
Knowledge creation and Research in Design and Architecture

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ABSTRACT. The key notion in this paper is that there are several kinds of knowledge that are essential to the successful development of the fields of Design and Architecture, some of which have been brought to prominence in recent research in other areas, specially management.

In the paper the authors discuss issues connected to knowledge creation processes in Design and Architecture. After a short historical overview, the authors elaborate on different types of knowledge which are distinguished in knowledge management and consider the transference of these concepts to the field of Architecture.

Knowledge creation can be seen as a mutual transition between implicit and explicit knowledge. The work of Cook and Brown as well as de Zeeuw reinforces the concept of a variety of knowledge created by acting.

The authors conclude by combining the above ideas into a stimulus for more research focus on questions of 'How?' in contrast to questions of 'What?' prevalent in traditional research. Designers need a type of knowledge that enables them to act (better) rather than just evaluate the likely outcome of their proposed actions: design-as-verb is an action.

KEY WORDS: Knowledge creation, research through design, research and action, how and what, design-as-verb.

1. Introduction

Historically, research in Design (particularly Architecture) has followed one of two traditions: that of art history; and that of applied sciences such as engineering and materials. More recently, there have been developments in, among others, philosophical approaches and Environmental Psychology. Research in Design and Architecture is typically demonstrated through research in (and using the perspectives and methods of) these separate but purportedly related disciplines. This article connects certain developments in research through design to concepts of knowledge creation recently explored in management disciplines. In doing this we recognise that many of these ideas have earlier roots in a number of other fields, one of which we refer to towards the end (the work of Gerard de Zeeuw).

2. Types of knowledge

Knowledge is that which is known. In daily life, we are confronted with many different pieces and types of knowledge. Each of them is important for our overall behaviour and actions.

Nonaka and Takeuchi (1995) claim (and we generally agree) ‘explicit knowledge can be expressed in words and numbers and can be easily communicated and shared in the form of hard data, scientific formulae, codified procedures or universal principles... Tacit knowledge is personal, context-specific and hard to formalise and communicate... Subjective insights, intuitions and hunches fall into this category.’

In the field of Architecture and Design explicit knowledge is available in the form of codes used to draw plans, sections, etc..., theory of Architecture, information on how to contract, how to develop structure.... Implicit knowledge is knowledge used in the initial stages of the design process to develop the first design concepts, it is the knowledge of how a specific design office works.... It is clear to us that the field can only perform when using both types of knowledge.

Collins (1993) distinguishes as follows between the ways knowledge is shared and communicated:

- *Embrained* knowledge: knowledge dependent on conceptual skills and cognitive abilities. This is knowledge of the type ‘knowing that’ and ‘knowing about’. Design support systems usually try to incorporate this type of knowledge.

- *Embodied* knowledge: ‘knowing how’ linked to knowledge derived from action and experience. This is the knowledge of designers of physical spaces using their experience.

- *Encultured* knowledge: knowledge shared by groups of people. This is connected to a shared understanding of a group of people. Architects for instance, share a common understanding of the quality of buildings, while the staff of an

office shares a deep understanding of how best to tackle a design competition problem. This knowledge resides in the culture of the office.

- *Embedded* knowledge: knowledge residing in systemic routines. This is prominently present in administrations.

- *Encoded* knowledge: knowledge externalised in code and available for external communication. Design offices (except larger ones) usually have only limited encoded knowledge.

In addition, we wish to introduce the distinction between Mode 1 and Mode 2 knowledge as introduced by Gibbons *et al.* (1994). Mode one knowledge is defined as ‘The complex of ideas, methods, values and norms that has grown up to control the diffusion of the Newtonian model of science to more and more fields of enquiry and ensure its compliance with what is considered sound scientific practise.’ Mode 2 knowledge on the contrary is ‘knowledge production carried out in the context of application and marked by its transdisciplinarity; heterogeneity; organisational hierarchy and transience; social accountability and reflexivity.... It results from the parallel expansion of knowledge producers and users in society.’

Mode 1 knowledge includes the scientific knowledge developed in university labs, concepts from architectural theory, etc.... Mode 2 knowledge is the knowledge which is transferred by architects from practice in the design studios.

3. Knowledge creation

The concept of knowledge creation has been extensively studied. Since the work of Donald Schön (for instance, 1983) the value and significance of design, especially design as practiced by architects in their studios, has gained growing acceptance as a distinct and valuable approach to the generation of knowledge and to solving problems. Designers and architects have been encouraged and strengthened by this evaluation.

However, not surprisingly, since Schön’s early work new concepts have been developed in the field of ‘knowledge management.’ Nonaka and Takeuchi’s (1995) concept of the knowledge spiral implies a focus on (two) different types of knowledge. These are implicit and explicit knowledge, which interact forming steps that lead to four phases of knowledge creation: socialisation (implicit to implicit), externalisation (implicit to explicit), combination (explicit to explicit) and internalisation (explicit to implicit) (see figure 1). These four processes are understood as sequential and additive, developing new knowledge as we cycle through them. Each circuit extends existing knowledge: hence the concept of a growing spiral, because more and more knowledge comes available each time the four processes have been active.

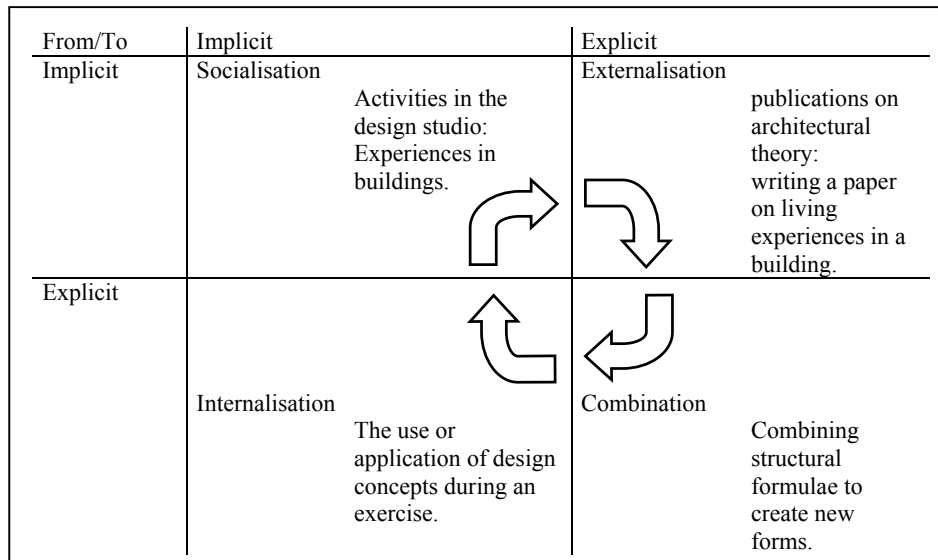


Figure 1. *The knowledge spiral applied to the architectural context.*

Socialisation, as we use it (above), is the process of transferring and sharing experiences and creating new mental models and/or competences and skills. This type of knowledge transfer is especially active in design studio teaching. For a lot of architectural schools this knowledge transfer is critical to educating competent architects and designers. This knowledge creation process is also dominant architectural offices. Experiences and insights are shared between the staff of the offices. Knowledge is shared while talking to each other.

Externalisation is the process through which tacit knowledge is articulated into explicit knowledge. Architectural theory and criticism try to capture available insights and develop them. Experiments in building physics establish explicit knowledge, eventually captured by formulae. Although not completely the same, an architect or designer will frequently use the intermediate medium of a journalist or writer to share part of the designer's knowledge with a wider audience. As another person cannot communicate internalised knowledge the same way as the designer him/herself, this implies a slower knowledge spiral compared to when designers themselves share and communicate their knowledge without an intermediary.

Combination is a classical process in academic environments where existing and referenced concepts are combined to create new insights and knowledge. It is also the active process in teaching theoretical courses. Explicit knowledge is transferred between teacher and student.

Internalisation is the process of embodying explicit knowledge into tacit knowledge. This is part of learning by doing. The experiences are internalised into individuals.

In architecture and design, it will be clear from the above, socialisation is enormously important in the development of the field. On the other hand, externalisation seems relatively underdeveloped. This insight is of prime importance, which we take to indicate that, to develop useful and relevant research in the field, processes of externalisation should be both promoted and activated. This, in turn, should (according to the knowledge spiral) increase the speed of development.

In this sense, we also support the position of Chesneau (in these proceedings) when she proposes the creation of favourable conditions for an exchange of explicit reflections and thought as an objective for PhDs in Architecture (see below).

Furthermore, in design and architecture implicit knowledge is of overwhelming importance in practice, while explicit (and academic) knowledge is relatively underdeveloped. The authors stress the importance of good balance and interaction between both types of knowledge in supporting innovation and increasing the likelihood of a breakthrough in a particular field.

4. Knowledge (created) by action

Sixteen years after the work of Schön in Design and Architecture (see above), Cook and Brown (1999) introduced the concept of knowledge creation ‘by action’ as an interaction between individual and group as well as between implicit and explicit knowledge to management studies. (Inter-) action is essential to the daily practice of designers and architects. Hence, assuming the notions of action are similar, these ideas may also be applicable in Design and Architecture.

Cook and Brown (1999) distinguish between tacit and explicit knowledge combining this with a second distinction between individual and group knowledge (see figure 2). The active knowing implied by practice is central to the processes by which new knowledge is generated. Cook and Brown question whether implicit can be turned into explicit knowledge and vice-versa. Knowledge is created by action when people interact and use different knowledge types.

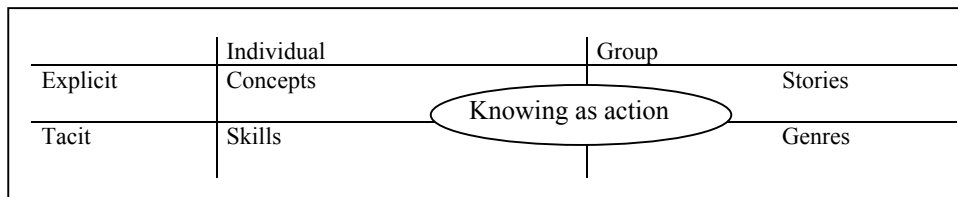


Figure 2. The process of knowledge creation following Cook and Brown (1999).

In this view, action is critical to the creation of knowledge implying that design studio activities are critical for integrating architectural and design knowledge.

This understanding suggests it is dangerous to focus only on theoretical and academic research to further Design and Architecture. Practice is essential in the development of these fields and the interaction of research with practice (even carrying out research in and through practice) is crucial (Glanville and van Schaik, 2003).

Bennett (1998) similarly stressed the importance of the idea that knowing involves practice: knowing without action and performance of what is known is scarcely knowing. We consider this a crucial concept and understanding.

We have introduced the concept of knowledge (created) by action particularly through the work in management of Cook and Brown. However, the concept already had currency for others working in different areas. The work of de Zeeuw in the design of social systems has particularly interested us and is closely connected to these concepts, predating many. Nor is de Zeeuw the first to link action and knowledge in a number of ways (action for knowledge, action of knowledge, etc, reflected in de Zeeuw's tell-tale notions of models for (exploring) and models of (proposals)—an idea similar to that of Frayling's commonly quoted and developed distinction). De Zeeuw's approach and method is intended to promote research and action (in social systems) but is design oriented and inspired.

What is critical in de Zeeuw's work, is that, based in theories of action and knowledge by action (designing is acting), it deals with problems instantly recognisable to architects and designers. So de Zeeuw understands that, especially when faced with very complex problems that may be ill-defined (often in principle) or which contain structural contradictions, there is not likely to be a "perfect" solution. The appropriate criterion is not finding the "right" solution, but finding an adequate one: there is no way to judge which might be the perfect solution.

Under these circumstances, what we can hope for is improvement: to improve the quality of our acting. It is an aim of de Zeeuw's work to develop methods that make improvement more likely, that is knowledge for, as well as based in action by improving the quality of that knowledge. A charming concomitant of this view is recognition of the importance to humans of replacing any question that is answered with another question, for humans without any reason to wonder (without questions to ask) are diminished, in de Zeeuw's view.

Any methodology for research in Design and Architecture must be based on such understandings. See Glanville (2002) for a succinct account of de Zeeuw's position.

5. Conclusions

The key notion in this paper is that there are several kinds of knowledge essential to the successful development of Design and Architecture, some of which have been brought to prominence in recent research in other areas, specially management.

Knowledge creation can be seen as a mutual transition between implicit and explicit knowledge. The work of Cook and Brown as well as de Zeeuw reinforce the concept of knowledge as created by acting.

The authors conclude by combining the above ideas into a stimulus for more research focus on questions of 'How?' in contrast to questions of 'What?' which are prevalent in traditional research. Designers need a type of knowledge that enables them to act (better) rather than just evaluate the likely outcome of their proposed actions: design-as-verb is acting, rather than action.

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7. Biography

***Dr. Ranuph Glanville** has a diploma in architecture, and doctorates in cybernetics and in human learning. He is a freelance teacher and researcher (with over 250 publications) who works with universities, companies and governments around the world. He is a regular visitor to RMIT University in Melbourne where he is Adjunct Professor and Senior Visiting Research Fellow. He holds a part-time post at the Bartlett, UCL London, and works on an ad hoc basis at the School of Architecture Sint-Lucas. He is often called on to advise on the development of research and to design new design programmes. He lives by the sea in the UK.*

***Dr. Johan Verbeke** is working at the School of Architecture Sint-Lucas in Brussels-Ghent (Belgium). His main field of research has been computer aided architectural design. He has been running many international projects and conferences and is Council member of eCAADe. Recently he has been connecting concepts from knowledge management to the field of Architecture and Design, reflecting on research in architecture and design. Since March 2003, he has become the head of the School of Architecture Sint-Lucas.*