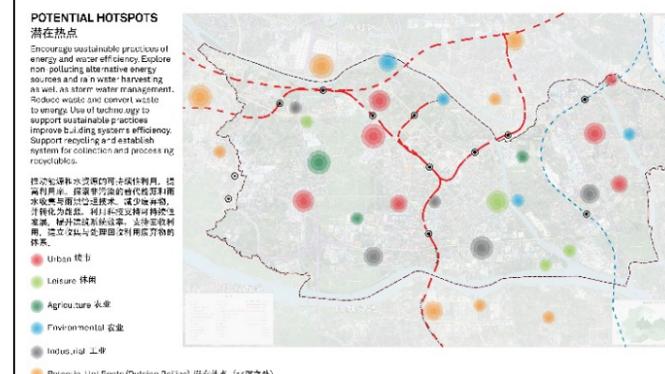


Concept



PROPOSED HOT SPOTS _ PLAN

规划热点-平面图



HOTSPOT _ CRITERIAS

热点-标准



			<p>Proposal</p> <p>MASTERPLAN _ STRUCTURE PLAN 总体规划-结构平面图</p> <p>PROPOSED URBAN HOT SPOT _ VISUALIZATION 规划城市热点-效果图</p> <p>PROPOSED MIXED_USE BUILDING 规划综合大楼</p>
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Table 23: Relation between EIMS framework operational steps, conceptual translation by Mauro Moro to the industry context and examples of work produced by students and Mauro Moro as a professional architect

To support planning and strategic development

Another case in point is my recent attachment as a consultant with URA. Besides the medium-term national masterplan described above, URA deals with long-term visions for Singapore's strategic development. In this context, the EIMS framework was applied to investigate and propose two feasibility studies:

1) Changi Point feasibility studies included a detailed analysis of the site, formulating a strategic development plan, articulating a base for public engagement and establishing opportunities for collaboration across different stakeholders. The study also included a proposal for development and improvement of the area both from the perspective of land distribution and urban design guidelines.

The research question that guided the study was:

How can we rejuvenate and bring life to Changi Point whilst retaining its identity, character and the memories it evokes?

The objectives of the exercise were:

- Improve the waterfront: facilitate human relation with the sea, both as an individual and as a social experience
- Explore ways to accommodate different social groups and people of all ages on the site
- Define the fundamental guidelines to preserve Singaporean's sense of belonging to the site
- Improve cycling connectivity to Changi Point and on the site

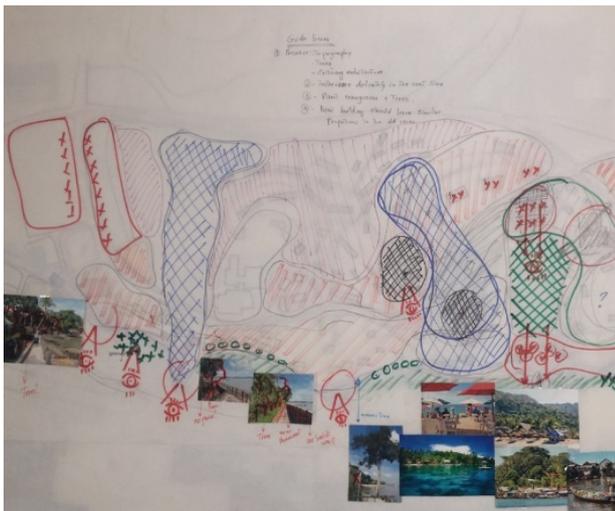


Figure 86: Analysis of land property, urban actors, views and relevant green areas. Neighbourhood scale



Figure 87: Analysis of built forms, views, coastal section. Neighbourhood scale



Figure 88: Strategies proposed. Site scale

2) Tampines New Town feasibility studies for cycling and walkability. This study focused on the articulation of the bus terminal with human social activities. Tampines bus terminal is an urban node; it is the heart of the district and spreads out through vast networks designed to support vehicular transportation. Tampines is a very densely populated district and the population naturally converges to this node, but the opportunities for social encounters are limited and contextualised inside the perimeters of shopping malls. The aim of this study was to identify opportunities in the urban fabric for human social encounters and pathways to integrate a more human network where pedestrians can feel safe and protected from the noise and air pollution produced by nearby major networks.

The research question that guided the study was:

What are the most fundamental interventions needed to improve cycling connectivity in Tampines regional centre?

How can planning and design facilitate the transformation of the bus interchange area into a civic hub for the community?

The objectives of the exercise were:

- Improve the cycling and bus connectivity in Tampines area
- Integrate and optimise the car, bus, cycling and pedestrian connectivity in Tampines regional centre.

- Define the fundamental guidelines to transform the bus interchange area into a more human friendly area, eventually inviting people to stay and socialise in the area rather than just transiting through.



Figure 89: Analysis of transportation networks, green and key urban sections in relation to human comfort. Neighbourhood scale



Figure 90: Analysis of the location of civic area, schools and parks. Neighbourhood scale



Figure 91: Cycling network's key issues. Interventions proposal. Neighbourhood scale



Figure 92: Interventions proposal. Site scale

In the two examples described above, the EIMS framework was translated in the approach described in Study 4 but this time was applied in the context of the industry, specifically in a context where people have been working in urban planning for decades and have developed patterns of understanding urban contexts and proposing urban solutions. URA is supported by a very well-informed database and holds vast amounts of digital information about the city which can be easily translated into layers and graphics. This gave me a great opportunity to use a similar methodology to the one developed in Study 4 but using accurate data and a much more efficient infrastructure.

In both studies, the information gathered from site observation and from the digital information available in URA's digital networks was collated and transformed into layers. As in Study 4, these layers were analysed in isolation and across different topics and areas of concern. Core findings were

extracted and translated into strategies which were then translated into urban and architectural guidelines, land distribution guidelines, network regulations, among other things.

URA planners, senior planners and managers were impressed with the depth of analysis the framework gave to the proposals. They commended the efficiency of the methodology in terms of speeding up the process of analysis and on the fact that it allowed the facilitation and management of great amounts of information. Actually, both feasibility studies were developed by one person within one month of work.

The methodology was so well accepted that URA decided to fund prizes for academic projects where the EIMS framework was applied and open places for internship for students who were familiar with it. Parallel to this, I was asked to design a short course to share with URA's planners the EIMS framework and how to translate it into the step-by-step process of the Layer Analysis described in Study 4. This opportunity shows clearly the acceptance and relevance of the EIMS framework as an urban planning and urban management tool, which opens doors to further research in the context of its application in the industry and for professional development of people already in the field.

Appendix 13

Subject brief: Cohort 2018/19

Partial Brief – Integrated Studio 2 – 2018-2019

Partial Brief – Integrated Studio 3 – 2018-2019

Partial Brief – Integrated Studio 2 – 2018-2019

Subject (code)
Credit Units : 6

EVD Integrated Studio 2 (DED 2833)

Semester Apr 2018

Figure 1 – The Design Process (adapted from <http://www.discoverdesign.org/handbook>)

Semester Apr 2018

Learning Objectives

This subject aims to equip students with knowledge and skills to:

- Conduct a comprehensive site analysis
- Work in teams to encourage collaborative inquiry and critical thinking
- Apply the design process to develop sound design proposals that integrate architecture and landscape architecture, with due consideration for context, biodiversity and sustainability
- Employ basic building construction in timber, masonry and steel detailing

2.0 Background

Pulau Ubin: Singapore's green back garden

Pulau Ubin, which literally means "Granite Island" in Malay, is a small island (10.2 km²) situated in the north east of Singapore. Rubber plantations and granite quarrying supported a few thousand settlers on Pulau Ubin historically, but only about a handful of villagers live there today, supporting the mainly **eco-tourism industry**. It is one of the last rural areas to be found in Singapore, with an abundance of natural flora and fauna.

The island is one of the last areas in Singapore that has been preserved from urban development. It's wooden house villages and wooden jetties, relaxed inhabitants, rich and preserved wildlife, abandoned quarries and plantations, and untouched nature make it the last witness of the old "kampong" Singapore that existed before modern industrial times and large-scale urban development.

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Subject (code)
Credit Units : 6

EVD Integrated Studio 2 (DED 2833)

Semester Apr 2018

EVD INTEGRATED STUDIO 2

Project Brief

Pulau Ubin: Singapore's green "back garden".
A sustainable, informative and fun place to be.

1.0 Objective

Synopsis

This subject introduces a design contextual framework with the focus on site analysis as a vital step in the design process. The subject involves the evaluation of a given site to identify environmental, program, and development constraints and opportunities. It covers the collation of data collected by site investigation that needs to be interpreted and assimilated to explore design proposals through the design process (fig 1). The subject will emphasise that proposals should be conceived as integrated environments of building and landscaping, which are mutually supporting one another.

Semester Apr 2018

Prepared by: Maria Miguel
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Subject (code) : EVD Integrated Studio 2 (DED 2833)
Credit Units : 6

Semester Apr 2018

The client aims to develop The Ubin Living Lab are:

- To create an integrated centre for environmental education, field studies and community outreach, supporting the five themes of The Ubin Project.
 - Biodiversity Conservation
 - Education & Research
 - Community, Heritage & History
 - Nature-based Recreation
 - Sustainable Design & Practices
- To create new gateway to Pulau Ubin eventually from Punggol & Sengkang
- To create barrier-free accessibility design
- To showcase the use of sustainable design & practices
- To design compatibly with the rustic & natural character of Pulau Ubin
- To complement the existing activity nodes, infrastructure & services.

In collaboration with Sustainable Design 2 students are requested to develop a site analysis from a macro level to the scale of the specific site. Students will be asked to develop a concept master plan for the area and select a specific site to develop their ideas. Students will need to reflect on the following considerations:

"Efforts to enhance Ubin's wildlife habitats are underway. What more can we do? Do you hope to see more nature and wildlife on the island? What ideas do you have to enhance the island's sense of discovery and adventure? How can we tap into what the island has to offer and enhance the recreational options? Do you have suggestions that can help to revive the kampong life and its activities? Do you see Ubin as a green living educational laboratory?"

Site Analysis



Partial Brief – Integrated Studio 2 – 2018-2019

Subject (code): Integrated Studio 3 (DED 2834)
 Credit Units: 6
 Subject (code): DED 2834

Subject (code): Integrated Studio 3 (DED2834)
 Credit Units: 6
 Subject (code): DED 2834

Oct AY2017/ 2018

Oct AY2018/ 2019

PROJECT BRIEF FOR CHANGI POINT STUDY AREA



BACKGROUND

Changi Point is known for its rustic and idyllic character with a unique combination of a waterfront setting, heritage buildings, chalets, sports & recreational clubs and F&B offerings. It also serves as a gateway to Pulau Ubin. Over the years, agencies have implemented amenities and infrastructure, such as the boardwalk and park connectors, to enhance public accessibility and enjoyment of the area.

In recent years, new hotels, chalets, a corporate training centre and F&B establishments have also been introduced, strengthening Changi Point as a get-away destination. As part of the upcoming Master Plan review, URA is looking at further opportunities to enhance the area. This is in line with URA's planning strategy to retain key identity nodes like Changi Point, while ensuring that a variety of sports and recreational options are available.

URA have engaged with some key stakeholders in the area. The stakeholders agreed with the importance of retaining rustic character of Changi Point and highlighted that there is poor public transportation accessibility, lack of carparking and public toilet facilities, and a lack of public awareness of Changi Point beyond Changi Village.

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 By Marta Miguel | 5 Oct 2018



DED2834 – Integrated Studio 3

Subject Introductory Sheet

Synopsis

This subject is issue-driven and introduces a design contextual framework with the focus on deriving and establishing design issues as a vital step in the design process. The subject involves the evaluation of a given site to identify environmental, program, and development constraints and opportunities. It covers the collation of data collected by site investigation that needs to be interpreted and assimilated to explore design proposals through the design process (fig 1). The subject will emphasise on how design problems may be identified through the exploration of an urban site and that proposals should be conceived as integrated environments of building and landscaping, which are mutually supporting one another. Design proposals will need students to employ basic concrete and composite construction detailing.

Aims

This subject aims to equip students with knowledge and skills to:

- Conduct a comprehensive site analysis
- Work in teams to develop and encourage collaborative inquiry and critical thinking
- Apply the design process to develop sound design proposals that integrate architecture and landscape architecture, with due consideration for urban design considerations
- Employ basic building construction in concrete and composite material detailing

Integrated Project 3 content outline has the following stages, topics and activities:

- Inception - Research, Analysis and Master Plan/ preliminary Design Proposal
- Design Development – Concept / Sketch / Schematic / Detail and Construction
- Project Proposal – Final Design Presentation

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Subject (code): Integrated Studio 3 (DED 2834)
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 Credit Units: 6
 Subject (code): DED 2834

Oct AY2017/ 2018

Requirements and Constraints

The following requirements and constraints are to be integrated in the design/intervention. It is mandatory that the design/interventions are to adhere to the stated requirements and constraints below.

Requirements:

- A) Contextual
- The design should relate to the existing infrastructure/architectural elements present on site
- B) Informative
- The design should allow the logical dissemination of information in any creative way/ methodology.
- C) Interact
- The design should allow interaction of users with the space. Consideration is to be given to how the spaces complement the existing community
- D) Program
- The design proposal and program should be appropriate and address issues and concerns identified by the group design strategy.

Constraints:

- No removal of existing trees
- No removal of existing amenities along the main roads i.e. Bus-stop, taxi bay, electrical over-ground boxes (OG box), manholes and inspection chambers, etc.

PROJECT DELIVERABLES

The urban design study proposal for Changi Point study area shall include:

- Overall Site & SWOT analysis for Changi Point study area
 (To be developed in Assignment 2 of Urban Design studies and Site Analysis of Integrated Studio 3)
- Overall Vision, Concept Master Plan and Land Use Plan, which can relate to:
 (To be developed in Assignment 3 of Urban Design studies)
 - Possible adaptive reuse and concepts for colonial heritage and existing vacant buildings (e.g. ex-Changi Hospital, ex-SIA Sports Club, Changi Beach Club building, vacant ex-chalets, etc.);
 - Strategies to improve the public accessibility to Changi Point study area;
 - A landscape and public transport / pedestrian / cycling connectivity plan that capitalizes on the existing greenery and park connectors to improve the accessibility, with emphasis on environmental sustainability, car-lite strategies and building a strong sense of community;

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Etc...

- At least 2 scaled sections of the site
- Sketches and diagrams relevant to describe the site
- Mood board: A4 collection of images that characterize the place.
- Scaled site model.

Note: the scale of the drawings and model will be deliberated in class.

Task 2. Interview 3/4 different profiles of people and ask their opinion about the site.

Note: you can use a time-based interview from morning, afternoon and evening. Different times of the day = different types of users.

Profiles of people to consider:

- People who worked near the site
- People who live near the site
- People who pass-by and/or use the place

Questions to consider:

- Where do these people come from?
- Why do they go the site?
- Where do they go after that?
- What do they like most about the place?
- What does this place mean to them?
- What do they don't like about the place?
- What would they like to see built at the place?

Deliverables:

Take a photo of the people you have interviewed and write a story of the place as seen thru their eyes.

Part 2 (Individual)

Individually you are to respond by designing an integrated architecture and landscape proposal to address the design strategy agreed by the group. This will need to take into consideration URA's conservation guidelines where appropriate.

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- iv. A heritage trail linking heritage trees identified by NParks and heritage buildings identified by URA(Conservation) and National Heritage Board as shown below;

c. Design ideas for:
 (To be developed in Analysis of Integrated Studio 3)

- i. A new building (s) / landscape proposal to serve as a community and park connector node to inject activities in the Changi Point study area, on the 3ha vacant land / ex-SIA Sports Club site as shown edged green in the study area plan;

Duration

The duration of EVD Project 3 shall be from **15th Oct 18 to 24th Feb 19** (Vacation: 1st Dec 18 – 1st Jan 19)
Studio session: 9am-12.00pm, Tuesday & Thursday

LEARNING AND TEACHING METHODS

Students will be taught using a studio-based learning approach of learning-by-doing in a studio environment. Studio teaching and learning is defined by the prominence on project-based work; learning through an investigative and creative process determined by research, exploration and experimentation, critique and reflection. The aim is to encourage students to drive their own learning. Also in this process, the students will extensively be engaged in collaborative learning activities in the studio setting. Students will employ the design process (Fig 1) iteratively through the various design stages from concept to final design, addressing contextual concerns, also known as wicked problems, in a stipulated real site and design brief through multimodal analysis, proposition and critique. In addition verbal and graphic presentations will be required of students as a means to hone their communication skills and to gauge their understanding and application of the concepts.

Site visits are necessary to broaden and instill in the students exposure and experience of real scenarios.

FORMATIVE ASSESSMENT

During studio sessions, consultations by tutors in the form of reviews will be conducted on a one-to-one basis or in small groups when students will also be

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encouraged to discuss various issues pertaining to their design explorations and to learn from each other. Besides consultations, design reviews will be scheduled periodically as further means to give feedback to students so that they are encouraged to develop and enhance their proposals through iterations of exploration.

SUMMATIVE ASSESSMENT

Assessment Methods

A range of assessment methods will be used to ascertain the application of knowledge amongst students:

- Individual project in the form of a design proposal and group assignment, incorporating presentations (critiques) will be designed to assess students' ability to apply and communicate the concepts learnt in the classroom. The assessment will take into account the design process and outcome as well as presentation skills.
- Reflective journal will encourage learners to make important connections between the content of learning activities and application. The journal will form part of continuous assessment and will assess a student's progress in learning.
- Peer evaluation will be deployed to evaluate each member's contribution for group work

Assessment Scheme

INCEPTION	30%	Site Analysis (Group) Ideation Review (Indiv.) Peer Evaluation
DESIGN DEVELOPMENT	30%	Scheme Design Review Technical Portfolio
PROJECT PROPOSAL	40%	Final Model Final Storyboard Final Presentation Journal
Group Component (Site Analysis)		20%
Individual Component		80%

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Appendix 14

Written coursework for Module 2 / PgCert Research Methods

Research student:

Marta Alexandra Godinho Miguel

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Dr Quazi Zaman, B. Architecture, Masters in Urban Design, PhD

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Title of research:

The Micro Project System:

An exploratory system to support a sustainable urban management.

Research Aims and objectives

The key driver for the research hypothesis is to learn from the adaptive character of human evolution and utilise the findings to manage the process of change in the city. It has as a framework the city as a complex, open system, and as an organic and self-organising structure.

This research aims to bring together different theories related to complexity and organic change to create a framework to support a philosophical consideration of the city compatible with human and urban evolution.

It aims to develop and test a conceptual urban management system which deals with the complexity of urban evolution in an active and sustainable way. That is to say; a system which supports the design and the management of cities and deals with urban change from a holistic perspective from both a micro and macro scale.

The research methodology aims to explore the potential of micro-interventions applied in the parts which constitute the whole of the city to steer urban change.

It embraces the idea that a new concept of urban management is necessary to address the needs of rapidly changing post-modern urban environments. Interventions made in the city should be part of a continuous process: a process which evolves with the city and its inhabitants. This framework will be used as a tool to assist a constant dialogue between the city, planners and the decision makers.

Appendix 15

PgCert Research Methods

Module 2: Planning, Organising, Evaluation and Dissemination of Research

FEEDBACK COMMENTS SHEET

Student Marta Miguel

Submission Date

Supervisor Richard Laing

Assessor David Moore

Assessment Criteria	Mark Awarded
Research aims and related review of literature. 40% weighting The research aims are generally clear. However, there is scope to add more specificity to these through the review of relevant literature that is not as yet included. This should focus on the work by IBM on networked cities, the design of 'instant' cities such as Songdo in Korea), and concepts of cities as autopoietic systems and arcologies (architectural ecologies).	21

Analysis of progress with objectives, methodology, data collection/analysis and interpretation. Related proposed work programme. 40% weighting A good critical analysis of progress. The proposed methodology could be developed further with regard to addressing problems arising from the incorporation of predictions of future developments (such as cities as hyperstructures) in a manner that evaluates previous models for the growth of cities.	23
Evidence of originality. Consistent and appropriate referencing. Report abstract. 20% weighting There is good evidence of originality overall. One area that could be strengthened is the critique of Portugali's proposal for cities as inter-related networks of 'agents' (which is increasingly being regarded as ill-defined and overly optimistic).	11
General comments An interesting, valid and suitably challenging research topic. The basis of the work so far is focused on more 'traditional' material (which is well-covered) but there is also a need to include more 'contemporary' material such as the work on autopoietic (biologically open) systems, etc.	55



Signature

Date 10/5/11

GRADE SHEET**Student** Marta Miguel**Supervisor****Assessor**

Grades	A Excellent	B Commendable	C Good	D Competent	E Marginal Fail	F Fail
	>70%	69-60%	59-50%	49-40%	39-31%	<30%

Supervisor's Grade

C

Assessor's Grade

C

Any **difference in grades** given should be discussed between the supervisor and the assessor and the written summary report of the agreement made to be completed (see below).

Should agreement not be reached, the Postgraduate Studies office will appoint a third marker to assess the work.

Summary Report of Agreement
Agreed grade – no difference in initial grade.

AGREED GRADE C

Supervisor's Signature

Assessor's Signature



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Appendix 16

Publications

Explorations of an urban intervention management system: a reflection on how to deal with urban complex systems and deliver dynamic change. (2016)

Book Chapter

MIGUEL, M.A.G., LAING, R. and ZAMAN, Q.M. 2016. Explorations of an urban intervention management system: a reflection on how to deal with urban complex systems and deliver dynamic change. In Caldwell, G.A., Smith, C. and Clift, E. (eds.) Digital futures and the city of today: new technologies and physical spaces. Bristol: Intellect [online], chapter 11, pages 193-214.

EXPLORATIONS ON AN URBAN INTERVENTION MANAGEMENT SYSTEM - A reflection on how to deal with urban complex systems and deliver dynamic change

MARTA ALEXANDRA GODINHO MIGUEL

**Prof. Richard Laing
Dr. Quazi Mahtab Zaman**

INTRODUCTION:

Concerns over how we plan and manage urban development have grown as a result of unpredictable and rapid conditional changes in postmodern cities. This chapter explores the shifting contexts of urban environments which change in an increasingly frequent and dynamic manner. These changes can be understood through the lens of real-time interactions between citizens, planning processes and designers, supported through the use of ICT. We argue for the recognition that urban change will happen in an unpredictable way, and that such interactions can be regarded as extremely valuable information to any urban manager. The approach suggested by the research concerns the scale of interventions in the building environment and the exploration of tools to facilitate public engagement and awareness of urban complexity.

Three debates emerge from these considerations. The first reflects on medias have generated a global culture which influences complex contextualised varieties (Cowen 2002) and standardised ideas of beauty (Stephens 2000). The second reflects on the emergence of new ways of experiencing the city including communication channels that contribute to urban formation and development (Laing et al 2009). The third explores the process of urban formation in relation to the human quality of life and appreciation of urban morphology (Marshall 2005). Today, we have modernism, post-modernism, classical - and all architectural styles in-between - but an argument can be made that global culture emerges from the flattening and standardization of diverse cultures by the media. Following this perspective, cultural expressions including architecture are also flattened. But are we really becoming the same? Is culture becoming flat? Is the standardization of building forms responding adequately to the way humans relate to their environment?

Today, media influences the way we design and perceive our environment but it also changes human relations and therefore the way people use urban spaces. Modern social life emerges from the intersection between architectural forms, the urban environment, social relations and the media, being the media an environment of its own (Venturi 1966). In this intersection each domain influences another in a variety of ways, creating not only different perceptions of the environment but new dimensions of the city. (Augé 2008)

The process of urban formation and the related scale of building influence human perception of and adaptation to, the built environment. From the perspective of urban planning, one of the major lessons learned from Modernism involved the unpredictability of the future and the fact that people take time to adjust to large-scale changes in their surroundings (Jacobs 1961; Jencks 1981; Coleman 1985; Panerai et al. 2004). Nothing is altering our current urban condition faster than the development and inclusion of new technologies and these, together with our experience of the misfortunes of top-down creationist approaches to the management of urban systems raise many questions as to how and whether we should design and plan our cities (Alfasi & Portugali 2004; Marshall 2009, 2012).

It is certain that the manner in which the public is able to interact and contribute with planning or urban areas can be supported through the use of ICT and that these tools will become more prevalent as we move forward. However, for them to be fully useful, the end results they seek and the methods they employ have to be based on an understanding of how we, as user-participants, currently understand participation and how our own creative and social engagement processes actually operate. Examples of how these methods support such interaction have been demonstrated in terms of public participation in planning and design multiple times (see, for example, Laing et al 2009).

The research reported in this chapter proposes a model to guide more informed public participations that does not foreground technology but does reveal some of the most significant human-centred issues and characteristics that the next generation of technological and social media participatory tools will need to understand. In addition, this chapter suggests that, whilst useful in terms of informing and guiding specific design processes, participatory design exercises cannot easily be applied to wider and less predictable urban contexts. Consequently, while we can use participation strategies and methodologies to support planned urban ‘interventions’, the interventions themselves should be regarded as being part of a dynamic system of urban change, part of which will be driven by occupants and communities whether they engage in traditional ways or through the various new forms of inclusivity offered by emerging technologies.

STRATEGIC INTERVENTION IN THE CITY:

Several researchers have considered dynamic ways to deal with the unpredictability of urban complex systems from a planning perspective (Friedman 1997; Marshall 2012; Portugali 2012), a similar number have focused on the issues of new medias and technologies. Nevertheless, this chapter draws references from human action rather than planning processes and frames *design* as one kind of human action and human actions as the building blocks of urban life, which hold a socio-cultural reality within them. It also defines these building blocks as short-term evolutionary steps that lead the way to long-term changes (Marshall 2009). A methodology is devised that gives a deeper meaning not only to design but to human actions themselves - transforming them into what this chapter defines as *strategic interventions*. This urban planning philosophy implies the nurturing of self-organizing strategies, which naturally emerge from everyday human actions in the city and which many new technologies seek to foster through the next wave of distanced interactions. It uses top-down *strategic interventions* as a tool to intentionally nudge urban development and improve human quality of life and suggests that this represents a base model that forthcoming digital models and tools need to understand.

Strategic interventions are human actions intentionally design to be utilized as a tool to nudge change and address urban problems within the modern complex urban environment. These interventions emerge from a deep understanding of a context rather than from mediated architectural solution. Complexity theory suggests that *strategic interventions* are those that are made of the basic elements

from which a complex system emerges and, therefore, have the capacity to change that system as a whole (Portugali 1997; Batty 1994; Portugali 2000; Batty 2005; Stedman 2006).

Strategic intervention can either originate from bottom-up or top-down actors or actions. Nevertheless, it is the responsibility of the top-down actors/actions to have an overview of the society and to manage urban change adequately. Strategic interventions embrace characteristics of both top-down and bottom up approaches (Alexander 1966; Jacobs 1970; Marshall 2009; Lane 2009). They should be:

- Contextual.
- Preferably of a small scale and emergent from an awareness and respect of the complexity of a place; therefore, they should aim to disturb consolidated systems as little as possible (Marshall 2009).
- An expression of the common good (Ostrom 1990; Wilson 2011).
- Designed and applied to speed up or to change the path of development. Their intention is to break the emergent continuity of development when things are not going in the right direction and nudge urban change towards a sustainable path. (Lane et al., 2009).

Evolutionary theory suggests that *design* and *artificial selection* serve as a mediator between the user and the urban environment; they can be interpreted as both a form of adaptation (Wilson 2011) and a reproduction strategy (Marshall 2009). In light of this, the *design* is interpreted here as a tool for innovation (Verganti 2009) and as a short-term local action that can define longer term changes in the system (Loorbach 2007).

Strategic interventions in the building environment - the relevance of architecture in the urban planning process:

In line with Marshall (2009), this research considers buildings, plots and routes as the basic elements of the urban syntax, and therefore, as examples of strategic elements to manipulate urban form and character. The research also considers urban building blocks that Alexander (1977) describes as *patterns of space*. Patterns of space are the elements that translate human every day activities in the built environment. Examples of these elements could be a bus-stop, a bakery or a supermarket. The basic elements of space syntax and Alexander's *patterns of space* can be used as tools to manipulate urban change as a whole. These elements can influence the way people move in the city and help to coordinate human social interactions (Bourdieu 1989). These changes will in turn influence the character of the people who use the city (Sassen 1999).

Lessons learned from Modernism discredited urban planning and shifted the focus towards the architectural object as a catalyst for urban change (Marshall 2009). Following this, fantastic and exuberant architectural design, nurtured in part by the media, have indeed brought dynamic change to places and improved quality of life. This chapter does not aim to debate the purpose of this kind of 'mediated architecture' and its apparent superficial understanding of the relevance of buildings in shaping human life. It focuses instead on the potential role of the kind of architecture that emerges from within a given context; the kind of architecture that emerges as a reaction to a contextual aim or need. Does the architecture that is a consequence of a deep understanding of the dynamic relations of different layers of complexity in a place reflect both the uniqueness of the problems present and their potential within a given context? Does that kind of architecture and design still have a role to play? Can one guide designers to reflect in such contextual complexities and give them the tools to combine

a holistic understanding of spaces with aesthetics? If so, can these issues be embedded in strategies we use today and that we will use in an ever more mediated and technologically near future?

This chapter suggests that we cannot rigidly plan and design the future form of the city nor let it grow organically. We suggest the complexity and self-organizing character of complex systems as a strategy to reflect on a new kind of urban planning and city design; one that would avoid standardizing and simplifying the urban form and uses design and architecture to guide, generate and maintain its functional complexity. The authors have designed an exploratory framework to explore ways to improve human awareness of the urban fabric as a complex and contextual system. In the future, such a framework could, and we suggest should, be available to all ICT users. It could be integrated in existing design software and eventually be used as a tool to facilitate urban planning processes.

RESEARCH APPROACH - the EIMS basic model

The research reported in this chapter led to the development of exploratory models to support professionals, including both designers and decision makers, to intervene in the city more adequately. They facilitate the design and selection of strategic interventions by guiding users to reflect on a series of complex relations between key intervention areas of urban systems. These areas are referred to here as *The Exploratory Intervention Management Systems* (EIMS). The EIMS is composed of two pragmatic models. The first model refers to an image of what a social/ urban system is at a given moment in time. The second adds dynamism to that view; it engages with notions of time and change. Both the EIMS models and the methodology to operate them emerge from the intersection of complexity theory, transition management (Loorbach 2007) and spatial planning (Roo and Rauws 2012).

The EIMS basic model is focused on the characterization of an urban complex system, along with the identification of the system's imbalances, the generation of an intention, and the exploration of strategies to act on the system. The EIMS basic model is characterized by the *system of focus* and the *system external* (Loorbach 2007). The *system of focus* is characterized by four intervention areas or the aspects of society on which one can intervene in order to improve the system or nudge the direction of urban development.

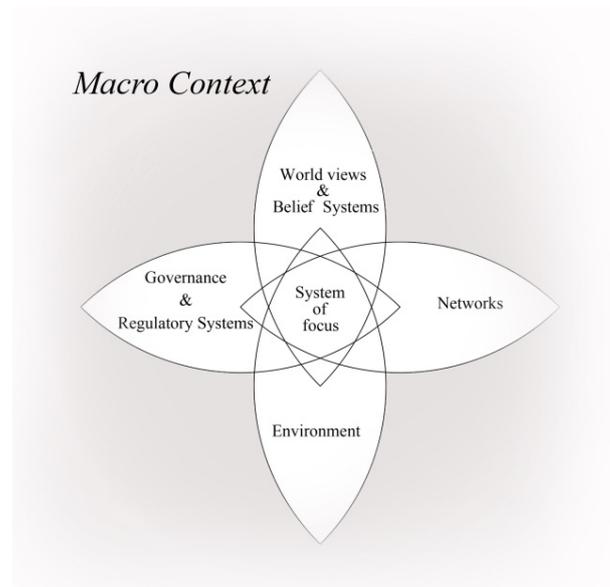


Figure 1: The EIMS basic model and its four intervention areas. It represents the four intervention areas which define the system of focus. It relates the system of focus with what is unknown about the system and its macro-context.

- World views and belief systems; religion and culture. This area represents the innate shared knowledge and memory. It is the lens through which one sees the world and judges what is right or wrong.
- Physical context or the natural and urban environment.
- Governance and regulatory systems; politics, economy and regulations. This area represents the system that allows us to exchange goods and services on a fair and ethical basis from the micro to macro scale (Ostrom 1990; Friedmann 2011).
- Communication and transportation networks. This area represents the networks that allow us to move and to exchange goods, ideas and knowledge.

All that lies around the four intervention areas is considered as the *systems external*. The external area of the model represents that condition which is not controllable, the unpredictable and the unknown. It also represents the macro-scale of the system in analyses (Loorbach 2007). The EIMS basic model defines interventions categorically by positioning them within the model's four areas of intervention and by relating them to specific subsystems. In other words, the model relates interventions to a specific time and place, to one another, to different hierarchical levels of social systems and to the system as a whole.

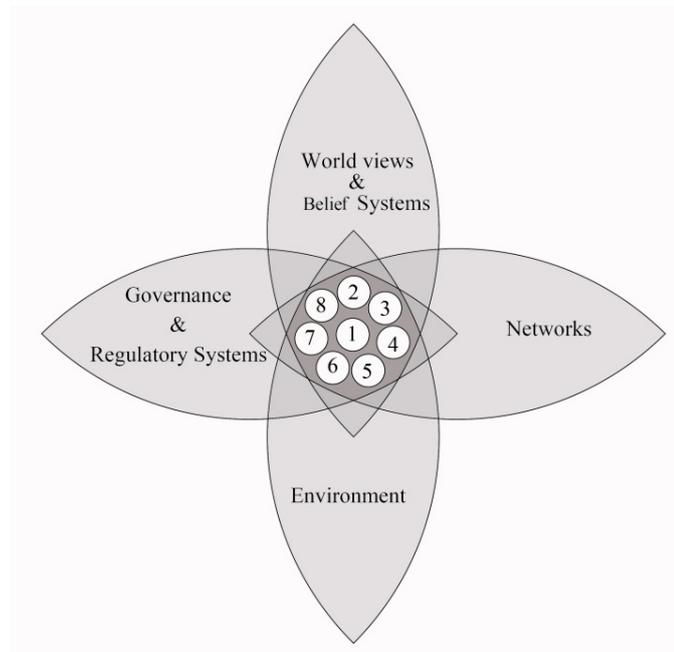


Figure 2: Relation between the heart of the system and its intervention areas (Hodgson 2011).

At the heart of the system is the intersection of all four intervention areas. The methodology used to characterize it is based on the *World System Model* and represents areas of focus relevant to human well-being (Hodgson 2011). Human well-being is contextual and fairly subjective, leading us to address the concept from the perspective of identifiable human needs. We use Hodgson's (2011) *World System Model* to identify the key human needs which will lead the user to define the system of study. These are: (1) health, (2) wealth, (3) food, (4) water, (5) security and sense of belonging, (6) shelter, (7) education and (8) energy.

In other words, the human needs represented in the heart of the model are used to:

- a) Identify the problems of the system and relate those to other aspects of social organization.
- b) Define the scale of the system in analysis or the group of individuals on which one aims to reflect.

This EIMS model is based on the notion of nested hierarchies. Each element of the system and the system as a whole are composed of smaller social groups whilst being part of a bigger one at the same time. The model can therefore be used to relate the system of analysis and intervention areas with both macro- and micro-levels of social organizations.

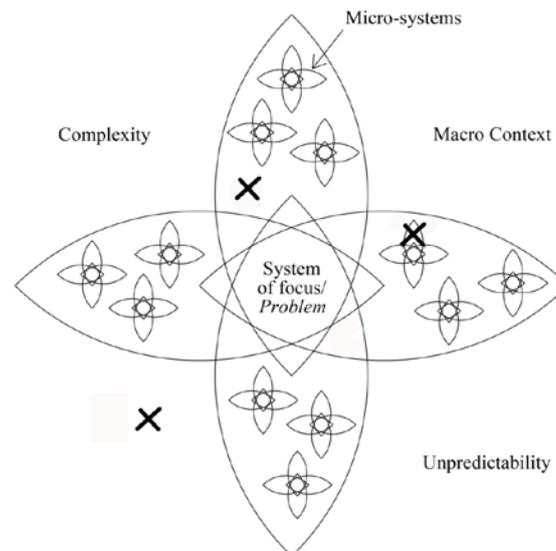


Figure 3: Relation between the heart of the system, intervention areas and different hierarchies of social organization. In addition, this image exemplifies how to define interventions within these three aspects of social organization.

Therefore, the EIMS basic model serves to define the social system available for study. It is used to define the needs and possible contributions of that system. This knowledge can be of key relevance to find a strategy to address a given problem and to formulate a vision or a common aim for the future (Loorbach 2007). The characterization of the system of focus in relation to the macro levels of the system might help to find the uniqueness of the system in relation to the whole. This can help define kinds of interventions which transform that uniqueness to a contribution that benefits the system as a whole.

The EIMS dynamic model:

The EIMS dynamic model introduces the notion of time and dynamic change to the basic model, confronting the users with the unpredictability of complex systems.

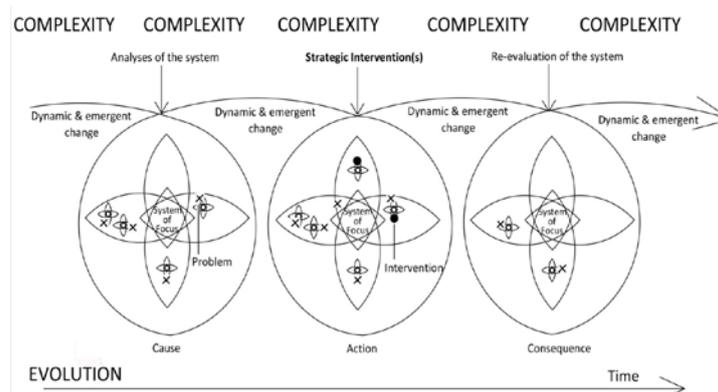


Figure 4: Relates the EIMS basic model with dynamic change. It places the operational phases of the models parallel to the process of urban and social change.

In the dynamic model, the word *complexity* refers to unpredictability. It is the domain where everything happens. *Evolution* refers to time and continuity and is represented as a background of the

system. *Dynamic change* is related to the self-organization of the system. It relates to the process of natural change and to the new social realities that emerge from it. *Intervention* refers to a human action, a system of actions or a happening in relation to a specific context in a specific time.

In short, the EIMS dynamic model puts both the problems and the solutions of social systems in the contexts of complexity and uncertainty. It leads the user to engage with notions of time and the relationship between cause and unpredictable emergent effects. In combination, EIMS models were designed to influence awareness of the complexity of social systems and lead users to reflect on the responsibility implicit in each human action.

PILOT APPLICATION:



Figure 5: Union Terrace Gardens Aberdeen.

Selected case studies tested the acceptance of the design and management approach and the ability of the EIMS models to serve as a platform to support a multidisciplinary dialog on urban systems in both academic and professional situations. Studies one and two focused on the selection process of interventions and study three focused on *design* as a means to create more adequate interventions in the building environment. The research case study area was Aberdeen City Centre (Scotland), where studies one and two evolved around a public discussion related to the selection of interventions suggested in 2008 and 2009 (*Union Terrace Gardens: The City Square*, and, *Peacock Visual Arts' Centre*). The influence of technology and media in the perception and use of the models was tested by giving the participants different platforms to engage with the models, namely the university ODL platform, different projections of the models and print out versions. Finally, the comparison of different kinds of data led to improvements in the research exploratory tools, the EIMS models and consequently to readjust the research methodology (Sampson 2004; Cassell and Symon 2004).

Case study one

Study one tested the openness of decision makers to the use of small-scale interventions in the built environment, checking the applicability of the EIMS models as a selection tool. It also served to

develop a deeper understanding of the dynamics in a real-life process of selection. Data was collected over a period of nine months of public and private discussions with key protagonists in the interventions suggested for the Union Terrace Gardens (UTG). To contextualize the role of media in the decision making process both the EIMS models and the research design proposal were presented as print out handmade drawings in opposition to the 3D renderings published in websites and blogs. During these discussions, notes were taken and semi-open interviews were conducted. Using Cullen's (1971) approach, sketches and notes were taken during several walks through Aberdeen city centre. Finally, information available on the Internet regarding the public discussion, especially reports published on the local press website, was systematically analysed.

Case study two

Study two tested the acceptance of the EIMS models in an academic context, the difficulties participants had in using them and the effectiveness of the models in guiding participants to a deeper evaluation and understanding of complex systems and their dynamics. Students participating in the workshop via the Internet were asked to apply the EIMS models in their urban context and to use the models to investigate in what way an intervention of their choice changed their living environment. In addition, data was collected from Internet discussions on the University ODL platform (Robert Gordon University).

Case study three

Study three focused on the role of architecture as a potential strategic intervention to nudge urban development and investigated how aware future architects (final year *Master of Architecture* students) were of the relations between the built environment, human condition (Arendt 1973) and human perception (Ponty 1962), and how deeply one influences the other (Wilson 2011). The study was also used to test the participants' awareness of the city as a complex open system (Portugali 2000). From the knowledge gained, we explored the extent to which EIMS models increased the students' urban and social awareness and how that shift in awareness influenced the participants' design proce

Summary of the studies' design		Study 1	Study 2	Study 3
Methodology	Qualitative research	*	*	*
	Case studies	*	*	*
Focus groups	People involved with the practice of urban planning	*		
	Academic environment		*	*
Intervention of focus: Strategic Interventions in the built environment.	Micro-intervention	*	*	
	Mid-scale intervention			*
	Macro-interventions			

			*	*	
Data Collection	Semi-open interviews		*		*
	Questionnaires			*	*
	Observation		*	*	*
	Document analysis		*		
	Analysis of information on the Internet		*		
	Sketches and notes		*	*	*
	Ethnography		*	*	*
Research context	Aberdeen city centre				*
	The Union Terrace Gardens – Aberdeen		*	*	
Research tools	EIMS: Exploratory Intervention Management System <u>Aim:</u> Improve the models and test their applicability as a tool to imagine, create and select interventions that can lead to a more sustainable and human friendlier urban environment. Questions: - Are the EIMS models applicable in real-life scenarios; in what way? - Are they useful? - What are their potentials and weaknesses? - How can we improve them?	Presented visually		*	*
		Described orally	*	*	*
		Operated by the participants		*	

Table 1: Summary of the research studies' design.

	Research aims	Study 1	Study 2	Study 3
General	Develop a deeper understanding of the dynamics in the design process of interventions in the built environment.			*
	Develop a deeper understanding of the dynamics in a real-life process of selecting interventions in the built environment.	*		
	Develop a deeper understanding of Aberdeen's urban context and its built environment.	*		
	Develop a deeper understanding of the relations and dynamics between top-down and bottom-up forces in Aberdeen; Explore the influence individual participants and organisations have in the decision process and in the decision product.	*		
	Develop an exploratory theory for sustainable urban management. Gather contributions from the participants that might lead to new theoretical approaches.	*	*	*
	Explore the participants' general innate awareness of the city as a complex and unpredictable system.	*	*	*
	Test the awareness of the change an intervention in the building environment can bring to the overall character and dynamics of the city.	*	*	*
EIMS	Test potential of the models to self-educate users and stimulate people to think in complex systems from a holistic perspective.	*	*	*
	Test the capacity of the models to be used as a common language and as a framework to share information between all parties involved in the design and selection of interventions in the built environment.	*		
	Explore to what extent the models are able to help people to be aware of the unpredictable character of complex systems	*	*	*
	Test the applicability of the EIMS models as a framework or a selection tool; Test the capacity of the models to improve the selection process of interventions.	*	*	
	Test the applicability of the EIMS models as a framework or a design tool; Test the capacity of the models to improve the			*

	adequacy of design concepts, the quality of the design forms and the design process of interventions.			
	Test the clarity of the models and identify the difficulties participants would have in operating them.		*	
	Investigate if a more holistic awareness of urban complex systems influence or adds complexity to the design process and their design object.			*

Table 2: Relation between the research aims and the studies' explorations.

RESULTS AND OBSERVATIONS FROM THE APPLICATION

From a comparison of the findings which emerged from studies one and two, we can conclude that the EIMS models were generally well accepted by the research participants. The models were efficient in leading participants to engage with concepts of complex systems, unpredictability, dynamic change, nested hierarchies and others, and that triggered relevant discussions about the problems Aberdeen city is facing today. In addition, they helped participants to define their own intentions and to identify key urban problems. They were efficient in helping to describe the character and the current state of urban complex systems and they helped to identify relevant sub-systems. The models helped the participants to relate their action to micro and macro-levels of social organization, to different aspects of urban life and different intervention areas.

One key finding is the fact that the participants who had to use the models to make a visual representation of an urban system engaged with a deeper level of analysis than the participants who were asked to just use the model as a framework for thinking. The challenges encountered by the participants who operated the models were used to improve them as well as to clearly establish a methodology to operate them. From studies one and two, we concluded that top-down protagonists perceived big-scale mediated interventions to be more effective. In addition, some argued that the risks related to them were necessary and worth taking (Huxtable 1984). Within the current research, *The Union Terrace Gardens Friends'* organization defended most of the small scale interventions suggested by this study.

Study one demonstrated that the EIMS models were inappropriate to help with the selection of interventions. They did not help to establish a common strategy and cooperation between different groups of participants. And, moving forward, with newer models in the future, participants should be asked to actively operate the models, and the models should be introduced in the first stages of the selection process. Furthermore, the study showed that ideals and preconceptions are very difficult to change and that they play a key role in the decision making process (Koprowski 1983). Beliefs and personal convictions influenced both the participants' preferences and actions – issues that will be relevant whatever the digital, analogue or manual platform used. This study demonstrated that ideals and visions are indeed both based on emotional and rational perspectives of the world. Together, they shape decisions and therefore the interventions we make in the environment (Morse 2006); they become the intentions that shape human interventions.

Study one also indicated that common ideals and a vision induce human cooperation and self-organization. As in living systems, people and organizations self-organized within and across groups to form alliances to defend their common beliefs and intentions for the city (Greenleaf 1977; Morgan 1997; Knowles 2002; Sheard and Kakabadse 2007; Polzer and Kwan 2012)., Jaina (2004) argues that coalitions are formed not only because of similar world views and meaning systems as Duck (1994) proposes but also according to personal judgments of the competence needed to complete a given task. Interestingly, bottom-down participants formed alliances with organizations because they believed they were more capable of opposing unwanted top-down pressures in that manner – a dynamic witnessed through various social movements in recent years in which online social media has played a fundamental role. The studies suggest that *image* and media do indeed play a role in the decision-making process – a finding in agreement with previous studies by the authors, which explored the use of ICT and visualisation with design participation (Conniff et al. 2010).

All participants, both from top-down and bottom-up perspectives defended their ideas around 3D images of the projects, as made available on the Internet and other media, but did not provide any other in-depth information of the projects themselves. This raises the question of whether the basis for the selection of interventions were the design features or the quality of the 3D images presented and the influence of the media in the decision making process – an issues of fundamental import if these participatory exercises are to be carried out on digital platforms in the future. The fact that the system of interventions suggested by this research was presented in the form of sketch plans and sections and did not leave the meeting rooms, might have contributed to the fact that it was not considered seriously next to 3D visualisations broadcasted on other proposals (Daft and Lengel 1986; Suh and Lee 2005; Daugherty, Li and Biocca 2008; Landa et al. 2013).

The context within which discussion and debate take place has been observed in previous studies as being important to the progress of designs, and the interaction between participants. The use of ICT to facilitate such interaction, including across disciplines and areas of expertise is also vitally important, (Leon et al 2014). It is important to bring attention to the fact that media was not able to influence the general public emotional relation with the site. It misled the perception of space and therefore influenced the selection process. Nevertheless media did not influence most participants' expectations for the site.

Architecture students participating in study three suggested that the theoretical framework enabled them to relate their design projects to specific contexts and their problems. In addition, it helped them to be more aware of the human aspect of things (Rapoport 1977) rather than focusing exclusively on aesthetics and technical issues. This opens the door for the possible alignment between the mediated architecture focused on the image of the design object and the so called 'social architecture' focused on the understanding of the relationship between human life and the building environment.

CONCLUDING REMARKS:

Morse (2006) describes how emotional-self awareness provides a way to avoid the 'bounded awareness' phenomena, which causes people to ignore relevant information when making decisions (Bazerman and Chugh 2006). The EIMS models addresses such problems by encouraging participants to reflect on their emotions and justify what they consider to be a rational choice. They also helped participants to formulate questions and look at problems from different perspective, significantly reducing the possibility of overlooking important information (Hammond, Keeney and Raiffa 2006).

This conclusion encourages further explorations on how to adapt the EIMS models to ICT which, if current trends continue, will be the basis of the sites and platforms upon which similar exercise in participation and design will take place. EIMS models could then be used to inform the decisions through real-time interaction between citizens, planning processes and designers that these platforms offer. Indeed, we would go one step further and suggest that the EIMS model has to be at the heart of the tools developed on these platforms.

In exploring an interdisciplinary approach based in human action to investigate alternative ways urban systems may be managed then, the contribution of this research rests on the challenges in the interactions and inter-relationships between disciplines and the underlying lessons it offers in the development of new media platforms for participation and design. It is suggested that future work should aim to further refocus urban theories and disciplines, and point to the importance of the interdisciplinary approaches to the study of cities and urban development on these platforms. In addition, it is argued that ICT can build on the human focus of these models and , potentially, bring more dynamism to urban planning without necessarily compromise adequacy of human intervention.

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