GENERALIZATING FROM DESIGN RESEARCH

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Abstract

This paper is an early attempt to guide the reporting of design research results in such a way that
generalizable and actionable knowledge results from the projects.

Keywords: Design research, Design theory.
1 Introduction

The discipline of Information Systems (IS) lies at the intersection of several reference disciplines (such as computer science, psychology, sociology, economics, management, and mathematics) and is influenced by several others (such as marketing, architecture etc.). In the absence of core IS theories, we borrow and adapt theories from these disciplines. Consequently, we also borrow research approaches from them as well as from natural sciences such as Physics and Chemistry. These research approaches help us in our quest for understanding “reality” and even explain relationships between objects in reality. In order to apply these research approaches, a necessary condition is that such objects already exist. The “understanding” and “explaining” approaches in research thus are re-active.

This is a dominant mode of research in information systems. Yet, we are often involved in “creating reality”. Whenever we design a system, we have altered reality by introducing something that did not exist before. Thus, instead of being reactive, we are pro-active when we employ design research. We alter reality instead of studying it in retrospect.

The essential aspect for us in the above is that knowledge is built in the same context that it is used. Thus, for the IS design researcher, design of an artifact is meaningful when done in the use context, i.e., in specific organizations. The key role of the context is based on more than the teleological mission of the designer – to achieve the intended result – but also to make design efficacious. Designing an artifact is an emergent process and the context plays a vital role here. The problem is then how do we evaluate research based on building of artifacts and altering the contexts through those artifacts.

To paraphrase the age-old concern: "Is building a better mousetrap research"? Translated, the question becomes: How do we evaluate design research, especially the generalizability of DR? Where is the learning aspect from designing and developing a system? Where is the theoretical yield of such research endeavors?

In this paper we seek to answer these questions by looking at what others have said about generalizing design research. We then develop our own idea of and generalizing from design research results.
2 Why Generalization is Important?

Much of DR in information systems to date has been heavily oriented towards building innovative systems that fulfill some specific purpose in some context. This is very good for demonstrating that some idea works in practice. However, this kind of research quite easily degenerates into just implementing systems without much of a research aspect into it. To avoid this trap we believe that DR practitioners should always think about the possibilities of generalizing the solution they propose or the learning from the design endeavor.

3 Previous research

Iivari and Venable comment, “One should note, however, that typically the developed artifact aims at addressing a class of problems (Walls et al. 1992) in a way that it is useful in addressing specific problems of a specific client.” (Iivari and Venable 2009) Similarly Purao (2002) and Sein et al. (2011) see as one of the goals of design research always to try to address not only the specific problem at hand, but as an instance of more generic class of problems. Analogously, when the DR process results in design rules or heuristics, the researchers should seek a higher level of abstraction, where the rules still apply. Kernel theories are identified as vital by Walls et al. (1992) and most DR writings after it. Kernel theory is usually defined as a guiding theory from another discipline.

Ultimately, a full design theory is often seen as the goal of design research and the key exemplars develop full theories. To define what constitutes theory, we use Gregor’s (2006) criterion of “the power to generalize”. Gregor considers systems of statements that allow generalization and abstraction to be theories. The level of predictive power can vary, and theories can range from universal laws of natural science to a more restricted scope, such as the Technology Acceptance Model (TAM). Following Venable (2006), we believe that Gregor’s (2006) theories of Type IV (Explanation and Prediction Theories) or Type V (Design Theories) are likely candidates for seeking generalizable theories from design research.

Theory in Venable 2006:

“The problem space represents the researcher’s understanding of the problem(s) being addressed by a proposed technological solution, specified and placed in context by relationships with other problems and problem aspects. “
“Ideally this description of the problem space would draw on descriptions developed in prior Design Science Research, which would help lead toward comparability of the results of different Design Science Research efforts. Descriptions of the problem space could then be used by practitioners to identify technologies relevant or applicable to their situated problems.”

Theorizing by Walls et al 1992:
“Given an artifact whose performance has been evaluated, it is important to determine why and how the artifact worked or did not work within its environment. Such research applies natural science methods to IT artifacts. We theorize and then justify theories about those artifacts” (p. 259)
“Theories explicate the characteristics of the artifact and its interaction with the environment that result in the observed performance. This requires an understanding of the natural laws governing the artifact and those governing the environment in which it operates” (p. 259)

Kuechler & Vaishnavi (2008) stress the creation of mid-range theories as results from DR. The mid-range theories act as a “bridge” between kernel theories and design theories. The bridge should allow the jump from explanations to prescriptions (see figure below).

Neither Iivari (2003), nor Hevner et al (2004) see theorizing as a necessary condition for doing design research. We also believe that if something is really novel and innovative as an artifact, there is less need for theorizing about it, as the artifact itself usually poses challenge to, or confirms, a previous theory and thus works as a proof of
concept. However, the goal of DR should be to advance science through artifacts, so there remains a need in most cases to find something to generalize to.

4 Generalization from Design Research

In this section we explain our perspective to theorizing and generalizing from DR. The artifact resulting from a DR study is, by definition, a bundle of properties in different domains. This ensemble represents a solution that addresses a problem. Both can be generalized. We suggested four levels for this conceptual move in (Sein et al. 2011) (See figure below):

1. Generalization of the problem instance
2. Generalization of the solution instance
3. Emerging design knowledge in the form of design principles
4. Feedback to design theory

![Figure 2 Levels of generalization from design research](image)

The first level in our model consists of casting the original problem as an instance of a class of problems. As noted above, this has been seen as important for DR at least
since Walls et al. (1992). We can say that this is a necessary pre-condition test for whether some proposed DR project could be seen as something worth studying.

The second level entails re-conceptualizing the specific solution instance into a class of solutions, because a DR effort will often result in a highly organization-specific solution. This step allows for the reuse of the specific artifact and points out possibilities of applying the artifact, and the principles that it is based on, in other contexts.

The third level requires re-conceptualizing the learning from the specific solution instance into design principles for a class of solutions. The design principles capture knowledge gained about the process of building solutions for a given domain (e.g. design rules (Van Aken 2004) or design propositions (Romme 2003) and encompass knowledge about creating other instances that belong to this class (Purao 2002). Thus the design principles are a critical output, as they will guide future designs of similar artifacts. They follow an inductive step similar to the move from empirical to theoretical statements (Lee and Baskerville 2003), and they are practically tested via the DR project (Romme 2003). A key variable in this conceptual move is the level of abstraction, which can precipitate the move from design principles to the formulation of Gregor’s Type V design theories on level four.

The fourth level, feedback to design theory, builds on the cumulative efforts described above. It determines the range of generalizability for the design principles. This may include the creation of mid-level design theories (Kuechler and Vaishnavi 2008) and the possible refinement of contributing theories (Baskerville and Wood-Harper 1998). Such theorizing should follow the form and requirements (e.g. anatomy of a design theory, which defines its purpose and scope etc.) suggested by Gregor and Jones (2007).

These four levels allow the research group to evaluate the extent of generalization possible. A full-fledged design theory (level four) may not emerge from a single DR effort, allowing for a longer program, multiple projects, several instances of ensemble artifacts, and multiple cycles of learning and reflection carried on with mechanisms not unlike alpha and beta testing (Romme 2003).

5 Conclusions

In this work in progress we have discussed how design research in general and design research in context, such as Action Design Research, can be a source for generalized design knowledge. Baskerville, Pries-Heje and Venable have developed evaluation
criteria for DR in several articles (Baskerville, Pries-Heje et al. 2008; Pries-Heje, Baskerville et al. 2008) and now we believe that it is time to start discussing not only about how to build design theories (Gregor and Jones 2007), but also how to theorize based on DR.

We sketched ways of generalization based on earlier research and our own experiences. We believe that actionable guidance for this kind of research is needed in practice and for DR to be useful in the long run we need to think carefully about where and how to generalize.

References


