A Mixed Methods Approach To Combining Behavioral And Design Research Methods In Information Systems Research

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A MIXED METHODS APPROACH TO COMBINING BEHAVIORAL AND DESIGN RESEARCH METHODS IN INFORMATION SYSTEMS RESEARCH

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Abstract

The design research method has recently been introduced in information systems research as an alternative to behavioral (i.e., qualitative and quantitative) research methods. It is, however, recognized in literature that behavioral research methods can be used as part of a design research project. Unfortunately, there are currently no clear guidelines on how both research methods can and should be combined. In this paper, we propose a mixed methods approach to how behavioral and design research methods can be combined in a coherent manner. In addition, we identify five specific mixed methods research designs that describe how a supplementary behavioral research study can be conducted within the context of a larger design research project. This mixed methods approach may draw more attention from design researchers to the methodological implications of using behavioral research methods. It may also expose the design researcher to a richer set of behavioral research approaches and techniques.

Keywords: mixed methods, design research, qualitative research, quantitative research, methodology.
1 Introduction

Traditionally, most studies in information systems (IS) research have used qualitative or quantitative research methods to study managerial and organizational issues related to the use of information technology (IT). Qualitative and quantitative research methods use empirical observations in order to describe, explain, or predict social and organizational phenomena (Johnson & Onwuegbuzie, 2004; Sale, Lohfeld, & Brazil, 2002). Both research methods are commonly referred to as behavioral research methods (Benbasat & Zmud, 1999; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007). The design research method has recently been introduced in IS research as an alternative research method. This method focuses on the creation and evaluation of IT artifacts to solve (rather than explain or describe) organizational problems (Gregor & Jones, 2007; Peffers et al., 2007). This approach was partly a reaction to the observation that the output of behavioral research is mostly explanatory (Peffers et al., 2007), the realization that behavioral research sometimes lacks relevance for application in practice (Benbasat & Zmud, 1999; Hirschheim & Klein, 2003), and the call for more attention to the IT artifact that forms the basis of the discipline (Orlikowski & Lacono, 2001).

Design research is a separate research method and can be used as the single research approach in a research project. However, it is accepted in literature that behavioral research methods (e.g., case studies, field studies, interviews or surveys) can be used as part of a design research project, especially during the problem identification and evaluation phases. Unfortunately, there are currently no guidelines on how both research methods can and should be combined in a coherent manner. As a result, considerable variability can be observed between different design science authors who discuss a behavioral research component.

To address this issue, we propose in this paper a mixed methods approach to combining behavioral and design research methods. The mixed methods approach is a research approach that originated in the social sciences and refers to combining both qualitative and quantitative research methods within a single study (Howe, 1988; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 1998). Over time, the mixed methods approach became a generally accepted approach within the social sciences (Tashakkori & Teddlie, 1998). Its goal is not to replace qualitative or quantitative research, but rather to combine the strengths of both methods and compensate their weaknesses in one study (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Johnson & Onwuegbuzie, 2004). The combination of qualitative and quantitative research methods has also been advocated within the IS community (Howe, 1988; Kaplan & Duchon, 1988). We argue in this paper for combining behavioral and design research methods in a single study in order to strengthen the overall study. To this end, we propose to use the term mixed methods approach to include research designs combining behavioral (i.e., qualitative and/or quantitative) and design research methods. Although the idea of using behavioral research methods within a design research project is not new, the main contribution is that we propose a coherent approach to combining both research methods.

The rest of the paper is structured as follows. We start by providing an overview of the design research literature of how behavioral research methods are used as part of a larger design research effort. We subsequently provide a brief background on mixed methods research. Next, we present a framework of how behavioral and design research methods can be combined by using a mixed methods approach. We further identify five specific mixed methods research designs that describe how a supplementary behavioral research project can be conducted within the context of a larger design research project. We then discuss how the use of these mixed method research designs can contribute to the design research discipline. Finally, our conclusions are offered.
Behavioral Elements in Design Research

Traditionally, research in IS has primarily relied on behavioral research methods to study the impact of IT artifacts on organizations and individuals, based on rigorous guidelines. In recent years, an increasing interest in the design research method can be observed (Purao et al., 2008). This interest originated in the 1990s, but especially gained momentum since the publication of the seminal article of Hevner, March, Park, and Ram (2004). This methodological shift is mainly motivated by the perceived lack of professional relevance of IS research (Benbasat & Zmud, 1999; Hirschheim & Klein, 2003). This lack of relevance is addressed in design research studies by selecting a real-world problem and by designing an artifact that solves this problem or improves upon existing solutions. Hence, the research approach is methodologically closer to engineering disciplines and computer science than it is to traditional IS research.

From the beginning, the design research method has been considered to be complementary to the behavioral research methods. For example, March and Smith (1995) state in their research framework that the “build” and “evaluate phases” of a design research project (i.e., investigating how a solution can be achieved) are followed by the “theorize” and “justify” phases of a behavioral research project (i.e., investigating why the artifact contributes to the solution). Some authors even argue that behavioral research methods are inherent to the evaluation phase of design research (Peffers et al., 2007; Venable, Pries-Heje, & Baskerville, 2012), thereby taking into account the organizational context and the complexities in which IS research is conducted. Further, Gregor and Baskerville (2012) stress the interdependence of behavioral and design science research and even argue for a “fusion” model in which the knowledge flows between both research types are an important element of research cycles. Indeed, several examples can be found in the design research literature of how behavioral research can complement the design research process. For instance, regarding evaluation methods, case studies and field studies were mentioned by Hevner et al. (2004) and surveys, laboratory experiments, field experiments, case studies, action research and verbal protocol analysis were described by Siau and Rossi (2007). Regarding the problem identification and solution design phases, Saat, Winter, Franke, Lagerström, and Ekstedt (2011) employ online-surveys, exploratory factor analysis and hierarchical cluster analysis for supporting their problem identification, while Tremblay, Hevner, and Berndt (2010) use focus groups during the refinement of their artifact. Based on these examples, it is evident that there is a consensus in literature that behavioral research methods can be used as part of, and complement, a design research project.

Nevertheless, when analyzing design research papers which use behavioral research methods, it is strikingly to note the considerable variability in how authors report on the methodology and results of their behavioral study that is embedded in their design research study. On the one hand, some authors seem to consciously adopt a behavioral research perspective by citing the basic methodological sources on the behavioral research method that was used and by documenting the methodology of the behavioral research component (e.g., Arnott, 2006). On the other hand, other authors do not elaborate on the methodology of the behavioral component or do not cite the relevant behavioral research literature, thereby mainly focussing on the methodological aspects of the design research study and considering the behavioral research component to be a subsidiary part of the design research project (e.g., Albert, Goes, & Gupta, 2004). One of the possible reasons for this variability is that there is currently no framework that indicates how behavioral research methods can be used within a design research project. To address this issue, we propose to use a mixed methods approach to illustrate how behavioral and design research methods can be combined in a methodologically sound manner.

Mixed Methods Research

Mixed methods research originated in the social sciences. Within this discipline, the qualitative and quantitative research methods were the two major research traditions (Howe, 1988; Johnson &
Onwuegbuzie, 2004; Sale et al., 2002; Tashakkori & Teddlie, 1998). Quantitative research methods study social phenomena by primarily aiming to develop a mathematical or statistical model between measurable constructs based on numerical data from, for example, surveys. Qualitative research methods in the social sciences attempt to gain a rich and profound understanding of the studied phenomenon in its context by performing for instance observations or in-depth interviews. Given the different background and assumptions of both research methods, qualitative and quantitative research methods were considered to be mutually exclusive in the past and not to be combined in a single study as expressed by the so-called “incompatibility thesis” (Guba, 1987; Smith & Heshusius, 1986).

Notwithstanding this qualitative-quantitative debate, several researchers have argued that the difference between both research methods is not as large as often thought (Datta, 1994; Howe, 1988; Reichardt & Cook, 1979; Tashakkori & Teddlie, 1998). Calls for combining both research methods indeed date back a long time in social science research (for an overview, see Datta (1994)) based on the fact that many researchers do make use of both research methods, that both research methods share the same goal (i.e., understanding and improving the world), and that the complexity of some phenomena may simply require the use of multiple perspectives (Datta, 1994; Sale et al., 2002). This awareness has prompted some researchers to formulate the “compatibility thesis” (Howe, 1988; Reichardt & Cook, 1979). Underlying this approach is the requirement that researchers should choose appropriate research methods depending on the phenomenon under study. As such, it is accepted that – under certain conditions – qualitative and quantitative research methods can be combined in a single study, since this allows to combine the strengths of both methods. For example, quantitative research typically focuses on confirmatory research based on a large sample. The use of a subsequent qualitative study could provide more in-depth insight into the results of the quantitative study. This use of multiple methods is also considered to be a form of “methodological triangulation” in which the validity of the findings can be strengthened by using multiple perspectives to investigate a phenomenon (Morse & Niehaus, 2009; Reichardt & Cook, 1979). Sometimes claimed to be the third methodological movement (Johnson & Onwuegbuzie, 2004) (in contrast with qualitative and quantitative research methods), the use of mixed methods research is nowadays commonly accepted in the social science research community (Tashakkori & Teddlie, 1998), including educational research, sociology, management and organizational research. In information systems research, several authors have equally recognized that qualitative and quantitative research are not mutually exclusive, and that both can be combined (e.g., Kaplan & Duchon, 1988). Also here, it has been noted that the use of multiple research methods can lead to richer and more reliable results (Mingers, 2001), as illustrated in, for instance, Koh, Ang, and Straub (2004).

A mixed methods study essentially consists of two components. Each component corresponds to a study that is conducted using either qualitative or quantitative methods (Morse & Niehaus, 2009). There are three main factors that influence the design of a mixed methods study. First, the theoretical drive of the project refers to the overall conceptual direction of the research project (Morse & Niehaus, 2009). It indicates whether the overall character of the research is qualitatively-driven or quantitatively-driven. This theoretical drive therefore determines which component of the research is considered dominant in the context of the overall research project. This core component must be conducted at the highest standard of rigor to allow its results to be published alone (Morse & Niehaus, 2009). The other, supplementary, component is considered to be more limited in scope, of which the results may not be separately publishable (Morse & Niehaus, 2009). However, the supplementary character should not be considered as an excuse for performing research without the necessary rigor: the supplementary component must be conducted conforming to the rules and guidelines of its corresponding research method (Morse & Niehaus, 2009). Second, the pacing of the components refers to how both components are synchronized in the context of the overall research project (Morse & Niehaus, 2009). Two main modes of synchronization are available: concurrent or sequential (Creswell et al., 2003; Morse & Niehaus, 2009). In sequential research designs, the two components are conducted at different times and one project can be said to further build upon the results of the previous study (Creswell et al., 2003; Morse & Niehaus, 2009). In concurrent research designs, the supplementary component is conducted simultaneously with the core component. The supplementary

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component therefore starts and ends during, and is performed within the context of, the core component. However, both components are kept separate in terms of research questions, data collection and data analysis (Morse & Niehaus, 2009). Third, the point of interface refers to the stage at which the results from both components are combined or integrated (Morse & Niehaus, 2009). Typically, the most common stages at which integration takes place is during data analysis or data interpretation (Creswell et al., 2003; Morse & Niehaus, 2009).

4 Combining Design and Behavioral Research Methods

In the previous section, we discussed how the term mixed methods research has been used in literature to refer to the combination of qualitative and quantitative research methods since these are the two dominant research methods in social science research. However, we argue that the term mixed methods research can also be used for research designs that combine design research with behavioral (i.e., qualitative or quantitative) research methods. Mixed methods research is indeed essentially concerned with combining multiple research methods in a single study in order to investigate phenomena which cannot be fully accessed by only using one of the involved methods (Morse & Niehaus, 2009).

We will now propose a number of types of mixed methods research designs that combine both design and behavioral research methods. To describe these research design types, we will make use of a slightly modified version of the notation proposed by Morse and Niehaus (2009). We use the term “behavioral” to refer to behavioral research methods (i.e., either qualitative or quantitative research), and “design” to refer to design research methods. The research component with the theoretical drive is represented in uppercase. The pacing of the components is indicated by an arrow for sequential designs and a plus sign for concurrent designs. Based on the theoretical drive and the pacing of the research components, we can identify six general types of mixed methods research designs, namely two concurrent (i.e., DESIGN + behavioral and design + BEHAVIORAL) and four sequential (i.e., behavioral → DESIGN, DESIGN → behavioral, design → BEHAVIORAL and BEHAVIORAL → design) research designs.

Since the aim of this paper is to illustrate how the use of behavioral research methods can supplement a design research project, we will focus in the remainder of this paper on the designs in which the theoretical drive is provided by the design research method. In order to fully describe these mixed methods research designs, we must also consider the point of interface where both the behavioral and design research components meet and when the results of both research projects are integrated (Creswell et al., 2003; Morse & Niehaus, 2009). Concerning the concurrent research design, “DESIGN + behavioral”, we can distinguish between three different points of interface. Within the design research method, three major phases have been identified: problem identification, solution design and evaluation (Hevner et al., 2004; March & Smith, 1995; Peffers et al., 2007). The behavioral research component can be used to support each of these three phases in the design research effort and the integration of the behavioral and design research component can therefore take place at each of these three phases. With respect to the “behavioral → DESIGN” research design, the design research component further builds upon the results from the behavioral study and the point of interface becomes the interpretation phase of the behavioral research component. Concerning the “DESIGN → behavioral” research design, the behavioral component further builds upon the output of the design research component, were the point of interface becomes the “communication” phase (Hevner et al., 2004; Peffers et al., 2007).

We can therefore identify five specific types of mixed methods research designs that combine design and behavioral research methods and in which the theoretical drive is provided by the design research component. These five types of research designs are listed in Table 1. Our analysis illustrates how the use of behavioral research methods can be beneficial within the design research process. Further, we will also provide some examples of design research papers that use behavioral research methods in a similar way. It must be noted, however, that the ex-post classification of previous studies into our
types of research designs is not always a direct match. Hence, rather than claiming that these previous studies have – implicitly – made use of these five types of research designs, we want to illustrate that examples of research approaches similar to those we present in this paper, can already be found in literature.

First, in the *concurrent exploratory research design*, the pacing of both components is concurrent with the theoretical drive provided by the design research method. The point of interface is the problem identification phase of the design research component. As such, the behavioral research component in this setting may assist in the problem identification (i.e., the problem to be addressed by the future artifact) by clarifying the vague problem descriptions or looking for root causes. Hence, it is investigated *what* artifact should be developed. While both qualitative and quantitative research methods seem plausible for the behavioral component in this research design, qualitative research methods are more likely given the exploratory nature of the design. If the design researcher prefers to maximize the external validity of the results of the behavioral research component, the use of quantitative methods may be more appropriate. In literature, an example of this design can be found in Kolfschoten and de Vreede (2009), who developed an approach for collaboration engineering. These authors first conducted a survey among 200 facilitators to better understand the current way of working. Next, they continued by conducting interviews with 16 facilitators to gain a more in-depth understanding. Another example is provided by Saat et al. (2011), in which the authors conducted a quantitative exploratory survey among 174 respondents in 5 countries. By analyzing the results of the survey, the authors argued to better understand and define the problem for designing artifacts to assist in improving business/IT alignment.

Second, in the *concurrent creative research design*, the pacing of both components is concurrent with the theoretical drive provided by the design research method. The point of interface is the build phase of the design research component. As such, the behavioral research component in this setting may assist in the artifact development (i.e., data which can be used to refine the artifact in the next iteration of the build phase), especially in case when tacit knowledge is held by field experts which should be explicit to facilitate the artifact design. Also, one of the tenets of the design research method is that it emphasizes the use of insights from other fields. As such, the behavioral research methods can assist in the construction of an artifact by detecting patterns of successful actions in other – but similar – contexts. Hence, it is investigated *how* the artifact should be developed. Therefore, qualitative research methods seem most plausible as part of the behavioral component, given the aim of capturing in-depth information and insight. In literature, an example of this design can be found in Tremblay et al. (2010), in which the authors conducted exploratory focus groups (EFG) to assist in building an artifact for calculating data quality metrics for data obtained from OLAP queries from a data research process.

<table>
<thead>
<tr>
<th>Research design</th>
<th>Pacing and theoretical drive</th>
<th>Point of interface</th>
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<tbody>
<tr>
<td>Concurrent exploratory research</td>
<td>DESIGN + behavioral</td>
<td>problem identification phase of the design research component</td>
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<tr>
<td>design</td>
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<tr>
<td>Concurrent creative research</td>
<td>DESIGN + behavioral</td>
<td>solution design phase of the design research component</td>
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<td>design</td>
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<tr>
<td>Concurrent evaluative research</td>
<td>DESIGN + behavioral</td>
<td>evaluation design phase of the design research component</td>
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<td>design</td>
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<tr>
<td>Sequential exploratory research</td>
<td>behavioral → DESIGN</td>
<td>interpretation phase of the behavioral research component</td>
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<td>design</td>
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<td>Sequential explanatory research</td>
<td>DESIGN → behavioral</td>
<td>communication phase of the design research component</td>
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Table 1: *Mixed methods research designs with emphasis on design research process*
warehouse. By analyzing the feedback obtained from the participants, the researchers argued to be able to realize rapid incremental improvements in the design of their artifact.

Third, in the concurrent evaluative research design, the pacing of both components is concurrent with the theoretical drive provided by the design research method. The point of interface is the evaluation phase of the design research component. As such, the behavioral research component in this setting may assist in determining whether the artifact provides a good solution for the observed problem. Hence, the behavioral component is fully contained in the evaluation phase of the design research, as generally accepted in design research literature. Consequently, it is investigated to which extent the developed artifact meets the predefined criteria. Both qualitative and quantitative research methods seem plausible for the behavioral component in this research design: qualitative research methods are more suitable in case the researchers wish to obtain feedback from a limited number of experts, whereas quantitative research seems more appropriate if one’s aim is to maximize the external validity of the study. Numerous examples of the use of behavioral research methods to support the evaluation of an artifact can be found in literature. We briefly mention here Tremblay et al. (2010), who conducted confirmatory focus groups (EFG); Arnott (2006), who performed a participatory case study; and Albert et al. (2004), who used a case study.

Fourth, in the sequential exploratory research design, the pacing of both components is sequential whereby the behavioral research component is followed by the design research component and the theoretical drive is the design research method. The point of interface is the interpretation phase of the behavioral research component. As such, empirical data is gathered to explore and describe a certain phenomenon before the design research component is initiated. While both qualitative and quantitative research methods are possible in this research design, qualitative research methods might seem more obvious given the exploratory nature of the design. Nevertheless, in order to obtain input from a large population considering phenomena, quantitative research methods, such as a survey, may be appropriate as well. While this research type may seem rather similar to the concurrent exploratory design, the latter primarily focuses on a given and chosen phenomenon. In contrast, a sequential exploratory research design could for example consist of a more general behavioral research regarding a set of relevant problems or issues in a certain domain, preceding the actual design research. In literature, an example of this design can be found in Rothenberger and Hershauer (1999), in which the author’s initial aim was to follow a case study based approach to study how project-level factors impact software reuse. As no suitable reuse measures could be found in literature, the author decided to initiate a design research study to develop such relevant reuse metrics. As such, the findings of their behavioral literature study were taken as an input for the design research study.

Fifth, in the sequential explanatory research design, the pacing of both components is sequential whereby the design research component is followed by the behavioral research component and the theoretical drive is the design research method. The point of interface is the communication phase of the design research component. As such, empirical data is gathered for developing and testing a theory, with the developed artifact as object of investigation. This is consistent with the research design described in the framework of March and Smith (1995). It is important to differentiate this research design from the concurrent evaluative research design. In the concurrent evaluative research design, the behavioral research component is contained within the design research component (i.e., the “evaluate” phase of March and Smith (1995)), while the behavioral part of the sequential explanatory research design should be situated in the “theorize” and “justify” phases of March and Smith. Hence, in the latter research design it is investigated why the artifact contributes to the solution. Both qualitative and quantitative research methods are possible in this research design, depending on the specific research question that is guiding the behavioral research component. While research examples were provided by March and Smith (1995), we were not able to find such research design presented in one integrated project. However, an obvious application of this research design could consist of a design research component that is followed by an adoption study to investigate whether, why, or how the artifact is adopted and used in practice. In the design research component, a given artifact can be developed for an organization (e.g., a software application or methodology). The behavioral study
could consist of an application of the Technology Acceptance Model by distributing a quantitative survey across all employees of the organization to determine whether employees intend to use the developed artifact. Indeed, although an artifact is evaluated as part of the design research component and therefore provides a solution to the identified problem, this does not guarantee its adoption in practice (Fichman, 2000). Hence, by conducting a behavioral research component, insight could be gained into why the artifact may (not be) used in practice.

5 Discussion

In the previous section, we described how design and behavioral research methods can be combined by using a mixed methods approach. Although mixed methods is a well-known approach in literature, the use of a mixed methods approach to combine behavioral (i.e., qualitative and quantitative) research methods with design research methods has not been described in literature yet. Therefore, this paper has two important contributions.

Our first contribution is that we have used the mixed methods literature to provide a framework of how behavioral research methods can be embedded within a design research study in a coherent manner. By using the term mixed methods, a more explicit awareness is raised with design researchers that research approaches and techniques are borrowed from the behavioral research methods. This should have two positive consequences. A first consequence is that the behavioral research component may be conducted in a more rigorous manner. When conducting mixed methods research, it is important to adhere to the methodological guidelines and quality standards of the respective research method of each component. However, given the generally limited resources, the supplementary component should not be considered as a complete and independently publishable research project, and subject to some relaxed criteria for assessing the rigor of the study. Rather, the study should be conducted up to the point that the researcher has the data to reliably and confidently answer his or her research questions. For instance, no theoretical saturation needs to be reached within qualitative studies, and less powerful statistical tests (i.e., nonparametric instead of parametric tests) can be performed within quantitative studies. However, we emphasize that design researchers adopting behavioral research methods and approaches (e.g., case studies) in their study should still adhere to the involved guidelines and assumptions (e.g., the use of theoretical sampling). Finally, if the behavioral component is conducted in a more rigorous manner, this can also have a positive effect on the rigor of the overall design research study such as a more confident problem identification and artifact validation. However, it is important to note that the design research component should still be conducted according to the guidelines of the design research method. We therefore do not argue for applying the methodological guidelines from the behavioral research methods to the design process as a whole. The creative inspiration which is needed for successful design decisions cannot be subjected to rigorous requirements. As a result, when a behavioral research study is conducted to supplement a specific phase of the design research process, the methodological guidelines of the behavioral research methods should only be adhered to within the context of the behavioral component.

A second consequence of this framework is that it may expose the researcher to a larger set of behavioral research approaches and techniques for data collection and analysis. Although the use of several behavioral research approaches and techniques have been suggested in literature, design researchers should be aware that they can use the full range of research approaches and techniques available in the qualitative and quantitative research methods. Some of them may not be very well-known to design researchers and may offer interesting new opportunities for future research. For example, when the researcher is concerned with understanding how an artifact may contribute to the solution of a problem experienced by employees in an organization, the use of observation as a data collection technique may be an interesting alternative or addition to the use of interviews. However, we are not aware of any design research study that makes use of this technique. Similarly, the use of quantitative research methods is not used that often in design research to evaluate artifacts. We therefore want to encourage design researchers to better explore the various options available to them.
when deciding on the use of a specific research method, approach, and technique when making use of behavioral research methods.

Our second contribution is that we have described five types of mixed methods research designs that design researchers could use as a basis to construct their own future research designs. The specific research designs used by researchers can therefore be considered instantiations of the research design types presented in this paper. The five types of research designs were constructed based on the principles of mixed methods research within context of design research. In general, all mixed methods research designs can be described in terms of three characteristics: the theoretical drive of the project, the pacing of the components, and the point of interface where both components meet. When describing a mixed methods research design, researchers should at a minimum discuss these three characteristics. One advantage of the five types of research designs presented in this paper is that they provide a common vocabulary. In addition, these research designs may provide ideas and suggestions to design researchers on how they can include behavioral research methods in their study by using a mixed methods approach. The research designs therefore have the potential to provide a foundation for a new line of research designs within the design research discipline.

5.1 Practical Issues in Mixed Methods Research

Notwithstanding the fact that the use of a mixed methods approach to design research offers a number of opportunities, there are also a number of practical issues concerning its use.

A first issue concerns the time and financial resources available to complete the study. In virtually all research studies both resources are limited. If a supplementary behavioral study is conducted as part of the design research project, the overall cost, effort and the time required to complete the project will increase. However, since the supplementary behavioral study is not considered complete, it does not have to be conducted as extensively as a stand-alone study. This raises the question of how far a design researcher should go in conducting this behavioral study in terms of methodological rigor and completeness. The mixed methods literature recommends to conduct a supplementary study to the extent that the researcher has the data to reliably and confidently answer his or her research questions (Morse & Niehaus, 2009). Researchers should therefore strive towards obtaining a minimally acceptable level of rigor to defend the behavioral research component. Evidently, the more complete the behavioral component is conducted, the more rigorous the study becomes and the more valuable the behavioral study in itself will be. Design researchers should therefore attempt to strike a balance between the benefits this additional effort may offer them and the additional resources that are required to complete the study.

A second issue concerns the background of the researcher. We have argued that the supplementary behavioral component should be conducted according to the guidelines and assumptions of the behavioral research methods. This requires that the researcher has knowledge of both design and behavioral research methods. Given the fact that the supplementary component does not have to be complete, the researcher does not have to be an expert in the use of behavioral research methods. Nevertheless, he or she still needs a sufficient working knowledge and some knowledge of behavioral research methods should be present within the research group.

A third issue concerns the selection of the mixed methods framework presented in this paper or other frameworks which extend the “traditional” design research methods, such as Action Design Research (ADR), as proposed by Sein, Henfridsson, Purao, Rossi, and Lindgren (2011). ADR presents a research method which, when compared to traditional design research methods, is more firmly embedded in organizational reality, and could therefore be considered to be similar to the mixed methods framework. However, significant differences between both frameworks exist. The research design types we introduced adhere to traditional design research methodology, since we selected design research as the theoretical drive. As a consequence, a behavioral component needs to be embedded within a single design research phase (following the stage-gate model as described by Sein
et al. (2011)). An essential element of the mixed methods framework is the identification of the point of interface between the research components. In ADR, the build and evaluate phases are combined in a building, intervention and evaluation phase and as such, a point of interface cannot be defined. Additionally, a mixed methods research design does not necessarily adhere to the ADR method, since the researcher can merely act as an observer, without intervening in any organization. Therefore, we adhere more to the view that action research can be considered as a qualitative research method (Baskerville & Wood-Harper, 1998), instead of an alternative for design research (Järvinen, 2007). This role of action research has been acknowledged by other design researchers as well (Iivari & Venable, 2009). Moreover, embedding action research within its own research component allows a researcher to respect the paradigmatic differences between action research and design research (for an overview, see Iivari and Venable (2009)).

A final issue concerns the publication of the results of mixed methods studies in academic journals. In case a mixed methods research design is used, the researcher should report on the results and methodological aspects of both studies. This may be a challenging task since the large majority of journals in the IS field offer limited space to describe the results of research studies. As a result, it may not be possible to elaborate in full on the research methodology and results of the supplementary behavioral component. There are, however, two possible solutions. First, in case a sequential research design is used and the supplementary component is conducted in a complete way, the results of both studies could be published in two separate papers. A disadvantage of this method is that the combined view of using both research methods may be lost. In that case, it is recommended that the second paper provides a holistic discussion in which the results from both studies are elaborated upon. A second solution can be found in the recent evolution towards electronic publishing. Most journals that are published electronically do not have strict limitations concerning paper length. Some paper-based journals also offer the possibility to submit an electronic appendix that provides additional details on the study. Researchers could therefore decide to submit to such journals to allow them to describe their results in more detail.

5.2 Future Research

This study provides several opportunities for future research. First, future studies can focus on identifying other types of mixed methods research designs that combine design and behavioral research methods. The five types of research designs we have identified in this paper are not the only possible research designs. Since we only elaborated on those research designs in which the theoretical drive was provided by the design research method, future studies can construct mixed methods designs in which the theoretical drive is provided by the behavioral research method. In addition, we encourage researchers to be creative in developing additional types of mixed methods designs. For example, it is also possible to combine some of the five mixed methods research designs. A combination of the concurrent exploratory and concurrent evaluative research designs is conceivable in which behavioral research methods are used in both the problem identification and evaluation phase of the design research process. This could possibly even be combined with a sequential explanatory design to conduct a study on explaining why the designed artifact works.

Second, researchers can use the five types of research designs presented in this paper as a basis to construct their future research projects, thereby creating instantiations of these types. We further encourage researchers to make use of an as diverse set of behavioral methods, approaches, and techniques as possible, thereby introducing novel and original approaches to the design research discipline.

6 Conclusion

It is accepted in literature that behavioral research methods can be used as part of a design research project. Unfortunately, there are no clear guidelines on how both research methods can and should be
combined. We addressed this issue by describing how the mixed methods approach can be used to combine design and behavioral research methods. Our study has two main contributions. First, we have built upon the mixed methods literature to provide a framework of how behavioral and design research methods can be combined in a single design research study in a coherent manner. Second, we have described five types of mixed methods research designs that design researchers could use as a basis to construct their own research designs. Although the idea of combining design and behavioral research methods is not new, we hope that a mixed methods approach will draw more attention to the methodological implications of using behavioral research methods. More specifically, it can help in making the researcher more aware of the guidelines and assumptions associated with the behavioral research methods they intend to use. In addition, we hope that design researchers may become exposed to a richer set of behavioral research methods that can be used as part of a design research project, thereby resulting in novel and original approaches in design research. Researchers that choose to adopt a mixed methods approach should, however, be aware that there are some practical issues involved in this process and that the use of mixed methods can sometimes be a challenge. Nevertheless, these issues can be overcome, and we hope that the mixed methods approach will be adopted by other design researchers, thereby building upon the approach described in this paper.

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