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INNOVATION THROUGH THE DESIGN OF KNOWLEDGE EXCHANGE AND THE DESIGN OF KNOWLEDGE EXCHANGE DESIGN

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In this paper we describe our research and its application to the design of knowledge exchange (KE) involving over 200 companies, ranging from micro businesses up to large multinationals, such as the BBC, Arup, and IBM. We discuss KE process design as a form of interaction design and go on to propose a new 'second order' approach to KE design, enabling others to design their own KE approaches based on a framework of tools and methods. This is explored through the idea of a KE design toolkit that provides resources and support for designing KE processes. The design of toolkits is as a KE problem itself requiring that users of the toolkit engage with the KE problems they are trying to solve.

This has implications for company innovation and the role of design and design thinking in innovation processes, particularly in the areas of open design and innovation. We also draw out some important implications for the design profession as a whole.

Keywords: Knowledge Exchange; Interaction Design, Toolkits

INTRODUCTION

Knowledge Exchange (KE) is not a term we often use in everyday conversation, but it is a key component of any collaborative, productive or creative process involving more than one person. Every productive workshop you have attended, every good meeting, creative conversation or even an interesting Twitter exchange is an example of good knowledge exchange. Generally KE is often the result of processes and mechanisms that are not well understood or examined. Who has not taken part in a brainstorming session, but what small percentage of these people know this approach was designed and developed in 1952 by Alex Osbourn (Osbourn1952)?

In the research presented in this paper we design and test new approaches and activities that promote innovation and creativity. KE research draws on a diverse range of theory and practice including interaction design, social network theory, innovation studies and graphic design.

This represents an important move away from both traditional knowledge transfer (clever people in universities telling companies what they should do) and consultation based design (using people as data banks for clever designers to exploit). KE is an approach in which everyone with an interest has something productive and creative to offer, if challenges can be framed in a way that is appropriate for the parties involved. This places KE in a strong corresponding relationship with participatory (Luck 2007), open and co-design approaches (Abel, B. van et al., 2011) in addition to a more general relationship to Open Innovation (Chesbrough, H., Vanhaverbeke, W. & West, 2008).

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We are interested in the explicit and considered design of KE mechanisms and processes. Our work explores the role of structure in collaborative activities and the tools, which can be used to design them. We see the design of KE as a type of interaction design in which human to human interactions are designed. This interaction could be without any mediating technology or media; for example we have worked with people exploring problem solving through body movement and choreography undertaken in silence. More often we employ designed products that enable the interaction. In many cases these will be physical cards, pro formas and objects. We have found that as the barriers to use of digital technology are lowered interaction can increasingly be facilitated by digital systems and products.

Within this KE design space, we use two complimentary approaches to the design of KE and in a nod to Richard Buchanan we term these first and second order KE design. The philosophical position that underpins these activities is broadly post-structuralist in character and is exemplified by openness, non-hierarchical engagement, multiple authorship and risk friendliness that permeates all our KE work in one aspect or another.

METHODOLOGY

Through our work with both large corporate partners and with (mostly creative industries and high technology) small and medium enterprises we have adopted an action research approach. The iterative nature of this method suits the design prototyping and testing approach taken in the project as does the opportunity for dual outcomes: most of our companies want to enhance their innovative potential, not do academic research. We go beyond conventional action research approaches through the extension of ideas first proposed by Carolan and Cruickshank (2011) where toolkits themselves can act as a more effective alternative to cultural probe approaches pioneered as an alternative to the conventional approaches of Bill Gaver (1999).

FIRST ORDER KE DESIGN

First order KE design produces mechanisms, tools or approaches that promote the sharing of ideas, results, expertise or skills between people. The outcome of this design process is typically a workshop-like event or series of events, with a fixed location and physically co-present participants. The role of KE design in such events is to formulate and then implement a structured process that makes the most of the knowledge, experience and creativity of the participants. In this respect, it is related to creative facilitation: methods by which groups of people are brought together to solve problems. Often a KE process will bring together individuals from different organisations and backgrounds to look at a problem. This could be something broad like the Future of TV or how to manage creative design departments that are distributed around the world to more specific problems such as the development of a particular city space.

Our approach to first order KE design brings together a number of disciplines including interaction design, graphic design, cognitive psychology and innovation studies. Core to the approach we take is the understanding that for a designed KE process to be successful, it must be specialised to the needs of the participants who will undertake it. For the designer of such a process this means understanding the perspectives of the participants and the problem spaces they operate within.

The role of the KE designer is to understand the perspectives and approaches of those involved and provide a structure that enables the interaction between participants to meet the agreed aims and objectives of the event. There are 2 different scales of design intervention in first order KE.

- **Tools:** These are very specific actions and techniques that are the smallest components of the design of an event, they have very specific functions such as exposing the assumptions participants have brought with them, moving participants around a space or documenting ideas.

- **Mechanisms:** These are collections of tools working together to enable and overarching aim to be achieved. This could be a 'workshop' like activity but could also span across a number of events and activities.

Across the range of tools and mechanisms developed, as part of this research there is a great deal of variety. Often tools can be very simple, specific activities with a closely defined function. An example of this simplicity is the fruit-sticker tool. One of the common requirements in workshop design is to split people into groups. Sometimes it is beneficial for participants to form their own groups, but sometimes more control is needed. Fruit-stickers provide this control when required.

Very simply on arrival participants are given a sticker with a fruit printed on it, this corresponds to bowls of fruit in the event space. When the time comes it is easy for participants to know what group they are in. Of course any label could be used for this approach, but fruit has significant but subtle advantages for the experience of the participants in comparison to numbers or letters for groups: The scent of the fruit keeps the air fresh in the room, it also provides a ready supply of high energy, slow release nourishment for when energy levels dip. This experiential approach where all elements of the environment are open for modification help the subconscious engagement as well as explicit interventions.

We talk about an experiential approach to interaction design where small details: the thickness of the paper, the smell of a room, the quality of light, all have a disproportionately large effect on the outcomes of an activity. An extreme example of this can be seen in a workshop undertaken for the BBC (British Broadcasting Corporation) to develop strategic new projects crossing between departments. This involved the development of 20 or so concepts that had to be paired down to 5 or 6 that would receive funding and other resources. With a mix of very senior and relatively junior BBC staff present the danger was that the outcome was dictated by politics and seniority rather than the best ideas. To circumvent this a new tool was developed. The ideas were mounted on a wall and each participant was given a card with stickers on, black for no and red for yes. We used green lights in the venue during this activity making it impossible to differentiate between red and black. Under these conditions people were able to freely use the stickers to vote both anonymously and publically. This also had the benefit of increasing the tension (and fun) when normal lighting was reintroduced and the results became instantly visible.

These simple and (once they are described) obvious tools are counterbalanced by some mechanisms that are highly complex involving weeks of software development and technical infrastructure. This could involve the creation, manipulation and visualisation of a set of data with multiple spatially separate groups working on the same information in real time.

At a more general level, a KE designer might see the need for a divergent ideation process during a workshop. Many important design decisions then need to be made, such as, what question(s) will drive the process, how large should the groups be, how long will the activity run for and how should the ideas be recorded? All of these decisions will have a substantial effect on the outcome of the activity and the experience of the participants who take part in it. Our approach is to make these design decisions explicit and explore the effect they have on the KE process.

This first order approach is exemplified by two projects, IDEAS at Daresbury in 2009 and Creative IDEAS in 2010, where co-creational approaches directly facilitated exchange between diverse groups of businesses, organizations and academia (Cruickshank et al, 2011).

Here follow up interviews indicated that the IDEAS at Daresbury project had significant positive impacts on their business (Fogg et al 2010). During the specially developed social network mapping exercises, including our tool NETS, the participants were able to see connections in their network and target this at solving a specific business problem (Mortati and Cruickshank 2012) furthermore, the feedback from the stakeholders in the Creative IDEAS project confirms that the events generated impact for the stakeholders; opening their eyes to knowledge exchange, changing their future strategies and linking together disciplines.

SECOND ORDER KE DESIGN

In second order KE design, our understanding of the design of workshop-like activities is complimented by a new and still emergent research question: What is required for people to design their own KE tools and mechanisms? While our philosophical position is implicit in our own first order KE design work, the second half of this paper explores how best to facilitate good KE design in others. For example, our research has shown the need for an approach tailored to the specific needs and context of activity, and for a willingness to be innovative and take risks. A simple recipe for others to follow would run counter to our experience. Tools and prescribed mechanisms alone are not enough to ensure good KE design; we want to help others create specialised mechanisms that address the problem spaces they face. We want to help people design their own KE mechanisms and approaches.

There are, of course, many toolkits that have already been developed for multiple applications such as Creative Whack Pack (Von Oech, 1992; Von Oech, 2009) and Oblique Strategies (Taylor 2003); for inspiration or idea generation, IDEO Method Cards for user centered research (IDEO, 2003) and Business Survival Toolkit for SME development (Creative and Cultural Skills, 2012), as well as Ketso (Ketso, 2010; Tippett and Connelly, 2011), Drivers of Change Cards (Luebkeman 2009) and IDEAS Factory for general group engagement. Ketso, developed by Dr. Joanne Tippet is an example of a 'toolkit for creative engagement', which helps 'overcome initial communication difficulties' in diverse groups (Tippett and Connelly, 2011, p.30), which was originally developed for community engagement for spatial regeneration (Ketso, 2011). For the most part we do not categorize these as truly second order approaches as they are about applying a technique rather than developing new approaches that fit the particular capabilities and needs of the specific context in which the tools and mechanisms will be deployed.

One of the few good examples of second order toolkits includes Delft University of Technology's Creative Facilitation course that equips students with the knowledge of designing and leading creative processes in teams (Tassoul, 2009). This is a clear example of second order KE design as the taught content of the course cannot and does not address the particular problem spaces it's alumni will work within; instead it provides a broad approach that can be brought to bear on any problem.

A more playful example of a second order toolkit is cars produced by i.am.auto, as part of musician will.i.am's venture (Cruickshank, 2012; RCA, 2012). The cars will be used as a mechanism for people living in East Los Angeles to learn how to repair car electronics and generate job opportunities. Here the tool is actually an attractor and representation of the cache the music group the Black Eyed Peas have. The mechanism draws disadvantaged people into a learning environment that uses the car as a test bed for KE around maintenance and repair of relatively new cars.

DESIGNING TOOLKITS

Our current research is focusing on second order tools and mechanisms. These are approaches that are designed to help people design their own tools and approaches for KE. The key here is that it's about developing a creative design process that facilitates the design of new approaches by people who are new to creating these sorts of processes.

The problem of creating a good toolkit for designing KE processes is itself a KE design problem. Our first order KE design research and practice has led to a number of tools, techniques and principles which we think make for good KE design. Making this knowledge available to others is made problematic by our belief that for a KE process to be effective, it must be specialised to the context in which it will function. As a result we can only provide 'fuzzy' tools that must be brought into focus in order for them to be used most successfully. We can also provide exemplar processes that illustrate how the tools have been used in different contexts and how they have evolved over time. Figure 1 shows many of the tools we have developed and how they have been combined and shaped each time they are used. Each particular KE design (workshops in the case of Figure 1)

draws on many tools. Each tool is the sum of all these different ways it has been used in many distinct KE processes.

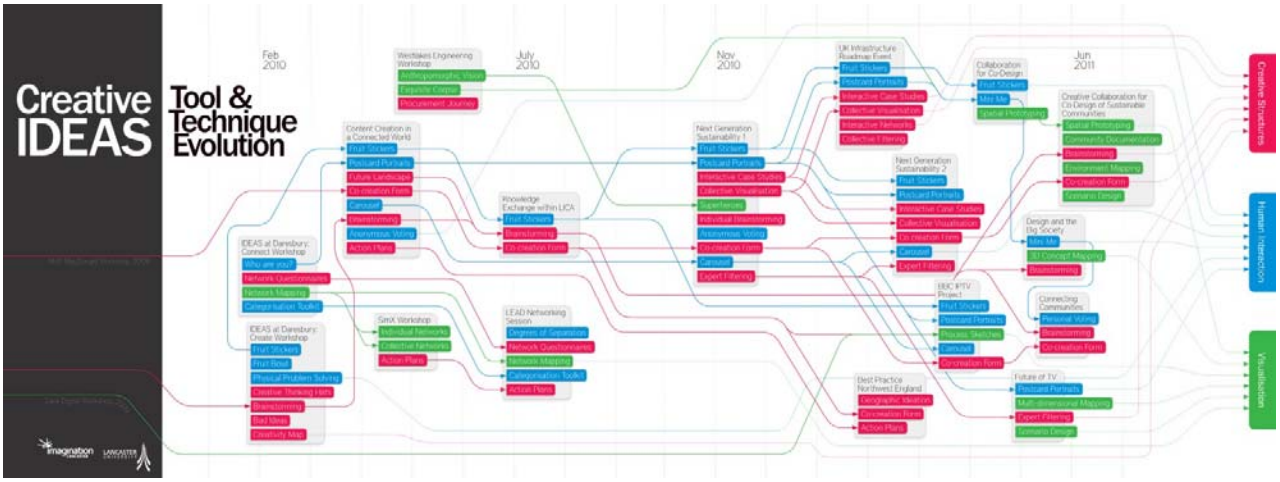

Figure 1 Map of tool and technique evolution throughout the Creative IDEAS project (2010)

Tracking how we have used our own first order KE tools is useful for our own research, but this information alone does not constitute a KE design toolkit. The Creative IDEAS project designed and implemented KE processes in a wide range of problem spaces, from local secondary education to national infrastructure policy. This breadth makes for a good level of variety in the exemplar KE processes we have available, but it does not capture the tacit design decision-making we undertook in our design practice.

Making the leap to proper KE design toolkits is the subject of our current research project New IDEAS. Our focus is on multiple toolkits rather than a single, monolithic one-size-fits-all approach. We believe that good second order KE design requires some of the specialisation found in good first order KE design. An example of this is the NETS toolkit we created to help a group of academics identify and engage with valuable people inside and outside of their organisation.

The NETS toolkit centred on a KE mechanism developed for the IDEAS at Daresbury project, represented in Figure 2. As originally implemented, owner-managers of high-technology small to medium Enterprises (SMEs) were taken through a process to visualise their network of contacts. The aim of this was to get the companies thinking proactively about shaping and using their networks rather than seeing networking as an endless process of collecting business cards or Linkedin connections.

The overall task was broken down into multiple steps, which resulted in a visualisation of each participant's network of contacts and a set of quantitative data about the network, including spatial distance between members and frequency of contact. This information was processed and fed back to participants in a bespoke report with an analysis of their individual network and advice for growing it.

The process was informed by social network theory. This is increasingly recognised as an important component in the propagation of innovation. This is only superficially connected with digital networks (Linkedin, Facebook and so on) rather it is a recognition that innovation is increasingly seen as a systemic process that needs more than traditional collaboration mechanisms (Fagerberg, 2005; Ming-Huei Chen and Hung, 2008; Pavitt, 2005; Powell and Gordal, 2005). Concepts such as communities of practice (Wenger, 1998), networks of innovation (Brown and Duguid, 2001) and Collective Invention (Allen 1983) and of course Open Innovation (Chesbrough, 2002, 2003, H. Chesbrough Crowther, June 2006) underline the importance of the transfer and/or exchange of knowledge. The NETS approach exploited this research to help propagate innovation in companies. In particular we used the ideas of Roland Burt and structural

holes (1992), we also looked at the qualities of networks in social networks using the strength of the ties in networks an approach pioneered by Mark Granovoetter (1973).

We did not mention this academic research on innovation and social networks directly with the companies involved in the project. Instead we developed a mechanism and set of tools that they used in an intuitive way to visualise a component of their network in a range of ways. We then used these visualisations and the data encoded in them to provide participants with insight on their networks directly in the event. We also worked with Management academics to undertake a formal network analysis and at a later date gave each participant an easy to understand analysis of their networks. This process is described in more detail in Fig. 2.

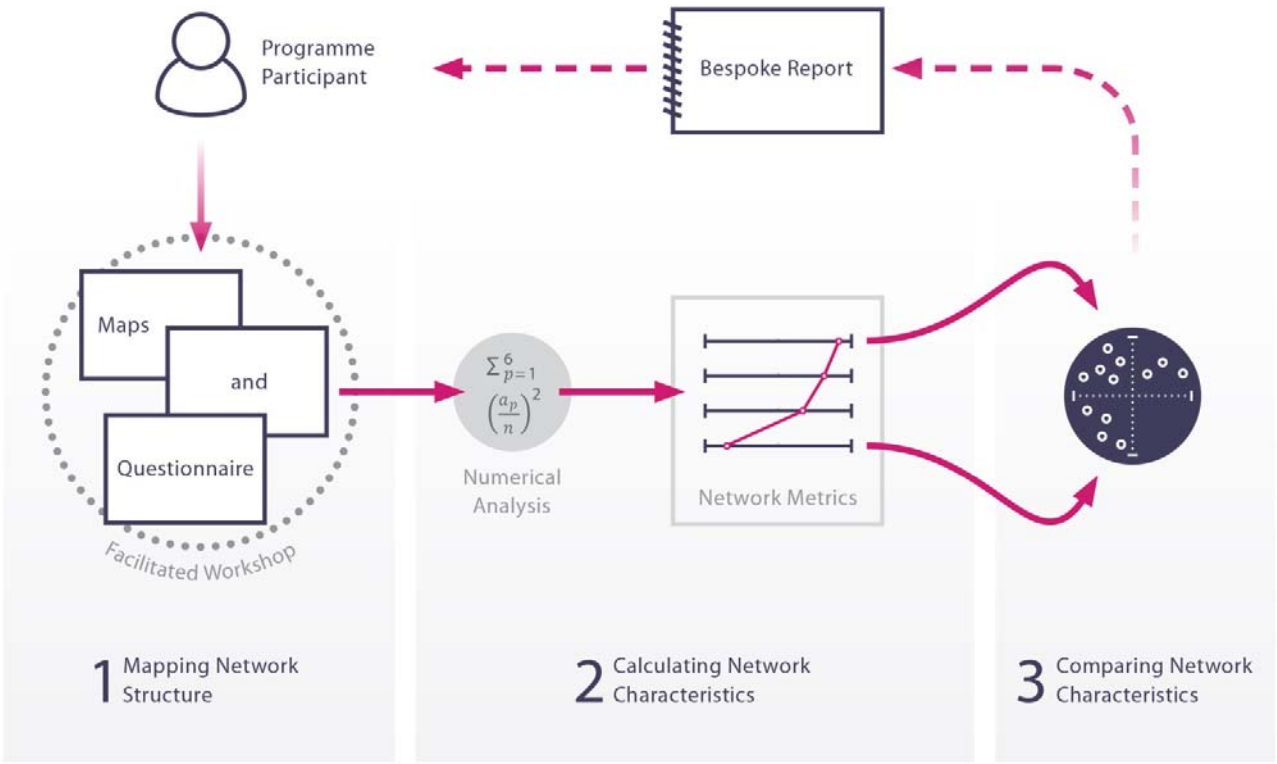

Figure 2 IDEAS at Daresbury, NETS KE Process

Some time after the first development of the NETS project we were invited to think about how it might be used as the basis of a toolkit for others to use the NETS concept. In creating the NETS toolkit, the first order KE design work undertaken during the IDEAS at Daresbury project needed to be structured and made available for modification. The toolkit also needed to invite and encourage users of the toolkit to be creative and change the way the process functioned. We did this by breaking the process down into a series of steps, each with a specific implementation. This provided a low barrier to using the toolkit in its most minimal application; following the steps in order would be sufficient to implement a basic KE process. In addition to the process steps, we also provided a higher-level description of the KE objectives at each step and a KE design rationale for the prescribed process. This second order structure is intended to allow the underlying function of each process step to separate from the specific implementation described in the toolkit. Figure 3 shows three of the cards included in the toolkit.

Figure 3 NETS toolkit cards

The steps within the NETS toolkit also vary in rigidity with one another. Some steps are highly prescriptive, providing firm points through which the KE process should pass (for example, having participants create lists of their contacts), while other steps require that the user of the toolkit thinks about who will make use of the mechanism. An example of this is the second step of the toolkit, which calls for a 'warm up' activity with participants, but does not specify what this should be. Instead it explains why the activity is needed and what role it should play in the overall process; users of toolkit must then make their own first order KE design decisions about what to do.

From our on-going work in this area a good KE design toolkit should:

- Provide 'fuzzy' tools which provide immediate basic functionality, but which reward modification and specialisation
- Include a useable prescribed (exemplar) KE process to allow toolkit users to try it out
- Encourage departures from prescribed structures and implementations by providing the rationale for design decisions
- Require different degrees of departure from the prescribed structure at different stages to engender experimentation

IMPLICATIONS FOR THEORY AND PRACTICE

While there are many consultants developing and delivering KE activities and tools, there are few designers active in this space who are consciously designing KE approaches and even less research on the design of KE tools and mechanisms. The literature on the design of KE (rather than the application of approaches such as Creative Problem Solving (CPS) or other management ideas) is still very much embryonic, as academics are often not involved in engagement projects that use them.

There is an urgent need to stimulate more research and discussion in this area because design thinking is becoming absorbed into business culture both through popular writing by authors such as Chris Brown and Roger Martin. Evidence suggests that to really get people exploiting the power of design thinking they need to apply this understanding. Similarly the drive towards understanding the impact of research, especially in the UK, is making the understanding and maximising of exchange between universities and external agencies very important.

Underpinning all this is a theoretical imperative to develop new forms of creativity and innovation that have a more nuanced understanding of design and designing in which they are part of an ecology of innovation rather than in an uncomfortable box between R&D and Marketing. This

requires new types of innovative people and new processes and approaches to maximize this more interconnected approach.

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