Designing Creativity Tools to Support Business Innovation

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ABSTRACT
There are a wide range of approaches and organizations, which have the common aim of supporting SME's to deliver new products and services. This paper examines the various approaches which have been taken and in particular describes the work of The Centre for Design & Innovation (www.c4di.org.uk), Aberdeen, which has been established to provide innovation support for small to medium sized companies in Scotland. The centre has adopted a user-centered approach that encourages companies to consider their core values, identify opportunities based on their customers needs and encourage new thinking based on a re-evaluation of the company's innovation culture. This paper examines the philosophical basis for the development of the new centre and subsequent methodology that has been adopted. It also describes a number of resources that have been developed to help SME's with their innovation processes. This is based on a user-centered, ethnographical strategy. Serious play is used to help companies shift their perspective which in turn leads to new insights. Recognition of the barriers to creative thinking enables companies to develop an innovation culture that promotes continuous innovation and development. Prototyping methods are described that help companies develop and evaluate concepts and encourage co-design and interdisciplinary working.

Keywords
Creativity, Design Thinking, Service Design, Serious Play, Service TRIZ

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INTRODUCTION
In 2005 Sir George Cox published his report on creativity in business [6], which recognized the importance of design as an essential driver of innovation. The review considered the UK's competitive position in the global context and made a number of key recommendations, amongst which were, ongoing support for the UK Design Council's 'Design for Business Programme', and the establishment of a network of centers of creativity and innovation around the UK, which would aim to support SMEs in their effort to use design to drive innovation. The report defined the critical link between creativity design and innovation. In response to this report funding was sought from the European Development Fund and the Scottish Government to establish a new centre for Design & Innovation in Scotland. The new centre (c4di) was established by the Robert Gordon University in 2008 to assist Small to Medium Sized Enterprises in Scotland with their innovation strategies. The new initiative looked to the UK Design Council's 'Designing Demand Programme' which provided case study examples of how designers could facilitate innovation within SMEs. Another key example of a similar centre which had been established for a number of years is the Centre for Design Innovation in Sligo Ireland, which provided a model on which to base the new centre in Scotland. Both the Design Council; and CDI in Ireland have workshop programmes aimed at one to many interactions followed by one to one project focused innovation activities. Both models use a design mentor to work directly with companies to develop the company's communication and branding. This paper describes the approach behind the Centre for Design & Innovation in Aberdeen, its philosophy and the methodology and the corresponding resources underpinning the work of the new centre.

A wide range of business strategies has been adopted over the years aiming to improve overall quality of products and management systems within companies for example Total Quality Management (TQM) in the 80's followed by Six Sigma in the 90's. [22] These systems emphasized

improvements in management systems, which would minimize variability in manufacturing and business processes. Companies that adopted these systems claimed major improvements in productivity and reliability. Business improvements were dominated by focusing on technology and management. It is only in the last decade that the importance of creativity within organizations has been acknowledged as a key factor in developing an innovative culture within organizations. Unfortunately creativity is very difficult to define and how you apply creativity in an organization is even more problematic. Companies require clearly defined activities which they can justify spending money on, activities which have clearly defined measurable outputs. Again unfortunately, measuring the value of design interventions is particularly difficult. In looking across organizations that have been established to support SMEs whilst they are clear about the value of innovation they are much more reticent about how they measure the success of the interventions

The need for companies to be innovative to develop new products and services has always been acknowledged, what has been more difficult to establish is the best way to bring about the innovation. The basis on which the centre in Aberdeen was established was that design used strategically could provide a methodology that would allow companies to identify opportunities for improving their existing products and services and provide insights into the business models themselves which in turn could lead to business innovations.

In practice this intention has been difficult to implement for a variety of reasons. Firstly, for many companies design is seen as an afterthought, so educating SMEs to think of design as a core activity that can be used to address a whole range of business issues including the development of the product, through to branding is a particular challenge [21] The next barrier is that companies may see innovation as a one off activity rather than a continuous process. This approach can be summarized in the following phrase as 'if it's not broken don't fix it'. In other words companies that are trading well and have a strong customer base don't have any incentive to introduce changes or invest in new design. One of the difficulties faced by c4di is how to describe the value of design in an abstract sense which is a necessary precursor before working with a company on a specific project. Developing a relationship with a company to the point where they understand what is being provided and how it is to be implemented, takes significant time. Our response to this issue has been to develop a workshop programme which introduces companies to design thinking as a tool for innovation. The term 'design thinking' is accredited to Tim Brown CEO of IDEO [4]. A number of other authors have adopted the phrase [15]. Workshops are intended to lead to a deeper relationship with the client, which can then lead to tangible outcomes that can then be measured in terms of improved performance. Many of our techniques are in common use in design practice however they remain novel in other disciplines.

1 CREATIVITY AND DESIGN

Defining creativity has always been somewhat problematic [26] [27]. The Cox Review [6] provides a helpful definition. *'Creativity'* is the generation of new ideas – either new ways of looking at existing problems, or of seeing new opportunities, perhaps by exploiting emerging technologies or changes in markets'. Further Cox defines the link between creativity and design, 'Design may be described as creativity deployed to a specific end. Innovation is the successful exploitation of new designs. It's the process that carries them through to new products, new services, new ways of running the business or even more ways of doing business.'

Therefore if creativity is a prerequisite for good design leading to innovation some consideration of how to encourage creativity is essential. Creativity is inherent to all human beings, however it is clear that just as there are different ways in which creativity manifests itself there are different problems that require creative solutions. In more recent years cognitive psychologists have been able to map the centers of the brain responsible for different types of activity and as a result it can be demonstrated that the right side of the brain is better able to deal with more abstract non linear concepts, whereas the left hand side is responsible for more logical sequential tasks, however both sides of the brain are required for successful problem solving. Being in a relaxed frame of mind appears to be a critical factor in allowing the brain to arrive at creative solutions. Tom Wujec [27] presented his research in a recent TED presentation describing the "marshmallow problem" a simple team building exercise that involves building a tower using dry spaghetti and a yard of tape and a marshmallow that has to be balanced on top of the tower. Wujec has run the exercise with a wide range of groups and describes how groups such as kindergarten children outperform particular groups of adults and how adding incentives of prizes reduces the ability of teams to build successful towers. The most successful teams continually prototype their tower as they go along. A similar example was put forward by Dan Pink [20] quoting research at Stanford & MIT in which different groups were asked to resolve a simple problem. Those given a financial incentive were all less successful. The conclusion appears to be that activities which require a creative solution requires those taking part to be in a relaxed state of mind free from constraining pressures which have the effect of making it difficult to think beyond known pathways. The implications of these examples are that in order to encourage creativity within an organization it is necessary to provide an environment which encourages a playful approach.

When looking at a new problem, we can either look for differences from previous problems, or we can look for similarities with other problems [14]. The result is two different creative processes, the first involves deriving new solutions from old ones, 'case-based' design, or what Guilford [8] has termed 'divergent production'. The second

involves transforming solutions by shifting contexts, thinking by analogy. Boden's [3] model is slightly more complex, but in outline similar: allowing different kinds of divergent production, allowing new solutions by association, analogy, exploration, and transformation. Design problems come in different sizes. Dym [7] describes the differences between 'creative' design, 'variant' design, and 'routine' design. For Dym creative design is the 'hard problem' of design – new design, usually where there is a lack of knowledge on the part of the designers. Variant design involves adapting existing designs. Routine design makes no demands on new knowledge. Adopting a user centered approach is an effective way of identifying opportunities for improving existing design and therefore suitable for variant design.

So on the one hand, the nature of the problem influences the kind of creativity that is likely to be relevant to it. This is not the only, or even the most important factor: there are at least two other important sets of factors: individual factors and external conditions as described by Rogers [24]:

Factors relating to the individual:

- Should be open to experience
- Making evaluative judgments should be internal
- Should be able to 'play' with elements and concepts

Factors relating to the context of collaboration

- Contributors and their ideas should be accepted for their own worth
- External evaluation should be absent
- Contributors should be understood empathically
- Contributors should be given freedom of symbolic expression

These factors are not specific to design. The issues that they raise are general to all types of creative work. Importantly, these factors reveal the tension between the creative individual and their social and collaborative context. True creativity can perhaps best be achieved by free creative individuals, given autonomy and freedom to solve complex problems in ways that they feel reveal their unique potential, yet the realities of innovation usually involve other stakeholders, who make their own evaluations of the work, whether it will help creativity or not! Dan Pink's [20] observations on what motivates individuals in organizations reveals how existing approaches to motivation based solely on financial incentives have been found to be counter-productive in solving creative problems and supporting a culture of innovation. He identifies 3 essential factors for motivating individuals promoting autonomy, mastery and purpose. An often-quoted example of a company recognizing the value of giving individuals autonomy over their work is Google with their 20% playtime. Mastery in this context refers to the idea of becoming as proficient as possible in your given field. Purpose, refers to having an agreed and valued common goal.

Don Norman's paper [18] appearing to criticize the value of Human Centered Design, challenges the assumptions on which HCD is based. In raising issues around the value of HCD and UCD Norman's paper caused us to reevaluate our own assumptions. When considering the 2 types of design as described above i.e. incremental versus transformational, user centered design has proved useful for observing the shortcomings in existing products and services which can be addressed through UCD. Helping companies to develop transformational design requires alternative approaches which are much less certain to produce results. Our approach is to focus on helping companies develop a supportive culture of innovation which in turn can help recognize opportunities for truly innovative concepts.

2 THE METHODOLOGY OF INNOVATION

In the field of design many of the methods and techniques for developing new ideas are tried and tested and well established. However, in business, design is still seen as largely about aesthetics. An issue for c4di is how to establish credibility for what we are doing. Even with case studies of successful interventions it still remains a difficult message to get across. Businesses are not short of advice urging them to innovate or die and it would be hard to find any competent manager who would not agree with this assertion. So if we accept that the will is there why do so many companies find innovation a very difficult thing to accomplish? Organizational structures may provide one source of constraints to innovation although both hierarchical and flat managerial structures have been shown to have equal potential for innovation [23]. We will argue that the constraints imposed within ourselves can be more important than external factors. Many of us are naturally risk averse, and have a fear of failure, or embarrassment. Overcoming the self imposed constraints requires a context in which our psychological safety is assured, recognition that all complex problems require an interdisciplinary approach to solving them and that judgment should be suspended, in other words all ideas are considered equally valid until evaluated.

One company that provides an excellent case study of supporting a culture of innovation is the 3M Corporation. The story of the invention of the Post-It Notes by Art Fry based on a weak glue illustrates how the company's support for unconventional thinking led to the development of new products which a less enlightened management would have dismissed as not being part of their corporate mission [2]. In the design world the best example comes from IDEO, which encourages a playful informality in which practical jokes and games are part of the culture [11],[4],[12]. As children we learn to play without inhibitions. We set rules for our play and have no difficulty making leaps of imagination. Once we are adults we lose this natural ability, our inhibitions constrain us. When

working with companies serious play can be a very effective strategy. Part of this strategy involves using board games, cards and special counters to reinforce the metaphor of game play.

The programme that has been developed at c4di mirrors a classic design process which includes:

- Understanding
- Observation
- Prototyping
- Synthesis
- Iteration
- Implementation

As a first step when working with companies we try to explore the client's core values to develop a joint understanding. To do this we use visual methods. Clients are asked to select from a pack of random image cards which are either representative or counter representative of their values. Related to this is the questioning of preconceptions and assumptions. The next step is exploring cultural barriers to creativity. This is where we introduce serious play to overcome the inhibitions that prevent creative thinking from taking place. [25] The next stage is developing prototyping as a key method in the innovation process. We define prototypes as anything which could include quick models made from recycled materials, card, foam board, though to scenarios to describe situations and storyboards to model processes. The ideation stage involves introducing clients to a range of idea generation methods. These include facilitating brainstorming sessions using a range of intuitive methods as well as more systematic creative problem solving techniques. Following the ideation stage we then introduce techniques for evaluating ideas. These include the development and testing of prototypes both physical and virtual.

Problem Identification

A useful concept for problem identification is that of the extreme user. An extreme user may be someone who really loves a product or service, perhaps is an early adopter or alternatively, is someone who is actively unhappy with the product or service. It is these people that can provide genuine insights about what works or more importantly what doesn't work. For example they may have found the product or service unsatisfactory because it does not meet their needs, alternatively they may be the person that delivers the product or service and knows more about it that anyone else as the result of firsthand experience. They could be the repair engineer for example who is most familiar with what goes wrong with a product. Fig 1 shows a standard distribution curve to illustrate where these two extreme user groups can be found

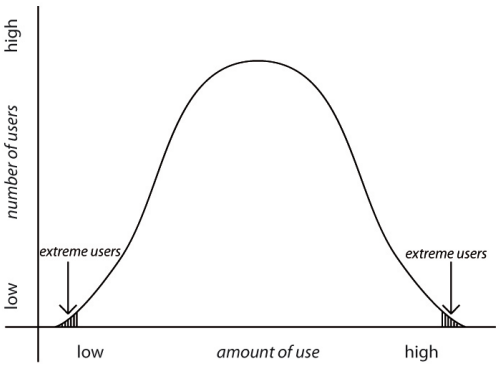

Figure 1. Extreme users are few in number who may use the product or service very little or a great deal. In either case their experiences can provide valuable insights.

The extreme user is a powerful concept for identifying the shortfalls in existing products and services. If it is not possible to identify an extreme user we can all become extreme users by simulating situations. In design terms this has become known as Empathic Design [16]

Deciding on which companies are ready to innovate and which will be receptive is very important as time and resources are limited. We have therefore developed a diagnostic tool to allow us to identify which companies will respond to our programme. The diagnostic tool is in the form of a two-part questionnaire. The questions themselves are in the form of semi-structured interviews. The interviews are conducted as part of events we have termed 'block of cheese' days. The title originates in the States and refers to an informal meeting for the exchange of ideas whilst eating cheese. We begin the discussion with a standard set of questions to establish at what stage the company is at in terms of their readiness to innovate. A key indicator of a company's ability to innovate is reflected by the way in which they prototype new ideas. The more a company prototypes the more likely they are to be innovative. [25]

3 SHIFTING PERSPECTIVES

c4di clients currently include SMEs, in the sectors of energy, biotech, health and food. We don't claim to be experts across all these fields, however we are expert at finding new ways of altering the companies' perspective on their own businesses and thus giving them new insights into what they are doing and how they might improve. We have designed a number of workshops which aim to introduce companies to the concept of design thinking, problem identification, ideation and how to develop a culture supportive of innovation. The approach is based on the use of 'serious play'. The term originated in the mid 1990s from work done with the Lego Company as an approach that would encourage managers to describe and

challenge their own view of their business. The conceptual framework for serious play originates in constructivism [19], and its subsequent development [9]: [13]. The connection between constructivism and serious play is through experiential learning. David Kelley [11] of IDEO uses the term 'thinking with your hands' to describe serious play.

By way of example an introductory workshop developed by c4di, called 'Fly Me to The Moon', takes as its starting scenario that a new spaceport it to be built locally and that the participants in the workshop are going to design the new service. Each participant is given a mission pack, which includes character cards. In addition there are separate personality cards and empathy cards. The personality cards describe characters representing individuals who may be customers or front of house or backstage personnel. The empathy cards can be used to give the individual a temporary disability such as a broken leg or visual impairment. Along with the character cards are scenarios that describe some of the activities the character will encounter in a typical day in the new spaceport. Working in pairs, participants imagine themselves occupying different spaces in the new facility. They decide on whether the space required for the activity is small, medium or large. This information is then used to label up pre-cut shapes made from Perspex in the form of triangles, squares and hexagons. Then follows the period of negotiation where the group can manipulate the shapes to form the footprint of the new building. The result of the workshop and the corresponding resources is to introduce a mixed group to the concept of co-designing using scenarios and a form of rapid prototyping. See Figure 2.

If time allows additional constraints can be placed on the participants either by imposing a maximum fixed perimeter in which the design has to fit or giving a value to each shape and an overall budget.

Figure 2 Perspex shapes used to design the footprint of a new imaginary Spaceport.

Manipulating the Perspex shapes to explore different designs is one form of prototyping. It is important to be able to see an idea as quickly as possible. To be able to talk about it, try it out with users and visualize it. The final step is to translate the two dimensional footprint into a 3D virtual model which can then be placed in-situ using Google Sketchup. We use the term prototyping to describe the cobbling together of anything that comes to hand that can be used to model an idea or concept.

Innovation Cultures - The Skunk Works Concept

Originally this was a department established by the Lockheed Aircraft Corporation called the Advanced Development Project (ADP). This department has been responsible for the development of some highly advanced and innovative aircraft including the U2 Spy Plane. Later the group developed the F-117 Stealth Bomber. The concept involves establishing a separate department which draws together an interdisciplinary team specifically tasked with developing new concepts. The term 'Skunk Works' is now widely used across a range of fields to describe groups, which are given a high degree of autonomy and protected from bureaucracy. Another example is provided by Mattel who initiated a project they termed 'Platypus' in which they established a twelve-week experiment in which members of the organization were relocated to an alternative space with the objective of creating new product ideas.[4] The term "Platypus' helps to emphasize the interdisciplinary nature of the group. c4di are helping companies develop their own version of 'Skunk Works' or 'Platypus' with a similar intention. This involves bringing groups together to work on specific projects, facilitating collaborative working.

Identifying Core Values

At an early stage of c4di's relationship with a client SME we try to establish the company's core values. These are the values that distinguish the company from other organizations and provide its unique mission and vision.

The core values provide a starting point on which to base a common set of values and goals. The subsequent group discussion can be used to generate key words and concepts that can be utilized later to inform discussion round the company's brand. Considerable effort is taken to find ways to shift the perspective of the individual or group. We found the most effective way to do this is through serious play. Observational methods are used to identify key problems or issues which we can then use to generate specific projects. The standard methods used for ideation can be categorized as intuitive or systematic. Intuitive methods would include brainstorming, mind-mapping [5], the use of various forms of analogy and checklists and by association which involves making connections between random images or words. Among the systematic methods are the use of attribute listing, morphological matrices and TRIZ (Theory of Solving Inventive Problems) TRIZ was

first developed by a Russian engineer named Genrick Altshuller [1] who began developing his theory of systematic invention in the USSR in the 1940s. Altshuller put forward 40 key principles that had been used to provide new inventive solutions. To apply the principles it is first necessary to identify a contradiction. The method then envisages an Ideal Final Result (IFR), then identifies all the resources available to the system and then applies one or more of the 40 principles to arrive at a solution. The TRIZ methodology has been built on from its original starting point which was in the world of engineering and technology to encompass business and other fields [22]. Essentially TRIZ provides a set of starting points for possible solutions. In the original TRIZ, the most likely solutions can be identified by reference to a contradiction matrix. Taking the TRIZ concept we have created a set of cards focused on providing solutions to problems relevant to businesses or service organizations. We have termed this Service TRIZ. In addition to the 40 main principles we have constructed a set of top tip cards which can also be applied to help in the ideation process. Top tips are as follows:

- Divide a problem into its smallest parts
- Identify unseen resources and repurpose them to make them useful
- Use the principle of convergence to create new hybrid ideas
- Use scenarios to model situations and behaviors
- Build simple models or prototypes quickly
- Use either direct, biological or human analogies to generate ideas
- Describe the ideal final result and work backwards from this point.
- Try to separate idea generation from idea evaluation.

The service TRIZ cards have on one side an image that has been designed to encapsulate the principle shown on the reverse and provide a visual stimulus. See Figure 3

Figure Pack of 40 Service TRIZ cards with instructions and examples

The cards have proved to be both fun and stimulating and develop further the general approach of using serious play as the basis of our approach. The full set of cards can be viewed at www.c4di.org.uk

All the resources that have been developed to support companies with innovation strategies encourage collaborative engagement, dialogue and participation. They use game metaphors to reinforce the concept of serious play and encourage an experiential approach to developing new knowledge. Many of the activities are designed to introduce companies to the idea of design being a fundamental driver of innovation.

The term 'design thinking' has not been properly defined though it is generally agreed that it refers to an approach that can be adopted by companies. It applies to situations where a level of ambiguity needs to be tolerated where fixed solutions don't exist. It is also associated with the idea of focusing on the larger problems that society faces also referred to as 'wicked problems' by Martin [17]. These problems are often complex with no obvious solutions.

CONCLUSIONS

All humans are born inherently creative. For proof of this we should remember that our ancestors have survived on earth for over 60 million years whereas ninety percent of other creatures that have existed on earth are extinct. However, many people find it difficult to access their natural creativity. Identifying possible sources of innovation relies on finding ways of shifting our normal perspective and taking a more critical view of the world based on design thinking. If we are to succeed in using design as a key driver of innovation we need to constantly innovate our own methods and ideas. With the help of a very talented team of creative individuals we are developing new tools to help companies shift their perspective, learn from their customers and co-create new products and services.

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