The Artifact's Theory – A Grounded Theory Perspective on Design Science Research

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ABSTRACT
The need for theoretical work in IS research has been pointed out frequently in past discussions on the cumulative tradition of our discipline. In order to distinct IS research from adjacent fields, the practice of designing artifacts plays a crucial role. On the one hand, the construction and evaluation of new and innovative artifacts solving real world problems is the core of our discipline. On the other hand, this designing aspect of IS research has been accused of not being linked sufficiently to theoretical considerations in the past. To help IS design researchers to address this challenge, our paper analyzes research generating theory based on the Grounded Theory Method. By identifying, analyzing, and reviewing such research we identify some process characteristics of grounded theory building that can help IS researchers to improve their design processes to also yield theoretical output. Thus, we aim to make an IS design researcher's work clearly distinguishable to the work of a software developer or a consultant. By also discussing the role of theory in this context, we intend to make a case for more theoretical work in IS design research.

Keywords
IS theory, grounded theory, design science, theory building.

1. INTRODUCTION AND MOTIVATION
The role of theory in scientific discovery is paramount. Providing a concise account of the "what, how, and why" of phenomena [119], theories offer the basis for the description, explanation, and the prediction of these. Moreover, theories can be used to facilitate the accumulation of knowledge over the course of scientific discovery. Such a cumulative tradition helps disciplines to advance their understanding of the subjects under investigation and to make that knowledge applicable in practice [66, 106]. Examples for the centrality of theories can be found in both the natural sciences (e.g., physics) and the social sciences (e.g., sociology and psychology) [1]. Beyond the documentation and accumulation of knowledge, theory is also a vehicle that can inform and guide the discovery and creation of new knowledge.

While natural sciences aim to generate universal laws and statements [85], generating theory in the information systems (IS) field is a particular challenge in light of permanently new and innovative technologies and a persistently changing attitude of users towards the application of that technology [49, 51]. In its young history, the IS discipline has earned harsh critique as some have described the investigation of information systems as a "mishmash of fuzzy thinking and incomprehensible jargon" [19, p. 90]. Put in less provocative terms, only few IS-specific theories have emerged [9]. Quite contrary, many of the phenomena observed in IS research have been explained using theories from neighboring disciplines such as sociology or psychology on the behavioral side and computer science or engineering on the technical side [3, 45, 91]. While this can be interpreted as a sign for the relevance of IS research by integrating knowledge at the intersection of its adjacent disciplines, many scholars – IS and non-IS – have complained about the lack of an IS-specific cumulative tradition of theory and emphasize the importance of generating IS-specific theories [e.g., 60, 116, 123]. Reasons for the importance of such powerful, general IS theories are the need for domain identity [6, 7], the legitimacy of the IS field in comparison to its neighboring disciplines [33, 69], and the "race for credibility" in the scientific discourse [115].

In this paper we take up the stance that IS has developed rapidly over the last decades and that IS research, as a discipline at the intersection of social, technological, and design sciences, has developed its own unique understanding of theory. This seems to be true more than ever when taking the discipline's recent turn towards the science of the artificial into account [95], that is, the paradigm of design science research (DSR). While the idea of DSR does already have a long-standing tradition in IS [e.g., 36, 70, 77, 114], this orientation of research on IS artifacts has experienced a huge surge in popularity following the seminal article by Hevner et al. [50]. While the approach has been refined in intense discussions [e.g., 2, 37, 54, 83, 120], researchers conducting DSR still face the challenge to show their theoretical contribution [89]; a particular challenge when trying to publish in some of the premier international journals of our discipline. Some describe DSR's missing link to theory as the largest issue of this research approach [83], probably because a designed artifact is mostly an individual or local solution of a specific problem [48, 79].

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One recent approach to address this challenge has been introduced by Gregor [47]. She suggests that design could and should be understood as a science of the artificial and continues to explain what this implies for DSR and its theoretical contributions. The discussion tries to aggregate some of the disciplines considerations with respect to design theories at the theoretical heart of each artifact [46, 58, 86]. While these approaches aim at explaining the role of theory in designing, the question of how to explicitly integrate theoretical work into design endeavors remains largely under-investigated. One promising approach is using the grounded theory method (GTM), originally suggested by Glaser and Strauss [39]. For instance, Goldkuhl [43] suggests that design theories should be inherently grounded in the context of artifact development. Summarizing earlier discussions, Gregory [48] compared the paradigms of DSR and GTM. While he points to some important differences, he suggests that DSR and GTM do, indeed, have similarities that make the latter a promising candidate to overcome some of the theoretical shortcoming of the former and offer a basis for a comparison and integration of the two.

Building on the current discussion on theories in IS research [e.g., 45, 60, 116], our paper aims at investigating how theories can originate in IS research, specifically in the DSR context. To do so, we look at GTM as a potential source of IS-specific theories in a design project. As theories originating from a GTM-approach in an IS setting are likely not influenced by a priori use of theoretical considerations from outside the discipline, they provide a good opportunity to observe IS-specific generation of theory. In the long run, we believe that our research contributes to a common understanding of the role IS-specific theory plays in the investigation of the phenomena we study as a discipline; in short, what role *can, should* or *must* theory play in IS design research?

IS design researchers – especially young ones looking for tenure – seem to be in a publication challenge, that is, they need top-ranked publications to get tenure while top ranked journals still do not seem to treat design based research as equally valuable. As mentioned above, we will not address this topic in detail. However, in order to increase the chances of getting design based research published in leading international journals, we will look at GTM-based research that has been published in some of the top-ranked international journals of the IS discipline. We intend to use the analysis of this particular sample to understand some of the specificities of grounded research – both with respect to the research process as well as with respect to developing its theoretical contribution – that could help to make DSR a more successful contribution to the theoretical discourse of the IS community.

To approach this question, our paper is structured as follows. In the following two sections we have a brief look at theory in IS research in general and grounded theories in particular. Section four outlines our research design and discusses the assumptions of our literature review. Section five summarizes the results and provides a first interpretation. Based on these results, sections six and seven introduce our conclusions with respect to GTM's possible implication for DSR. The paper closes with an outlook on future research opportunities and a discussion of our current research's implications and contributions.

2. THE CONSTITUENTS OF THEORY

A first step towards understanding theory and its role in DSR is looking at the constituents of IS theory itself. Some authors have identified this as a rather challenging task since defining "theory" per se is not trivial [9, 34, 98, 116]. Looking at the literature from our adjacent fields, much emphasis is placed on concepts and their relations. In their seminal article on theory, Sutton and Staw [98] highlight the need to identify concepts and causal arguments in order to produce strong theory. In their review of various approaches to theoretical understanding in the IS field, Burton-Jones et al. [9] also highlight these constituents. Gregor [45] offers a broad discussion of theory in IS and identifies a set of constituents common to all theories. She concurs with the identification of constructs and relationships and adds the means of representation and the scope of a theory. Kaplan [56] points to theory's ability to explain why certain (empirical) patterns occur when a phenomenon is observed. Whetten [119] adds to this by suggesting that theoretical contributions go beyond the mere description of the what (i.e., concepts or constructs), but will specifically discuss the how (i.e., conceptual arguments) and why (i.e., causal arguments). This is also supported by Sutton and Staw [98] who emphasize that strong theories discuss the nature of causal relationships and identify their timing. Glaser and Straus [39] underline the importance of explaining why certain findings are observed. They describe the purpose of theory as to enable prediction and explanation of behavior and to support a discipline's theoretical advance.

Beyond constructs and relationships – closely related to the property of enabling predictions – the literature highlights the attribute of being falsifiable or testable as an important characteristic of theories [23]. Looking at the components of theory, Gregor [45] suggests that this property, however, is contingent on a theory's purpose. By looking at the interrelationships among theory types, she suggests that this characteristic seems to be more important for theories that go beyond the analysis and explanation of phenomena. These are two of the five types of theory that Gregor [45] introduces in her seminal work on the nature of theory in information systems research. Beyond these, called type 1 and 2 respectively, she describes theories of prediction (type 3), explanation and prediction (type 4), and analysis and design (type 5).

Across all theory types, Glaser and Straus [39] require a theory to be usable in solving practical problems. This indicates a link between the domain in which theory is deployed and the domain of the empirical and theoretical analysis underlying it. This is a property closely related to some of the basic characteristics of DSR [48, 120]. Artifacts are seeking solutions to real world problems which they are then directly related to [58]. Thus a closer look at the research approaches of GTM might help to identify some practices that could also be used to address the alleged theoretical shortcomings of DSR.

3. DEVELOPING GROUNDED THEORIES

In order to understand IS theories and how they are built, we want to look at theories that emerge from IS-specific research as a source of inspiration. Urquhart et al. [105] suggest that GTM is a good source for theories originating in the IS field. As one of the most renown techniques to generate theory, GTM was introduced through the work of Glaser and Strauss [39]. Later, GTM developed in two schools of thought [72]: an approach suggested by Strauss and Corbin [96] which focuses on the process of building grounded theories and a conceptualization advocated by Glaser [41] which is focused more on the underlying theory itself.

In the origins of GTM, Glaser and Strauss defined it as "the discovery of theory from data – systematically obtained and analyzed in social research" [39, p. 1]. The systematic approach to theory

development they suggested is characterized by a deep immersion in the empirical data on a given phenomenon of interest. The researcher then engages in an iterative process of discovery and formalization in which theoretical sampling leads to the addition of more and more "slices" of empirical data. This process continues until the theoretical categories under investigation and their properties are theoretically saturated, that is, additional empirical data does not lead to a change or extension in the new theory. The results are theories grounded in empirical observations that explain the relationships between the theoretical categories constituting a phenomenon. In a recent review of GTM literature, Urquhart et al. [105] identify four general characteristics of GTM: (1) focus on building theory, (2) no pre-formulated hypotheses, (3) joint data collection and constant comparison, and (4) theoretical sampling producing "slices of data."

Applications of GTM to build grounded theory (GT) are generally found in the context of qualitative research [76]. However, GTM is not just a description of how to code data but an approach to build theories. As such, GT is paradigmatically neutral [42] and, as a method, not bound to any prevailing ontological or epistemological position [105]. As an approach to investigate IS-related phenomena and to build respective theories, Scott [92] finds that GTM has reported strengths that qualify it to be employed in the process of scientific discovery in our discipline. For some time, IS scholars have engaged in a discourse on the right usage of GTM in IS research and how to maximize its potential to build GTs [e.g., 8, 103, 105]. They develop guidelines on working with GTM in the context of, for example, case studies [11] or action research [20]. While there are first steps towards an analysis of GTM in the context of design research [48, 89], a detailed analysis of what can be learned from GTM for DSR is missing as yet.

Taking this brief profile of GTM research into account, it seems like an interesting candidate to address our research question. In looking at GTM, we hope to identify practices and examples that illustrate GTMs potential to help with theory building in DSR, thus increasing DSR's theoretical contribution. We regard GTM to be a source of inspiration that provides an analogy for how the development of theories in a DSR-context can look like. Relevant work should therefore go beyond the mere use of GTM as an instrument for coding data [8] and should provide some form of a theoretical account [as, for example, described by the theory types identified in 45]. We thus design our research to identify papers that reflect these properties and do produce IS-specific GTs in order to look at what we can transfer to DSR research.

4. RESEARCH DESIGN

To identify such papers, we chose to review relevant publications from the IS discipline. In structuring our review, we rely on established guidelines for reviewing and synthesizing literature [12, 32, 117]. Literature reviews have been identified as a well suited approach to provide an overview of current work on a given concept in a series of disciplines [21, 75]. Especially their ability to aggregate and facilitate current knowledge as a basis for building new insights has been pointed out [102, 108].

For our work, we have reviewed the extended AIS senior scholar's basket of scholarly journals [90] known as the 'basket of eight.' The reason to focus our work on these eight journals is their acknowledged quality and their centrality in the international IS discipline. They are also likely to provide insight into what editors of these journals are looking for in a grounded theoretical contribution which we regard to be a good proxy for understanding the requirements towards DSR's expected theoretical contributions. All journals in the basket were covered from their first issue to the most recent issue available in the respective electronic databases (EBSCO, ScienceDirect, JSTOR, AISeL, and Ingenta-Connect). We also used the homepages of the respective journals or publishers (e.g., Wiley and Palgrave Macmillan) to ensure completeness and reliability of our search. Within the databases we conducted an extended search for articles that contain the phrase "grounded theory" in their title, abstract, or keywords. The rational for this approach is to exclude articles that only refer to GTM superficially or extend work of a previous article that was based on GTM. The resulting 27 articles were included in our detailed review and are listed in table 1.

Table 1: Overview of the articles reviewed in details

Journal	**Papers**
European Journal of Information Systems (EJIS)	[35, 109, 121]
Information Systems Journal (ISJ)	[10, 44, 57, 68, 93, 94, 105]
Information Systems Research (ISR)	[53]
Journal of the Association for Information Systems (JAIS)	[17, 20, 88, 110, 112]
Journal of Management Information Systems (JMIS)	[18, 82, 92, 122]
Management Information Systems Quarterly (MISQ)	[65, 78]
Journal of Strategic Information Systems (JSIS)	[55, 84, 99]
Journal of Information Technology (JIT)	[81, 113]

With these articles at hand, each author went through the papers separately. This review was conducted to assign the papers to one of three groups: (1) papers that use GTM to actually build GT, (2) papers that use GTM or elements of the method but do not build GT (e.g., work with a priori theoretical considerations or provide detailed empirical accounts of a phenomena using coding element of GTM), or (3) papers that deal with GT or GTM from a methodological standpoint [4, 49]. Aggregating our analyses, a total of 4 papers (out of 27) were rated differently by the authors. Primarily, we disagreed with respect to the categorization of papers in groups 1 and 2, that is, when to recognize a paper as such that actually contributes to the disciplines theoretical body. A joint discussion on the methodology – that is, the standards of our groups – and an additional review of the papers allowed us to resolve the discrepancies, ensured inter-rater reliability [100], and enabled aggregation of the results.

Looking at this methodological approach, we want to highlight an important property of our review: In the context of this report, the literature we sampled is not intended to be an exhaustive account of all the IS studies that follow GTM or that build theory. As mentioned in the introduction, instead of a complete overview and classification of such publications, we rather intend to select a set of exemplary articles that help us understand how theoretical contributions can be build from scratch in the context of IS research as an indication of how to extend current DSR approaches.

This leads us to acknowledge a set of limitations of our approach that might have an impact on our intended contribution. With

respect to the selection of journals we have chosen, we are aware that they are not all of the same age and have different target groups. This means that they are likely to show variances with respect to the number and nature of GTM-based papers they published. Focusing on the basket of eight is a limitation, too. With respect to journals outside the basket of eight, especially the Journal of Information Technology Theory and Application (JITTA) as well as the Scandinavian Journal of Information Systems (SJIS) published GT and GTM research. While such papers are not included in our review, we draw on their contributions to inform our approach and in our discussion and analysis of the review [e.g., 8, 43, 80, 103]. Beyond the journal-related issues, also our sampling of GT/GTM articles impacts our findings. First, some of the journals also published articles using GTM or producing GT in IS that are not labeled so in their titles, abstracts, or keywords [e.g., 30, 59, 87]. For reasons of consistency of our search criteria and overall feasibility of our study we decided to not include these in the review. However, we believe that this does not adversely impact our sample due to its exemplary nature. Finally, even though we conducted the analysis of the articles separately and read all papers carefully to ensure inter-coder reliability, a categorization of our colleagues' work always leaves room for potential misinterpretation or individual bias.

5. RESULTS AND DISCUSSION

In a first step, we reviewed the 27 articles that fall within the search criteria we defined to group them with respect to their theoretical contribution (table 2).

Table 2: Overview of the groups of GTM-articles

Journal	Gr. 1	Gr. 2	Gr. 3	#
EJIS	-	[35, 109, 121]	-	*3*
ISJ	[44, 93]	[10, 57, 68, 94]	[105]	*7*
ISR	-	[53]	-	*1*
JAIS	[17]	[20, 88, 110, 112]	-	*5*
JMIS	[18, 82, 92]	[122]	-	*4*
MISQ	[65, 78]	-	-	*2*
JSIS	[84]	[55, 99]	-	*3*
JIT	[81, 113]	-	-	*2*
Total	**11**	**15**	**1**	***27***

Group 1: papers that use GTM to build GT
Group 2: papers that use GTM or elements of it but do not build GT
Group 3: papers with a methodological viewpoint on GTs or GTM

To refine our observations, we extended our analysis of the theory building papers (group 1) by looking at the kind of theory they provide. We draw on Gregor's [45] discussion of the nature of theories in IS to distinguish between theories for (1) analysis, (2) explanation, (3) prediction, (4) explanation and prediction, and (5) design and action. This allowed for deeper insights into the theory building publications. As shown in table 3, all five types of theory were present with a noticeable peak of type 2 publications, that is, papers concerned with theories for explanation.

Table 3: Classifying group 1 based on Gregor [45]

Theory of …	Papers
… analysis	[93]
… explanation	[17, 65, 78, 82, 84, 92]
… prediction	[81]
… explanation and prediction	[18]
… design and action	[44, 113]
Total	**11**

Overall, our review shows that only one of the 27 papers from the basket of eight deals with GT/GTM from a methodological standpoint (group 3). Within the group 1 papers, over half the papers that actually build theory produce theories for analysis or explanation of a phenomenon. Only four papers out of the 27 we reviewed provide theories that allow for predictions of some kind, inform the design of artifacts, or prescriptively guide actions. Even more surprising, 15 out of the 27 papers we reviewed only revert to GTM as a methodology but do not explicitly use it to build theories. Most of these papers go to great length to provide detailed empirical accounts or use GTM to code data to work with a set of pre-established hypotheses. While some would argue that the latter is a misconception of GTM altogether [97], we feel that all of these papers provide rich insight into the phenomenon they study and that the application of GTM allows for a deep emersion in the materials the authors analyze. Nevertheless, none of the papers in this second group of our review made an additional effort in framing its results in a way that would make it an explicit theoretical contribution to IS research in its own right.

In the context of our investigation our primary interest are the papers published in group 1. As stated before, group 1 contains papers that actually build theory that is grounded directly in empirical observations from an IS-specific context. Through our analysis of these papers we made two interesting observations. First, only few of these papers explicitly express that they are producing theory. Based on a thorough analysis of their empirical work, most papers aggregate their findings into an abstract representation that summarize the factors and relationships the authors identify in their work. Only few of them state the theoretical nature of their findings. Second, and possibly related, all of the group 1 papers produce theory in a very specific context. While this has impacts on their generalizability [62], they still qualify as "early" or "small" substantive theories which describe a specific area of inquiry [45]; a property quite related to theories that are likely to emerge from a specific design's context.

6. THE THEORY BUILDING PROCESS

Glaser and Strauss [39] highlight that any interesting observation or lived experience can be a source for empirical material to build a theory with – a GTM characteristic that seems to be especially suitable for design science projects since the DSR paradigm makes similar assumptions.

Looking at the group 1 papers, the authors of the studies we analyzed all use their detailed empirical material to gradually define and refine their theoretical understanding of the phenomena they study; as suggested by GTM [39]. Some authors use an initial review of relevant literature to inform and motivate the research [17, 18, 65, 82, 84, 92, 93].These reviews are, however, not designed to develop an a priori understanding of the phenomenon, but to frame the context of the research and enable the researchers to focus their attention in the field. Thus, such a review is not a violation of the GTM principles [22, 104] and could also help researchers to better frame the problem they are trying to solve and to identify the relevant problem aspects and how an IS artifact would support their interaction.

Looking at the sources of empirical data used to generate theory, all of the studies rely on either open or semi-structured interviews. Going beyond this, some studies also use documented informal

discussions [44, 82] during their time in the field as a source of data extending the official statements gathered during the interviews. Follow ups (e.g., via telephone) for clarification [44, 82, 113] are also an established approach to increase the validity and reliability of observations. Participant observations [18, 44, 78, 82, 92] or analytical field notes taken by the researcher [65, 84] can be another important instrument to ensure that the researchers have gathered information comprehensively and exhaustively. Some studies also used strategies beyond the immediate interactions of the subjects in the field. An example is the analysis of both internal and external documents [44, 78, 84, 92]. Such an analysis can also include various press releases [17], blogs [17], or records of meetings [18], even though these sources were less prominent in our sample. The same is true for the use of questionnaires to gather additional information from study participants [18] or the implementation of focus groups [81]. Within the studies we analyzed, action research or action learning [82] were not used frequently. With the data at hand, one study summarizes its observations as a concise case study [65] in which the authors are developing a comprehensive narrative that incorporates all their data and observations from the field. With respect to DSR, we think that all of these strategies are currently used in the context of (software) design. While the materials are often used to identify requirements or to conduct evaluations, they could easily be leveraged to also identify underlying theoretical considerations.

Looking at the way data was analyzed to support theory building some studies follow the Straussian strand of GTM [13, 96, 113] and use respective coding schemes [17, 82]. Other studies use more general inductive-hypothetic research strategies [18, 44, 78, 84, 92]. All the studies used intertwined data analysis and theory building. Some had rather short cycles in which both occurred almost simultaneously (e.g., after each interview individually), others relied on a more granular approach by abstracting their findings towards theory only after one instance had been completed (e.g., theoretical analysis of the materials only occurred after one entire company had been captured).

With respect to actually building the theory, the studies mostly followed a process theoretical understanding. The authors used their empirical materials and their understanding thereof to identify causes, contexts, intervening conditions, actions, interactions, and the consequences of phenomena [17, 18, 44, 65, 78, 81, 82, 92]. With respect to the framing of these results, the studies differed according to the type of theory they develop. While some only focus on a deep analysis and description of the problem [93], others use their theoretical understanding to give advice to future system designers [17]. Either the insights were used as an extension of existing theoretical models [18] or the improved understanding of processes and their context was used to suggest an own conceptual framework [44, 65, 78, 81, 82, 84, 92, 113]. Some authors even go beyond the mere description and make recommendations on how to improve these processes [44, 113].

Beyond the 11 group 1 papers, especially the group 3 paper by Urquhart et al. [105] is of particular interest when analyzing how to enrich DSR using GTM. The authors are providing very detailed and elaborate guidelines on how to conduct GTM-based research in IS and offer an up-to-date view on important methodological publications and examples of IS studies using GTM.

Table 4: The emergence of a grounded theory

Stage	**Purpose**
Codes	Identifying anchors that allow the key points of the data to be gathered (open coding)
Concepts	Collections of **codes** of similar content that allows the data to be grouped (axial coding)
Categories	Broad groups of similar **concepts** that are used to generate a **theory** (selective coding)
Theory	A collection of explanations that explain the subject of the research

Taken altogether, table 4 shows how GTM can be understood as a process of carving out the theory form observations while collecting and coding of data occur simultaneously. By adding additional observations, mere descriptions of single observations (codes) gradually become more general (concepts and categories) until, ultimately, a theory emerges [e.g., 105]. Beyond the methodological literature on GTM in a general context [e.g., 13, 41, 96], there also is some literature that suggests guidelines for techniques and application and provides practical examples of IS-specific GTM research [c.p., 74, 105]

7. THE ROLE OF THEORY IN DSR

Looking at the group 1 articles to better understand how they create theory and what the role of theory in their projects is reveals some interesting patterns. Reverting back to the principal understanding of a theory's components and comparing it to the results of our review, we believe that theories are going through a process of maturing as they help IS researchers to document and accumulate knowledge. Such a process in which theories are maturing is not uncommon in other disciplines. Holström et al. [52] suggest a similar process in operations management research and in the administrative sciences, van Maanen [107] highlights the need for a strong basis of descriptive narratives before being able to build strong theories. But, as Mintzberg points out [73], data alone does not generate theory, only researchers do. Quoting Weick [118], Sutton and Staw [98] highlight that knowledge grows by extension and that providing accounts of small but comprehensible events is a chance to build cumulative theory. We believe this to be a good link to DSR. At first, designs of an artifact are likely to be isolated, single possible solutions to an individual real-world problem [48]. Repeated instantiations of an artifact and its systematic introduction and constant evaluation in several different contexts are an excellent way to add additional grounding to the artifact and its theoretical core [24].

In IS research, Lee and Hubona [63] support this view by highlighting that there are two general forms of validity of theories. The formative validity of a theory is achieved through theory building and describes a theory's property to adequately capture a phenomenon's concepts and their relations. A theory's summative validity means that it survives repeated empirical testing and that its external validity grows as the theory is able to model or predict more and more instances of the phenomenon. The interrelationships among theory types identified by Gregor [45], as well as the fact that the ability to predict and guide action are only covered by theory types three through five, also suggest that such a process of maturing is present in IS theories. Looking at our review, GT-based work seems to produce the detailed empirical accounts needed to build substantive theories as a starting point for the development of mid-range or even grand theories.

Building such theories starts with the invaluable work of providing interesting empirical accounts [25]. This helps initial IS theories to have fit and relevance [39] and to be current and interesting in their domains [5, 16, 67]. In our review we were able to identify some examples of such accounts. The works by King [57] and Work [121] (both group 2) document the extensive analyses the authors have conducted in their respective areas and offer a great opportunity to influence the design of respective artifacts and develop a respective theoretical core at the same time.

Once the understanding of the phenomena grows beyond good stories alone, the identification of constructs and relations that are present beyond individual cases will help to build theories [27, 28]. For example, Day et al. [17] (group 1, type 2) use their insights from investigating the disaster response to hurricane Katrina to identify a set of factors that explain how information flows are impeded in extreme cases. The authors also highlight some implications this understanding could have on the design of future disaster recovery systems in general. Pauleen [82] (also group 1, type 2) offers a detailed discussion how leaders facilitate relationship building in virtual teams.

Such explanation in IS-specific substantive theories will enable a certain degree of prediction. A good example is Palka et al. (group 1, type 3) who describe their contribution as follows: "The outcome is a grounded theory of mobile viral marketing with respect to the consumer and his social network, decomposing the mobile viral effect and identifying the determinants of reception, usage, and forwarding of mobile viral content" [81, p. 172]. Such an understanding will, in turn, give practitioners an understanding and some control of the situations they find themselves confronted with [8]. We believe this to be important to highlight that while IS research accumulates knowledge on a certain subject, these insights should also be integrated back to the larger body of (IS-specific) theory. This corresponds to both the suggestions of enfolding extant literature often recommended in the context of case-based theory building [26, 38] as well as to the requirement of DSR to contribute back to the knowledge base [50]. A GTM example is the paper by de Vreede et al. [18] (group 1, type 4) in which the authors use a grounded analysis of the acceptance of a group support system in an African context to identify constructs refining the technology acceptance model [14, 15]. In our study, however, most studies use multiple sites or instances and only one uses a single site [17]. This is a property not fully compatible with DSR as most designs focus on individual contexts and specific problems they intend to solve [48].

Once theories incorporate explanation and prediction, they might be ready to inform the design of IS artifacts by serving as kernel theories [50] to design theories [46, 111]. From our set of reviewed articles, Webb and Gallagher [113] (group 1, type 5) are suggesting a methodology for multimedia systems development which they ground in a study of development processes across 16 companies. Abstracting from an individual or local focus, their work certainly points direction to draw broader, more general conclusions – i.e. generalize DSR.

Observing the behavior of actors and systems as they are confronted with the effects of the artifact in the field will then serve as an opportunity to extract knowledge relevant to extend, refine, or even reject theories [58]. This way, in terms of GTM and DSR, instantiations of IS theories in practice by means of designing artifacts can serve as an additional "slice of data" in the process of theoretically sampling more data to work towards theoretical saturation. Such an approach will enable the empirically grounded extension and maturation of IS-specific theories. Glaser also provides guidelines how to develop formal theory based upon prior substantive theories [40]. We suggest that it could be this process of transforming behavioral theories into kernel theories for design theories and using the design to feed back into theory development and extension that might be a remedy for DSR's alleged lack of theoretical contributions. Many of the group 1 papers we looked at build their contributions from scratch – that is, they are not based on prior empirical or theoretical work but grounded in the observed data. This fact also concurs with the basic assumptions of the DSR paradigm. On top of that, this paper shows some interesting opportunities for future investigations with respect to the theoretical work in DSR. It is intended to help design researchers to frame their research results in a way that makes them a theoretical contribution and to leverage the rich empirical materials many of us gather in a way that supports the IS-specific accumulation of knowledge.

Of course such an approach raises further questions on the nature of theory in IS research like, for example, "can a generalized, isolated, and IS-specific theoretical body exist after all?" or "what is the specific role of IS theories at the intersection of computer and social sciences?" Gregor's [45] seminal article has provided an influential discussion on the nature of theory in the IS discipline. Since the discussion is still relatively young, we feel that these questions have not been sufficiently answered to date. Given our findings, we would like to emphasize the need for a discussion on how DSR related work can contribute the emerging body of theoretical knowledge in our discipline.

8. CONCLUSION

Given the IS-specific background of our analyses, our research presents the example of the grounded theory method applied to developing theories in IS research. We conducted a literature review which shows that some authors rely on GTM to produce IS-specific theory. We look forward to some of the work we present in this paper helping IS design researchers to understand the principal components of theory that constitute a respective contribution. Moreover, our analysis also highlighted the important role of theory in the process of discovering, extending, and refining, or in short maturing IS theory in general and in the context of designing in particular.

Looking at the findings presented in the last section, we concur with Gregory in highlighting that "developing grounded substantive theory about IT artifact use and its relationships with human behavior and the organizational environment may provide the means for IT artifact evaluation […] and leverage a design science research project to make a theoretical contribution to the knowledge base to go beyond the local solution of a problem and the implementation of an IT artifact" [48, p. 11]. We believe that the considerations on the processes of conducting the research project and of developing grounded theory we highlighted above are an important step towards understanding how DSR and GTM can actually be integrated and to promote the role of theory in DSR-related work. While the methodological discussion on GTM in the IS discipline is still relatively young [8, 103, 105], we expect that our review and discussion offers scholars a first insight into the subject and shows the potential of GTM to theoretically extend DSR. Beyond what we discussed here, general descriptions of

GTM-based research and respective guidelines can be found in a variety of sources – both IS-specific [e.g., 31, 64, 74, 105] and outside the IS discipline [e.g., 22, 71, 72, 97, 101].

Our contribution to this discussion can, however, only be a first step into a more thorough analysis of the potentials and implications of theory building in the context of DSR. We believe the analogies between GTM and DSR at are the foundation of our results have some interesting implications with respect to the next steps in this discourse. However, the results need to be carefully evaluated in light of our study's limitations we discussed earlier. As mentioned in the paper's section on research design, the selection of papers we used for our review is supposed to be an exemplary illustration of grounded theory building that could also occur in DSR. To strengthen this argument, future research will have to more thoroughly explore the epistemological and methodological underpinnings of GTM and DSR in order to determine whether an integration of the two can go beyond the analysis of analogies as introduced here.

Beyond the study's considerations on theory, also an explicit step towards an analysis of seminal DSR papers would be necessary to develop a concise set of recommendations that could guide DSR scholars in their theory building efforts. This could help to produce a better and more detailed understanding of how to integrate theory building into designing explicitly. Possibly, a more detailed distinction of a-priori grounding design work theoretically, doing theoretical work while designing, and re-integrating theoretical contributions to the larger body of knowledge ex-post (e.g., through evaluation) can also result in a more refined understanding of how to increase DSR's theoretical contributions. This might help to improve the distinction between mere design as consultants' work and DSR as the task of the scientists [120].Moreover, the fact that IS-specific theory does not necessarily have to be built using GTM needs to be considered. Gregor [45] suggests a wide selection of methods that can be used in the context of building any of her five theory types. As other methods can also produce IS theories, a more inclusive selection of theories produced in the IS context is a logical next step in continuing and extending our research. Analyzing some of the theories identified by the wiki on theories used in IS research [91] could be an interesting opportunity to better understand theory building in IS.

In further developing our understanding of design as a distinct source of knowledge in the IS discipline, we want to conclude by highlighting some of the potentials we see in enabling DSR to also produce relevant theories. In IS research, there are technological artifacts on the computer science side and behavioral research paradigms on the social science side [29]. We assume that bridging this gap is one of the core challenges of the IS field and that IS-specific theory can help to do so. Lee [61] supports this view by pointing to the value of examining the interaction between technological and social systems. Emphasizing the role of the IT artifact in theorizing in IS research, Orlikowski and Iacono [79] highlight how IS theories can inform research and practice on how understanding behavioral processes influences the design of IT artifacts and how these, in turn, impact behavioral processes. Gregor [47] points to the need for theories that help us understand the links between the natural sciences, the social sciences, and the sciences of the artificial to bridge this gap.

However, current IS research seems to be reluctant to rely on the early and often small theories that originate from IS-specific contexts. Quite to the contrary, many IS researchers seem to be more enthused by relying on (grand) theories from our adjacent disciplines [116]. DSR can help to offer viable alternatives by providing detailed theoretical accounts of the phenomena encountered during artifact design and evaluation. Explicitly discussing the role of theory and integrating respective recommendations into IS research approaches might help DSR to mature and to "catch up" in the race for credibility. Moreover, it could help IS researchers to refine their expectations towards DSR – that is, improve our understanding of what theoretical contributions based on design are and what role they can play in the context of IS research. Beyond this, a more refined conceptualization of theories and their role can help IS (design) researchers to frame their results in a way that makes them a valuable theoretical contribution. This will make even the smallest pieces of empirical observations accessible to building a cumulative tradition in IS and make them valuable contributions to build, extend, or refine IS-specific theories. On top of that, this should help to get more of the valuable design work conducted published in our discipline's premier journals, thus making it accessible for the whole IS community.

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