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Pedestrian routes and accessibility to urban services: an urban rhythmic analysis on people's behaviour before and during the COVID-19.

ZECCA, C., GAGLIONE, F., LAING, R. and GARGIULO, C.

2020

TeMA

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THE CITY CHALLENGES AND EXTERNAL AGENTS.
METHODS, TOOLS AND BEST PRACTICES

THE CITY CHALLENGES AND EXTERNAL AGENTS. METHODS, TOOLS AND BEST PRACTICES

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Pedestrian routes and accessibility to urban services: An urban rhythmic analysis on people's behaviour during the Covid-19

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Abstract

The Covid-19 emergency has changed the face of our cities, preventing most urban activities, limiting travel over large, medium and short distances and drastically reducing the number and intensity of social relationships. The restrictive measures imposed on the entire population have significantly influenced the experience of our built environment, as well as the assets of pedestrian and bicycle network to access essential urban services. On the one hand, these limitations have drastically imposed a change in the habits of people who now spend more time walking and cycling in the absence of other activities; on the other, they have revealed the need of a reorganization of pedestrians and cycle paths, as well as open spaces. The morphology of these urban spaces is unable to cope with the current situation of social distancing and to adapt to a new normality. Local decision makers face a new demand for urban space for pedestrian and cycle access that has not yet been explored. In order to contribute to future planning decisions, this paper proposes a comparison between pedestrian flows and accessibility of essential services before and during the lockdown, taking a decentralised area in the city of Aberdeen as a case study. As a conclusion, the paper proposes specific recommendations for urban planning in order to deal with emergency situations, such as mobility limitations due to an outbreak.

Keywords

People's behaviors; Pedestrian networks; urban accessibility; rhythmic analysis; GIS

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1. Introduction

On 30th January 2020 the World Health Organisation (WHO) declared an emergency due to Covid-19. This put in crisis not only the health system of European realities, but at the same time, it required an immediate response from administrators in promoting a different organisation of the built environment.

The first outbreak was found in Wuhan in China and subsequently in over hundreds of countries, but the WHO declared the global pandemic just on the 11th March (Allam & Jones, 2020).

Italy was the first nation in Europe to have a high spread of the virus followed by France, Spain and the United Kingdom. The daily records of the infections varied in different countries. This was due to different ways of dealing with the emergency.

Italy was the first country to implement restrictive measures. Many others followed it, such as Spain, France, Germany and later the United Kingdom. The latest report, issued by the British National Government (7/05/2020), outlined a 15.8% higher ratio between deaths and positive cases than other European countries, due to a delay in the development of provisions provided to the population.

The outbreak required not only a rapid response to the forms of organisation of health systems but also a new urban spatial structure (Soharabi et al., 2020). Social distancing, movement restrictions, travels allowed almost exclusively for the access to the services identified as essential, forced the local authorities to face and deal with a different demand of movement and accessibility to urban services (Papa et al., 2017).

The European countries and the whole world find themselves experiencing a real emergency that has overturned the indisputable role of our cities.

1.1 Scientific framework

The emergency produced significant impacts on all components of the economic-productive, socio-cultural urban system including the change in social relations (Sturzenegger, 2020; Gargiulo et al., 2020; Gargiulo & Russo, 2018) and effects on long-term use and organization of cities (Pirlone & Spadaro, 2020).

The effects inevitably led to an urban asset change and, as a consequence, to the need of new configurations for the cities. The idea of defining an appropriate safe distance is a point from which to start to adapt our cities to different layouts in the near future.

Adapting our behaviours certainly implies a different regulation of the use of public spaces and a redefinition of our priorities and greater reflexivity in acting individually and collectively within the community. Squares, open spaces and meeting places lose their meaning without the users living in the city.

The organisation of our urban spaces and pedestrian network for accessing essential urban services that must remain open for citizen's subsistence, is unable to respond to an emergency and to the needs of a population.

The characteristics of the built environment combined with users' behaviour, expectations and aspirations affect spatial and urban accessibility to places and activities (Gaglione et al., 2019; Meshur, 2016). Accessibility is a fundamental element to understand the interactions between the activities and the ways of users' moving for reaching them (bicycle, on foot) (Bonotti et al., 2015). In this regard, the scientific community continues to question the issue of neighbourhood and urban spaces walkability.

Rodriguez et al., 2015; Cerin et al., 2006, Gharaveis, 2020; Loo et al., 2012 investigated the identification of the physical characteristics of pedestrian routes (width, state of the pavement, etc.), the environmental density of lighting and functional characteristics that affect the walkability and safety of users (Gargiulo et al., 2018; Rossetti et al 2014). The purpose of this investigation was to improve accessibility to urban areas on a neighbourhood scale in terms of usability, safety and attractiveness of the pedestrian paths.

Another line of research has developed qualitative and quantitative indicators of walkability in order to define the areas where the priority should be given to the improvement of pedestrian accessibility to neighbourhood services and liveability (Brainard et al., 1997). The studies examined the factors that influenced the perception

of safety, usability and the level of cognitive familiarity of the built environment (Arellana et al., 2020; Arshad et al., 2016; Carnegie et al., 2007).

The ability to freely walk to enjoy urban places and essential services has positive effects in terms of health conditions of a population (D'Orso & Migliore, 2020; Ribeiro et al., 2018).

Today, the rules to avoid the spread of Covid-19, imposed by governments in most of the countries in the world, led to more sustainable modes of movement. The high risk of spread the virus, in the public transportations, posed a further research question related to the cities' walkability. Particularly, it focuses on new possible adaptations of pedestrian network to reach, to queue and to access commercial services (Aghaabbasi et al., 2018; Blečić et al., 2014). Furthermore, we can argue that pandemic fear led users to prefer walking and cycling short distance but also to use private cars for longer distance. This raises further the question related to the theme of urban dimensions and liveable distances to access places and services.

1.2 The role of commercial services within the city

In most of the European cities, the distribution of commercial services is based on a model of centralisation over large areas (Wang et al., 2006) compared to their spread over small areas. In other words, the commercial activities are structured on a shopping centre layout which today cannot host the public due to the pandemic. Particularly in the UK various essential services are located together with other non-essential service in the same centre or even directly within the same shop module. This overlap of functions, during Covid-19 time, generated further issues related to the accessibility. The closure of centre malls led to long queues and waiting times along the pedestrian walkways in order to access single essential retailers (Fig. 1). Furthermore, in some countries, such as the UK, access to single urban health and essential commercial services is timed due to the different types of users (children, elderly, travelled with disabilities).



Fig.1 Thursday's scene outside Asda in the Kings Heath area of Birmingham

The mall by nature is a highly organized complex consisting of a variety of retail stores and service facilities concentrated in one building in order to provide a complete customers service (Shi et al., 2015). A large scientific study was produced on the identification of the best position of large shopping centres through spatial analyses in GIS (Erdin & Akbaş, 2019; Shi et al., 2015); furthermore, the study investigated what the effects generated by the presence of shopping centres were within urban areas (Lens & Meltzer, 2016).

Moreover, Pope & Pope's studies (2015) and Nega & Timm (2015) examined how the presence of a shopping centre can affect the real estate values of a neighbourhood. and the relative impact they produce in the urban areas adjacent to them with the aim of estimating the impacts that these large centres produce in the urban areas adjacent to them.

Other studies examined what the effects of shopping centre are in terms of increasing or decreasing the attractiveness of a neighbourhood. The results showed that the presence of these large commercial centres induced negative effects such as an increase in air pollution, crime, noise and traffic congestion (Ihlanfeldt & Mayock, 2010; Koster & Rouwendal, 2012; Kuang, 2017). Effects that will now be questioned again in order to deal with the emergency of Covid-19 and the associated reorganisation of commercial services.

In light of these brief considerations where pedestrian routes and essential services accessibility are clearly intertwined, the need of implementing urban planning actions and strategies to respect social distancing in the short and medium term, is clearly emerging.

The new strategies should respond to the emergency with flexible and interchangeable solutions in order to restore a new normality. In doing so, the current and shared aims of more versatile design principles would be met, and public and private spaces would be accessible to every category of people, regardless of the age, cultural, social, physical and cognitive conditions. (Bianconi et al., 2018; Türk, 2014).

In this perspective and in order to support local authorities to improve liveability and urban organisation in terms of pedestrian mobility and accessibility to primary services, even in emergency conditions, the paper examines the pedestrian accessibility of large shops before and during Covid-19 within Aberdeen urban context; on the other hand it proposes how to adapt the pedestrian paths and spaces to reach larger retails such as supermarkets, pharmacies in compliance with social distancing and with the aim of providing useful suggestions to decision-makers.

2. Methodology

This paper discusses how urban spaces, services and mobility changed since the Covid-19 pandemic emerged, taking Aberdeen, Scotland, as a case study. The proposed methodology aims to define the pedestrian accessibility of essential commercial services in two different scenarios before and during Covid-19.

The proposed methodology combines two different approaches adopted in urban planning and on the topic. In the first part of the research, a qualitative approach, aimed to monitor, through a direct survey on sites, the urban flows for access services, routes and roads. Data were expressed in terms of number of users during certain scheduled times every day. In the second part, a quantitative approach, starting from the number of users, aimed to define pedestrian accessibility through the use of a network analysis tool in the GIS environment. More in detail, this method is divided into four phases. The mixed methodology, qualitative and quantitative, is illustrated in the following paragraph.

2.1 Rhythm-analysis

The complexity of contemporary urban spaces is remarked by relations and conflict between different mobilities and interactions. Their configurations generate urban rhythm (Smith et al., 2013).

In this regard, the study of spatio-temporal phenomena enabled to individuate possible inefficiencies of the spaces and infrastructures but also provided the basis for design improvements.

Urban rhythms, in this paragraph, are defined to outline the uses of urban spaces and essential services in relation to how users move in two different scenarios. In this sense, the choice to consider the rhythmic analysis of urban flows was useful to understand how during the lockdown the behaviour of users living in the city changed. Urban spaces are experienced with the body and perceived with different levels of engagement (Vergunst, 2010), and this implies an analysis of both presences in the urban space and functions offered in that particular space. Functions are mainly related with the services that follow particular timetable during the day. In this sense, it is possible to perceive the movements and presences as data depending on the functions and so the services opening times. According to Mareggi (2017) the time can be understood in different ways, however for this research, the time was conceived as opening time of the activities and the

rhythm was perceived as the intensity of users flows. This to understand how the users' habits and lifestyles varied, especially during the pandemic, where temporality took on an important role.

The first phases of the research took rhythmic urban analysis in order to identify the users' flows on the streets, pedestrian paths and access to services around the main retails in Garthdee, Aberdeen, before and during the lockdown. The areas were monitored through site surveys carried out during two working days and one day along the weekend. In this sense, the intensity of users has to be considered as an overage number of users during three scheduled times each day (10am; 15pm; 17pm). According to Lefebvre (2004), this analysis also shows the complexity of the urban spaces and their use in relation to the flow and the opening times of the services present there.

2.2 Pedestrian accessibility analysis in GIS environment

The second phase involved the creation of data model of the rhythmic analysis of urban flows expressed in terms of number of users through the ArcGis software in two different scenarios before and during Covid-19. The data have been spatially referenced with the aim of having a framework on the urban phenomenon before and during Covid-19 (Grekousis, 2020; Stillwell & Clarke, 2004). The data collected were associated in GIS environment with the graph of the pedestrian in the network before and during Covid-19 by implementing the pedestrian graph starting database. For each scenario, the average daily flow was calculated in order to better understand the intensity and trajectory of the attendance at different times (Mareggi, 2017). These data were translated into rhythmic maps with the aim of understanding the relationships between the characteristics of the built environment and the pedestrian behavioural variation of the users along the walkways. In addition, rhythmic maps aimed to classify pedestrian flows using the natural breaks method. These maps were also useful for obtaining potential insights on where and how to adapt urban space in an emergency situation.

Due to the pedestrian flows defined on each arch of the pedestrian network, the third phases aimed to define pedestrian accessibility to essential urban services before and during the pandemic through the use of a network analysis tool in environment GIS. Pedestrian accessibility is defined, on the pedestrian graph, by relating the ability of users to travel on a pedestrian network with the speed of walking.

To define the walking speed of users, the study of the scientific literature made possible to consider as useful, for the purposes of this work, the research carried out by Colclough (2009) which determined such values based on different groups age of the population combined with the topological characteristics of the network, such as slope and connectivity of the pedestrian network. More in detail, an identified average value of walking speed 1.33 m/s was defined. This value defines the walking speed of a user on each pedestrian network in relation to his ability to walk a pedestrian path. Particularly, on the pedestrian graph, the accessibility was defined by the length of the route based on the users walking time; the average daily pedestrian flows, over each arch, was considered before and during the Covid-19, generating the function attributed to the pedestrian graph with the implementation of the Network analysis tool.

Due to pedestrian accessibility on the network and the location of urban services, in phase four, urban areas were classified in terms of pedestrian accessibility to urban services, using a network analysis tool in the GIS environment. The classes were defined in relation to the restrictive distances imposed to access the commercial services during the pandemic. This enabled to understand whether the organisation and distribution of the urban service offered responds to the emergency at a neighbourhood scale. The classification of urban areas, in relation to pedestrian accessibility to urban services, is an indispensable premise for the construction of a tool to support the public decision-makers and for the implementation of interventions on the territory.

The aim is to identify pedestrian routes which need interventions to respond to the new needs of the population. Interventions that require further and stronger relation to the characteristics of the built environment. The combination of these two methods enables to better understand how to rethink the reorganisation and distribution of essential urban services.

3. Case Study

During the lockdown several changes in the use of urban spaces happened and this inevitably affected the servient and ancillary spaces of urban services.

The paper specifically focuses on Aberdeen city which has a particular reality. It is the third city in Scotland and its city centre is mainly developed along a spine, Union Street. The city is characterised by three main centre malls while supermarket chains are located out of the city centre. Local commercial activities, despite the country is reach of farms and agriculture sites, are not present within the city. This is due to its economy developed only around the oil and gas sector and to its urban improvements and masterplan which are proposed mainly by developers from private sector, aiming to appealing investments. Furthermore, the peripheries and neighbours, including those ones designed for elderlies, are not served by various retails and consist just of residential buildings. During the lockdown, farms located in the countryside started to offer at home-delivery of goods and this had a good success around the population (Foodiequine, 2020). In view of the above considerations, the study focuses on Garthdee area in Aberdeen, which is served by supermarkets, a pharmacy, petrol stations and a DIY, and shows the data collected on week and weekend days at different times during each day. Particularly, excluding the early opening time specifically dedicated to key workers and vulnerable people, the survey took place in the morning, afternoon and evening. Every monitoring lasted around one hour and half.

The area is characterised by various residential areas, two main British supermarkets with adjacent petrol stations, one of the main pharmacy stores of the city and a multination DIY (do it yourself) and home improvement retail. All services have wide carparks which were used, during the lockdown, as queueing and waiting area to control and limit the access to the stores. Two main infrastructures, serving the area and services, were monitored, in the first phases, as a result of a rhythmic urban study on users' flow: 1. Holburn Street which is one of the major spines of the city connecting the North and the South parts of Aberdeen. It is intensively used by private vehicles, public transportations and goods transportations; 2. The Deeside path which is a cycle and pedestrian route along the river Dee, and which connects the Duthie Park and the retailing area. For both infrastructures, only the pedestrian and cycling flows were considered for this study. The following tables show the data obtained during a week between April and May 2020.

Retail	Opening time	Key workers / dedicated time	Flow overage 10am	Flow overage 15pm	Flow overage 17pm
Sh 1	9am – 10pm	9-10am NHS & elderly (Mon-Wed-Fri-Sun)	79 pep. in queue	83 pep. in queue	50 pep. in queue
Sh 2	8am – 9pm	7.30-8am NHS (all days) 8-9am elderly & disable (Mon-Wed-Fri)	32 pep. in queue	40 pep. in queue	31 pep. in queue
DIY	8.30am – 5pm	N/A	40 pep. in queue	65 pep. in queue	closed
PH	8.30am – 8pm	N/A	5 free entrance	5 free entrance	4 free entrance
Petrol stations		N/A	3 cars	10 cars	16 cars
Pedestrian/cycle paths					
	Deeside path		35 people	64 people	42 people
	Holburn Street		6 people	2 people	36 people

Tab.1 Aberdeen Site survey carried during a weekday Wednesday 29/04/20

Retail	Opening time	Key workers / dedicated time	Flow average 10am	Flow average 15pm	Flow average 17pm
Sh 1	9am – 10pm	9-10am NHS & elderly (Mon-Wed-Fri-Sun)	45 pep. in queue	74 pep. in queue	60 pep. in queue
Sh 2	8am – 9pm	7.30-8am NHS (all days) 8-9am elderly & disable (Mon-Wed-Fri)	32 pep. in queue	34 pep. in queue	35 pep. in queue
DIY	8.30am – 5pm	N/A	40 pep. in queue	52 pep. in queue	closed
PH	8.30am – 8pm	N/A	5 free entrance	4 free entrance	2 free entrance
Petrol stations		N/A	4 cars	7 cars	7 cars
Pedestrian/cycle paths					
	Deeside path		55 people	59 people	36 people
	Holburn Street		6 people	14 people	5 people

Tab.2 Aberdeen Site survey carried during a weekday Friday 01/05/20

Retail	Opening time	Key workers / dedicated time	Flow average 10am	Flow average 15pm	Flow average 17pm
Sh 1	9am – 10pm	9-10am NHS & elderly (Mon-Wed-Fri-Sun)	19 pep. in queue	18 pep. in queue	18 pep. free entrance
Sh 2	8am – 9pm	7.30-8am NHS (all days) 8-9am elderly & disable (Mon-Wed-Fri)	0 pep. in queue	15 pep. in queue	16 pep. in queue
DIY	8.30am – 5pm	N/A	57 pep. in queue	50 pep. in queue	closed
PH	8.30am – 8pm	N/A	0 pep. in queue	0 pep. in queue	0 pep. in queue
Petrol stations		N/A	3 cars	2 cars	0 cars
Pedestrian/cycle paths					
	Deeside path		23 people	25 people	36 people
	Holburn Street		0 people	0 people	4 people

Tab.3 Aberdeen Site survey carried during a weekend day Saturday 02/05/20

The analysis suggests that retails, despite the wide spread furloughing condition of the country and so more spare time during the week, continued to maintain regular pace with an increased flow during the weekend. Interestingly, the most popular retail, according to the monitoring, was the DIY which had long queue outside the store all days. Particularly, the DIY was the only shop with outside queuing lanes erected on the parking spaces in front of the shop.

The other supermarkets instead, used marking lines on the pavement to take customers 2 meters apart from each other and distributed in a linear shape. Certainly, the intensity of the flow was slowed down by precautions taken by the retails in order to maintain social distancing inside. This generated longer lines and waiting times.



Fig.2 Aberdeen shop 1. Site survey carried during both week and weekend days



Fig.3 Aberdeen shop 2. Site survey carried during both week and weekend days



Fig.4 Aberdeen DIY. Site survey carried during both week and weekend day

Differently from the shops, the Deeside path was more populated than usual with a continuous flow of visitors who used the path to reach the shops and for leisure purposes. The width of the path cannot provide the minimum social distancing required and so users spread out around the park, creating new alternative routes. In the second phase, pedestrian flows were associated in the GIS environment with the graph of the pedestrian network and its average was defined before and during Covid-19.

The results, gained from the comparison of the maps, show that before the Covid-19, in the residential areas of Garthdee, the pedestrian flows were very low and had a value of 5 due to the use of other forms of movement such as private cars and public transports to access urban services. Pedestrian flows were higher in Garthdee Crescent area due to a greater concentration of urban services adjacent to residential areas.

In Ferryhill and Ruthrieston's neighbourhoods the pedestrian flows were greater than the Garthdee area due to the presence of Duthie Park and the area adjacent to Aberdeen harbour, redeveloped in the 70s through a high concentration of urban services.



Fig.5 Aberdeen Deeside path. Site survey carried during both week and weekend day

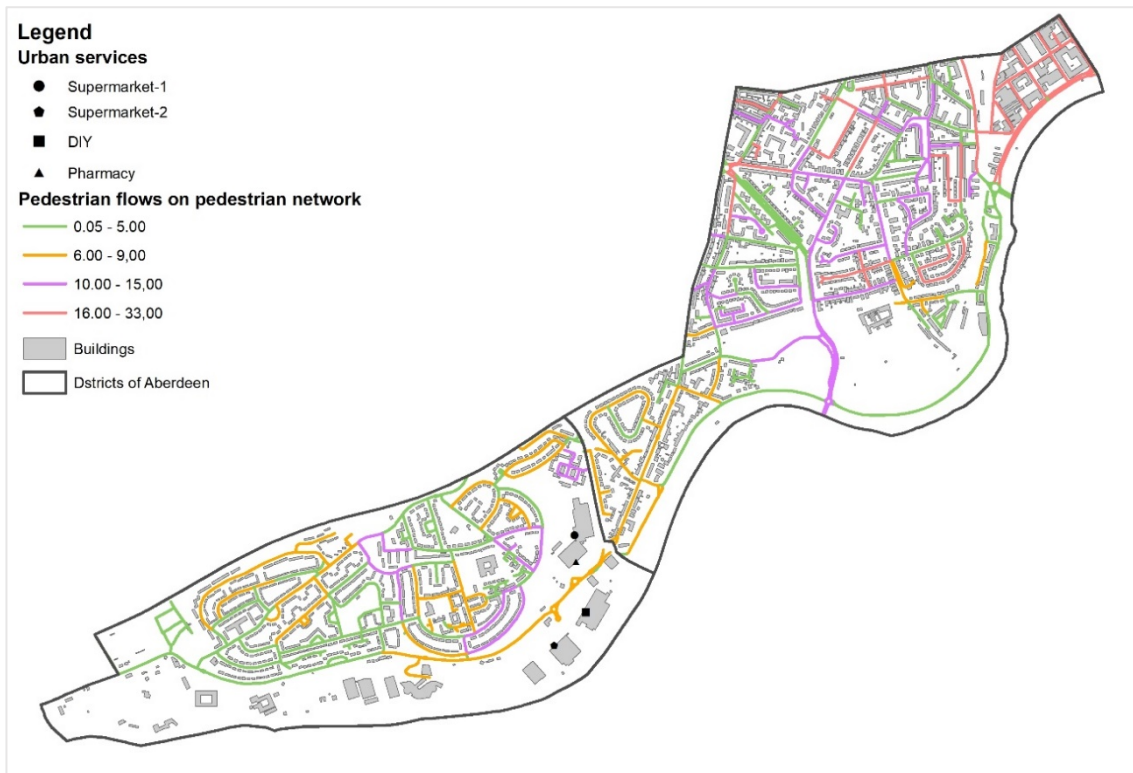


Fig.6 Pedestrian flows of the districts of Garthdee, Ferryhill and Ruthrieston before Covid-19

During the Covid-19 period, it is clear how the fear of infection changed the habits and lifestyles of users who live in the city. More in detail, it can be noted that in the residential areas of Ferryhill and Ruthrieston the pedestrian flows were almost completely zeroed while in the residential areas of Garthdee the pedestrian flows were almost completely unchanged before and during Covid-19. On the contrary, in the proximity of essential services, within the area of Garthdee road and Garthdee Crescent, pedestrian intensity increased considerably. The high pedestrian intensity was due to both the new ways of access the urban service and to the new social distancing in place. Both of them imposed a review and new organisation of the urban system particularly in terms of spaces and pedestrian networks.

Moreover, the Scottish government restricting measures imposed a limiting travel of 5 miles. This, together with the increased and forced spare time, led to more sustainable travel modes, encouraging the use of pedestrian and cycle path. In this regard, Holbourn Street pavement and the Deeside Path had a considerable increase in pedestrian flows compared to period pre Covid-19. As a result of this shift, more places and leisure areas in the city were more experienced than before by the users, even if the spaces were still not organised to maintain a safe distance (Figs. 6 and 7).

In this regard, it seems important to highlight how the continuity of the pedestrian and cycle network in the area, appears fragmented and moreover its width does not allow safe journeys particularly in relation to the surrounding built environment and roads. The vehicles infrastructure continuity and the effective connections have been so far prioritised, reducing the possibility to positively influence the users to consider other types of mobility. Furthermore, what emerged from the survey and as highlighted by an ongoing research at Robert Gordon University (Civitas Portis, 2020), the fragmented walkability of Aberdeen, together with the limited possibilities of having cycling continuity within the centre, are still an important issue in terms of safety.



Fig.7 Pedestrian flows of the districts of Garthdee, Ferryhill and Ruthrieston during Covid-19

In the third phase, the pedestrian accessibility was defined on the network considering both the pedestrian flows defined along the pedestrian network graph and the actual users' ability to travel through each pedestrian network. In phase four, because of the measure of pedestrian accessibility on the network and the location of urban services, urban areas were classified into three pedestrian access levels. The pedestrian accessibility

levels have been defined on the basis of the restrictive measures that the Covid-19 imposed in terms of pedestrian distances to reach essential services (Figs. 8 and 9).



Fig.8 Pedestrian flows of the districts of Garthdee, Ferryhill and Ruthrieston before Covid-19



Fig.9 Pedestrian flows of the districts of Garthdee, Ferryhill and Ruthrieston during Covid-19

The western area of Garthdee, again, is predominantly residential while the eastern one offers a high range of urban services. This disconnection increases the needs of alternative ways of travel to the pedestrian one.

In light of these brief considerations, the necessity to rethink the general organisation and distribution of urban services appears fundamental especially within the residential areas. This implies a switch towards a smaller-scale of retails scattered around and about the neighbourhoods against the centralised model of bigger centre malls concentrated in dedicated areas within the city as, at the present, shown on an urban scale.

The distances were defined because of the particular restrictive measures during the pandemic. More specifically, the results, obtained for the urban spaces considered, show how pedestrian access to urban services increased during the pandemic. Furthermore, the restrictive measures of moving demonstrate that the urban services' distribution in clusters around the city is not suitable during emergency periods.

In this sense, it is possible to notice that Ferryhill and Ruthrieston's neighbourhoods are totally absent on the maps and therefore unable to reach certain essential services on foot.

4. Conclusions

The fragility of the urban system has been revealed by a pandemic. The virus generated a structural damage for cities requiring more flexibility of the spaces, especially those ones commonly used just as car parks serving supermarkets and other services. In this sense, it is important to rethink and reorganise the spaces in order to host different functions and in order to transform them in more porous places.

Accessibility, routes and waiting spaces imply a spatiotemporal experience which can be effectively and critically analysed through the rhythmic analysis. The sequence of the spaces, along with the experience of passing thought, walking, cycling, resting, is intrinsically related to the temporality.

Space and temporality are then key aspects to consider in re-designing the city and which can be clearly understood through their rhythm analysis. In this sense, it seems pertinent to recall the recent idea of Anne Hidalgo (The alternative UK, 2020), the mayor of Paris, on the *15-minutes city* and clearly inspired by Jacobs' proximity concept (1961). The 15-minutes city addresses both aspects related to the urban dimensions and time by offering all essential and non-essential services within a radius of kilometres walkable in 15 minutes. The factor 'space' would be addressed through the introduction of micro-local green cities within neighbours; and the factor 'time' would be addressed through the reduction of time lost for transportation from one side of the city to the other.

Using the 15-minutes city as a theoretical reference, this research proposes conceptual guidelines for the two main categories of spaces analysed here and different in their morphology: the infrastructure with a linear configuration and the ancillary spaces of activities with a more areal layout but still re-proposing a linear configuration for the waiting queues. Through the analysis and graphical elaborations, it is possible then to draw some conclusions as guidelines for the improvement of both spaces.

4.1 Pedestrian path

In the case study the rhythm was constant and the linear morphological configurations in place did not enable any rhythmical variations. A linear configuration reminds to the concept of boundary, but the challenge proposed is to perceive that boundary as Heidegger (2001) suggested:

"A boundary is not that at which something stops, but, as the Greeks recognised, the boundary is that from which something begins its presencing."

What is proposed here is a form of de-linearization together with a reinforced continuity of the routes which may combine both dimensional and functional solutions.

If the city is going to change its dimensions in terms of carbon reductions (Civitas Portis, 2020), then parts of the space could be re-thought in order to implement the width and the continuity of pedestrian and cycle routes while offering more multifunctional services both essential and non-essential.

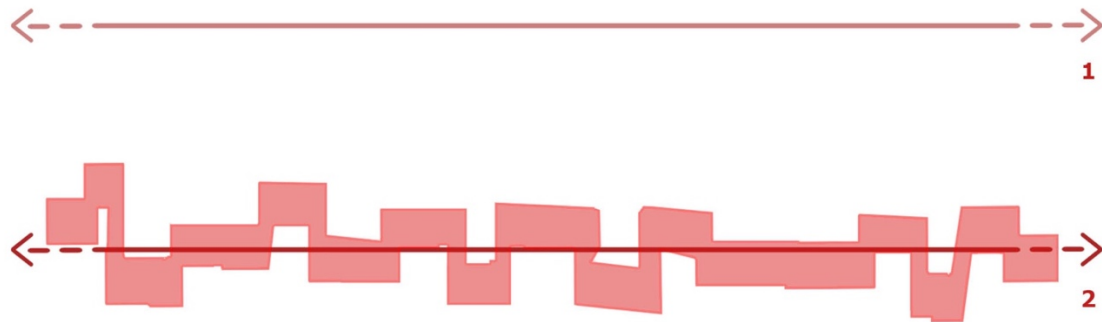


Fig.10 Conceptual diagram wider and multipurpose pedestrian paths. 1 current configuration; 2 "pockets of multiple activities"

Public mobility infrastructure should be more capillary, multifunctional and reversible, particularly in terms of width. This dimension is crucial to maintain effectively the minimum social distancing and can be achieved with the introduction of green areas and relaxing pocket areas along the paths. It appears important to re-think the infrastructure as a sustainable and more green catalyst able to connect, to serve and to host various physical activities from running, cycling and walking, to the leisure ones such as sunbathing, sitting areas and green spaces (Gargiulo et al., 2018).

In terms of morphology, this implies a radical shift from a thin, linear and monofunctional spaces to a more elaborated and thicker sign within the territory with fragmented borders able to generate "pockets of multiple activities".

4.2 Ancillary Spaces

During the pandemic, car parks serving shops, were used to moderate the flow of users while maintaining the social distancing. In view of a more sustainable city and referring to the specific case of Aberdeen, which lost its micro-localism due to an economy heavily focused on the oil and gas sector and on a globalised market, we argue that large areal spaces can be an occasion to reinforce the local sense of identity.

These spaces are extremely wide and sometimes distributed on two floors. The areal dimensions suggest that there is enough space to host car parks and pedestrian paths along with the possibility to reintroduce some localisms against the more globalised and standardised function of the big chains. Particularly, the covered car parks can be transformed as space for pedestrian use to access the shops but also as multipurpose space able to host temporary market and small activities to complement the main shop.

4.3 General considerations

The new meaning of distance, as a safe measure for any relation, overturns the idea of urban space and reveals the importance of slowing down its physical growth, and of rethinking its relations with the surrounding areas and nature. Social distancing should be read as an opportunity rather than a limitation in order to re-imagine the relation between linear infrastructure paths, ancillary spaces and nature (Gargiulo et al, 2016). Nature may help to guarantee the distances and the social sharing of the space at the same time.

Furthermore, the relation with nature rises another important aspect that deserves attention in the near future. It can help to slow down the mobility, making the movements more enjoyable and help to reflect on the possibility to psychologically reduce the distances between areas by providing more services and attractiveness accessible by pedestrian and cycle flows.

The importance of reactivating micro-localism, private and small local activities together with a hyper-proximity of various services, may provide more cultural identity and easy accessibilities to different services especially in the peripheral areas of the city.

Author Contributions

Although this paper should be considered a result of the common work of the authors, C. Zecca and R. Laing for the section 1, 1.1 and 1.2; F. Gaglione and C. Gargiulo for the section 2 and 2.2; F. Gaglione for the section 3; C. Zecca for the section 2.1, 4, 4.1, 4.2 and 4.3.

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