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Observational Research and Verbal Protocol Methods

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Abstract

This paper describes observational research and verbal protocols methods, how these methods are applied and integrated within different contexts, and how they complement each other.

The first case study focuses on nurses' interaction during bandaging of patients' lower legs. To maintain research rigor a triangulation approach was applied that links observations of current procedures, 'talk-aloud' protocol during interaction and retrospective protocol. Maps of interactions demonstrated that some nurses bandage more intuitively than others. Nurses who bandage intuitively assemble long sequences of bandaging actions while nurses who bandage less intuitively 'focus-shift' in between bandaging actions. Thus different levels of expertise have been identified.

The second case study consists of two laboratory experiments. It focuses on analysing and comparing software and product design teams and how they approached a design problem. It is based on the observational and verbal data analysis. The coding scheme applied evolved during the analysis of the activity of each team and is identical for all teams. The structure of knowledge captured from the analysis of the design team maps of interaction is identified.

The significance of this work is within its methodological approach. The maps of interaction are instrumental for understanding the activities and interactions of the people observed. By examining the maps of interaction, it is possible to draw conclusions about interactions, structure of knowledge captured and level of expertise. This research approach is transferable to other design domains. Designers will be able to transfer the interaction maps outcomes to systems and services they design.

Keywords: expertise, focus-shift, product design, software design, design process

Introduction

Observational research is commonly used to understand human interactions, activities or experiences within various contexts. The techniques involve team or individual observation, field or laboratory observations, videoing and mixed techniques (Abrams, 2000). On the other hand protocol method is used for studying various domains from design activity, to usability studies (e.g. Cross, Christians & Dorst, 1996; van Someren, Barnard & Sandberg, 1994). The techniques involve asking participants to 'think aloud' or 'talk aloud' while performing tasks. Both research methods complement each other. The coding scheme applied for each approach is dependent on the context observed, task verbalized and activities undertaken. Research rigor is maintained by triangulation. The application of these methods and integration within different contexts are demonstrated by the following two case studies.

Case Study One: Interaction, Expertise and Focus-shift

The first case study investigates compression bandages used in the treatment of leg ulcers and how nurses interact and engage with these compression bandages as they use them (Popovic & Kraal, 2008; Kraal & Popovic, 2007). In order to investigate this understanding of the illness, its effects on people and the role of artefact (i.e. physical interface) during the activity was required. The expertise and experience of the nurse who applies compression bandages is critical in achieving the correct level of therapeutic compression. In one study (Coull, Tolson, & McIntosh, 2006); 38% of nurses had "inconsistent bandaging technique". Another study found that, when measured with a sub-bandage pressure monitor, a surprisingly low number of nurses had effective technique (Feben, 2003) or could achieve the correct sub-bandage pressure. Neither study described the similarities or differences in techniques used by nurses who did achieve correct pressure. Clearly a gap exists for an exploration of the interaction between nurse and bandage that could begin to explain the differences in how bandages are applied.

This research was conducted as qualitative study of nurses applying compression bandaging to patients with venous leg ulcers. Eighteen (18) nurse-patient pairs were video recorded during the application of compression bandages. Pairs were selected as patients entered the treatment settings, called "Leg Clubs". The nurses observed were skilled practitioners of compression therapy.

Following coding of verbal and observational data, The Observer (Noldus, 2010) was used to produce time-event maps (Bodker, 1991, 1996) of interaction derived from the coding scheme. These maps are instrumental in analyzing and understanding the interaction, both from a bandaging point of view, and as tool to investigate mediated interaction.

By examining the time-event maps (Bodker, 1991, 1996) it was found that nurses frequently experienced "focus shifts" (Bodker, 1991, 1996), which can also be called "breakdowns" (Winograd & Flores, 1987), while bandaging. A focus-shift occurs when work is interrupted to focus on the tool at hand (Bodker, 1996, p. 150). Two types of focus-shift were observed. In the first type, a focus-shift occurred when the bandage was not applied correctly and was significantly re-wound to begin the bandaging task again. In this type of breakdown the activity, applying a bandage to a leg, is the same, but the "purposeful actions" (Bodker, 1996, p. 154) have changed. The second type of breakdown occurred when a nurse finished applying one bandage to a leg and then had to leave the bandaging area to locate the next bandage in the set. In this case the activity itself has changed from applying a bandage to locating a bandage. Some nurses would focus-shift frequently while bandaging while other nurses would only rarely focus-shift. The following examples show a bandaging episode with few examples of focus-shifts. Figure 1 shows the full map of the interaction for an experienced nurse.

Figure 1 Map of interaction for an experienced nurse. Box shows location of detail view (Figure 2)

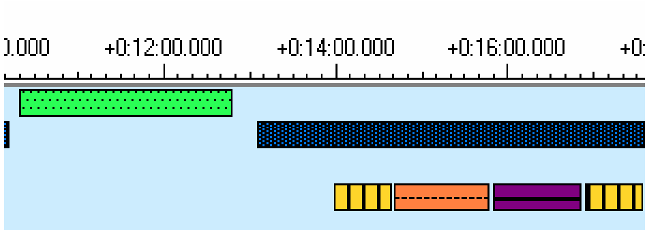

Figure 2 Figure 1 Detail

Figure 2 is a detail view of Figure 1 from time 0:10:20 to 0:17:35 minutes. During this time the nurse prepared bandaging materials and then bandaged the patients left leg. Figure 1 shows how the nurse did all her preparation before bandaging and then performed all the bandaging without breaking away from bandaging actions to return to preparation of materials. In order to prepare all the materials necessary for bandaging, the nurse planned all of her actions before beginning the bandaging process. This demonstrated her high level of expertise and experience in bandaging. The nurse only exhibited one focus shift at 0:18:10 minutes and then only during a preparing stage. This is supported by the research on expertise in other areas saying that the more experienced the nurse, the fewer focus shifts and breakdowns. Nurses who experienced few focus-shifts seemed to be relying on tacit knowledge as they bandaged. Rather than considering each action, they performed sequences of actions fluently, linking many different bandaging actions into a larger process.

Figure 3 example shows that this nurse experienced frequent focus shifts during bandaging. In this case the nurse is bandaging only one of the patient's legs. This map begins after the washing and preparing of materials has taken place. She experiences a brief focus shift while applying the undercast and then bandages fluently for almost two minutes. The next part of the interaction is depicted more fully in figure 4.

Figure 3 Map of interaction for an inexperienced nurse. Box shows location of detail view (Figure 4)

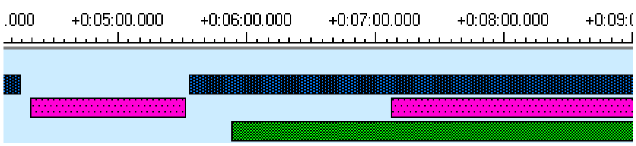

Figure 4 Figure 3 detail

In figure 3, from 0:04:05 to 0:09:00 minutes no planning is depicted. From 0:04:05 to 0:04:15 minutes the nurse is completing the previous bandaging action by cutting and taping the bandage. The nurse begins doing bandaging at 0:05:30 minutes, first by briefly explaining what she will do to the patient before actually beginning the use of the type 3c bandage at time 0:05:50 minutes. She bandages continuously, without verbalisation until 0:07:05 minutes. It seems that she was using tacit knowledge until this point. At 0:07:05 minutes she begins using explicit knowledge during the bandaging procedure (indicated by the reacting code in conjunction with the doing code). The video for this portion of the interaction shows the nurse was applying bandage incorrectly. This nurse then asks for assistance and advice from a more experienced nurse for the remainder of the time. She relied frequently on explicit knowledge and demonstrated focus-shift.

Case Study Two: Design Process: Similarities and Differences – Product and Software Design

The study presented here compares the design process of two different domains—product and software design (Popovic & Kraal, 2010). The main thrust is on the identification of similarities and differences within the design process within and between the domains. Two empirical studies were developed based on earlier work of product design process and software design process.

The analysis of the observational and verbal data on how the designers worked was conducted on a macro level for which a coding scheme was developed. The coding schemes applied evolved during the analysis of the activity of each team and were identical for all teams. Noldus Observer (2010) was used to assist in the analysis of observational data and Atlas.ti verbal data (Atlas.ti,2010). The analyses encompass eight codes: (i) problem exploration, (ii) market search, (iii) documenting, (iv) sketching, (v) exemplar, (vi) model details, (vii) story/narrative, (viii) UI Details. The observational and verbal data codes are summarised as follows:

1. Problem exploration: The problem exploration code refers to the product/software designers' approach to defining/exploring the problem in order to understand the various possibilities within the project. They tried to understand the project by decomposing the constraints into smaller 'chunks' or models.
2. Market search: The designers were searching for similar products already available on the market. This is a common approach within the product design practice.
3. Documenting: The product designers were silently documenting relevant points from the Internet search or making notes in reference to brief to help them understanding the task. When the documenting code overlaps with another code, one designer is documenting while the other designer's behaviour is captured in the overlapped code.
4. Sketching: Sketching ideas played a significant part of the product design process. The designers used sketches to communicate design concepts and product details to each other. The designers used words, images and shapes to communicate concepts and represent the understanding of the physical world of artifacts.
5. Exemplar: During the design process designers refer to an exemplar or precedent. In design practice previous experience or design solutions are represented, stored, retrieved in various ways. When this experience is related to physical products it is called design precedent or exemplar.
6. Model Details: The model details code refers to the objects that designers grouped or regrouped into sub-models.
7. Story: The story code is used when the software designers tell a narrative story about an aspect of their design. If the story code is used in conjunction with the model code, the designers are narrating how data flows through the model or are telling a story with the model in order to verify that the model reflects the world, as they understand it. If the story coded interacts with the UI (User Interface) code, the designers are telling a story about the use of the user interface. When the story code is used at the same time as the problem exploration code, the designers are narrating an experience that helps them understand the problem. This might also trigger new requirements.
8. UI Details: The UI (User Interface) details code refers to the user interface (UI) details where software designers considered the interface and user interaction during the design process. This might occur concurrently during problem exploration.

Product Design Process

The analysis of the product design process is based on the work of three design teams who were working in pairs on the same problem. The design brief concentrated on a sustainable design task involving practicing designers working in pairs with experience from three to more than ten years. The designers were asked to design portable CD or DVD storage. The brief provided general design constraints and a list of online resources. Data collection methods were: observations, talk-aloud protocol and retrospective protocol. The teams were video recorded for 45 minutes.

Figures 5, 6 and 7 illustrate the maps of the product design team activity. They illustrate the process over the whole session and demonstrate their approaches to understanding the problem. This analysis focused on designers' activities during the overall project time. Only the selected episodes are described for each product design team. Problem exploration activity was occurring concurrently during the early stage of the design process. This was relevant for all three teams.

Product Design Team 1 (Figure 5) began at 00:00:00 by exploring the problem. This has been happening in various intervals during the process. The designers applied decomposition strategies and domain knowledge by starting to explore possibilities around the problem. Market search started at 00:03:00 and continued until 00:23:00. The team was searching on the Internet for similar examples of the product they were to design. The designers were documenting their findings concurrently with market search. They were designing the product by decomposing and grouping constraints. Close to the end of the task their sketching activity intensified and became more fluent. During the process the designers referred to exemplars frequently. Team 1 spent 40.00% of time on problem exploration, 32.00% on market search, 04.00% on documenting, 14.00% on sketching and 10.00% on referring to an exemplar.

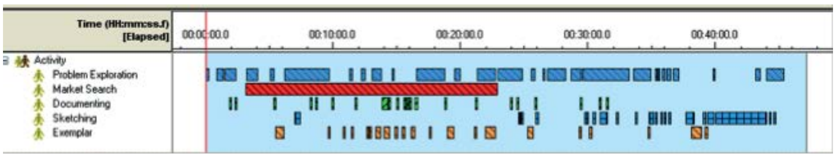

Figure 5 Product design process map (Team 1)

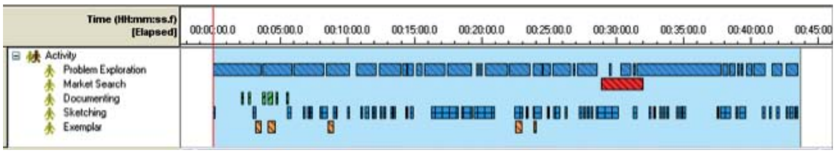

Figure 6 Product design process map (Team 2)

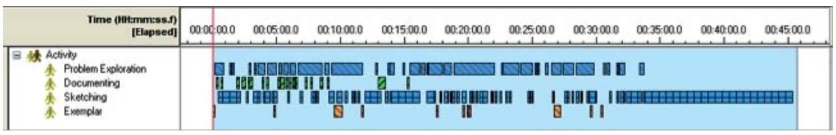

Figure 7 Product design process map (Team 3)

Product design Team 2 (Figure 6) began at 00:00:00 by exploring the problem and continued until the end of the task. The designers applied decomposition strategies and domain knowledge by starting to explore possibilities around the problem. The traces of the process map were more fluid and the strategies stronger. Market search occurred from 00:29:00 to 00:32:00. It seemed that the designers were evaluating their ideas against the existing market. Documenting occurred at the start of the project (00:02:00 to 00:05:50). Sketching started from 00:03:00 and occurred in larger or smaller intervals and lasted until the end of the task. The designers referred to the exemplar at the beginning of the task (00:03:00-00:08:50) and in the middle of the process (00:21:50). Team 2 spent 62.00% of time on problem exploration, 5.00% on market search, 01.50% on documenting, 28.20% on sketching and 03.30% on referring to an exemplar.

Product design Team 3 (Figure 7) began at 00:00:02 by exploring the problem and continued until the end of the task. They referred immediately to the exemplars of the product they knew by referring to the brands. They addressed the brief by exploring it and making a decision on how to work. This strategy was guiding the team and designers' interaction during the design process. They did not search similar products on the market. During the process the designers applied decomposition strategies and domain knowledge by starting to explore possibilities around the problem**.** Problem exploration finished at 00:33:70. The remaining time was spent on sketching. Documenting occurred at the start of the project (00:00:50 and finished at 00:09:10). Sketching started from 00:00:30 and occurred in larger or smaller intervals and lasted until the end of the task. Team 3 spent 40.30% of time on problem exploration, 00.00% on market search, 06.00% on documenting, 50.20% on sketching and 03.50% on referring to an exemplar.

Software Design Process

The analysis of the software design process is based on the work of three design teams who were working in pairs on the same problem (Popovic & Kraal, 2010). The design prompt was to design a traffic flow simulation program, and the broad constraints were given in the prompt. The design teams were video recorded for 1 hour and 50 minutes. The expected outcomes were that the teams would 'design interaction that the students will have with the system' and provide 'a basic structure of the code that will be used to implement this system'. The designers were allowed to re-use an existing software package if they wished.

The designers were all expert software designers. Teams 1 and 3 applied a Model-View-Controller paradigm that represents a frame in which user input, modelling of external world and user interface are separated by three specialised tasks: the 'view' refers to the output (user interface), the controller interprets an input, and the model manages the data and behaviour of the domain (Burbeck, 1992). Team 2 adopted a different approach in intending to build an Entity Relation (ER) Diagram to communicate and frame their concept. The coding schemes applied evolved during the analysis of the activity of each team and were identical for all teams.

Figures 8, 9 and 10 illustrate the maps of the software design team activity. They describe the dynamics of the process over the whole session and demonstrate the differences and similarities in their approaches to understanding the problem. This analysis focused on designers' activities during the overall project time. Design activities such as model detailing; documenting and providing narrative about the model were undertaken concurrently at various intervals during the early stage of the design process. Toward the end of the process, the designers discussed the model again. In summary, Team 1 spent 73.29% of time on problem exploration, 28.27% on model details, 17.88% on narrating the story, 10.98% on UI details and 1.21% on documenting. The Team 2 spent 47.56% of time on problem exploration, 23.43% on model details, 20.00% on UI details, 6.13% on narrating the story, and 2.76% on documenting (Figure 9).

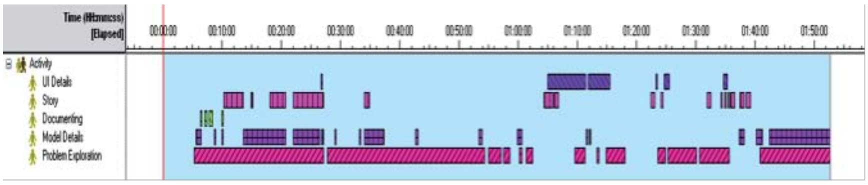

Figure 8 Software design process map (Team 1)

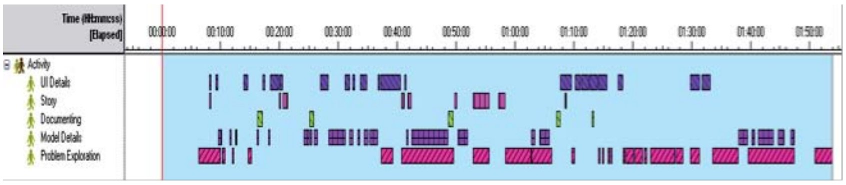

Figure 9 Software design process map (Team 2)

Figure 10 Software design process map (Team 3)

The Team 3 designers (Figure 10) began by exploring the problem. At 00:08:53, they explored the details of their model in the context of exploring the problem, before returning to only consider the problem. At 00:09:25, they considered the model in the context of understanding the problem. From 00:11:06 to 00:11:19 they worked on the model, again using it to aid and explore their understanding of the problem. At 00:12:49,they told a brief story, stopping at 00:13:00. They then worked on the model again, still exploring and understanding the problem. As they finished using the model to understand the problem (00:14:28), they told another story (from 00:14:27 to 00:14:34) to complete and illustrate their new addition to the model. They were still working on understanding the problem. They continued with exploration and, at the end of the project, they concentrated on the details of the model. The team spent 87.95% of time on problem exploration, 38.13% on model details, 20.73% on narrating the story, 1.64% on UI details, and 0.00% on documenting.

Discussion

The findings presented in Case Study One have the potential to be valuable not only to the nursing field because they could be used to identify different degrees of expertise and are transferable to other domain. Identifying expertise is important because of its effects on interaction and outcomes. The typical way that expertise in bandaging is assessed is to have nurses bandage people who are wearing sub-bandage pressure sensors on their legs. People with leg ulcers cannot wear the sensors. Consequently, sub-bandage pressure sensors can only be used on people with healthy legs who do not actually require compression therapy.

The results of this study demonstrate an additional way of assessing expertise (Popovic & Kraal, 2008). Importantly, this way of assessing expertise is non-invasive and can be used in the field as well as in laboratory settings. Therefore, it is suggested that observation of practice complements existing methods of assessing expertise. If the expertise is assessed within the context, then it has better potential to be applied to the design of future activities, artefacts and interfaces that will better support the required interaction.

Each nurse whose interaction is described experienced at least one focus-shift while treating the patient. Nurse 1 had a brief focus-shift while preparing to bandage the patient’s second leg. Nurse 2 had, among others, a long focus shift while bandaging that was related to her inexperience with the bandage at hand. These different experiences of focus-shifts demonstrate different levels of fluency in bandaging. Nurse 1 is clearly the most experienced as she bandages fluently without focus shifting to acquire additional materials,

Nurse 2 shows a focus-shift while using a bandage rather than between bandages. It seems that the nurses who experience frequent focus-shifts are relying on explicit knowledge when they bandage. Nurse 2 uses explicit knowledge about the application technique of the bandage in order to complete the process. In contrast, Nurse 1 bandages only using tacit knowledge. She has prepared all the bandaging materials before beginning bandaging, making it possible for her to use her tacit knowledge while bandaging and maintain a "flow state" (Csikszentmihalyi, 1992). It is apparent that Nurse 2 has also prepared the materials beforehand, as she does not break away during bandaging to prepare subsequent materials however Nurse 2 is hampered by her apparent lack of experience in performing bandaging. The main difference is that the expert nurse demonstrated the high level utilisation of tacit knowledge represented through planning (Popovic & Kraal, 2008), continuous interaction and engagement.

Having seen that the more expert nurse’s interaction with the bandages is more fluent, it can be suggested that when nurses bandage fluently, demonstrating high expertise, they interact through the bandages in pursuit of the higher goal of "treating a patient". That the tool being used by an expert "disappears" while being used is often taken as read. As Bodker puts it "The proficient user normally does not carry out actions on the artefact" (1991, p. 83). Conversely, it is usual to suggest that when the nurses experience focus-shifts they cease their pursuit of the higher goal of "treating a leg ulcer" and instead focus on "using a bandage". This can be seen in the map of Nurse 2's long focus shift (Figures 3 and 4) while bandaging that suggests that the bandage became the object of her interaction rather than the patient.

However, in contrast, it is not apparent from the maps that the more fluent nurses were unaware of the bandages. Indeed, having observed many nurses bandaging, and spoken with many about the process of learning to bandage, it seems that nurses who bandage fluently are simultaneously aware of the bandage and their higher goal. As Verbeek notes “someone who plays the piano is directed toward the music and at the same time is substantially involved with the piano itself. [I]ts machinery is not completely in the background but not entirely in the foreground either” (2005, p. 194). Verbeek calls this “focal engagement” (2005, p. 195) and contrasts it with “effort” (2005, p. 195). This distinction can be seen where Nurse 2 puts a lot of effort into her engagement with the bandages (Figure 4) while Nurse 1 is focally engaged, that is aware of both the artefact and the thing that the artefact makes possible.

This duality of awareness possessed by experts is not described in standard models of expertise. Instead, experts are thought of as having operationalised lower-level actions to the degree that they are no longer aware of the functioning of the artefact (Dreyfus, Dreyfus, & Athanasiou, 1986, cited in Bodker, 1991, p. 83). This simultaneous awareness of material and goal may be more tacit than explicit. This duality of awareness can be attributed to her expertise level as she was able to accesses the knowledge in a more efficient way. This is demonstrated by an ‘intuitive’ performance (Blackler at al., 2010). An earlier model of novices and experts in which their differences were outlined also supports this. Based on this earlier research, the expert nurse demonstrated stable internal representation and large pattern perception. In this case context-mediated interaction (CMI) is demonstrated by the level of expertise and experience, tacit and explicit knowledge. CMI allows a consideration of the wider context in which an artefact is used, both in the physical and the emergent sense.

There were differences and similarities in the product/ software design teams’ approaches within and across the domains. Product design teams’ approaches differ. Teams 1 and 2 explored the problem until the end of the project, while Team 3 concentrated on sketching. The product designers transformed incomplete information into specifications and requirements. Team 1 and 2 did market search during the problem decomposition. The designers wanted to be sure that their designs stood out compared to existing products. They wanted to ensure that their designs would have competitive advantage. Team 3 did not do market search. Rather they applied an opportunistic approach and concentrated on ‘idea generation’. All teams were documenting, sketching and referring to exemplars (precedents) during the design process. Designers were also referring to products’ physical details in order to interpret their use. The designers made decisions at the various levels of problem decomposition (Figures 5, 6 and 7); some of them did not carry them out until the end of the project. The strategies were not strong and the focus was on goal-limited strategies (Alexander & Judy, 1988; Popovic, 2004). The teams inferred from the expected solution (Cross, 2004; Popovic, 2004). All three teams demonstrated that sketching was an important part during the design process. The visual language that designers used might represent their thoughts and knowledge, or new thought generation and stimulates new creative and analytical thinking (Oxman, 2002; Popovic, 2004).

Software design teams’ approaches also differ. Teams 1 and 3 adopted a more structured combination of top-down and bottom-up approaches (prescriptive software design models) during the problem decomposition (Figure 8 and 10), while Team 2 adopted a more opportunistic and iterative approach (Figure 9), however, some of them did not carry them out until the end. Guidon (1990) points out that, in the early stage of the design process, software designers transform incomplete information into the specification and requirements. The ill-defined strategies and goals prevented the emergence of strong strategies as the focus was on goal-limited strategies (Alexander & Judy 1988; Popovic, 2004) with the emergence of constraints grouping into the larger or smaller partial solutions (Popovic, 2004), particularly with respect to sub-models.

Conclusion

Case Study One informs nursing practice but its findings are transferable to other domains including design. Within the design domain their applicability is mainly within interface and interaction design. This includes their potential transfer to the design of interfaces, designing for user experiences and an activity focused scenario. For example: an interface can be designed to support an intuitive performance and minimize focus-shift by researching and identifying users' experiences (Popovic & Kraal, 2008). By transferring knowledge about their experiences and familiarity into an interface design the transition between expertise levels will be achieved faster. Another example of application refers to context aware interfaces. In this case, an interface should have the potential to adapt and support users' awareness of higher goals and an artefact simultaneously. These are just few examples of potential knowledge transfer and its applications. Further research is needed to test this. This research has opened another opportunity that is to apply the same research approach and study focus-shift of expert and novice designers and its implication to the design process and outcome.

The research methodology and analysis techniques are novel, particularly with regard to the areas of investigation. Visualization of long sequences of interaction has allowed seeing hidden relationships between actions and tacit and explicit knowledge and expertise differences. The complex interplay and interrelation of interaction, tacit and explicit knowledge, expertise and experience was demonstrated.

The significance of the Case Study One research is in its potential application to artefact design. This research has advanced knowledge about user experiences, expertise, performance and engagement. It shows when and how tacit and explicit knowledge were used. The most significant findings are about user's focus-shifts and how these relate to expertise level and performance. However, this knowledge is also transferable to other domains. Its relevance to design is outlined and supported by examples. Future research will test the findings demonstrated in this paper within the design domain and expand this research toward the investigation of designer's focus-shifts during the design process. This can contribute to the significant expansion of the design process as a whole.

The Case Study Two confirms that level of expertise plays an important role in problem representation, and this is demonstrated by studying different levels of expertise during the early (conceptual) stage of the product/ software design process. However, the main strength of this work is that it describes expertise through the early stages of the design process, and has opened an avenue for better understanding of the importance of interaction among general strategies, domain-knowledge and narratives. The structure of knowledge captured from the analysis of the design team maps can be utilized to contribute to a better understanding of the connection between and integration of interface variables.

The maps of interaction are instrumental for understanding the activities and interactions of the people observed. By examining the maps of interaction and associate verbalization, it was possible to draw conclusions about interactions, structure of knowledge captured and level of expertise. This research approach is transferable to other design domains. Designers will be able to transfer the interaction maps outcomes to systems and services they design.

Acknowledgements

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Vesna Popovic (PhD) is a Professor in Industrial Design at Queensland University of Technology, Brisbane, Australia. She has made an international contribution to product design research where she has integrated knowledge from other related areas and applied to the artifact design (e.g. human factors/ergonomics, product usability, design and cognition, expertise and experience, design computing or applied design research) in order to support and construct design applications. She has successfully integrated the industrial (product) design research agenda with diverse disciplines such as medicine, science, engineering, humanities and information technologies in order to enhance or change their practices. In particular, she has been a founder of People and Systems Lab research at QUT. The impacts of Vesna's research lies in the cross-fertilisation of knowledge across humanities and technologies to design humanised artifacts/ systems by facilitating the understanding of diverse expertise and experience. Vesna is a Fellow of the Design Research Society (UK). She is recipient of three Australia Research Council grants (v.popovic@qut.edu.au).

Ben Kraal (PhD) is a Research Fellow with the People and Systems Lab at Queensland University of Technology. During the last six years he has made significant contributions to design research. Dr Kraal's approach adapts rich sociological techniques to investigate the complex interplay between people, the tools they use and the environment in which they work, allowing the identification of the essential elements of the work practice in question, making it clear where technology and design interventions are able to achieve the greatest positive impact. His ongoing research looks at how people use airports and how doctors and nurses collaborate with digital telehealth stethoscopes (b.kraal@qut.edu.au).

Alethea Blackler (PhD) is currently a Senior Lecturer in Industrial Design at Queensland University of Technology, Brisbane, Australia. Her principle area of research interest is intuitive interaction, in which she is one of the world leaders. She pioneered the work on intuitive interaction with the first empirical work in the field. Dr Blackler has led a prestigious ARC Discovery project on Facilitating Intuitive Interaction for Older People. She is continuing work on developing design methodology for intuitive interaction as well as applying intuitive interaction into other areas, such as navigation and expertise. She has published extensively, been invited to give presentations at intuitive interaction workshops in Europe and is the recipient of several awards. She has regularly reviewed papers for international conferences and journals. Dr Blackler is a member of the Design Research Society (DRS) (a.blackler@qut.edu.au).

Marianella Chamorro-Koc (PhD) is a lecturer and the Subject Area Coordinator of Industrial Design at Queensland University of Technology, Brisbane, Australia. Her research work is within the areas of design, human factors/ergonomics, product usability, experiential knowledge and context of use. Dr Chamorro-Koc's current research focuses on understanding the ways in which technology influences people interactions with products and complex devices; in particular, her work aims to identify the experiential knowledge embedded in people's activities and interactions, and the contextual aspects shaping them. She is a researcher within People and Systems Lab at QUT where she leads the area of context of use. Dr Chamorro-Koc has been publishing nationally and internationally and has been a reviewer for conferences and journals. She is a member of Design Research Society (DRS) and Design Institute of Australia (DIA) (m.chamorro@qut.edu.au).