A Critical Perspective on Interaction Design Patterns as Theory Representation

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A CRITICAL PERSPECTIVE ON INTERACTION DESIGN PATTERNS AS THEORY REPRESENTATION

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Abstract

Abstract. This paper provides an interpretation of interaction design patterns from the perspective of design-oriented research in information systems. It is concluded that interaction design patterns do not meet certain ideals for contemporary information systems design theory: Rigor, practical utility, novelty/innovation, acknowledgement of the social setting, and cumulative research. The lack of explicit ideals governing the formulation of interaction design patterns is discussed, and implications for research are drawn.

Keywords: Information Systems Design Theory, Interaction Design Pattern, Design Science Research
1 INTRODUCTION

Design patterns were originally suggested as a representation of design guidance within architecture (Alexander et al. 1977). The well-known ‘gang of four’ adapted the concept and introduced it to the computer science community (Gamma et al. 1995). Their work has been heavily cited, and a multitude of design patterns have been proposed since its publication. These patterns typically show generic object-oriented design solutions to common software design problems. A pattern is a generic solution to a problem class. By applying a design pattern to a problem, a solution adapted to the problem may be rapidly developed. A pattern is thus a way of re-using knowledge on how to find design solutions to a certain class of problems. Each pattern is named, and typically consists of a problem description, a generic solution, and advice as to when the pattern could be applied, along with potential drawbacks.

The success of design patterns within computer science has led to an interest in the concept within related disciplines, one example being the emerging discipline of interaction design. Löwgren (2008) explains two interpretations of interaction design: Interaction design as a design discipline and interaction design as an extension of HCI. Löwgren mentions some influential and recognized names in interaction design as an extension of HCI, including Jenny Preece, Ben Shneiderman, and Donald Norman. Influential names from interaction design as a design discipline include among others Terry Winograd and Pelle Ehn. Löwgren concludes that these two interpretations of interaction design are converging (Löwgren 2008).

Interaction design researchers have adopted the design pattern concept and adapted it into interaction design patterns (IDPs), i.e. patterns (primarily) addressing user interface design issues. Several scholars have put forward ideas on how to structure IDPs (Borchers 2001; Folmer et al. 2005; Tidwell 2005; van Welie 2003). A large number of patterns have been formulated, for example the two comprehensive collections presented by Tidwell (2005) and van Welie (2008).

Interestingly, the academic field of information systems (IS) has also shown an increased interest in design-oriented research over the last two decades. Scholars express that design science research is becoming recognized as equally important to behavioural research in the IS field (Hevner 2007; Iivari 2007), and design is depicted as “fundamental to the IS discipline” in the introduction to a recent MISQ special issue on design science research (March and Storey 2008). Design science research in IS is in the middle of an ontological and epistemological discourse, which is manifested through special issues in leading journals, conference tracks, and dedicated conference for design science research in IS. Purao et al provide a thorough presentation of this development (Purao et al. 2008).

Publications in major IS journals (Hevner et al. 2004; March and Smith 1995; Walls et al. 1992) served as an inspiration for other IS researchers, and showed a pathway to performing design science research. These publications clearly address important issues such as relevance and rigor in design science research. Apart from the ontological and epistemological issues addressed in these seminal publications – which are far from agreed upon within the IS community – there is an ongoing discussion on how to represent design science research results. Gregor & Jones’ anatomy of a design theory guides scholars to formulate theories in a rigorous way, building upon previous scholarly publications (Gregor and Jones 2007). Their work is a theoretically grounded refinement of the framework presented by Walls et al in 1992 (Walls et al. 1992). An important issue being addressed is the importance of establishing design science research in IS as a cumulative research tradition.

Carlsson (Carlsson 2007) depicts the development of design-oriented research in IS as the emergence of these two different ‘strands’, sharing an interest in design, and a focus on the IT-artefact: First, a number of publications (Hevner et al. 2004; March and Smith 1995) focusing IS design science research activities and methodological issues. Second, dealing with the issue on how to formulate design theory in IS (Gregor and Jones 2007; Walls et al. 1992; Walls et al. 2004). This paper is biased towards the latter: The formulation of design theory. However, since formulation of theory to a large is
related to the epistemological ideals governing the research process, characteristics of theory cannot be discussed without some regard to research methodology.

To some extent, interaction design patterns may be conceived of as IS design theories. March & Smith (1995, p. 254) state that “rather than posing theories, design scientists strive to create models, methods, and implementations that are innovative and valuable”. Interaction design patterns consist of models (relations between problem classes and solutions), methods (how-to-instructions to create specific solutions based on a generic pattern), and instantiations (e.g. user interface exemplars that represent solutions to problem classes). The explicit formulation of a solution to a class of problems is may also be conceived of as a technological rule. Such rules have been proposed in management research as a way of packaging design theory (van Aken 1994). Furthermore, The criteria for formulating an Information Systems Design Theory (ISDT) proposed by Gregor and Jones (Gregor and Jones 2007) also overlap considerably with the categories for representing interaction design patterns. See Sjöström and Ågerfalk (2009) for a detailed analysis of this overlap. Even though IDPs share some characteristics with ISDT as it emerges within IS research, IDPs are not commonly discussed within the design-oriented community in IS research. Conversely, interaction design patterns do not acknowledge important related work in the IS field. The relation between IDPs and ISDTs has not been thoroughly explored, although the problem on how to represent design theories is evident both in IS (Gregor and Jones 2007; Walls et al. 1992; Walls et al. 2004) and in interaction design (Zimmerman et al. 2007). Zimmerman et al (2007, p. 499) express that “there is no agreed upon standard of what research through design means nor what a high quality contribution should be.”

With this backdrop, arguing that design science research in IS and interaction design research share an interest in formulation of design theory through design-oriented research, there is a need to further examine the relation between these two fields of research. The purpose of the paper is to highlight some critical concerns regarding interaction design patterns as representations of knowledge. The concept of interaction design patterns as representations of theory is assessed, partially based on the ongoing design science research debate in IS, and partially on meta-theoretical discussions from within the interaction design community.

2 FIVE CONCERNS ABOUT INTERACTION DESIGN PATTERNS

This section shows a set of notable differences between IS design theory and IDPs. Five differences are grouped into the following topics; each representing an ideal found in design-oriented IS research.

- Acknowledgement of the social world
- Practical utility
- Theoretical rigor
- Innovation
- Cumulative research

Each topic is discussed in a subsection below.

2.1 Acknowledgement of the social world

*By including situational adaptations of the design process, and by recognizing the inseparable phenomena of IT design and organizational change, interaction design patterns would be better suited as representations of theory.*

IS researchers, along with many interaction design researchers, tend to recognize the IT artefact as part of an emergent social context (even though there are divergent meanings on how to conceptualize and understand the relation between IT and the social world). Recent design-oriented IS publications show that scholars recognize the importance of the social context of the artefact (Bratteteig 2007; Carlsson 2007; Sein et al. 2007). Likewise, in the interaction design context, the social setting of interactive products is typically recognized. A few examples follow. Preece (2000) suggests the concept of
sociability in online user communication and communities of practice. Norman (1996, p. 1) states that he has "... come to recognize that industry faces numerous problems that are outside of the scope of the traditional analyses of design. In particular, there are management and organizational issues, business concerns, and even corporate culture." Moreover, Shneiderman (2007) along with others propose that a multidisciplinary discipline of ‘web science’ needs to be established to properly research emerging social and technical phenomena related to the inception and emergence of the World Wide Web. That is; what used to be a rather narrow scope of HCI – previously biased towards user-system interaction and usability - has expanded into a field which clearly recognizes issues of inter-human communication and attempts at understanding IT as part of a social setting.

Interestingly, while interaction design patterns are proposed as being useful for designing internal (Folmer et al. 2005) and external properties (Borchers 2001; Folmer et al. 2005; Tidwell 2005) of IT artefacts, they tend not to consider the social environment of the artefact. The solutions are biased towards the IT artefact, rather than 1) the social setting that brings the IT artefact into being (the design process) and 2) the social setting(s) where the IT artefact is put into action (the ‘embedding’ social setting). These social settings are clearly important, and part of the solution to a problem may be to adapt the design process, or induce changes to the ‘embedding’ social setting. Interaction design research acknowledges these settings by advocating user-centred design. Use qualities of the IT artefact are affected by, and affect, these social settings.

However, when it comes to theory representation in interaction design patterns, solutions are biased towards the characteristics of the design product. This is evident in proposed pattern collections (Tidwell 2005; van Welie 2008). Scholars who propose interaction design patterns refer to generic characteristics of a design process, rather than situation-specific design activities depending on the type of problem that is to be solved. For example, Tidwell proposes a user-centred approach (Tidwell 2005), and Borchers (2001) recommends that design patterns are used as an integrated part of usability engineering.

Several IS scholars (Checkland 1981; Goldkuhl and Lyytinen 1982; Mumford 1993; Orlikowski 1992; Orlikowski and Iacono 2001) propose a view of IT artefacts as embedded in a social setting. Checkland's soft systems methodology (Checkland 1981), for example, thoroughly points out the difference between design of technical (hard) systems and the induction of change in human (soft) systems. The idea of problem solving as a social process is also in harmony with a predominant goal within interaction design research: Building usable IT artefacts (Bevan et al. 1991; Preece et al. 2003). This is typically achieved through a user-centred design process and through the application of techniques such as mock-ups, scenarios and prototypes to promote learning and communication between users, designers, and other stakeholders (Preece et al. 2003). Research on participatory design (Ehn 1995) and socio-technical design (Bansler 1989; Mumford 1993). Carlsson (2007) emphasizes the need for an understanding of change work in the social setting accompanying the development of IT.

Interestingly, interaction design patterns propose artefact-focused solutions to classes of problems, even though the solution sometimes is more likely to be a result of changes in the target social setting, i.e. by educating people, attempting at changing norms in a group, or through some other induction of change in the soft system.

Conclusively, both with respect to the design process (principles of implementation), the IT artefact, and the social setting embedding the IT artefact, there is a need to acknowledge the social context in which design takes place and which design aims at improving.

2.2 Practical utility

Interaction design patterns are formulated so that they shall make sense for designers. However, their relevance for practice and practical utility is yet to be shown through rigorous research approaches.
Practical utility deals with the question “For whom is IS design theory and interaction design patterns created?”

Carlsson (2007, p. 77) argues that IS design science research results should benefit “[...] Professionals who plan, manage and govern, build, implement, operate, maintain and evaluate different types of IS/IT initiatives and IS/IT.” Design science research stresses that research should be relevant for practice (Hevner 2007; Hevner et al. 2004), and design theory should be accessible and applicable for practitioners (Gregor and Jones 2007; Walls et al. 1992; Walls et al. 2004; van Aken 1994). In Gregor and Jones’ model (Gregor and Jones 2007), the inclusion of the category constructs is a means to communicate core concepts of the theory both to practitioners and researchers. The separation of justificatory knowledge into a distinct category allows for scholars to differentiate a practical theory description from its philosophical and theoretical underpinnings, which should contribute to anyone who wants to make sense of the problem and the proposed solution.

Interestingly, the categories in interaction design patterns show an absence of academic lingo. This is especially evident in Tidwell’s model (Tidwell 2005). This is an example of language games (Wittgenstein 1953/2001). It appears that IDPs are oriented towards the design practitioners’ language game, while ISDT is more closely connected to the scholarly language game among researchers in the IS discipline. As a consequence, Tidwell’s model is more likely to appeal to practitioners than the model presented by Gregor & Jones (2007). Borchers’ IDPs (Borchers 2001) clearly aim at being practically useful through its multiple representations of solutions: The opening illustration (which is a visual representation of pattern), the diagram (which provides an overview), and the solution (which explains the solution to the problem class more detail). On top of these different representations of form and function, there are examples illustrating how the design pattern may be implemented.

Formulation of theory clearly becomes more complex when the problem and the solution reside in both the technical and the social domain. Properties of an artefact are clearly easier to illustrate, than the characteristics of the social world. The focus on social issues makes it more complex to communicate the problem and its solution (Sjöström and Ågerfalk 2008). Still, it needs to be communicated in some way. Gregor & Jones’ (2007) inclusion of constructs and justificatory knowledge is clearly a means to do this. By presenting the constructs and the theoretical perspective, the ‘reader’ is given the prerequisites to make more sense of the theory. Unless, that is, the added theoretical complexity and academic lingo scares practitioners away, a discussed in Sutcliffe (2006). However, even though patterns appear to be formulated to be practically useful, Dearden & Finlay (2006, p. 86) state: “one of the most obvious weaknesses in HCI research on patterns to date is the lack of substantive evidence of their benefits for actual design practice”.

To sum up, IDPs use a more practitioner-oriented lingo than ISDT, and are more creative when it comes to representing solutions. This is arguably due to the reduced complexity following the bias towards solutions as characteristics the IT artefact (excluding the social world). On the other hand, IS design science research stresses the need for relevance in research (Hevner 2007; Hevner et al. 2004); and suggests that core concepts of the theory should be defined, and that theoretical discussions are included but kept a separate category (Gregor and Jones 2007). Basing design theory on theories such as Orlikowski’s duality of technology, which may be conceived of as fairly advanced sociology, makes it harder to communicate the theory to a broad target group. Sutcliffe (2006) proposes that design claims need to be structured or unfolded in a way so that it appeals to both designers and scholars.

Depending on the addressee, a theory needs to live up to different ideals. From a practitioner’s perspective, the ideal of relevance for practice and practical utility is in the foreground, while other ideals such as methodological and theoretical rigor (c.f. section 2.3) are typically in focus for researchers. Different representations of theory should ideally cross-reference one another, to ensure traceability, and the establishment of a cumulative research tradition (c.f. section 4.5).
2.3 Theoretical rigor

*Interaction design patterns, as representation of theory, should explicitly account for the justificatory knowledge on which the pattern is based. The pattern may be justified by theory, rigorous evaluations of real-world settings where the pattern has been operationalized, or both.*

Theoretical rigor concerns epistemological issues. The rhetorical question would be “What is the role of theory in design science in IS and interaction design?”

Following the discussions on justificatory knowledge in IS design theory, there appears to be two major ways of justifying design theory: Theoretical grounding and practical utility. The credibility of a design theory can be assessed based on these ideals. Thus, in my view, it is reasonable as a scholar to explicitly communicate this justification, as an important rationale for the prescriptive theory at hand. As researchers, we are reasonably skilled to present such rationale in a traceable way through theoretical references, allowing for others to understand the origins of our thoughts; and assess our underlying philosophical assumptions. On the other hand, the social landscape is undergoing rapid change in this era of IT development and technology dissemination, and design may be experimental and creative. Sometimes, theory may be the results of such creative work followed by reflection and evaluations. Such theory, albeit it may lack theoretical justification, may very well be an important contribution to the IS and/or interaction design body of knowledge.

However, the lack of theoretical justification in interaction design patterns appears to be the result of some other rationale: It is more likely to exist due to a lack of ontological and epistemological reflection, than stemming from experimental and creative design work without a prior theoretical body of knowledge to lean on.

Moving back to the pragmatic roots of design theory, there is a pragmatic standpoint implying that there is a need to apply a concept in practice to in order to determine its degree of truth (James 1907). By putting the concept into action, the door to evaluating its consequences is opened. James (1907) argues that the practical usefulness is the first indication of the goodness of a concept; but there is also a need to anchor concepts in older truths. James, however, does not state that there is an absolute need to anchor a concept in older truths, but that there is a better chance of succeeding in conceptualizing when one is well informed of relevant schools of thought. While IDPs lean towards practical utility as an indication of truth, IS design theory tends to also recognize theoretical rigor (the connection to older truths) as a truth indicator. Interestingly, other parts of the HCI community suggest that there is a need for both theoretical rigor and practical utility (Sutcliffe 2006; Sutcliffe and Carroll 1999).

In HCI research, there are several common types of design guidance. The concept of *claims* (Sutcliffe 2006; Sutcliffe and Carroll 1999) addresses the need for a sound theoretical grounding in addition to empirical design examples. Dearden & Finlay (2006, p. 69) state: “patterns emphasize their grounding in multiple examples of successful designs, whereas claims emphasize grounding in theory.”

In my view, there is no clear rationale to exclude theoretical justification from interaction design pattern representations (at least not in the context of academic research). Iivari (2007) points out that the use of the term “theory” requires that our results are based on existing theory. If the formulation of interaction design patterns is not an attempt at formulating theory; then what is it? And on what grounds should the credibility of such patterns be assessed? As discussed in section 2.2, practical utility is an important ideal for IDPs, but there is no substantive evidence for the actual benefit to practice (Dearden and Finlay 2006). The lack of theoretical rigor and substantive evidence of the usefulness of patterns may be contrasted with a statement by Hevner (2007, p. 91): “[..] practical utility alone does not define good design science research. It is the synergy between relevance and rigor and the contributions along both the relevance cycle and the rigor cycle that define good design science research.”
2.4 Innovation

The concept design ‘patterns’ is terminologically incommensurable with innovation. It appears to be suited for documentation of existing best practices, rather than representations of innovative design ideas. This makes the concept of design patterns inappropriate as a representation of theory for innovative design research, which is proposed both by some interaction design scholars, and scholars within IS design science research.

Some IS scholars put forward the ideal that design theory should primarily deal with innovation (Iivari 2007; Jarvinen 2007; March and Storey 2008). March & Storey (2008, p. 726) state that “contributions of design science research are in the combined novelty and utility of constructed artifacts”. This view has also been proposed within the interaction design research community. As an example, Zimmerman et al (2007, p. 499), while discussing important qualities of design research within HCI, claim that “interaction design research must constitute a significant invention.”

The necessity of the rigor requirement in IS design theory is also questioned (Iivari 2007). Such a requirement may be a counterforce towards innovative research, which may very well be considered an important task for academia. The OO paradigm and Xerox’s WIMP GUI:s are examples of design theories which emerged as a result of creativity (Zimmerman et al. 2007). These ideas have proven practically useful, and had a great impact, without an initial solid theoretical grounding to support the ideas. One way of understanding this is that those innovations were heavily disseminated over time, thus became best practices.

The concept of a pattern intuitively makes one think of designs that already exist in several settings. Thus, the formulation of such a pattern appears to be quite the opposite of innovation. This invites to a (potentially provocative) way of conceptualizing the difference between IDPs and ISDT:

- A best practice approach, where researchers study the world to find existing and working design solutions to re-occurring problems. The solutions are abstracted and packaged as design patterns; applicable for others facing similar problems. The inductive generation of patterns explains the absence of a strong theoretical justification. However, there is still a need for rigorous empirical justification.

- An innovation approach, where researchers aim at coming up with new and innovative and relevant ideas on how to solve problems using IT. These new ideas are informed by theory; relevant practical problems that are not yet appropriately addressed by research, and creative design activities.

Both these types of design guidance require that the resulting design theory be assessed through operationalization and evaluation. The latter approach also requires design activities as an integral part of the research process.

2.5 Cumulative research

By incorporating justificatory knowledge (see also section 2.3), interaction design patterns will become more valuable to the discipline of interaction design. Such a change to pattern descriptions will increase the traceability in research results, thus contribute to a cumulative tradition of research.

An important aspect of revealing justificatory knowledge is that it expresses the theorist’s rationale and values. Doing so, it becomes an important part of the theory representation. It shows not only what the theory is based upon; it also expresses the value-laden characteristics of design theory. Design theory, while being prescriptive, may be conceived of as value-laden (Jarvinen 2007). Further, the inclusion of theoretical justification in a design theory makes it a ‘node’ in a ‘web of theories’. It is both an acknowledgment of what has been done; and a means to increase its credibility, thus make it part of other scholars’ theoretical justification in future theorizing. Researchers need to be able to
assess the ontological assumptions behind a theory, in order to determine in what way they may base their own work upon it. Further, by clearly expressing the theoretical grounds for a design theory, a cumulative research tradition is established (Gregor and Jones 2007). Similar ideas on the formulation of theory in design-oriented research are presented within the HCI research community. Zimmerman et al. (2007) propose extensibility as a relevant criterion for evaluation of design-oriented research in HCI: “Extensibility means that the design research has been described and documented in a way that the community can leverage the knowledge derived from the work”.

Interaction design patterns may be part of pattern languages: Compositions of patterns that together form design theory. This way, patterns on different abstraction levels are related to one another. Zimmerman et al. (2007, p. 495): “The method [pattern languages] turns the work of many designers addressing the same interaction problems into a discourse for the community, allowing interaction designers to more clearly observe the formation of conventions as the technology matures and is reinterpreted by users.” Various ways of relating patterns to one another have been proposed. Several authors propose a layered approach, e.g. that we conceive of patterns as belonging to different domains: the business domain, business process, task, conceptual design, and design (Granlund et al. 2001). Clearly, we may consider the concept of pattern languages as an initiative to create frameworks of theory. However, pattern languages relate patterns based on how they may be applied in concert, rather than showing the way they are based on one another ontologically and theoretically in a tradition of cumulative research.

3 CONCLUDING DISCUSSION

As shown through the five concerns, there are a number of similarities between the fields of interaction design and design-oriented information systems research. Both fields recognize the importance of understanding the IT artefact in a social context, and in understanding design as a phenomenon as such and as a strategy for research. However, as pointed out in section 2, there are also a number of important differences between these means for theory representation.

Within design science in IS, there is a series of publications (Dubin 1978; Gregor and Jones 2007; Walls et al. 1992; Walls et al. 2004) which at this time has lead to a meta-theoretical model on how to formulate design theory (Gregor and Jones 2007). This model is proposed as a basis for representing theory in a rigorous manner, and, consequently, establishing a cumulative tradition within design-oriented research in IS. In the model, there are (arguably) some tensions in the attempt to strike a balance between rigor and practical utility. There is an equally important responsibility for researchers to package and communicate design theories to practice. IDPs, on the other hand, tend to focus practical utility too much (even though there is a lack of evidence that they actually contribute to practical design situations). A large amount of patterns may very well be the result of rigorous research. However, the lack of justificatory knowledge in pattern presentations reduces the traceability and credibility of interaction design patterns. How should one find the research publications showing how the pattern came into existence? On what grounds should one believe in the proposed design advice? By incorporating the concepts of justificatory knowledge and testable propositions into design pattern descriptions, interaction design researchers explicitly create a fertile ground for rigorous and cumulative research, and allow their readers to understand their theoretical perspective and values, thus assess the quality of their work.

Based on the reasoning above, scholars should consider formulating multiple versions of their theories: Practical design guidance for designers, and justified design theory descriptions for scholars. Cross-references between such facets of theory are necessary to ensure traceability for designers who seek deeper knowledge, and for researchers who are interested in a practitioner’s view of some theory.

Further, this paper has shown that interaction design researchers recognize social aspects of technology and incorporate those into their theories. Interaction design patterns, however, appear to be based on an underlying assumption that situation specific solutions are to be found in the characteristics of the artefact, rather than in the social processes in which the artefact is (i) embedded
in its use and (ii) brought into existence. In addition, there are other significant differences between interaction design research in general and interaction design patterns as a concept for theory representation. This is evident in the design pattern concept, which marginalizes important matters such as the social context of IT, the idea of novelty as an ideal for interaction design research, and the extensibility of research (a well reflected strive for a cumulative tradition).

The argumentation in this paper builds up to some important implications for research: As an IS researcher, one must approach the concept of interaction design patterns with caution, since it is sprung from a different tradition of research. In their current form, there is a great chance that an arbitrary pattern suffers from a lack of both theoretical and empirical grounding. This could be explained using the paradigms of design-oriented research presented by Cross (2001). Interaction design patterns appear to belong to design as a discipline (a.k.a. design thinking), while the way design-oriented research is approached in IS appears to be better understood as a science of design and as design science (as compared to the two strands of design-oriented IS research discussed in the introduction). This, however, does not imply that the concept of interaction design patterns bears no value for IS research, or vice versa. However, it does suggest that IS researchers need to carefully reflect about the characteristics and credibility of such patterns when they incorporate them into their research. The five concerns presented in this paper constitute an instrument for such reflection. Conversely, the five concerns should be taken into consideration by interaction design researchers targeting the IS community.

Finally, it should be pointed out that this paper aims at making a contribution in the intersection of two fields. There is a significant overlap in phenomena studied within IS research and interaction design. This paper has addressed design knowledge representation within these disciplines, based on the proposition that interaction design patterns have been almost completely left out of the contemporary discourse on design-oriented IS research. The hope of the author is to initiate such a discussion through this paper.

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