

In the Eating

Grounding the validation of investigative designing in the experience of stakeholders.

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Abstract: This paper describes an approach to practice-led inquiry that puts the tacit knowledge of stakeholders at the centre of the research process as a research instrument but also as an important resource for validating the results. I will describe how this was done in several projects conducted over the past 10 years and how evaluation with relatively small groups of people who have relevant tacit knowledge might be justified.

The research that I examine here addresses questions that may not be suitable for more analytical or quantifiable research, for example because they cannot be atomised into manageable components, because they explore ill-defined or "wicked" problems or because the most relevant reference point for evaluation is tacit rather than explicit knowledge. Such problems may be addressed by methods designed to employ tacit knowledge but validating the methods is often challenging, given that practice-led research in design is a relatively new field of activity so there is a limited amount of prior research to draw on for methodology.

However theories of tacit knowledge and wicked problems can provide a starting point for the methodological framework required and this paper will seek to develop some ideas that might contribute to such a methodology. In particular it will examine how experts with rich tacit knowledge might play a part and why it would be valid to work with very small numbers of such people, how the tacit moves of designers might form valid ways of processing the data that they encounter and how the artefacts of the research, in themselves, might be an important source of validation, for example by allowing assessment of the techniques employed.

Key words: Tacit Knowledge, Artefact, Practice-led

1. Introduction: topic and context

To introduce this paper I will describe the incident that led me to explore the role of tacit knowledge in designing and research. In 1998 I was involved with a research project conducted by the designer, Graham Whiteley, who was exploring how artificial arms might be constructed with joints that replicated the natural motion of human arm joints. Whiteley had constructed a prototype hand and wrist that represented his thinking at an early stage of the project and we had some concerns about how true the lateral movement of the wrist might be. There were no reliable mathematical descriptions of human joint motion against which we could evaluate the joint, which had been developed through a process of close observation of skeletal anatomy to derive a relatively simple mechanical analogy for the complex combination of hard and soft tissues in a real human wrist.

We attended a medical physics conference where one of the speakers explained that her main expertise was in the function of the wrist. Having the model hand and wrist with me I asked her if she could tell

me how realistic the motion was. Her reaction was to take the model from me and hold it as she might hold the hand and wrist of a living person. She manipulated the wrist through its range of movements and, after a short time handed it back saying, “No that’s fine.”

This might seem a very casual approach, and not to be relied on. However it was grounded in the experience of an expert who had manipulated a great many wrists, healthy and diseased, alive and dead, in the course of her work. It seemed to me that her confidence in assessing the wrist model came from reliable tacit knowledge, the kind of knowledge that a highly skilled and experienced person uses to come to reliable judgements in situations that cannot be easily or quickly analysed to reach a more ‘rational’ conclusion. In this paper I will explore how such knowledge might be exploited in research, in and beyond design, and how it might help us realise an often-stated aspiration to conduct research “through design”. First I will set out some concepts.

2. Tacit/Explicit...Holism/Atomism...Art/Science

The title of this section implies a binary world of opposing ideas where we are invited to take sides. Of course life is much more messy than that and it is rare to find ourselves in circumstances governed entirely by one of these poles. Nevertheless we often encounter an assumption that research deals with explicit knowledge, often by a process of isolating specific factors rather than examining a complete picture.

This may be reinforced by the relative simplicity of explanations found by an atomistic process. It may be easier to accept a precise if limited explanation than a more open one that attempts to deal with whole situations. It is also relatively easy to decide that holistic thinking is mostly relevant to art where scientific rigour is not usually expected. Michael Polanyi (1958, 77-82) hints at this when he asserts that our ability, as humans, to advance knowledge has depended our having developed simple alphabets - components that allow us to construct many complex words and ideas to deal with new complex situations.

Despite his avowed interest in tacit knowledge Polanyi does not give equal value to indivisible whole images which communicate rich understanding of matters that would be extremely difficult to convey by a more explicit analytical approach. In the history of science the ability to capture such images by drawing was once an essential skill, something we overlook in today’s world of technical imaging. Modern imaging systems, for example medical scanners, also tend to conceal their dependency on the judgement of experts, whether in forming the rules of the system itself, or in applying it to particular situations, all of which requires engagement with messy wholes rather than the precisely delineated parts that the final images so neatly present.

More recently scientists have started to investigate tacit knowledge, which had been mainly the territory of philosophers, notably Polanyi, and there has been a growing interest in the idea that our thought processes are much less explicit than most people have imagined. Arthur Reber, one of the leading figures in this area of experimental psychology, has suggested (1993, 14) that, whereas we tend to assume that most of our decisions are rational, based on explicit reasoning, in fact we should start with the assumption that the great majority of our decisions are “arational”, based on tacit knowledge. More importantly he proposes that we should not assume that there are two separate domains of implicit and explicit thought, rather that both are present in most of our actions.

In approaching the question of tacit knowledge in design research I have sought a similar integration of the tacit/holistic qualities of designing with other, more explicit or analytical concepts of inquiry. This has required conscious attention to the idea of a single inquiry and rejection of many of the ideas about “practice-

led” research that tend to confuse new researchers. For example notions about divisions between theory and practice and between writing and making or a project having distinct “components” continue to be put forward in a very regressive way.

3. Wicked Problems – Just an interesting idea?

To bring this discussion closer to designing I would like to bring in Rittel and Webber’s concept of wicked problems, which has attracted a great deal of interest in the design community since being promoted by Richard Buchanan (1992). Some sceptical commentators have suggested that, while wicked problems give us an interesting theory, they have no practical application – they do not contribute to method or methodology. However Rittel and Webber (1984) give us a persuasive description of the process of solving wicked problems:

...an argumentative process in the course of which an image of the problem and of the solution emerges gradually among the participants, as a product of incessant judgement, subjected to critical argument.

Although this description was intended to characterise the professional activity of designing, it has also been used by Nicola Wood (Wood et al 2009) to explain an approach to research which has some similarities to action research but places more emphasis on the emergent qualities of the work. Henrik Gedenryd (1998, 156-157) examining design as a form of cognition, explains how designers will typically start work by modelling tentative solutions to a problem that have yet to understand, contradicting conventional wisdom that rational people proceed from problem statement to solution via analysis then synthesis. Gedenryd’s main thesis is that cognition requires interaction with an environment rather than being “intramental” and designers create the conditions for effective thought by creating an environment of speculative design representations. The emergence of new understanding can be aided greatly by the tentative modelling/sketching that designers take for granted in their daily work.

Wood’s research (eg Wood 2006) has developed a body of knowledge about how multimedia designers might support craft skills learning. She achieved this, as a designer/researcher, by resolving the design problems and testing the theories of action that emerged from her earlier research, to reveal deeper layers of design problem and deeper theoretical questions. For example, having previously developed a theoretical model for a learning resource, Wood prototyped such a resource and tested with learners to reveal barriers to eliciting some of the expert skills that she was seeking to convey. Over the course of her research, by creating a network of learners and craftspeople, collaborating to review and develop the design of the learning resource, she was able to develop new theories about craft learning as well as more sophisticated design methods for eliciting and transmitting skills. Her later models for designing learning resources were quite different from the early proposals but they emerged from her willingness to develop tentative designs based on a limited understanding of the problem and her openness to the emergence of new directions for the research.

This experience, as it relates to Gedenryd’s and Rittel and Webber’s theories seems to provide a general model for research that employs designing and tacit knowledge: The researcher/designer must create a situation which allows ideation and argumentation to be present throughout the project. Rather than attempting to define fully the problem to be resolved, the researcher should start by visualising some possible solutions which provide the environment for thought and the reference point for argumentation. Stakeholders, such as the craftspeople and learners in Nicola Wood’s research, provide a potentially rich source of knowledge and insight

which can be released by engaging them with designing and the evaluation of prototypes. Through this process, in Rittel and Webber's words, *an image of the problem and of the solution emerges gradually among the participants*. In research we might say that it is an image of the problem and *our contribution to knowledge* that emerges.

4. Engaging with tacit knowledge through artefacts

Having discussed principles I would like to go on to describe some relevant practices from different doctoral research projects. In the research by Graham Whiteley referred to earlier, it became apparent that the experience we had with the tacit knowledge of a medical physicist could be replicated with other experts to extend our evaluation of the anatomical analogies that Whiteley was developing. He embarked on a programme of evaluating model arms and hands with surgeons and an osteopath. This was extremely helpful to the research as it provided triangulation of other evidence that the analogies were true but it also revealed that each of the different experts consulted had different insights to offer, for example the osteopath operated at an extremely subtle level and perceived shortcomings of the design that were not evident to the other experts (Rust 2004).

This indicated in turn that such engagement can reveal as much about the participants as the artefacts. This is one of the most interesting aspects of the use of artefacts in design research or professional practice, exploited by Simon Bowen (2009) in his research into "Critical Artefact" methods for eliciting novel design ideas from stakeholders. Bowen's methodology for designers is based on the idea that provocative design concepts can stimulate people to debate their needs and desires in a more open way, allowing the designer to identify new concepts. His process moves through successive cycles of designing and group work with stakeholders. The first discussion leads to a first design idea which is completely unrealistic but relevant to the issues revealed in the discussion. Successive cycles of engaging stakeholders in discussion about the design concepts reveal more ideas and the design concepts become more relevant, eventually forming concepts that have practical potential.

The move from working with stakeholders to producing new design concepts does not rely on the designer to analyse the sessions with stakeholders. Bowen relies on the designer's ability to tacitly 'process' their experience of the group sessions into more relevant new designs without any explicit work to identify needs. One of the interesting aspects of his thesis is the way he develops a description of this 'processing' using Michael Polanyi's theories of tacit or personal knowledge in action to validate the principle (Bowen 2009 171-173).

For a more direct example of how designing and designed artefacts can be instruments of research, Owain Pedgley has conducted a PhD project to discover the design principles for acoustically excellent plastic guitar bodies. Like Whiteley's research into defining analogies for complex anatomical joints, this was not a problem that could be solved by conventional engineering analysis. The excellence of a guitar is both highly subjective and dependent on a complex assembly of forms and materials together with a musician, an audience and a venue. Early attempts to atomise the problem having failed, Pedgley set out to make a series of guitars and evaluate them with the help of two very experienced professional people: a guitarist and guitar maker.

On the one hand this is quite a radical approach, building the research around speculative designs rather than some form of technical analysis and employing a very small sample of experts rather than a more statistically reliable test. On the other hand it exemplifies the Rittel and Webber approach of allowing the

solution (and the problem) to emerge among the participants through critical argument. By employing the rich tacit knowledge of very experienced people a different kind of reliability can be found. Pedgley's designs may not be the only ones possible (an inevitable feature of wicked problems), they do not provide an absolute standard for how a guitar should perform, but we can be confident that, as long as the designer and expert stakeholders are genuinely experienced and skilled, their tacit abilities will provide us with a valid new design that results from a rich exploration of the question of excellence. **While this new design itself embodies much of the new knowledge from the research about how to construct excellent guitars, the main contribution of the research, arguably, is a methodology for other designers of musical instruments to advance their craft.**

5. Discussion

The title of this paper invokes the English aphorism, *the proof of the pudding is in the eating*. I have set out to show how designing, making and using artefacts can form a useful instrument of research, based on both the theory of tacit knowledge and wicked problems and the practices of some doctoral researchers who have looked for ways to incorporate their skills as designers into their inquiries.

The underlying question of this IASDR special session is concerned with the relationship of knowledge and designing, I would suggest that the artefacts of designing play an essential part in that relationship, that new knowledge can emerge from the interplay of the different elements of designer, stakeholder, creative practice, artefact and critical argument.

However for that to happen there are some preconditions. In all the examples I have given, and other successful projects by designer/researchers, there have been some common factors that appear to be very important:

Competence

It may not be essential for the designing in a research project to be in itself particularly 'advanced' or at the leading edge of practice, whatever that may be. However it must be highly competent, the designer/researcher must have the insight and skill to produce work that is highly appropriate for its purpose and likely to elicit the engagement that the project requires. In Graham Whiteley's work, for example, one of the key factors was that the development work that led to the complete analogous arm was visibly competent, by somebody who could observe, draw and make objects with great conviction and insight, as well as writing clearly and knowledgeably about the scientific context for the work. Given the lack of scientific data to validate the design this visible competence in the process, along with the validation by experts, was essential to the acceptance of the final design and the new principles that it embodied.

In all these projects, where there was engagement between different stakeholders and the artefacts of the research, it was essential that the stakeholders were selected for their competence to take part. Owain Pedgley could not use just any guitarist and guitar maker, he needed people who had a deep and lengthy experience, who were widely recognised for their abilities and could be expected to have a high level of relevant tacit knowledge. Nicola Wood chose master craftsmen and learners for their ability to engage with her work as well as their expertise as craft masters or their ability to learn as novices. She had to be adept at recognising when an individual was not able to engage constructively with the research and develop 'templates' for the different players needed to make her project work. Simon Bowen was able to find consumers who would engage constructively with the possibility of design ideas that went beyond their personal experience but only by

adopting a concept of “Lead Users”. This was based loosely on the work of Eric Von Hippel (eg Hippel and Kratz 2002) who discovered that there was a class of stakeholder who tended to experience needs ahead of the rest of the community and be flexible in adapting resources to meet those needs.

A Single Inquiry

A second feature of these projects was the clarity with which the researchers understood and pursued a single inquiry. They may have had a variety of aspirations as designers but everything they did was driven by the research project and they understood that their aim was a contribution to knowledge. Each project had a different aim and a different methodology, in fact one of the contributions of each was the distinctive methodology developed, and none of them followed a particular prescription for ‘practice-led research’. On the contrary, the practice of designing was completely subservient to the research.

Arguably there are many research projects where some designing takes place, for example to create an environment for some social or technical research. There is some research where designing becomes a significant part of the inquiry and there are some projects where designing is central to the methods and present at all times. It would be most fruitful to see this as a spectrum with no sharp divisions to say that a project is, or is not, practice based.

Emergence

In the most progressive design research projects that I have observed, including the examples here, the topic, the methods, the contributions and the methodology have all emerged together. Generally there have been early ‘versions’ of questions, designs, theories and methods that have seemed to be convincing at the time but, as understanding has grown through interaction between these different factors and the engagement of stakeholders, deeper, more relevant questions, designs, theories and methods have emerged.

In particular the projects have evolved methodologies than can only be completely described when the work is complete and often they encounter the problem that Simon Bowen has described informally as “methodology squared” where the project results in two parallel methodologies, one for the research and another, with many similarities, that might inform practitioners who wish to work in the same general area.

6. Conclusion

This session was partly inspired by Bruce Archer’s concept of research “through design” and Archer’s paper, *The Nature of Research* (1995) has been an inspiration for my own work as a researcher and PhD supervisor for the past 14 years. However Archer did not go very far in describing how his concepts might work and the examples he gave were mischievous rather than helpful. It has taken a long time for examples to emerge and theories to develop but I feel that today we are in a position to answer the question that Archer asked.

I have set out some relevant theories that relate to design as an inquiring activity. I have described some projects that show these theories in action and I have discussed some of the practical considerations that researchers might need to consider. I do not believe that there is a single paradigm for research ‘through design’ but I am confident that we now have the means to conduct research that is appropriate to our profession and discipline, which makes a distinctive contribution to knowledge that complements that of other disciplines and, crucially, has the potential to inform professional practice.

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