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Constructs in the Mist: The Lost World of the IT Artifact

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Abstract

Recent years have seen much discussion in the literature about the core of the IS field. While extreme positions in this debate see IS research either as purely technical or purely behavioral work, we believe that one area of competence and contribution for IS researchers lies at the boundary of technology and individual human psychology. In addressing this question, IS researchers frequently invoke psychological constructs at a high level of abstraction, in order to achieve theories that allow wide knowledge claims. We contend that this fails to provide operationalizable and actionable linkages between the IT artifact and the psychological user model: exactly that area that should represent the contribution of IS research. This paper addresses these shortcomings by urging researchers to focus on the "forgotten" constructs on the "left hand side" of the model, characteristics of the artifact that serve as antecedents to user behavior. We propose a theory template that can be used to instantiate specific theories. We illustrate this template by examining how it can be used to instantiate existing theories and develop new theories.

Keywords: Theory building, relevance, template, individuals, research methodology

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CONSTRUCTS IN THE MIST: THE LOST WORLD OF THE IT ARTIFACT

Abstract

Recent years have seen much discussion in the literature about the core of the IS field. While extreme positions in this debate see IS research either as purely technical or purely behavioral work, we believe that one area of competence and contribution for IS researchers lies at the boundary of technology and individual human psychology. In addressing this question, IS researchers frequently invoke psychological constructs at a high level of abstraction, in order to achieve theories that allow wide knowledge claims. We contend that this fails to provide operationalizable and actionable linkages between the IT artifact and the psychological user model: exactly that area that should represent the contribution of IS research. This paper addresses these shortcomings by urging researchers to focus on the "forgotten" constructs on the "left hand side" of the model, characteristics of the artifact that serve as antecedents to user behavior. We propose a theory template that can be used to instantiate specific theories. We illustrate this template by examining how it can be used to instantiate existing theories and develop new theories.

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Introduction

There has been much discussion about what exactly constitutes the core of the IS discipline and the importance of the IT artifact. While there is no consensus on this issue, important research and opinions have proposed a focus on the IT artifact and its immediately surrounding nomological network (Benbasat and Weber, 1996; Benbasat and Zmud, 2003; Orlikowski and Iacono, 2001; Weber, 2003; Whinston and Geng, 2004; Sidarova et al., 2008), although some call for less prescriptive definitions (DeSanctis, 2003; Lyytinen and King, 2004; Robey, 2003). Despite this call, the IT artifact seems to have been consistently under-investigated in IS research. An early survey (Alavi and Carlson, 1992) showed that IS characteristics had only been addressed in 41 out of 828 papers on the top three research issues (Category "HD" in the classification schema of (Barki et al., 1988) representing "Information Systems – IS characteristics"). The situation was similar a decade later as these low numbers are reflected in a later survey that found issues of "System/Software" were addressed in only 7% of papers between 1995 and 1999 (Vessey et al., 2002). In response to this, a first commentary laments "that the field of information systems (IS), ... has not deeply engaged its core subject matter — the information technology (IT) artifact. ... IT artifacts in IS research tend to be taken for granted or are assumed to be unproblematic" (Orlikowski and Iacono, 2001, pg. 121f.) and researchers focus on context variables or dependent variables instead (Orlikowski and Iacono, 2001). This observation was taken up a few years later (Benbasat and Zmud, 2003) with a call to establish the core of the IS discipline around the IT artifact: "IS scholars and IS practitioners strive to increase their collective understandings of (1) how IT artifacts are conceived, constructed, and implemented, (2) how IT artifacts are used, supported, and evolved, and (3) how IT artifacts impact (and are impacted by) the contexts in which they are embedded." (pg. 186). We agree with

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their definition that the *IS discipline and IS research is concerned with the immediate nomological network around the IT artifact*, as just described. We define the IT artifact as “bundles of material and cultural properties packaged ... as hardware and/or software” (Orlikowski and Oacono, 2001), which is narrower than Benbasat and Zmud’s (2003) definition, which also includes task, structures, and context surrounding the technology. In the terminology of Benbasat and Zmud (2003), the absence of the IT artifact or its characteristics in a theory that is otherwise within the boundaries of IS, as just defined, is called an *error of exclusion*. Evaluating the state of the IS field, Benbasat and Zmud (2003) note that about one third of published studies commit this error.

In this paper, we focus on IS research at the level of the individual because, while it occupies, according to some surveys (Alavi and Carlson, 1992; Vessey et al., 2002), a relatively small space in the IS area, it has contributed many well-known theories that IS researchers argue are theories at the core of our discipline. These include Task-Technology-Fit (TTF) (Goodhue, 1995; Goodhue and Thompson, 1995), Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), Cognitive Fit (Vessey, 1991), Cognitive Dissonance and Expectation Disconfirmation (Oliver, 1977; 1980; Bhattacherjee, 2001), Computer Self-Efficacy (Compeau and Higgins, 1995). However, on closer examination these theories also commit the error of exclusion of the IT artifact. To demonstrate this, we briefly examine these theories.

TAM (Davis, 1989) defines the concepts of ease of use and usefulness as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, pg. 320) and "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, pg. 320). While Davis applies the concepts to information systems, there is nothing in the concepts, or in their operationalization, that is specific to the IT artifact. For example, items like "I would find

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... useful in my job" and "I would find it easy to get ... to do what I want it to do" may be applied to bicycles just as well as computer systems, an example of an error of exclusion (Benbasat and Zmud, 2003). When examining the immediate theoretical network into which this construct is embedded, the initial study examined actual use as a consequence but did not study any IT specific antecedents.

UTAUT (Venkatesh et al., 2003), building on TAM, introduces concepts such as effort expectancy and performance expectancy. Again, these are defined without reference to IT characteristics: "Effort expectancy is defined as the degree of ease associated with the use of the system" (Venkatesh et al., 2003, pg. 450) and "Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003, pg. 447). The operationalization of these constructs includes items such as "I would find the system easy to use" and "Using the system increases my productivity" (Venkatesh et al., 2003, pg. 460). As with TAM, these concepts and their operationalization could be applied to bicycles just as well as computer systems, demonstrating a similar error of exclusion (Benbasat and Zmud, 2003). In this study, too, the nomological network includes only generic consequences, such as behavioral intention and use behavior. No antecedents or other IT specific concepts are included.

Cognitive Fit (Vessey, 1991) is defined as "matching representation to task [which] leads to the use of similar, and therefore consistent, problem-solving processes, and hence to the formulation of a consistent mental representation" (Vessey, 1991, pg. 221). Vessey uses this concept to explain the understanding of graphically presented information, but again the concept itself is not specific to information systems, showing yet again an error of exclusion (Benbasat and Zmud, 2003). The study only includes consequences of cognitive fit, and no IT specific concepts are included.

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Computer self-efficacy (Compeau and Higgins, 1995) is the adaptation of the generic self-efficacy concept to the IS area and is defined as "judgment of one’s capability to use a computer." (Compeau and Higgins, 1995, pg. 192). The adaptation to the IT context still yields very generic measurement items such as "I could complete the job using ... if I had seen someone else using it before trying it myself". Only one of the items given by (Compeau and Higgins, 1995) is specific to the IT context in that it refers to a built-in help facility, which could not be expected of bicycles, but of computer systems. Here again, we see an error of exclusion. The theoretical network in which the concept is embedded is also generic rather than IT specific, containing antecedents like encouragement and support, and consequences such as anxiety and usage.

Of the prominent IS theories, only Task Technology Fit (Goodhue and Thompson, 1995), which is defined as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" acknowledges that the generic nature of its focal construct needs to be adapted to and operationalized for specific technologies: "To defend these assertions ... and to test them, requires applying the perspective to a specific task domain, at a detailed level." (Goodhue, 1995, pg. 1831). Based on a process model, 14 specific dimensions of TTF are identified.

While it may be argued that all of the theories examined here were developed before the debate about the IT artifact began, more recent studies in the IS field have similar characteristics. For example, recent work on TAM (Karahanna et al., 2006) extends the original model to include several compatibility concepts as antecedents. However, these are also generic concepts and their operationalization, e.g. "Using the CRM system is a new experience for me", are not IT specific either. Extensions of TAM to include source credibility and argument quality as antecedents (Bhattacherjee and Sanford, 2006) and to include perceived personalization, familiarity and trust (Komiak and Benbasat, 2006) may be seen as specific to some IT characteristics such as knowledge management

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systems or recommender systems and are not quite as generic as other theoretical networks examined here. In summary, we believe that this overview of major IS theories shows that current research in the IS field appears to focus mainly on consequences of the mere presence of an IT artifact, and fails to account for characteristics of specific types of IT or specific characteristics of an IT artifact. Hence, we agree with Orlikowski and Iacono (2001) that the IT artifact is under-researched.

We suspect the focus on consequences may be one reason why IS research is not considered relevant to practitioners (Benbasat and Zmud, 1999; Davenport and Markus, 1999): There are too few specific and operationalizable prescriptions. For example, for a business it is not terribly insightful to know that it must increase the usefulness of an application in order to foster its use. Businesses need to know the specific characteristics of an information technology artifact that make it more useful. This requires either adaptation of the usefulness construct to specific technologies, or seeking technology-specific antecedents to the generic construct. Similarly, while it is important for businesses to know that recommender systems convey trust, which may lead to increase a user's intention to adopt the recommendations of that agent, it is much more important and useful to know how the level of trust conveyed by an agent can be increased.

Based on the shortcomings of current IS theory with a focus on the individual identified in the previous paragraphs, this paper develops a theory template to guide researchers in developing theories that do not commit the error of exclusion. The template is based on the processes by which characteristics of the IT artifact lead to consequences that are relevant to an individual.

The remainder of the paper is structured as follows. The next section discusses the notion of theory and introduces the idea of a theory template. We then show the development of the theory template from a small number of first principles. Following

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this, we show that our theory template is sufficiently expressive to encompass the major IS theories discussed above. We then demonstrate how to instantiate the template to generate concrete theory with a focus on the IT artifact. The paper closes with a discussion and outlook to future work.

Theory and Theory Template

Theories are sets of propositions that relate concepts or constructs, bounded by a specified context (Bacharach, 1989). Theories may exist for different purposes, among them explanation and prediction (Gregor, 2006). Theories that explain and predict provide causal explanations of a phenomenon and testable hypotheses (Bacharach, 1989; Gregor, 2006). A representation relationship relates the theoretical level of constructs and propositions, to the level of variables and hypotheses: Variables represent constructs and hypotheses that relate variables are derived from the propositions that relate constructs (Bacharach, 1989).

Theories exist at different levels of generalization. Gregor (2006) calls the most general level "grand theories". These are relatively unbounded in space and time. In contrast, mid-range theories have a more limited scope. Mid-range theories may be substantive theories about a specific area of inquiry, or formal theories, which cover a broader conceptual area. Gregor (2006) unfortunately leaves the further discussion of generality as "a potential area for further work" (pg. 616). Other work on generalizability in the IS discipline is more concerned with generalizing from a sample to a population and the criteria for the validity of such generalization (e.g. Seddon and Scheepers, 2006) than in the generalization of abstraction of concepts. It is however the latter that this research is interested in. Nor do widely cited philosopher's of science like Dubin (1969), from whom Gregor (2006) borrows extensively, offer a description of generality and generalizability.

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When adopting or "borrowing" theories from reference disciplines such as sociology, or as in this case, psychology, the reference theories are frequently very general, and need to be applied to the IS context. For example, TAM (Davis et al., 1989) is built on the work by Fishbein and Ajzen (1975). In that work, Fishbein & Ajzen discuss how perceptions combine to form beliefs, which in turn are the cause of attitudes that can cause intention and actual behavior. Importantly, Fishbein & Ajzen *do not* discus specific perceptions and beliefs. In other words, they present the general category of "beliefs", but do not discuss instances of this category, e.g. the "belief that a system is easy to use". Similarly, they present the general category of "perceptions", but do not discuss instances of this category, e.g. the "perception that the system provides function X". Similarly, the theory of Cognitive Fit (Vessey, 1991) is based on the work by Newell and Simon (1972). Newell and Simon propose that task and problem representations must be congruent to support problem solution. However, they *do not* discuss specific tasks and specific problems, thus leaving the instantiation to the user of theory and a particular use.

The instantiation of IT characteristics goes hand-in-hand with the instantiation of general theoretical constructs because they typically form part of theory. For example, Fishbein & Ajzen (1975) construct of "beliefs" requires something about which beliefs can be held, typically the IT artifact and its characteristics. Hence, when we specialize and instantiate the "beliefs" construct, we must at the same time specialize and instantiate the characteristics of the IT artifact. For example, at the highest level we might have "beliefs about technology". This can be specialized to "belief that the IT is useful", and further instantiated to "belief that system X functions will help with task Y."

We use the terms category and instance, but we are aware that classification of instances is a special type of specialization (Storey, 1993). For example, "perceptions" might have a more specific sub-class of "perceptions of this IT", which in turn could be

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specialized to “perception of the placement of this screen element”, ultimately yielding an *instance*, i.e. a sub-class containing a single, unique element. Hence, we use specialization and instantiation synonymously.

With the notions of specialization and instantiation defined, we note that IS research deals with theories on at least two levels of generalization. General or formal theories contains as theoretical constructs only large classes. Fishbein & Ajzen’s (1975) or Newell and Simon’s (1972) works are such general theories that have been adopted for IS research. However, when we wish to use such a theory, we must *instantiate* it to form a particular concrete theory (“subjective theory” in terms of Gregor (2006)). Instantiation selects zero or more instances from each construct class of the general theory. For example, a theory built on Fishbein & Ajzen’s work might contain more than one belief and more than one attitude. In the remainder of this article, we use the term *Theory Template* to refer to a general theory that is to be instantiated to develop concrete, testable theory.

Our notion of instantiation and theory template is perhaps most closely related to that of “stage two” of the generalization process described by Baskerville (1996), that of “projecting the general case (e.g. a systematic model) onto goal cases”. Baskerville (1996) suggests that “the general case *is* the theory” (emphasis in original). Hence, general theories such as those of Fishbein & Ajzen (1975) or Newell & Simon (1972), which are themselves the result of a generalization from individual studies and observations (“stage one generalization”), serve the role of general case that the researcher “applies” to the goal case. The goal case is the IS setting to which the theory is adapted. A similar notion is also developed by Lee and Baskerville (2003) who call this “TE Generalizability”, which “involves generalizing a theory … to descriptions of other settings” (pg. 233). However, neither Baskerville (1996) nor Lee and Baskerville (2003) offer concrete guidance on this process.

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The following section develops a theory template for theories on the level of the individual that includes the IT artifact. It is intended to guide researchers in the development of new theories.

The Forgotten "Left-Hand Side"

Theories are can be described by means of causal diagrams, which, in many cases, proceed from left to right to show antecedents and their consequences. In Section 1 we have argued that as IS researchers, we need to focus on the IT artifact in order to avoid errors of exclusion and to stay relevant for practitioners. The review of theories in the introduction has shown that much of IS research with a focus on the individual deals with consequences of the IT artifact, not antecedents. Hence, the specific characteristics of the IT artifact should be found on the left-hand side of causal models. As we have demonstrated in the introduction, this part of a theory is frequently under-specified or completely omitted in IS research. Our proposed theory template is based on two fundamental principles:

1. IS research is located at the intersection of humans, tasks (or contexts) and IT artifacts, "the application of IT [by a human] to enable or support some tasks embedded within a structure that itself is embedded within a context" (Benbasat and Zmud, 2003, pg. 186).
2. Because we are concerned with theories of the individual, our template is based on the foundational psychological idea that perceptions cause beliefs, which in turn cause attitudes and give rise to intention and subsequent behavior (Fishbein and Ajzen, 1975). Thus, as we move from "left to right" in causal diagrams, we expect to see perceptions, beliefs, and subsequently attitudes.

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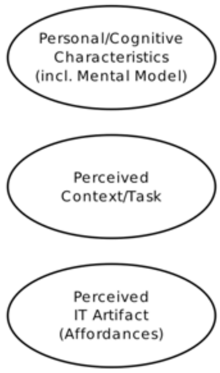

Figure 1: Three foundational concepts of IS research

The first principle is initially represented by three concepts in an initial model (Figure 1). Humans are generically represented by their mental model and cognitive characteristics. This includes background knowledge and reasoning procedures. While Benbasat and Zmud (2003) separate the task from the context, we decide to collapse the two in order to achieve some parsimony and not to detract from the focus on the IT artifact. The IT artifact is characterized primarily through its affordances, i.e. actions a human can perform with it, on it, or to it. Other, non-functional characteristics may also be added and subsumed under this construct. We emphasize the point that all three concepts are psychological concepts; they are perceptions of the IT artifact and perceptions of the task. It is these perceptions that matter and cause in part any consequent behavior.

Our first principle above suggests that IS research is located at the intersection of the concepts in Figure 1. We now turn to modelling this intersection and represent it as interaction terms between the three concepts. We can combine them in four different ways:

1. **Perceived IT Artifact × Personal characteristics**: The interaction between artifact and personal characteristics allows us to examine issues such as whether a knowledge management system provides information that is relevant to the user or whether the reasoning of an automated system is understandable to the user.

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2. **Perceived IT Artifact × Perceived task**: The interaction between artifact and task characteristics allows us to examine issues such as the usefulness of an IT system for the task it is used for, or to examine whether different systems lead to different performances on task.
3. **Perceived task × Personal characteristics**: The interaction of these two concepts does not contain any IT specific concepts and thus falls outside the scope of IS research, as it would lead to an error of exclusion (Benbasat and Zmud, 2003).
4. **Perceived IT Artifact × Perceived task × Personal characteristics**: This three-way interaction allows the richest study of context-situated use of an IT artifact by a particular type (or even a particular instance) of individual. For example, it allows us to examine whether an expert system provides reasoning procedures that are useful to domain experts for a certain task.

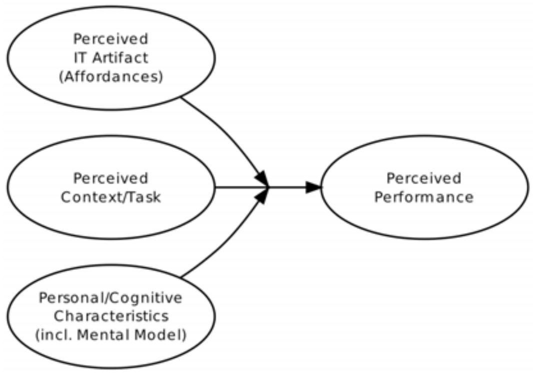

Figure 2: Typical notation for interaction effects

Benbasat & Zmud's (2003) definition of IS research, to which we also subscribe ("understandings of (1) how IT artifacts are conceived, constructed, and implemented, (2) how IT artifacts are used, supported, and evolved, and (3) how IT artifacts impact (and are impacted by) the contexts in which they are embedded"), shows that interaction of technology, task and personal characteristics is itself a relevant concept of interest to IS researchers.

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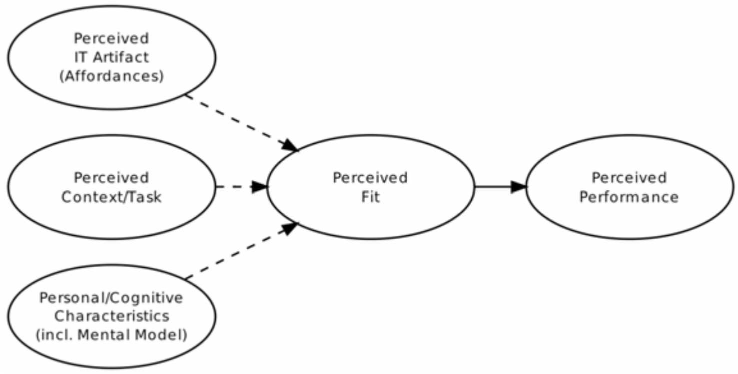

Figure 3: Reifying the interaction of Figure 2 as Perceived Fit

Typically, interaction terms are modeled in the form shown in Figure 2 (e.g. Venkatesh et al., 2003), and one of the interacting variables may be called the moderator of the relationship between the other interacting variable and the consequence. However, this kind of modeling omits the actual concept of interest, the interaction, and assumes that the interaction is measurable only as a function of its constituents, not as a construct in its own right, separately from its constituents. Hence, as we are interested specifically in the interaction term, we reify, i.e. "make as a thing", this concept as Perceived Fit, shown in Figure 3. Notice that the arrows connecting the three antecedents to fit are not of causal nature. Hence, we do not draw them as solid lines, but as dashed lines. It would be wrong to assert that perceptions of the IT artifact cause perceived fit. Instead, as the perceived fit is the reification of the interaction of the three antecedents, it is appropriate to assert that perceived fit *is a function of* perceptions of the IT artifact, perceptions of the task and personal characteristics. We use dashed arrows to signify such functional relationship. Perceived fit is measured in functional form, typically as difference or indicator products scores. A well-known example of difference scores is the service quality concept (Parasuraman et al., 1988) where the same item wording is used for two concepts, and the scores subtracted to compute the difference. A recent paper by Klein et al. (2009) discusses difference scores and the service quality instrument in

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more detail. Product indicators are common in regression and structural equation models to represent interaction effects. Here, the values of indicators of the involved concepts are multiplied with each other (Cortina et al., 2001; March et al., 2004). Finally, perceived fit may be measured directly, rather than as a function of its functional constituents. For example, Goodhue's (1995) Task-Technology-Fit instrument and Vessey's (1991) Cognitive Fit instrument are direct measures of a perceived fit.

As a next step, we recognize that subjective perceptions frequently differ from objective reality. Experimental researchers recognize this and include manipulation checks in their experiments (Benbasat, 1989) to ensure that the objective characteristics of a task or artifact are actually perceived. Perceptions of the IT artifact are caused (in part) by the actual characteristics of the IT artifact. This is not necessarily a perfect causal relationship, because people may not be aware of actual characteristics, or, less commonly, may perceive characteristics that do not actually exist. Similarly, the perceptions of the task and context are caused (in part) by the actual characteristics of the task and context. This too is not a perfect relationship. These additions are shown in Figure 4.

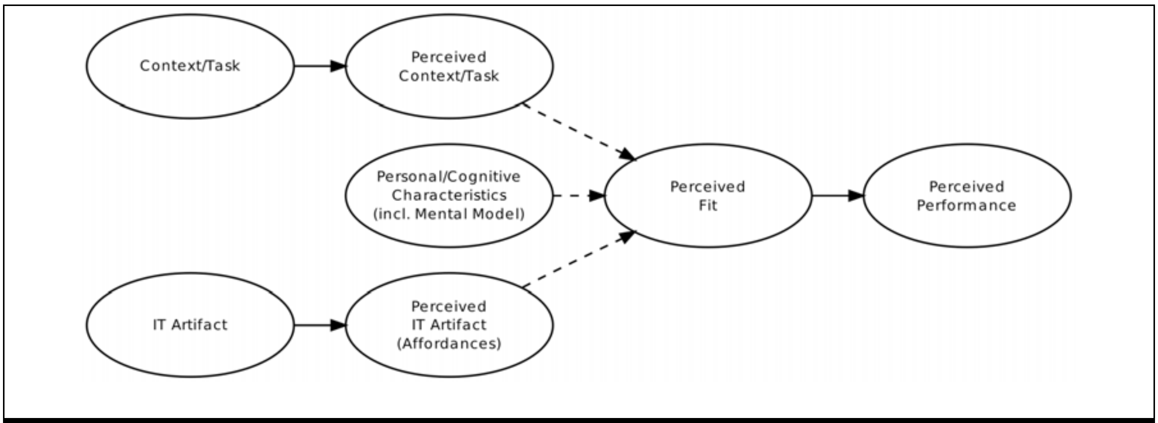

Figure 4: Perceptions may differ from reality

Finally, a person's perception of fit may not match the actual fit and, similarly, a person's perception of performance may not match her actual performance, although we would

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expect them to be correlated to a significant extent. For example, a person may believe that a system supports her style of work and believe that she performs well at the task, while in fact the system is designed to support a different work style and her performance is (objectively) low. We thus add the Fit and Performance concepts to our template as shown in Figure 5. While actual fit may not be measurable (or measurable only using invasive technologies such as fMRI), actual performance can certainly be measured, e.g. experimentally, and such experimental performance results may, and are likely to, differ from measures of perceptions of performance that are elicited by questionnaires or similar means. We have indicated the expected correlation as a double-headed arrow here. Note that this is not a structural equation model where we would not model these correlations explicitly but would find them explained by the data.

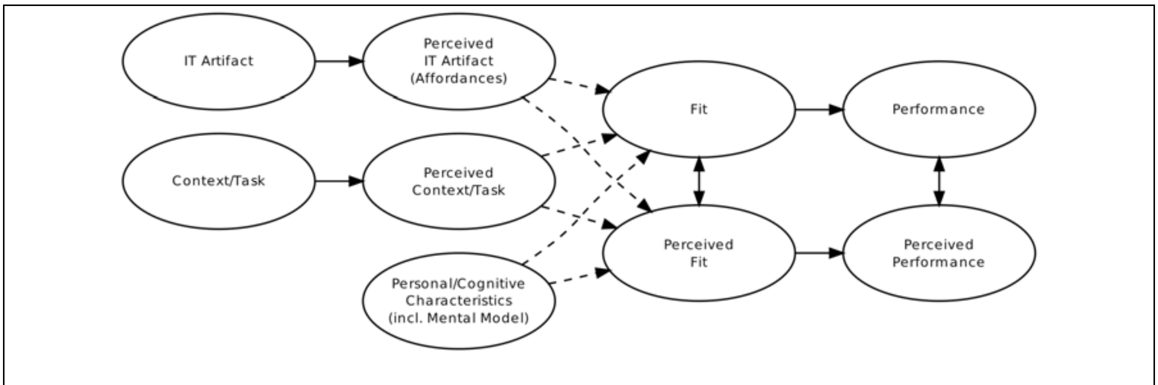

Figure 5: Adding actual fit and performance

While the perceptions of the IT artifact can interact with perceived task and personal characteristics in the form of fit, a second type of interaction is that of differences. Cognition and the mental model that are part of the personal characteristics concept may give rise to certain predictive beliefs, called expectations, and normative beliefs, beliefs about what should or ought to happen. We clearly separate these two types of beliefs; it is possible to believe the world ought to be in a certain state, but not to expect the world to be in that state, and vice versa. These beliefs may interact with both the

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perceived task and perceived IT artifact in that they can be confirmed or disconfirmed (Oliver, 1977; Oliver, 1980). However, the interaction of expectations and perceived task is not relevant to IS research, as it excludes the IT artifact (Benbasat and Zmud, 2003). Thus, we extend the template using the concept of a Perceived Gap between expectations and perceptions. This perceived gap, together with the perceived fit, causes evaluative beliefs, which in turn may lead to attitudes (Fishbein and Ajzen, 1975). This final model is shown in Figure 6. Similar to our definition of fit, gap is a reified interaction concept, and thus it is *not caused* by perceptions of the IT artifact and predictive and normative beliefs, but is *a function of* these concepts. Again, it is measured in its functional form, e.g. through difference scores (Klein et al., 2009), product indicators (Cortina et al., 2001; March et al., 2004) or direct measurement.

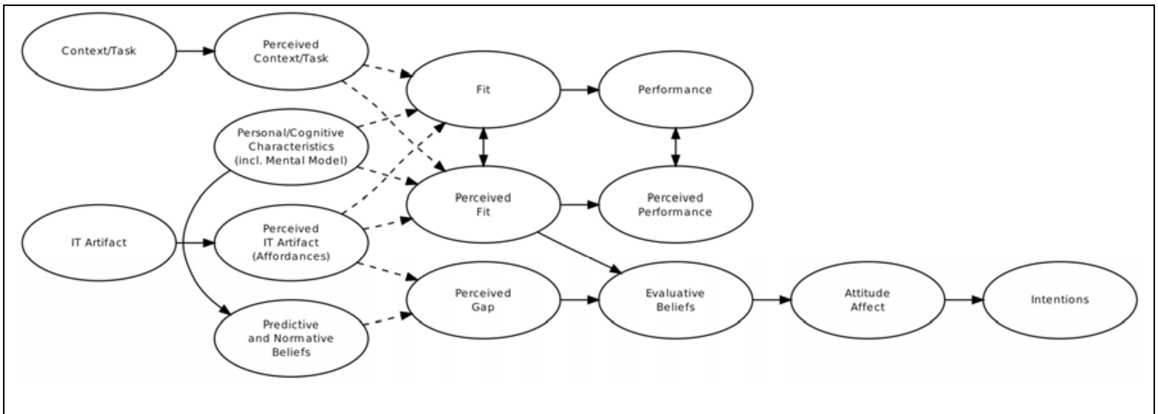

Figure 6: Adding expectations and gaps

There are important features of our theory template that we wish to draw attention to. First, we note that Figure 6 contains two types of arrows between concepts. The solid arrows in the diagram represent standard causal relationships. The causal relationships on the right hand side of the diagram have been examined in detail by extant IS literature. For example, we can say that the perceived gap between expectations and perceptions *causes* evaluative beliefs about the IT artifact. The dashed arrows in the center of the diagram are different and do not represent causal relationships. For

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example, it makes no sense to say that predictive or normative beliefs cause a perceived gap. Instead, these arrows indicate *functional relationships*: We say that a perceived gap is a function of both predictive or normative beliefs and perceptions of the IT artifact. Hence, the concept is measured in functional form, e.g. as indicator products (Cortina et al., 2001; March et al., 2004) or difference scores (Klein et al., 2009). We find that gap or fit measures are frequently mis-conceptualized. For example, in the Task-Technology-Fit model presented by Goodhue et al. (1995), fit is modeled as being caused by task characteristics as well as being caused by technology characteristics. This is clearly not the case; the fit may be a function of both of these, but not caused by them.

A second important feature is the level of generality of the theory template. For example, the concept of IT artifact is neither measurable nor immediately operationalizable. What is measurable is not the artifact, but properties of the artifact. Hence, not the IT artifact but its properties or characteristics play a role in theories (Dubin, 1969). This is analogous to the natural sciences. For example, Newton's law deals not with objects, but with their mass and distance, i.e. properties. Thus, the template will have to be instantiated with specific properties of the IT artifact under investigation. Similarly, there are no generic tasks that are studied, but specific tasks an IT artifact can be used for and that a researcher might be interested in. Once these two general concepts are instantiated by concrete instances, the remainder of the instantiations follows accordingly. For example, the specific kind of performance is usually determined by the task and the evaluative beliefs are beliefs about a certain characteristic of the IT artifact. Notice also that each concept in our template may be instantiated multiple times. As we discuss in the next section, multiple evaluative beliefs about different aspects of the artifact are common in IS theories.

Third, our template specifically includes not only psychological variables, but objective characteristics of the IT artifact and the task. This is to ensure relevance both in terms of

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coverage of the IT artifact (Benbasat and Zmud, 2003) but also to ensure actionable outcomes for practitioners. As we indicated in the introduction section, it is not sufficient to show that beliefs cause attitudes and subsequent usage, but practitioners need to know how to vary objectively given characteristics, either of task or IT artifact, to affect those beliefs. This is in contrast to many of the foundational theories in IS, as we discussed earlier. We believe it is this area of the template to which IS researchers ought to pay increased attention. While computer scientist and engineers deal with the IT artifact and psychologists deal with perceptions and beliefs, the IS researcher's focus should be on the linkage between the two.

Fourth, our template maintains rigorous distinctions between psychological concepts and objectively present concepts. This has implications both for theory as well as for measurement. Psychological concepts such as beliefs and perceptions are best measured by means of questionnaires. This is not possible for objectively present concepts such as performance or fit. These need to be measured by observation, typically by experiment. Similarly, characteristics of the IT artifact and the task will need to either be designed (as they are antecedent concepts) or they need to be measured by observation. Further, this distinction encourages the theorist to attend to the specific nature of the instance. For example, is it the perceived fit, or the actual fit that should play a role in the theory?

The next section shows how this theory template is sufficiently expressive to capture core IS theories as instances. Following that, we show how the template can be instantiated to generate new theory.

Example Instantiations

In this section we show how existing theories with a focus on the individual fit into our template. We do this to demonstrate three points. First, our template is sufficiently

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representative to capture a wide variety of IS theories with a focus on the individual. Second, these examples will make clear the concept of instantiation. Third, we show that the theories we examine are theoretically commensurable i.e. they are based on the same set of assumptions (these assumptions are the two principles we introduced in the previous section to develop our template). We show the example instantiations by highlighting and adapting the concepts in our template, based on Figure 6.

We begin with the Technology Acceptance Model (TAM). TAM includes the concepts "Perceived Ease of Use", "Perceived Usefulness" and "Intention to Use". These are all psychological variables, best characterized as beliefs about the artifact. For example, perceived ease of use is measured by an item worded "I would find ... easy to use" which asks respondents about their beliefs with respect to the ease of use of an artifact (although in the initial paper by Davis (1989), subjects are asked about hypothetical usage situations, so that rather than perceptions, the instrument actually measures expectations). As we had indicated earlier, TAM itself makes no mention of specific IT characteristics, and hence its constructs are to be found as instances of the right hand side of our template. Figure 7 highlights the concepts instantiated by TAM. Evaluative beliefs are instantiated twice, as Perceived Usefulness and Perceived Ease of Use.

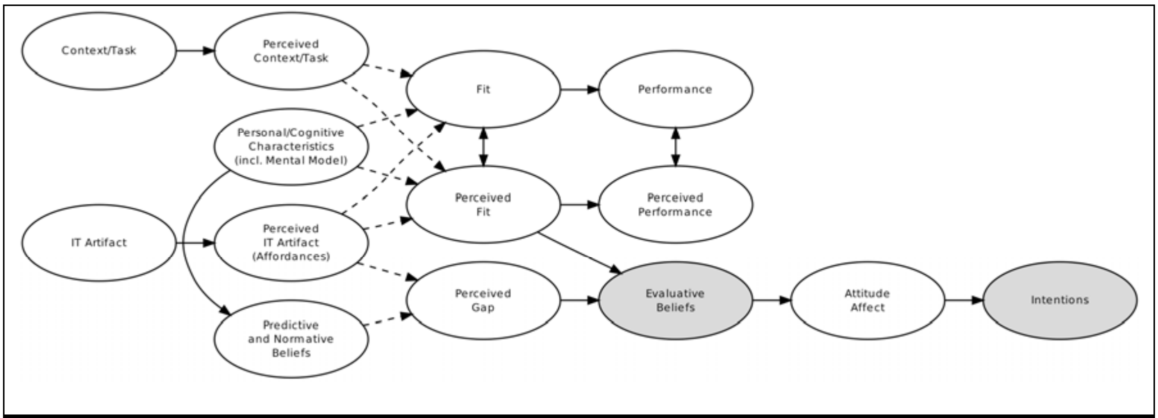

Figure 7: TAM as an instance of the theory template

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The second example is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). UTAUT uses concepts such as performance expectancy, effort expectancy, social influence, facilitating conditions and a number of personal characteristics. Personal characteristics are instances of our concept "Personal/Cognitive Characteristics". In UTAUT these are moderated by gender, age, experience and voluntariness of use. The latter moderators are however unlike our personal/cognitive characteristics. In fact, Venkatesh et al. (2003) scarcely theorize about these moderators but include them based on previous findings. Hence, we suggest that UTAUT instantiates the same template concepts that TAM does (Figure 7). Additionally, some concepts outside the scope of IS are used, such as social influence and facilitating conditions.

Cognitive Fit (Vessey, 1991) is defined as "matching representation to task [which] leads to the use of similar, and therefore consistent, problem-solving processes, and hence to the formulation of a consistent mental representation" (Vessey, 1991, pg. 221). Cognitive fit is clearly an instance of our Fit concept, and Vessey examines the performance consequences of this fit. Hence, cognitive fit instantiates the concepts in our template that are highlighted in Figure 8.

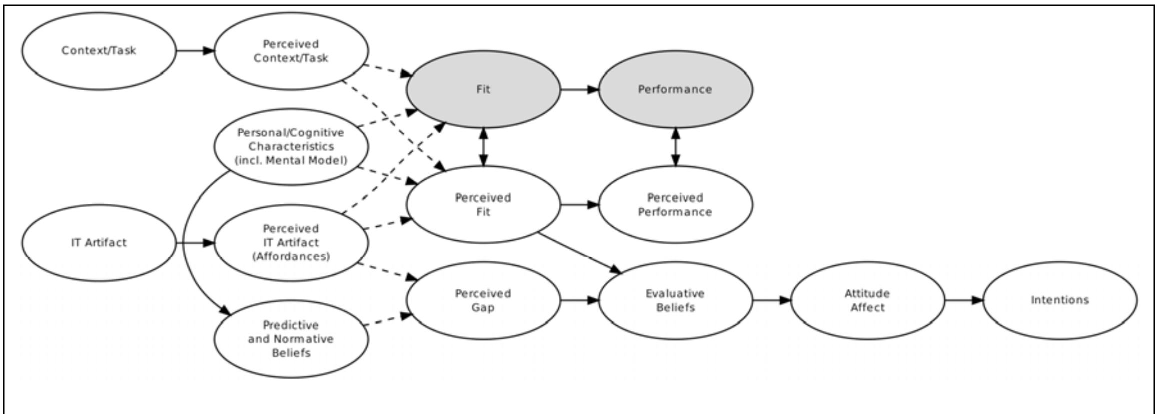

Figure 8: Cognitive Fit as an instance of the theory template

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Computer self-efficacy (Compeau and Higgins, 1995) is the adaptation of the generic self-efficacy concept to the IS area and is defined as "judgment of one's capability to use a computer." (Compeau and Higgins, 1995, pg. 192). We argue that this is the perceived fit of the personal or cognitive characteristics with the task characteristics. The IT artifact is scarcely theorized and is only generically included. Self-efficacy is thus perceived fit, primarily of personal characteristics and perceived task. The self-efficacy is argued to ultimately lead to affect and usage. We show the instantiated concepts highlighted in Figure 9.

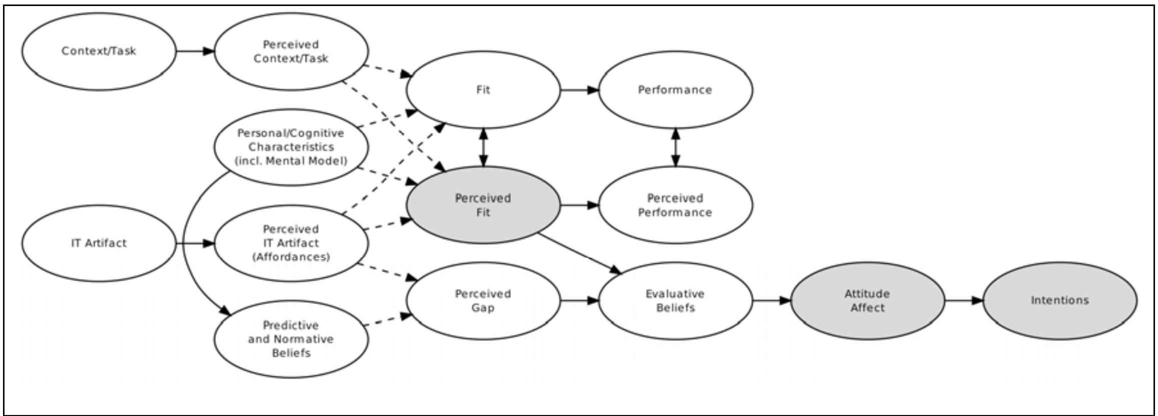

Figure 9: Computer Self-Efficacy as an instance of the theory template

Next we turn to Task-Technology-Fit theory (Goodhue, 1995; Goodhue and Thompson, 1995). As the name implies this is a theory of perceived fit between the perceptions of a task and the perceptions of a technological capability of an IT artifact. The authors of TTF identify 14 dimensions of this fit, leading to multiple instantiations of the concept, which leads to an evaluative belief about the IT system. Of the prominent IS theories, only Task Technology Fit (Goodhue and Thompson, 1995), which is defined as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" acknowledges that the generic nature of its focal construct needs to be adapted and operationalized for specific technologies: "To defend these assertions ... and to test them, requires applying the perspective to a specific task domain, at a detailed level."

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(Goodhue, 1995, pg. 1831). Based on a process model, 14 specific dimensions of TTF are identified. Figure 10 shows TTF as an instance of our theory template.

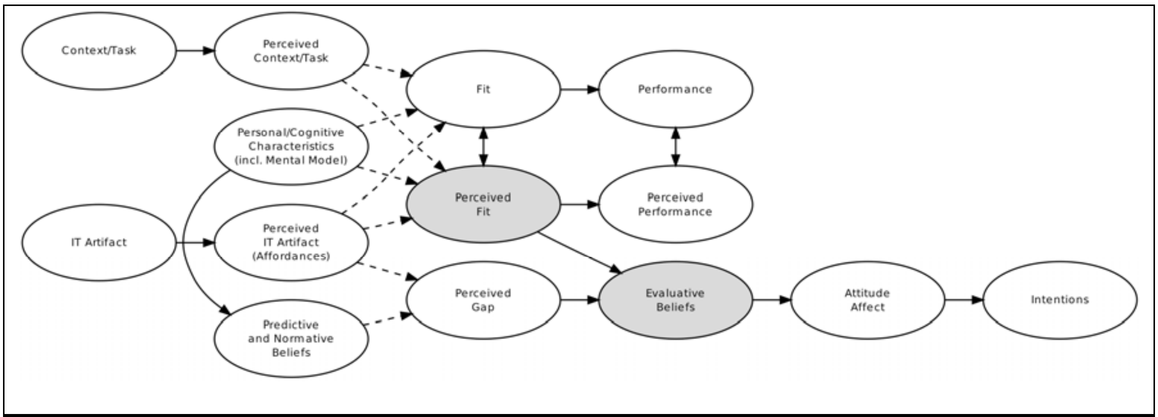

Figure 10: Task-Technology-Fit as an instance of the theory template

Finally, we show how service quality can fit into this template. Service quality originated as a difference concept (Parasuraman et al., 1985, 1988) between expectations and experience. Originally developed for the services industry, it has been adapted to the IS context in (Pitt et al., 1995) and has led to many debates on its properties. However, the main interest here is that the model fits into our template as we reify the gap between expectations and perceptions. The service quality literature has few suggestions about the consequences of perceived quality, but it it not unreasonable to assume that evaluative beliefs are formed based on the gap that exists. We note also that service quality is recognized to require more specific adaptation. For example, in the original work (Parasuraman et al., 1985), service quality was measured on 14 dimensions. This was later reduced and the dimensionality of the concept remains a point of active debate. Figure 11 shows how service quality fits into our template. Note that due to different dimensions, each shaded concept is instantiated multiple times, once for each dimension.

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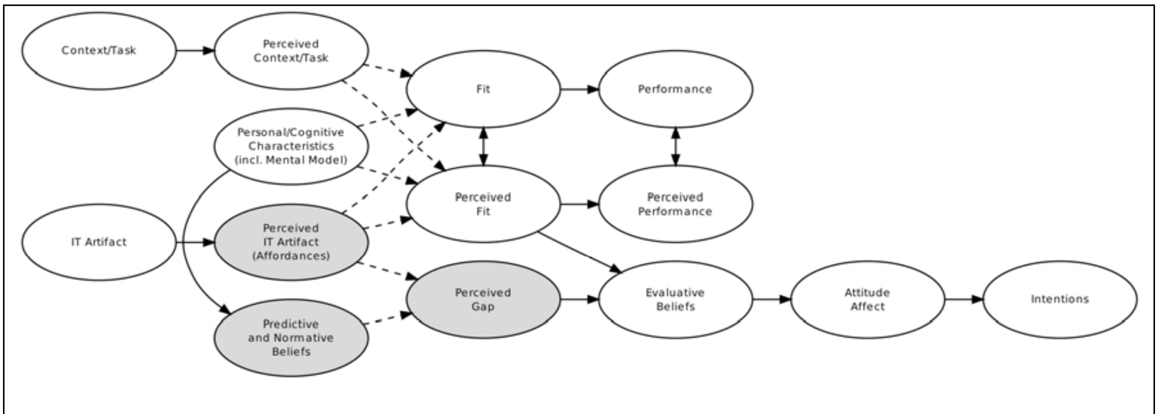

Figure 11: Service quality as an instance of the theory template

In this section, we have shown that our theory template encompasses many of the fundamental theories in information systems. The fact that our theory template is sufficient to capture a wide range of existing IS theories also demonstrates that these theories are commensurable, i.e. they are not based on inherently contradictory paradigms or assumptions. This is perhaps not surprising. For example, Goodhue (1995) integrated Task-Technology-Fit, based on Newell and Simon's (1972) work with Fisbhein and Ajzen's (1975). Both TAM (Davis, 1989) and Self-Efficacy Theory (Compeau and Higgins, 1995) were subsumed under UTAUT. In the next section, we illustrate how the template may be used to generate new theories.

Instantiating the Template

In this section, we present how the theory template can be instantiated to yield concrete, testable theories. For this example, we assume that the following research question:

How does social network bookmarking on news sites affect user retention?

Social networking bookmarks (SNB) allow site operators to offer their users an easy way to link to an article or page from their account on a social networking system. Figure 12 shows how this is implemented on the BBC news web site[1]. With a single click, users

[1] http://news.bbc.co.uk

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can link to the article from their Digg, Facebook, and other sites. Typically, this allows their social network to see what pages or articles the user has read.

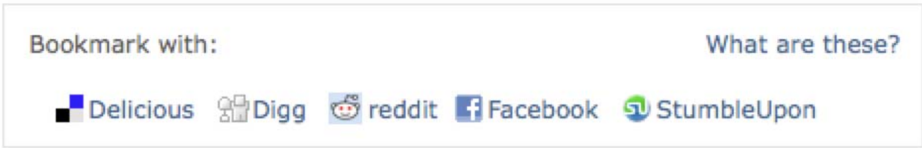

Figure 12: Social network bookmarking on the BBC news site

We now use our theory template to develop a theory that can help answer the research question. Of course, this theory remains to be tested, which is beyond the scope of this illustration. We proceed from left to right through Figure 6, beginning with the IT artifact. To instantiate the IT artifact, we cannot focus merely on the presence or absence of SNB; we must instead identify measurable properties (Dubin, 1969). Examining SNB functions on different sites one finds that they differ primarily in the number of social networks they include. The example shown in Figure 12 shows five, but other site operators offer up to a dozen. Other ways in which these differ are the placement of the bookmarks: some sites place them at the top of a page, others towards the bottom of the page, while modern browsers allow them to always float at a given position in the browser. We would assume that a floating presence is most noticeable, a top placement second most noticeable and a bottom placement least noticeable. Finally, the size of the icons may be manipulated. Thus*, we instantiate the IT artifact in Figure 6 three times*. Consequently, we instantiate the perceived IT artifact three times, corresponding to users perceptions of the three properties extent of SNB, placement of SNB, and size of SNB. The latter two may contribute independently to a concept we may call visibility. This assumes that what a site lacks in placement can be made up for in increasing the size and vice versa.

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As a second step, we instantiate the perceived artifact and its perceived affordances. We suggest that a higher visibility of SNB will cause a higher awareness of the extent of SNB by the site user. Thus, we instantiate the perceived IT artifact once, as perceptions of the degree of SNB presence on a site. We suggest this may be influenced by an interaction of the visibility and the extent of SNB presence. Figure 13 shows our theory to this point.

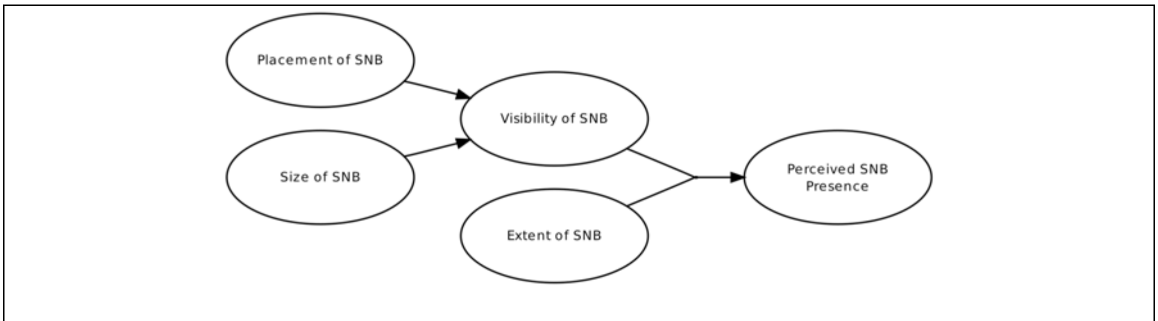

Figure 13: Social network bookmarking theory, stage 1

An alternative to this is to keep maintain the separation of the three IT artifact characteristics into the perceptual sphere, as shown in Figure 14. Here, the assumption is that the use has three distinct perceptions which all contribute to a perception about SNB presence. Which of these two theories is correct must be decided empirically.

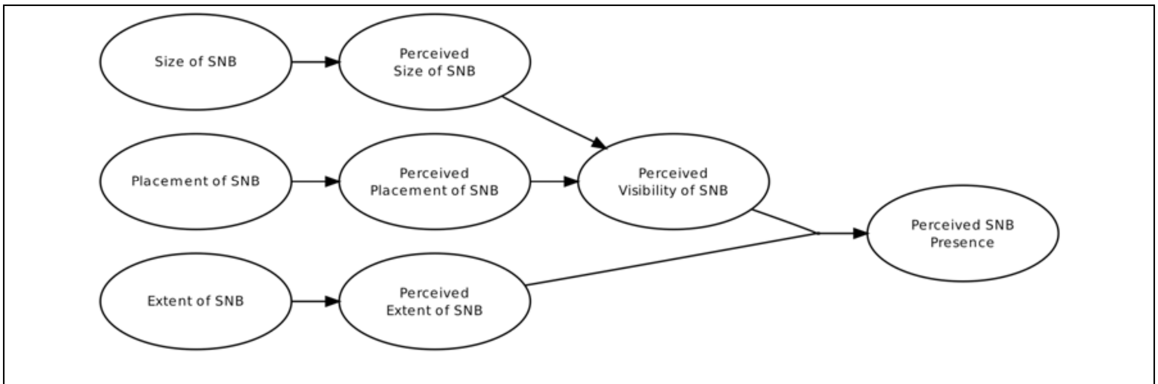

Figure 14: Social network bookmarking theory, stage 1, alternative

Next, we instantiate the personal/cognitive characteristics of the user, including the user's mental model. This may include familiarity with social networking, the extent to

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which the user wishes to expose her activities to her social network, communication with peers, etc. We do not aim to be exhaustive in our theory, so we instantiate the concept twice, once yielding familiarity with social networking, and, second, yielding the degree of extroversion, a concept known from personality research. It is plausible that extroverts react differently to social networks and SNB than introverts. Both of these concepts are measurable on a continuum and both are perceived measures.

Based on the instantiations to this point, we can either continue to build a theory around perceived fit (possibly adding task characteristics) or we can proceed with instantiating predictive and normative beliefs towards a theory of perceived gap. We choose to do the latter for this illustration and propose that the degree of extroversion causes an increase in normative beliefs about the SNB that should be present on sites. Familiarity with social network on the other hand may contribute to expectations about the presence of SNB that will be provided on sites, i.e. predictive beliefs.

The gap model then suggests that two gaps exist. First, there is a gap between the perceived number of SNB and the expected number of SNB. Second, there is another gap between the perceived number of SNB and the normative beliefs about the number of SNB. We model both gaps in Figure 15. Note that neither of these gaps is measurable directly using questionnaires. In fact, the gaps are not perceptions, but functions of perceptions, as we pointed out previously. Hence, they should be "measured" using difference scores. This is also made clear by the fact that we have used dashed lines in Figure 15, indicating not a causal, but a functional connection.

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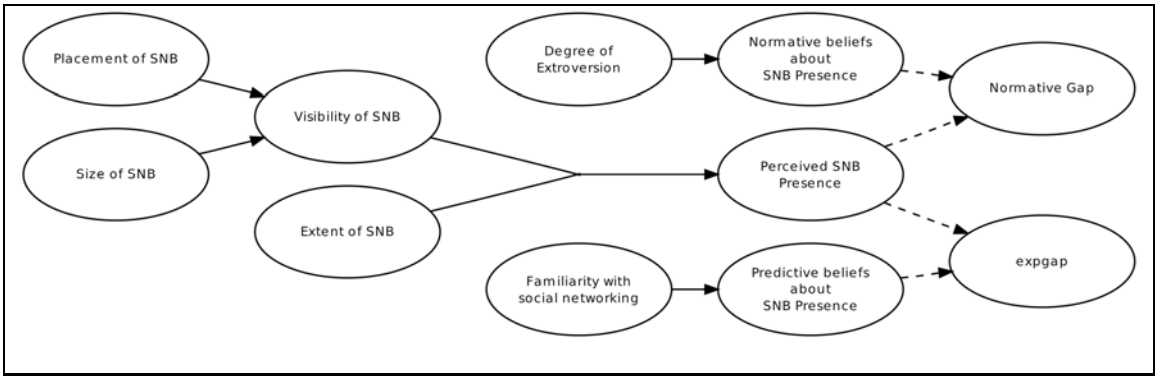

Figure 15: Social network bookmarking theory, stage 2

Finally, after instantiating the two gaps, we suggest, in accordance with previous gap theories, such as expectation disconfirmation or service quality, that a larger gap will cause a lower evaluation of the IT artifact. Negative evaluative beliefs will lead to a lower of affect and a lowering of intentions to use or re-use the IT artifact. We instantiate each of these concepts once, as shown in the final model in Figure 16. We have labeled the instance of evaluative belief as quality, while realizing that this theory will not be able to predict all of the quality beliefs. First, SNB is but one aspect of an IT artifact, and there are others, which we do not examine in this theory. Second, as can be seen from Figure 6, a second predictor of evaluative beliefs is perceived fit, usually in the context of a given task. As we do not examine tasks, task perceptions, and fit, we expect significantly less than perfect prediction of evaluative beliefs.

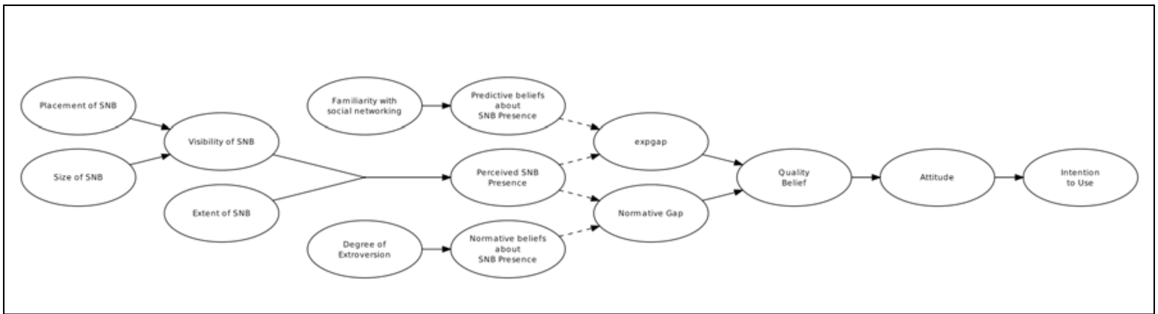

Figure 16: Social network bookmarking theory, stage 3

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In summary, this section has demonstrated that the theory template can form a guide to creating IS theories. Because the instantiation of the template begins with the IT artifact, the resulting theories are focused on characteristics of the IT artifact, and therefore located around the core of the IS discipline (Benbasat and Zmud, 2003). In our example, we attempt to explain how SNB features can contribute to usage intentions of a web site. This focus on the IT artifact also makes the theories practically relevant. If supported by data, our theory might tell practitioners that to increase usage intentions they need to increase visibility and extent of SNB functionality, with the visibility being a sum of placement and size of SNBs.

Table 1: Instantiating the Template

Step	**Template Concept**	**Task**
1	IT Artifact	Identify and instantiate (possibly multiple) characteristics (properties) of the IT artifact that are of interest
2	Context/Task	Identify and instantiate (possibly multiple) characteristics (properties) of the task or context that are of interest
3	Perceived IT Artifact (affordances)	Based on step 1, instantiate perceptions corresponding to characteristics of the IT artifact
4	Perceived context/task	Based on step 2, instantiate perceptions corresponding to characteristics of the context/task
5	Predictive and normative beliefs	Identify and instantiate (possibly multiple) predictive and normative beliefs about the characteristics of the IT artifact identified in step 1
6	Personal/Cognitive characteristics	Identify and instantiate characteristics that are of interest
7	Fit **or** Perceived Fit **or** Perceived Gap	Decide whether to proceed with Fit, Perceived Fit, or Perceived Gap (or multiple of these).
8a	(For a fit model)	Identify and instantiate (typically one) performance of interest, congruent with characteristics of context/task identified in step 2
8b	(For a gap model)	Instantiate (possibly multiple) evaluative beliefs
8c	(For a gap model)	Instantiate (typically one) attitude and intention

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Table 1 shows a recommended process when instantiating the theory template. The process begins with the identification of characteristics of the IT artifact and the context/task. It is here that care must be taken to theorize about the IT artifact and identify interesting characteristics (properties) rather than just examine its presence or absence (Dubin, 1969). Related academic disciplines such as computer science or human computer interaction can also provide relevant and interesting properties of the IT artifact. The remainder of the instantiations is to a large extent guided by the IT characteristics of interest, as Table 1 shows. Our guidance cannot be more specific than this. The intention is for the researcher to decide what characteristics of the IT to focus on (and to instantiate) and what perceptions or beliefs are relevant and interesting. Following the template guides the researcher to build theories that include the IT artifact and encourages her to construct theories that are logically consistent with the framework provided by Fishbein & Ajzen's (1975) work, which underlies, as the psychological basis, a host of IS theories and theories in related areas that focus on individual behavior

Discussion and Conclusion

In this paper, we have presented a theory template that is based to a large extent on well-accepted work in psychology (Fishbein and Ajzen, 1975). In that work, perceptions give rise to beliefs, which in turn cause attitudes and behavioral intentions. Our theory template is structured along these causal links.

We have developed a theory template, rather than a theory, as it needs to be instantiated. This instantiation can be done multiple times for each concept in our template. Thus, here is a clear distinction between specific theories and general theory templates. While templates may be comparatively simple, the resulting theories need not be so, as shown in the previous section. In fact, we would expect theories not to be as

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simple as templates, as the IS domain at the intersection of artifact, human, and task is complex with a wide range of phenomena to be studied. While we may wish for parsimony in our aim to be easily understood, we do not believe that all of human experience can be explained by a theory with two or three concepts.

Second, we have shown that theories contain at least two kinds of concepts and two kinds of links. Concepts such as perceptions, and beliefs can be measured and may, depending on the reader's philosophy, be assumed to be real. On the other hand we have concepts that are reified interaction terms, expressed primarily as mathematical functions, such as gaps or fits. Being mathematical functions, we suggest these are not real. For example, we disagree with (Parasuraman et al., 1988) who suggest that perceived service quality is a gap. Instead, we suggest that service quality is a belief about an artifact or process (the service) that is a result of a gap. With the two different kinds of concepts go two kinds of "links" or "arrows" in our theory. The first type are ordinary causal arrows that form the focus of any theory. However, we also introduce functional input/output relationships in connection with functional concepts. We urge researchers to closely attend to the distinction between causal and functional relationships in their theories. As pointed out above, the Task-Technology-Fit model by Goodhue et al. (1995) is a negative example where this distinction has been neglected.

Third, our theory template makes a clear distinction between perceptions and objective concepts. For example, researchers could measure “problem solving performance” objectively, perhaps as a sum-score of multiple experimental tasks. They could also measure “perceived problem solving performance', perhaps using a questionnaire. This distinction is important not only for theory but also for measurement. For example, the demonstrated, objective, performance might be formed as the sum of a set of observations, while the perceived performance causes a subject to respond in certain ways to questions. Hence, in the terminology of Petter et al. (2007), the first is a

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formative measure, while the latter is reflective. When the researcher fails to make this distinction, confusion arises about the measurement. By clarifying the nature of key concepts and relationships in the information systems field, we hope also to contribute to the quality of IS theory by reducing the number of theories that conflate concepts that are conceptually distinct and incommensurable.

Fourth, we have shown that our theory template is sufficiently complete to allow us to express existing IS theories by means of its concepts on the basis of a single, unified theory template, showing that these theories are part of the same paradigm, and are commensurable with each other. This should go a long way towards satisfying critics of the field in providing a single, well integrated core theory that satisfied the requirements of a discipline in terms of a single, overarching, paradigmatic framework into which individual theories can be sorted.

Finally, we have noted that most existing IS theories commit an error of exclusion in that there is little regard for the IT artifact. In contrast, we have demonstrated that a systematic instantiation of our template leads to theories in which characteristics of an IT artifact form the ultimate antecedents. Hence, we argue that these theories are most relevant to practitioners who are able to affect these characteristics in their practice. By providing a theory template whose instantiation begins with objective characteristics, researchers are encouraged to extend their theories into the intersection of technology, humans, and tasks, and thus to ensure that the developed theories that are relevant and useful to practitioners. This ensures that we as a field continue doing IT research that matters.

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