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The Impact of Functional Affordances and Symbolic Expressions on the Formation of Beliefs

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Abstract

Research on IS success and IT adoption has shown that object-based beliefs about IT systems have a profound impact on subsequent IT usage. However, we still lack knowledge on and need to identify antecedents and determinants of object-based beliefs in order to understand how the belief formation process works and how it can be influenced. Our research builds on and extends Markus and Silver's (2008) concepts of functional affordance and symbolic expression to examine how IT-related factors influence the formation of beliefs. To test our research model, we surveyed 183 users of a student information system. The proposed model was supported, offering evidence that values, meaning, and functional affordances provided by an IT system positively affect information quality and system quality.

***Keywords**: Structuration Theory, IS Adoption, Object-based Beliefs.*

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1. Introduction

Information technology (IT) pervades important aspects of human life at different levels, such as individuals, teams, or organizations. The effect of IT on human behavior has been investigated, especially in two major research streams—the IT adoption and user satisfaction literature (DeLone & McLean, 1992; Venkatesh, Morris, Gordon, & Davis, 2003)—and both research streams have converged to reach a shared understanding of the salient predictors of an individual's acceptance and intentions to use IT. An important and long-standing research question in the information systems (IS) field deals with individual beliefs about IT systems that have been shown to have a large effect on subsequent IT effects and IT usage behaviors (Sabherwal, Jeyaraj, & Chowa, 2006; Wu & Lederer, 2009). Beliefs can be understood as the cognitive structures that individuals develop after gathering, synthesizing, and processing information about IT, and they incorporate individual assessments of various outcomes associated with technology use (Agarwal, 2000; Lewis, Agarwal, & Sambamurthy, 2003). Research on IT adoption and IS success has made important steps to understand which kind of beliefs contribute to a successful adoption process (Petter & McLean, 2009; Wixom & Todd, 2005). At the same time, the necessity to better understand the processes and determinants that affect the formation of key acceptance and success constructs has arisen and has become a focal point of interest among researchers (Benbasat & Barki, 2007; Petter, DeLone, & McLean, 2013; Venkatesh, 2000; Venkatesh & Davis, 1996). This knowledge is crucial to inform researchers and practitioners about how beliefs are shaped in the first place and what kind of factors affect the formation of beliefs. Given the fact that the decision to implement new IT is connected with large investments, managers need to know how the design of IT systems influences users and how it can be improved to foster the IT adoption process and serve an organization's purpose (Al-Natour & Benbasat, 2009).

Prior empirical studies have analyzed several institutional (Lewis et al., 2003), social (Sabherwal et al., 2006), and individual (Karahanna & Straub, 1999; Venkatesh, 2000) antecedents of beliefs and developed a sound knowledge base concerning the formation of beliefs. However, the question of how IT-related factors shape beliefs about technologies has not been conclusively answered (Petter et al., 2013)[1]. Even though a positive relationship between technology on the one hand and beliefs on the other hand is assumed, it is not clear how the mechanics shaping beliefs about IT work and how actions induced by these beliefs shape IT-related factors guiding people's behavior.

Apart from the lack of studies that focus on technology-related antecedent that shape beliefs, extant research mostly focuses on the use of an IT system as a whole, even though an increasing number of studies have shown that different users use the same IT system differently (Leonardi, 2013; Sun, 2012). So far, few studies have investigated the use and effects of specific features of an IT system or have tried to uncover the effects of different functions that influence individual users in their use of different features of IT systems (Cenfetelli, Benbasat, & Al-Natour, 2008; Sun & Zhang, 2008). Therefore, we examine how, on a feature level, IT-related factors shape individual beliefs about IT in the context of a single empirical study.

In this paper, we build on and extend Markus and Silver's (2008) conceptualizations about the relation between users and IT artifacts in order to empirically study IT-induced effects on the formation of beliefs about IT systems. Individuals who use IT create perceptions about the role and utility of IT for their activities. These perceptions can vary widely across individuals and groups and influence the way IT is adopted and used. Specifically, Markus and Silver (2008) examine IT-related social structures and propose that users as human agents are related to IT systems through two major structurational concepts; namely, "functional affordances" and "symbolic expressions" (Markus & Silver, 2008). Both concepts relate users and technical objects and help to explain how structures emerge that determine to some degree how people use and interact with IT. Thus, functional affordances and symbolic expressions offer initial implications that explain how these IT-related sources for structure affect the formation of beliefs. We build on both conceptualizations to identify

[1] Wixom and Todd (2005) have introduced technology-related sub-dimensions of information and system quality that should not be confused with influence factors. On the contrary, in their conceptualization, information quality and system quality are modeled as second-order constructs that are composed of sub-dimensions such as information accuracy or system reliability.

and empirically test determinants of object-based beliefs, which leads to the following research question: “To what extent do the structures provided by IT systems affect the formation of object-based beliefs?”.

This paper has the following structure: in Section 2, we discuss the theoretical groundings and assumptions we build on to study the structurational effects of IT systems on the formation of object-based beliefs. In Section 3, we develop our research model. In Sections 4 and 5, we present an empirical study of a student information system. Finally, in Section 6, we discuss our study’s contributions and limitations and provide an outlook for future research.

2. Understanding Structurational Potentials of Technical Objects

2.1. A Structurational Model of IT Effects

One of the most influential structurational theories in IS research that has been put forward to study the interactions of human agents and IT is adaptive structuration theory (AST) (DeSanctis & Poole, 1994; Jones & Karsten, 2008). Basically, structurational theories claim that society should be understood in terms of action and structure; a duality rather than two separate entities (Jones & Karsten, 2008; Poole & DeSanctis, 2003). On the one hand, social structures serve as templates for planning and accomplishing tasks; on the other hand, they are reproduced and altered through human interaction (DeSanctis & Poole, 1994; Poole & DeSanctis, 2003). Therefore, structuration can be described as a circular process of (re-)producing social structures that shape human agents’ actions and beliefs and are, in turn, shaped by human agents’ actions (Al-Natour & Benbasat, 2009; Griffin, 2003) (Figure 1). At its core, AST is a holistic attempt to examine the interplay between advanced technologies, social structures, and human action (DeSanctis & Poole, 1994; Poole & DeSanctis, 2003). This theoretical framework explains how the structurational potentials of an IT system affect the formation of beliefs (Bostrom, Gupta, & Thomas, 2009; DeSanctis & Poole, 1994).

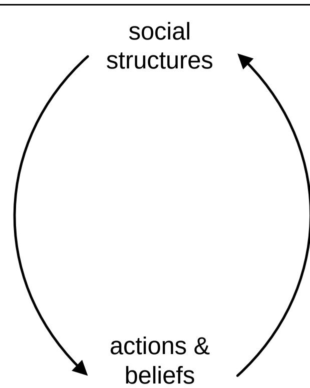


Figure 1. Structuration: Circular Relation between Agents’ Actions & Beliefs and Social Structures

In an effort to advance AST (DeSanctis & Poole, 1994; Poole & DeSanctis, 2003), Markus and Silver (2008) introduced a new conceptualization for studying IT effects and proposed two novel concepts that serve as a source for social structure and that relate IT artifacts to individual human agents: functional affordances and symbolic expressions A third concept, linked by functional affordances and symbolic expressions to users, are the IT artifacts themselves and their component parts, which build the technical system and are called technical objects (Figure 2). Technical objects are made by humans and are the outcomes of intentional design and manufacturing processes. They are real things, whether material or abstract (Faulkner & Runde, 2010), with properties that may have causal potential (Markus & Silver 2008). These properties influence the feature set of an IT system and may be intended or not because technologies do not merely assist in everyday lives but are also powerful forces acting to reshape human activities and their meanings (Bijker, 2010). The differentiation between intentional design on the one hand and the impact to reshape human action on the other hand is called the dual nature of IT artifacts (Houkes & Meijers, 2006; Kroes, 2010).

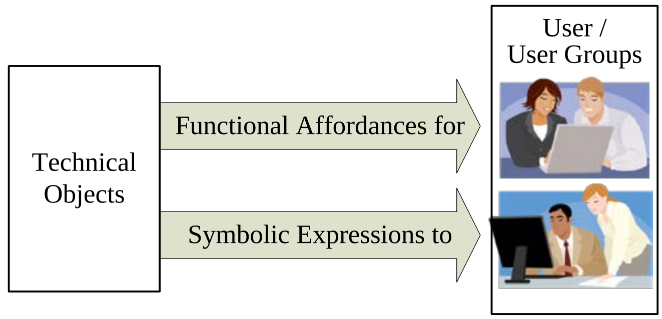


Figure 2. Functional Affordances and Symbolic Expression (Markus & Silver, 2008)

The importance of the relation between technology and humans is accentuated in Markus and Silver's (2008) conceptualization by not directly attributing the properties of technical objects to the technical objects themselves but to the relations between technical objects and users instead. Every individual user or user group perceives, understands, and grasps the structures that are provided by specific technical objects differently; thus, the technical object or "technology-in-practice" and the user are inextricably connected and cannot be studied separately (Orlikowski, 2000). In other words, "it is the capabilities of the technology, just as much as the choices people make about how to use those capabilities, which explain the ultimate effects that technologies have on social structures. They are two sides of the same coin" (Leonardi, 2013). Therefore, the concepts of functional affordances and symbolic expressions are central to the study of IT adoption and the formation of beliefs as bridging concepts that tie users and technical objects together (Figure 3).

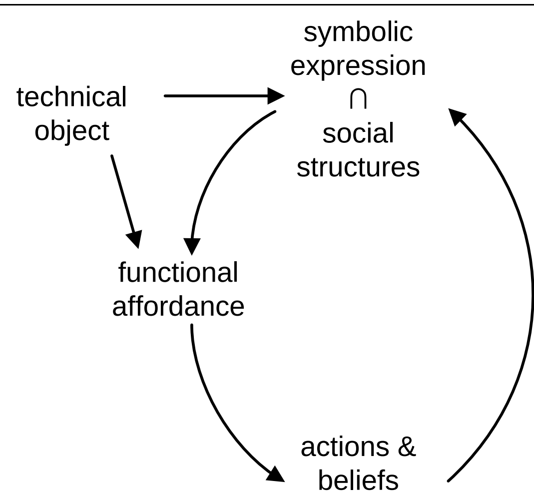


Figure 3. Symbolic Expression and Functional Affordances as Bridging Concepts

Compared to concepts such as perceived usefulness (Davis, 1989) the concepts of technical object, functional affordance, and symbolic expression offer unique and important opportunities to investigate the relation between IT artifacts and users. The concept of technical object allows for one to analyze the artifact-user relation on the level of properties and features of the IT system under consideration. Concepts such as perceived usefulness do not offer this possibility since usefulness is defined as the extent to which a person believes that using a particular system as a whole would enhance their performance (Davis, 1989). Social structures directly impact the actions of users through the concepts of functional affordances and symbolic expressions by influencing the relation between technical objects and users. Perception and action, therefore, depend on social structures that are not considered in the concept of perceived usefulness but in the structurational perspective. Additionally, the dual nature of IT artifacts helps to differentiate between IT designers' intentions and the impact IT has on social structures that shape human actions. IT adoption theories generally do not take this dual nature into account and presume that every user perceives the IT system as initially intended by the designers.

2.2. Functional Affordances

The term affordance was first introduced in ecological psychology by Gibson (1977) and refers to a combination of physical properties of the environment; "what it offers the animal, what it provides or furnishes, either for good or ill" (Gibson, 1986). Affordances are actionable properties offered by any real-world object to an actor in a given situation: a stone can be a missile and other things as well, such as a paperweight, a bookend, a hammer, or a pendulum bob (Gibson, 1986). Functional affordances are relations between technical objects and users in specific situations. They can be described as cues and instructions that are offered by a technical object to the user in order to provide opportunities for particular types of individual behavior (Chemero, 2003). Functional affordances comprise the possibilities for action offered by a technical object and, therefore, determine the potential use of a technical object (Markus & Silver 2008). They can be purposefully designed to assist and help users to accomplish tasks (Hartson, 2003). However, the same technical object can support multiple affordances because affordances do not exist without users' intentions and, depending on these perceptions, users assess the usefulness of a functional affordance. Users might differ in their perception and use of IT artifacts and, therefore, enact different individualized affordances from the same technology, depending on the situation they are in (Leonardi, 2013; Markus & Silver, 2008). Because the number of functional affordances that can be studied for the same technical object potentially becomes very large, the focus of our study is on individualized functional affordances of members of a specified user group that have similar demographic characteristics (Leonardi, 2013). These members should, therefore, share roughly the same structure of feature use, and features that are unknown or unfamiliar should not belong to their set of functional affordances (Sun, 2012).

As Section 2.1 describes, there are key differences between the concepts of perceived usefulness and functional affordances. Although perceived usefulness also taps into the instrumental outcomes a user associates with a technology, it is a conceptually distinct construct from functional affordances. Perceived usefulness is a belief that captures an individual's overall assessment of the utility offered by a system as a whole to enhance the individual's performance (Davis, 1989), while functional affordances as a feature-centric concept emphasizes the specific features a of a technology and additionally takes the user's individual situation into account, which perceived usefulness does not.

2.3. Symbolic Expressions as Communicated Values and Meanings

Symbolic expressions are defined as the communicative possibilities that are provided by a technical object for a specific user group (Markus & Silver 2008). Referring to de Souza and Preece (2004), Markus and Silver (2008) mainly focus their elaborations of symbolic expressions on the conveyance of values, although they explicitly state that they also use the concept to refer to expressions about functionality. We suggest considering both interpretations because the understanding of the meaning attached to a symbol (intentionally or unintentionally) is as important as the intent of a technical object with regard to values. Therefore, we propose decomposing the concept of symbolic expressions into two separate sub-dimensions to make it accessible to quantitative studies and to discern the different effects resulting from symbolic expressions: communication of values and communication of meaning.

The manner or form in which a thing is expressed in any kind of symbol is called the communication of meaning. A meaning (the signified) behind a symbol (the signifier) is conveyed by this symbol (de Saussure, 1974). Symbols serve as a means of communication, and successful communication requires the know-how to produce the relevant symbols with the intended meaning (Bühler, 1990; Hesse, Müller, & Ruß, 2008). If a symbol is to convey some meaning in the context of technical objects, it must be recognizable and identifiable by a user group, and the symbol must communicate a similar meaning to all users in the group. For instance, concerning the example of the Windows key on PC keyboards in the form of the symbol “⊞”, a question posed is do users understand the meaning of the Windows key and how it has to be used (e.g., as a shortcut for entering a menu in Microsoft Windows XP or Windows 7)? Thus, the concept of communication of meaning is a sub-dimension of symbolic expression that relates to the understanding of functions or symbols provided by a technical object. The meaning of technical objects is partly defined by the context of use, while its physical form and function remain fixed across time and contexts of use (Orlikowski, 1992). This understanding is useful for demonstrating how meanings arise around a technical object (Bijker, 2010).

While we mostly consider “meaning” as the interpretation of an underlying real-world phenomenon by a user that a symbol refers to (Margolis & Laurence, 2006), a symbol also promotes values that are related to the symbol. For example, the color red signifies danger in some cultures and celebration in others (Everett, 2005; Nakakoji, 1996). The concept of communication of values comprises the sub-dimension of symbolic expression that deals with values, which are intentionally or unintentionally conveyed by a technical object to support certain functionalities or tasks. “Values” refer to those criteria and standards of judgment that govern both goals and behavior as part of our “deep structure of personality” (Pollay, 1987). In general, technical objects can promote very different values such as control, freedom, or reliability and induce specific perceptions of and beliefs about a technical object (DeSanctis & Poole 1994). These may be in relation to a feature or affordance, but the reason why the offered feature is desirable is because of something valued by the user (Pollay, 1987, p. 30). For example, the Windows key signifies a functionality but it may also signify some value-laden interpretation to users who use or do not use Microsoft Windows. Table 1 summarizes the key concepts that guide our research.

Table 1. Concept Definitions

Concept	Definition and description	Key source references
Functional affordances	Functional affordances refer to potential uses of IT artifacts for users in specified situations. They are relations between technical objects and users, who identify what could possibly be done with the objects The concept focuses on issues related to technical functionality and comprises the feature set of a technical object as perceived by an individual. Functional affordances are possibilities for action that are afforded by technical objects to a specified user group.	Markus & Silver (2008), DeSanctis & Poole (1994), Chemero (2003), Gibson (1977), Hartson (2003), Leonardi (2011, 2013), Sun (2012)
Communication of meaning	The conveyance of meaning attached to a symbol or function. We consider meaning as the interpretation by a user of an underlying real-world phenomenon that a symbol refers to. Symbols serve as a means of communication; successful communication requires the know-how to produce the relevant symbols with the intended meaning.	Markus & Silver (2008), DeSanctis & Poole (1994), Bühler (1990), Hesse et al. (2008)
Communication of values	A technical object communicates values and therefore induces specific behaviors and perceptions of the technical object. Values may be in relation to the entire IT object or to specific functions, but the “reason why” the offered function is desirable is because of something valued.	Markus & Silver (2008), DeSanctis & Poole (1994), Pollay (1987)

2.4. Advancing the Model of IT Effects

Markus and Silver (2008) consider symbolic expressions and functional affordances as two parallel concepts that connect technical objects and users. However, they explicitly do not limit the concept of symbolic expressions to the relation between users and technical objects. They also use the concept to refer to expressions about functionality in order to support potential analyses of the relationships between functional affordances and symbolic expressions (see Figure 4). Symbolic messages, therefore, may relate to an IT artifact as a whole or to any of its functional components. An Internet forum, for example, might convey values such as empowerment and democracy because it offers the possibility to post and comment messages, to ask questions, or to discuss topics. However, a posted message might need to be approved by an administrator before it is published or specific threads and topics might be restricted. Thus, functional affordances and value-oriented expressions may be in conflict with each other because users might not be able to use a function that is offered by a technical object. Conversely, symbolic expressions might also be positively related to a function. E-commerce websites that are expressing values such as security and control are positively contributing to the overall awareness of the website (Hu, Wu, Wu, & Zhang, 2010). These values encourage users to provide personal information or to use supplementary services that are offered by a website. In doing so, users extend their individualized set of functional affordances and gain knowledge of novel possibilities for action.

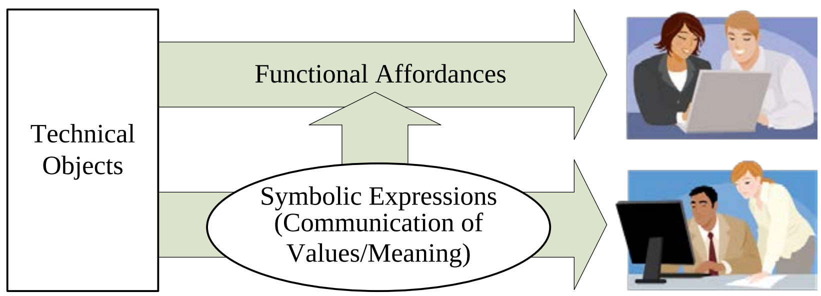


Figure 4. Relationship between Symbolic Expression and Functional Affordance

The concept of communication of meaning helps increase understanding of how meaning influences the functional affordance of a technology. Understanding the meaning that is attached to a function fosters the development of a wider set of individualized functional affordances. For example, a user who understands the meaning of the symbol "🖫" (depicting an icon in the form of a 3.5 inch floppy disk) will basically know what kind of functionality underlies the symbol (e.g., saving the current version of one's work). Thus, understanding the meaning that is attached to a function will also influence the awareness and perceived possibilities of a functionality. Figure 5 summarizes the extended research framework based on the deliberations of Markus and Silver (2008). The concepts of functional affordance and communication of meaning and value as the sub-dimensions of symbolic expression help researchers to explain the outcomes observed when a technology is used.

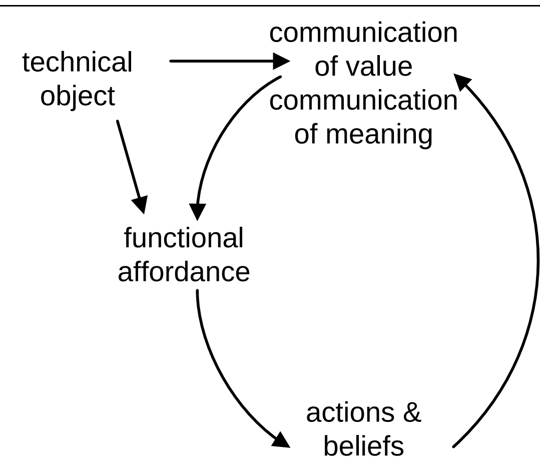


Figure 5. Research Framework

To recap, AST describes an IS as a socio-technical system (Bostrom & Heinen, 1977) in which each element may impact others, and the nature of interaction may change over time (Bostrom et al., 2009, p. 30). The embedding and emergence of these interactions between people and technology are not fully determinate (Avgerou, Ciborra, & Land, 2004; Ciborra, 2001). Nevertheless, in the framework of socio-technical systems, the two sub-systems, the technical and the societal sub-system, are characterized by complex and dynamic interactions over time (Markus & Robey, 1988; Orlikowski & Scott, 2008). Therefore, our research framework has the following implications. Since structuration proposes a circular relation between actors' actions and beliefs on the one hand and communication of value and communication of meaning as structurational elements on the other hand, two directions of analysis are possible: 1) researchers may analyze how actions and beliefs shape communication of value and meaning, and functional affordance, which corresponds to the right part of Figure 5, and 2) how communication of values and meaning impact functional affordances and actors' actions and beliefs, which corresponds to the left part of Figure 5. Specifically, this means that any structurational analysis of the relation between technical objects and actors' actions and beliefs is dependent on the point in time of analysis. As Figure 6 illustrates, for example, functional affordances at time t depend on the communication of values and meaning induced by an existing technical object and affect actors' actions and beliefs. These may shape future communication of values and meaning concerning the same technical object modifying functional affordances at time t+i. In this paper, we specifically analyze how IT-induced communications of value and meaning relate to functional affordances and affect actors' beliefs at a given time t. Future research may analyze how actors' actions and beliefs shape communications of value and meaning, the duality itself, or the interaction of both over time.

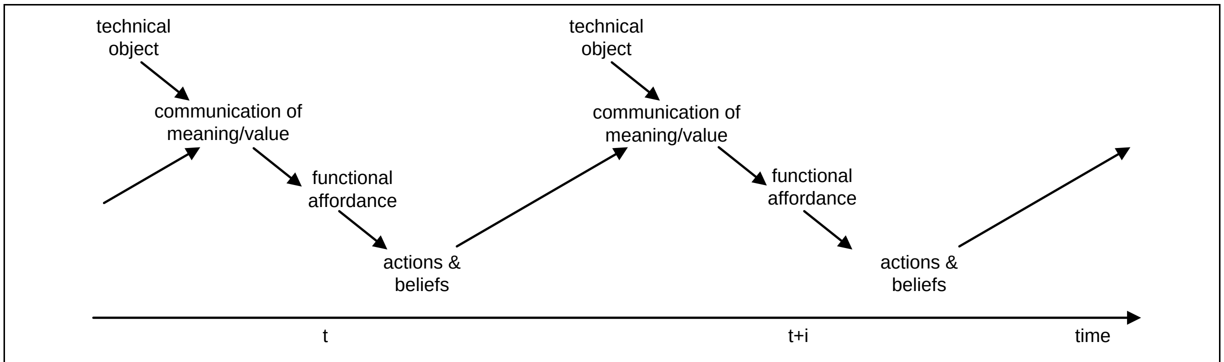


Figure 6. Time Variance of Structurational Analyses

2.5. Object-based Beliefs

We build on Markus and Silver's (2008) conceptualization of IT effects as a theoretical framework that relates the structurational potential of a technical object to individuals. However, we have to differentiate between behaviors that are determined by technical objects and how technical objects are perceived by individuals before any action takes place (Al-Natour & Benbasat, 2009). This differentiation is important because social structures determined by technical objects indirectly influence IT usage behavior through the formation of beliefs about a technical object (Al-Natour & Benbasat, 2009; Wixom & Todd, 2005). According to Fishbein and Ajzen (1975, p. 131), "belief formation involves the establishment of a link between any two aspects of an individual's world".

In our conceptualization, links that connect an individual and a technical object are the functional affordances of a technical object and the values and the meaning provided by a technical object (Markus & Silver 2008). The structurational concepts can, therefore, also be regarded as antecedents of object-based beliefs (cf. Table 2). They can be understood as the information an individual has about a technical object by relating the technical object to certain discriminable attributes that the individual believes the artifact to possess (Al-Natour & Benbasat, 2009). Among the most commonly investigated object-based beliefs are information quality and system quality, which are important constructs in the IS success model (DeLone & McLean, 2003; Petter et al., 2013; Petter & McLean, 2009). We omitted service quality, which has become a salient concept in the IS success literature (Petter, DeLone, & McLean, 2008; Petter & McLean, 2009), from our study because the concept measures the quality of an IS department. In contrast to information and systems quality, service quality is not directed at the relation between users and a technical object but at the relation between users of a technical object and a service department.

Table 2. Object-based Beliefs

Concept	Definition and description	References
Information quality	Overall quality perception of the information provided by a system.	Wixom & Todd (2005), Xu, Benbasat, & Cenfetelli (2013)
System quality	Overall evaluation of a system in terms of quality.	Wixom & Todd (2005), Xu et al. (2013)

3. Research Model and Hypotheses

Stemming from the above discussion, the possibilities that technical objects afford for action may or may not be perceived by individuals in differing ways and may, therefore, elicit different kinds of beliefs (Faraj & Azad, 2012). An individual user can consider a technical object to be of higher information or system quality if it provides information and functionalities that confer benefit to the user; for example, in order to accomplish certain tasks in a more efficient way or to support decision making. In other words, a higher information quality or system quality is dependent on the functions afforded by technical objects and users will perceive a higher quality if generally the system and information are perceived to be advantageous (Cenfetelli et al., 2008). However, at the same time, users need to be aware of the functional possibilities and need to recognize what kind of functionalities a technical object offers (Faraj & Azad, 2012; Sun, 2012). Therefore, users will evaluate how well functionalities are delivered and will develop their own object-based beliefs based on their experience with the technical object (Faraj & Azad, 2012).

Functional affordances, which depend on both the material properties of technical objects and on the ability of users to grasp them, may thus be perceived and used differently over time as users experiment with technical objects and discover new features that afford different kinds of action and form object-based belief (Robey, Anderson, & Raymond, 2013). As such, we suggest that functional affordances will positively influence the formation of object-based beliefs if, on the one hand, useful functionalities are offered by a technical object and, on the other hand, users are aware of those functionalities (Al-Natour & Benbasat, 2009):

> **H1:** *Functional affordances (useful functionalities offered by a technical object and perceived by users) will have a positive effect on information quality.*

> **H2:** *Functional affordances (useful functionalities offered by a technical object and perceived by users) will have a positive effect on system quality.*

Gibson (1977) developed his affordance concept in response to arguments that meaning only exists in the mind of the perceiver, which would make perception a wholly internal mental process. Countering this extreme constructivist argument, Gibson (1977) theorized that affordances represent meaning that exists in the environment itself and could, therefore, be directly perceived. In contrast, in the relational view advocated by Robey et al. (2013) and Markus and Silver (2008), which tries to preserve ontological distinctions between technical objects and users and which we adopt in our research, material properties of technical objects become necessary conditions for functional affordances but are not the functional affordances themselves.

Seeing that different users can see different meanings for the same technical object and functions, Markus and Silver (2008) explicitly introduced the concept of symbolic expressions to address concerns about DeSanctis and Poole's (1994) definition of the concept of spirit, which captures intents and values (concepts that most researchers attribute solely to humans), as a property of the technology. Symbolic expressions, and its sub-concepts of communication of values and meaning, can be understood as potentially communicated messages from designers to users about how users must interact with the technical object in order to achieve a certain range of goals and experiences (Markus & Silver, 2008; de Souza & Preece, 2004). A technical object, for example, may provide differing symbolic expressions (values and meanings) for a specified user group, just as it may have many functional affordances (Markus & Silver, 2008). Consequently, communication of values and communication of meaning should not be confused with designers' intentions. Users may perceive certain symbols or messages differently because they have distinct "interpretive schemes" and different frames of reference with regard to their background, expertise, or knowledge base, which, in turn, affect the extent functions are perceived (Faraj & Azad, 2012; Giddens, 1984). It follows that modified knowledge bases and experiences will affect users' interpretive schemes (e.g., a person may never have used a floppy disk but may become aware of the meaning of the symbol "🖫"). The same technical object may be perceived differently by the same user group at later points in time; communications of value and meaning and functional affordances are time-dependent. Therefore, at any given point in time, the concept of communicated values and meanings are not restricted to the relation between users and technical objects but also refer to the relationships between symbolic expressions and functional affordances (Markus & Silver, 2008) (see Figure 7).

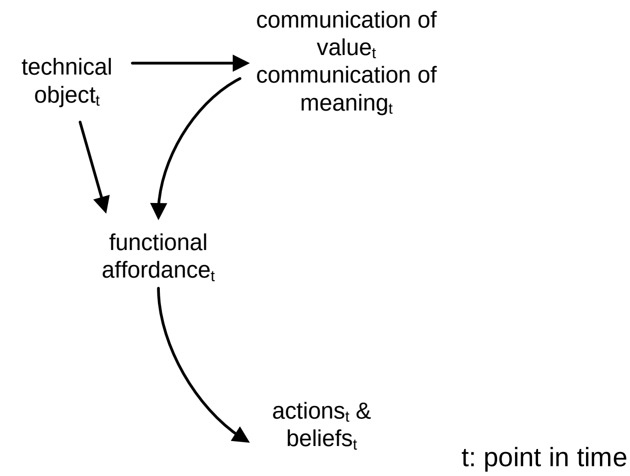


Figure 7. Relationships between Communications of Value and Meaning and Functional Affordance

The communication of values helps increase understanding of how values affect user perceptions of functionalities. Values guide user decisions and provide norms that specify how resources should be used and how users might behave. For instance, Wikipedia, a collaboratively edited encyclopedia, is an example where communicated values such as freedom, democracy, and altruism affect how functional affordances of a platform to share knowledge and experience with the broader public are perceived and that contribute to the willingness of users to voluntarily add to the pool of knowledge with user-generated content (Soliman & Beaudry, 2010). Because Wikipedia is an open and free platform where everyone can contribute content, functionalities that offer the possibility of editing and discussing articles are perceived and ultimately used by many authors and editors during the process of writing an article. Likewise, research on e-commerce has shown that shopping behavior is affected by values such as trustworthiness, risk, and security (Hu et al., 2010). Users are more willing to provide personal information, to pay a premium to purchase, and to use recommendation systems if those values are presented by the e-commerce site by, for example, displaying Web assurance seals and privacy statements (Hu et al., 2010). Technical objects that successfully promote positive values will, therefore, positively contribute to the perception of functions afforded.

Users must understand the meaning that is attached to a function so that they can grasp the idea of what kind of possibilities a function might offer. A function, therefore, can only be a part of an individualized functional affordance if users develop a general understanding about the function and what kind of outcomes can be achieved by using the function (Markus & Silver 2008). This is why the meaning communicated by a technical object will positively affect the set of functional possibilities that are provided by a technical object. We expect a positive effect of successfully perceived communication of meaning and values on the concept of functional affordances. As such, we hypothesize:

H3: *The more effectively meaning is communicated by a system, the better functional affordances will be perceived.*

H4: *Positive values communicated by a technical object will positively affect functional affordances that are perceived by users.*

As we outline above, the structure provided by a technical object partially influences the formation of object-based beliefs (Al-Natour & Benbasat, 2009). Users will attribute a higher quality to the information provided by a technical object if information is easily understandable and information transfer is supported by the technical object. For example, many IT systems offer graphical tool tips, status bars, and other graphical elements to support the display of information. At the same time, these elements also contribute to the overall system quality perception. Users will only be able to develop a positive belief towards a system if they understand what the system does and what the functionalities and information mean. Thus, users who know how to use a system and understand its functionalities will perceive a higher information and system quality. As such, we hypothesize:

H5: *The more effectively meaning is communicated by a technical object, the better information quality will be perceived.*

H6: *The more effectively meaning is communicated by a technical object, the better system quality will be perceived.*

In recent years, several studies have investigated IT-related values as important constructs in order to explain the formation of different beliefs (Karahanna, Agarwal, & Angst, 2006; Soliman & Beaudry, 2010). They have suggested that technical objects that are consistent or compatible with one's value system will positively affect the formation of beliefs. However, such a compatibility-based perspective might not always be applicable because compatibility is measured on an aggregate level. When it comes to specific values such as reliability, control, or productivity, the compatibility between values cannot be easily measured, and, in some cases, compatibility might not be reasonable (e.g. the compatibility between the credibility of a technical object and one's credibility might not make sense). Another value-based research stream focused on special value-laden seals that are presented on online shopping sites to promote values such as trust and security (Hu et al., 2010; Hui, Teo, & Lee, 2007). These studies showed that positive values generated by a website through Web assurance seals affect trust and information disclosure behavior. Altogether, IS research has dealt with values as predictors for beliefs in different settings and has demonstrated how values shape user beliefs. In contrast to the aforementioned studies, the concept of communication of values extends these value-based approaches because it allows one to examine the diversity of values in more detail, which is a useful way to investigate the possibilities that technical objects offer for users (Markus & Silver, 2008). Generally, we can state that positive values communicated by technical objects affect the way users perceive the system and, therefore, positively affect the formation of object-based beliefs. Thus, we expect that values that are positively associated with a technical object will have a positive effect on information quality and system quality. As such, we hypothesize:

H7: *Positive values communicated by a technical object will positively affect information quality.*

H8: *Positive values communicated by a technical object will positively affect system quality.*

Figure 8 summarizes the research model and underlying hypotheses.

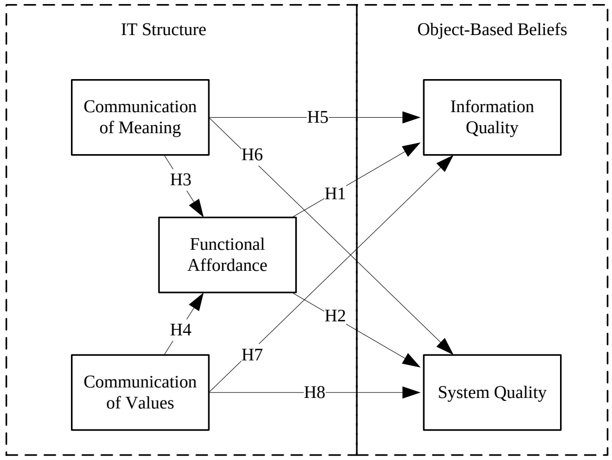


Figure 8. Research Model

4. Methodology

4.1. Instrument Development and Pre-testing

We focused on users of a computerized student IT system (SIS) in place at a Western university. The IT system provides students with information about lectures, seminars, and courses and offers the possibility to plan and manage the entire semester. We chose the SIS as the technical object in question because the feature set and the purpose of the SIS from the perspective of a student are limited and precisely determined.

In order to develop items for the new constructs, we first interviewed four students who were users of the SIS. The main reasoning behind the interviews was to understand the SIS from the point of view of a student and to find out its most important characteristics. Based on the theoretical deliberations and the interviews, we created a first set of measures. A second independent researcher who was also familiar with the SIS reviewed this first item set. In order to guarantee construct validity and to identify ambiguous and poorly worded items, we asked 9 undergraduate students and 6 PhD students to match the items to the concepts as presented in our research model. We conducted 2 Q-sorting rounds using an Excel spreadsheet in which the students could label each item with one of the constructs (Moore & Benbasat, 1991). We computed and checked substantive validity using the approach that Anderson and Gerbing (1991) propose. After 2 sorting rounds, we altogether achieved 8 items for communication of meaning (COM), 7 items for communication of values (COV), and 5 items for functional affordance (FA) with substantive-validity coefficients above 0.6. We subsequently discussed the measures that resulted from the sorting rounds and chose a final set of measures that we used in a pre-test survey.

In addition to the measurement scales for the new constructs, we included open questions in the survey to capture any functional affordances, meanings, or values that were potentially missing. In order to pre-test the measurement scales, we conducted an online survey with 93 student participants (47 male students and 46 female students). Respondents ranged from 18 to 32 years of age, with a mean age of 21.3 (SD = 2.3). On average, students were in their second semester (M = 2.2, SD = 1.00). The open questions did not provide any additional items that were missing in the questionnaire. We ran an exploratory factor analysis to check the two-dimensionality of symbolic expressions. We conducted a principal components analysis (PCA) on the items for COM and the items for COV with orthogonal rotation (varimax). Of the eight items for COM, we had to drop three due to low factor loadings; we retained the items for COV. We ran a second exploratory factor analysis with the final set of items. The results of the analysis verified the sampling adequacy for the analysis (Kaiser-

Meyer-Olkin measure (KMO) = 0.88). All KMO values for the individual items were higher than 0.83, which exceeds the acceptable limit of 0.5. Bartlett's test of sphericity was significant ($\chi 2$ (78) = 1109.7, $p < 0.001$) and indicated that correlations between items were sufficiently large for PCA. The analysis resulted in two components with eigenvalues over Kaiser's criterion of 1 that explained altogether 73.9 percent of the variance of the variables. Given the large sample size, the analysis of the scree plot, and the Kaiser's criterion, we retained two components in the analysis. The analysis of the rotated component matrix yielded a simple structure in which items that were assumed to measure one construct loaded higher on one single component than on any other component with factor loadings above 0.66. The pattern of factor loadings suggests that component 1 represents COM (Cronbach's α = 0.93) and that component 2 represents COV.

Because we operationalized FA and COV as formative constructs, we computed the variance inflation factor (VIF) to determine if multicollinearity did pose a problem. We had to drop two items for COV due to a VIF score higher than 3.3 (Petter, Straub, & Rai, 2007). We retained the items for FA.

4.2. Research Site and Data Collection

We collected data for this study by surveying students as users of the SIS. The students attended a basic information systems course during the winter term in 2011. A total of 200 students out of approximately 380 students participated in the online questionnaire. After we removed all incomplete or unreliable questionnaires, we received a total of 183 usable questionnaires. Respondents ranged from 18 to 42 years of age, with a mean age of 21.8 (SD = 2.8). On average, students (106 male students and 77 female students) were in their second semester (M = 2.2, SD = 0.88).

4.3. Measurement Model

The final measurement model contained items for all constructs. We operationalized the constructs, except for functional affordances (FA) and communication of values (COV), as reflective indicators (Jarvis, Mackenzie, & Podsakoff, 2003). We measured all variables using multiple items on 7-point Likert-type scales, ranging from "strongly agree" to "strongly disagree" (cf. Table A-1 in the appendix). We measured communication of meaning (COM) using three reflective items[2]. We asked students if they generally knew and understood how the SIS works. We also modeled aggregated information quality (IQ) and system quality (SQ) as reflective constructs using three items per construct (Wixom & Todd, 2005; Xu et al., 2013).

We operationalized communication of values (COV) using five formative items (Petter et al., 2007). Since the SIS serves as a tool to support students during their studies, the focus was on values that are associated with teaching and productivity. We asked students to rate to what degree the SIS conveyed the proposed values. We also operationalized the construct of FA as a formative construct. We based our decision to model a formative construct on different criteria (Jarvis et al., 2003; Petter et al., 2007). We were especially interested in finding out what kind of functional affordances and values the IT system offered to the group of students and to what extent these were important for the students. While one could easily define general items that ask to what extent the IT system as a whole is used, we wanted to focus on the most important set of affordances from a user's perspective. This user-centric set of functions builds and, therefore, defines the construct of functional affordances of a technical object. This is why changes in the variables influence the meaning of the construct. In other words, if we added different functions to the IT system or we asked a different user group (such as teaching staff), the functional affordance of the SIS (thus. what the IT system affords to do) would change significantly. In addition, the formative measures may not be interchangeable since every measure accounts for a unique dimension of the construct (Ou, Pavlou, & Davison, 2014). This is true for the construct FA and COV as well. Therefore, we operationalized both constructs as formative.

[2] Out of the remaining 5 items for COM, we dropped two items because they were not interchangeable and, thus, not reflective items (Petter et al., 2007).

5. Data Analysis and Results

5.1. Scale Validation

We tested the measures and the research model with PLS using SmartPLS 2.0 (Chin, 1998; Hair, Ringle, & Sarstedt, 2011; Ringle, Wende, & Will, 2005). We examined internal consistency and convergent validity by assessing item loadings, composite reliability, and average variance extracted (AVE). All factor loadings were significant (Table A-1 in the appendix) and above the recommended threshold of 0.7 (Chin, 1998; Hair et al., 2011). Composite reliabilities (CR) were above 0.8 and each AVE was above 0.50 (Table A 2), indicating that the measurements are reliable and the latent construct can account for at least 50 percent of the variance in the items (Jöreskog, Sörborn, Toit, & Toit, 2001; Nunnally & Bernstein, 1994). Discriminant validity was also achieved since the correlations between each pair of latent variables were less than the square root of AVE (Fornell & Larcker, 1981).

The traditional evaluation criteria such as factor loadings and AVE are not applicable for evaluating formative measurement models. Because these measures assume high internal consistency (high intercorrelating indicators), they are inappropriate for formative indicators, where no theoretical assumption is made about inter-item correlation (Petter et al., 2007; Straub, Boudreau, & Gefen, 2004).

For FA and COV, we assessed construct validity by using principal components analysis to examine the item weights for the measurement model (Petter et al., 2007). For FA, the results show that three weights were significant while two weights (FA2 and FA4) were insignificant (Table 3). We had to drop one indicator for COV because it shared more variance with another indicator than with the construct COV so that we retained four indicators for COV (Cenfetelli & Bassellier, 2009). The results for COV show that three weights were significant (COV1, COV3, COV4) and one item was not significant. However, small absolute and insignificant weights should not inevitably be misinterpreted as a poor measurement model (Chin, 1998; Hair et al., 2011). Instead, one should further examine each indicator's weight (relative importance) and loading (absolute importance) (Cenfetelli & Bassellier, 2009). For FA2 and FA4, the loadings were positive and significant; thus, we can understand these items to be an important aspect of FA (Table A 1). The insignificant weight of FA2 and FA4 should, therefore, be interpreted as their relative contribution to FA after controlling for the other affordances. In summary, these results are consistent with the expectation that these five different individual affordances might not be equally important to the functional affordance construct. Likewise, COV2 showed an insignificant weight but a significant loading. Therefore, we also retained COV2 in the measurement model because of its relative contribution to COV. To ensure that multicollinearity does not pose a problem, we computed the variance inflation factor (VIF) statistic to determine if measures were too highly correlated. Multicollinearity is a concern if the VIF is higher than 3.3 for formative measures (Diamantopoulos & Siguaw, 2006). Table 3 shows that the final VIF scores were below the recommended threshold.

Table 3. Factor Weights and Variance Inflation Factor

Construct	Items	Outer weights	VIF
Functional affordance	FA1	0.337***	1.224
	FA2	0.254	1.325
	FA3	0.458***	1.354
	FA4	0.018	1.712
	FA5	0.383**	1.811
Communication of values	COV1	0.380***	1.388
	COV2	0.151	1.253
	COV3	0.493***	1.880
	COV4	0.268**	1.706

***p<0.001, **p<0.01, *p<0.05

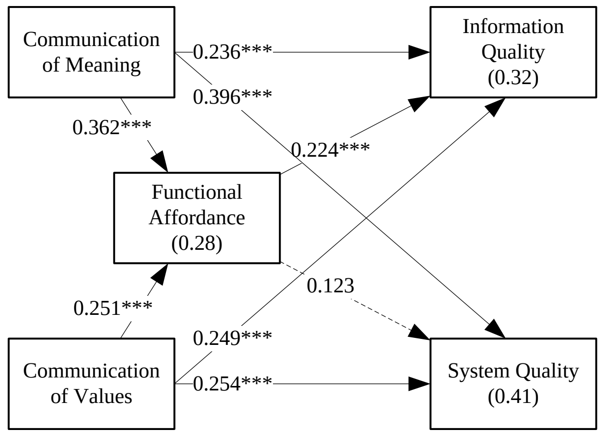
5.2. Common Method Bias

As with all self-reported data, there is a potential for common method bias (CMB) resulting from multiple sources such as consistency motif and social desirability (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To check for CMB, we used the unmeasured latent method construct (ULMC) approach that Liang, Saraf, Hu, and Xue (2007) propose. The CMB analysis only included the reflective constructs because, to the best of our knowledge, there still is no agreed-on method for testing CMB for formative constructs. The results demonstrate that the average substantively explained variance of the indicators was 0.8, while the average method-based variance was 0.009. The ratio of substantive variance to method variance was about 89:1. In addition, none of the method factor loadings were significant. Given the small magnitude and insignificance of method variance, it is unlikely that CMB poses a serious concern for this study. Although, recent research has shown that the ULMC technique might not be adequate to detect CMB accurately (Chin, Thatcher, & Wright, 2012), we can assume that CMB does not pose a problem since all items were randomly shuffled in the survey.

5.3. Structural Model

In order to test the relationships between the structurational potential and the object-based beliefs, we ran a structural model. Figure 9 provides the R^2 and path coefficients along with their respective significance levels from PLS analysis. As for H1 and H2, Figure 9 shows a significant link from FA to IQ but a non-significant link to SQ. We found support for H1 but not H2. We found a significant correlation between COM and FA and between COV and FA, which supports H3 and H4. The effect of COM on IQ and on SQ was significant, which supports H5 and H6. H7 and H8 propose that COV impacts IQ and SQ. Figure 9 shows significant paths from COV to IQ and SQ, which supports H7 and H8.

Figure 9 shows the explanatory power of the research model. The results indicate that COM, COV, and FA accounted for 32 percent of the variance in IQ. COM and COV explained 41 percent of SQ. Also, 28 percent of the variance of FA was explained by COM and COV. We tested the model's capability to predict by computing the cross-validated redundancy measures for each construct (Stone-Geisser's Q2). The blindfolding procedure is only applied to endogenous latent variables that have a reflective measurement model operationalization. All measures were larger than zero, which indicates that the latent constructs exhibit predictive relevance (Hair et al., 2011). A post hoc power analysis using G*Power 3 (Erdfelder, Faul, & Buchner, 1996) showed a power of 0.99 and an overall large effect size for IQ ($f^2 = 0.47$) and SQ ($f^2 = 0.7$) (Cohen, 1988).



R^2 are Reported in Parentheses, Path Significance: ***p<0.001, **p<0.01, *p<0.05

Figure 9. Model 1: Structuration and Object-based Beliefs

5.4. Reassessment of Model Properties

Recent publications have argued that IS researchers have improperly use formatively specified endogenous constructs in IS research and have shown that parameter estimates obtained from PLS analyses might not capture the underlying theoretical relationship between exogenous constructs and endogenous formative latent constructs adequately (Aguirre-Urreta & Marakas, 2013; Cadogan & Lee, 2013). Because of these recent debates concerning the validity of parameter estimates, we employed an additional analysis to further test the role of FA and its antecedents COV and COM (see also appendix B, where we use the construct “functional range” as a proxy for FA).

To avoid the problems concerning parameter estimates with formative endogenous constructs, Cadogan and Lee (2013) propose to model the relationships with endogenous formative variables at the indicator level (Figure 10). We ran a second PLS analysis where we modeled FA as a composite variable and COV and COM were antecedents of FA and operate through the indicators of FA.

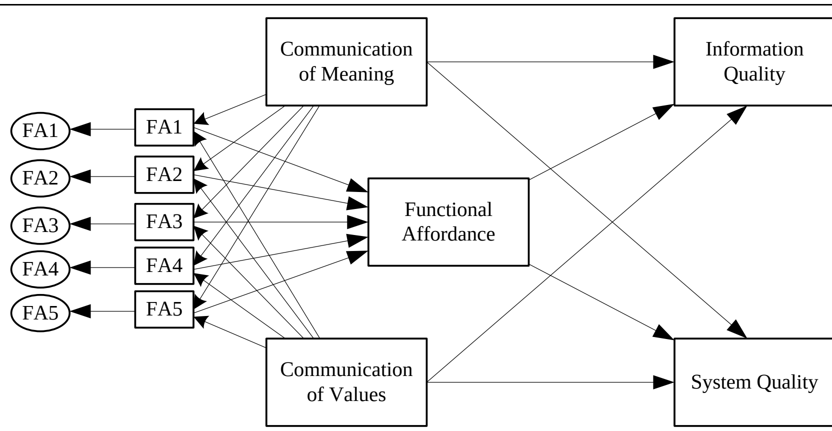
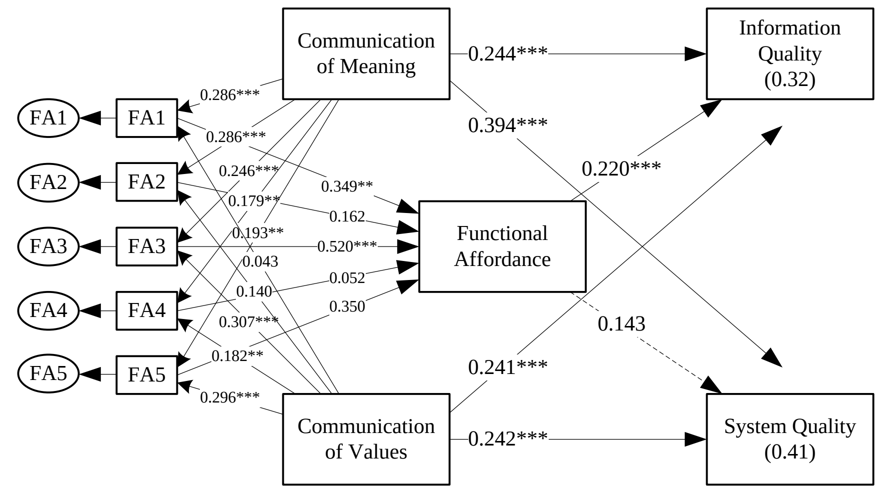


Figure 10. Functional Affordance as Second-Order Composite Variable

The results from the PLS analysis shows that the measurement model of FA was slightly different compared to the first model. The items FA1 and FA3 were also significant, while FA5 was only significant on a 10 percent significance level (Figure 11). We achieved measurement validity and reliability for the remaining constructs.

Figure 11 illustrates the results for the structural model from the analysis. The relationship between COM and FA (H3) could be supported at the indicator level. However, concerning the relationship between COV and FA, only three out of five relationships showed a positive significant link. Thus, the relationship between COV and FA and, therefore, H4 were only partly supported. We could also find support for the hypotheses H1 to H8, except for H2, which is also congruent with our findings from the first model.



R^2 are Reported in Parentheses, Path Significance: ***p<0.001, **p<0.01, *p<0.05)

Figure 11. Model 2: Structuration and Object-based Beliefs with Formative Relationships at the Indicator Level

In summary, the results from our analysis at the indicator level support our findings from the first analysis (Table 4).

Table 4. Results Comparison

Hypotheses	Relationship	Model 1	Model 2
H1	FA → IQ	0.224***	0.220***
H2	FA → SQ	0.123	0.143
H3	COM →FA	0.362***	Fully supported at the indicator level
H4	COV → FA	0.251***	Partly supported at the indicator level
H5	COM → IQ	0.236***	0.244***
H6	COM → SQ	0.396***	0.394***
H7	COV → IQ	0.249***	0.241***
H8	COV → SQ	0.254***	0.242***

***p<0.001, **p<0.01, *p<0.05

6. Discussion

In order to understand what factors contribute to the formation of beliefs, we explored the effects of IT-related structurational concepts on object-based beliefs. Our results support 7 out of 8 hypotheses and suggest that the structurational potential of technical objects is an important influencing factor for object-based beliefs.

6.1. Structurational Potential and Object-based Beliefs

We developed and operationalized a set of antecedents for object-based beliefs and show that each of the antecedents predicts an acceptable amount of variance in object-based beliefs. Our model shows that users perceive a high system quality if they basically understand the meaning of the functions that a IT system provides. Moreover, our results suggest that communication of values is positively related to system quality as well. Values that are positively associated with the SIS, therefore, lead to a higher system quality. The same applies to the link between communication of meaning/communication of values and information quality. The better users understand the underlying functional affordances and the more effectively the IT system communicates values that are positively associated with the system, the higher the perceived information quality of the IT system. Our study provides some evidence that functional affordances directly influence perceived information quality. This result indicates that functions provided by the SIS are primarily important when it comes to assessing information that an IT system offers. The functional affordances, such as the possibility to exchange opinions with other students, the bulletin board feature, or the information provided about seminars and lectures, directly impact the perceived information quality in the case of the SIS. In contrast to our proposition, the results from our analysis do not support the relation between functional affordance and system quality. It seems that users evaluate the quality of a system based on values and meaning that are communicated and that the mere provision of functions is not sufficient to increase system quality. Overall, the results suggest that values and meanings are more important when it comes to assessing system quality, whereas all structurational concepts positively affect information quality. However, these findings need to be further corroborated and replicated in additional studies.

Our model shows that communication of values has a positive impact on functional affordances. This result suggests that values conveyed by an IT system positively affect how functions are perceived. In the case of the present study, the SIS supports values such as productivity and control, which ultimately impact the awareness of the functions offered by the SIS. Communication of meaning positively affects functional affordances as well, which provides some evidence that users need to understand the underlying functional affordances to be able to interact with the SIS. In summary, it is not only the functional affordances provided by a technical object that impact the success of an IS, but also the way a technical object conveys meaning and values to the user.

6.2. Contribution

This study reconceptualizes and extends Markus and Silver's (2008) model of IT effects to be amenable to quantitative causal studies. First of all, we argue for the two-dimensionality of symbolic expression and introduce the concepts communication of values and communication of meaning. We extend the theoretical concepts that Markus and Silver (2008) provide and show that values and meanings as two distinct dimensions contribute to the understanding of belief formation. Second, we augment the relations that Markus and Silver (2008) and we argue for communication of values/meaning as possible antecedents of functional affordances to account for the fact that expressions also refer to functionalities of technical objects. Our model not only supports the analysis of the relationships between functional affordances and symbolic expressions but also the relationships between the structurational potential of technical objects and users. Thus, our study fits well with Jones and Karsten's (2008) call for more attention on the interaction between technology and human action.

The definition of the concepts and the steps for empirical evaluation may now be used in different studies as well to investigate the formation of beliefs in different settings. On a conceptual level, the model can be applied and tested in different research contexts, while the concepts themselves have to be operationalized anew. What at first glance might seem disadvantageous to researchers because of the additional effort for the development of measurements is one of the main advances of the model of IT effects. By evaluating a technical object through an affordance lens, researchers have to recognize that values and functional affordances need to be addressed and clarified depending on the viewpoint of the user and the research context (Faraj & Azad, 2012). The advanced model of IT effects demands a focus on the relation between users and a technical object and, therefore, compels researchers to explore the technical object and its relational concepts in more detail in each case.

The model of IT effects encourages researchers to investigate the relation between human agents and IT systems in more detail since the functional affordances construct has to be adapted to every new IT system and the user groups in focus. Researchers have to realize which kinds of functions are provided to a certain user group to support a specific task in order to develop items that grasp the functional affordance of an IT system. The same applies to communication of values. Researchers have to be aware of what kind of values an IT system is supposed to provide; for example, an ERP system should convey different values than collaborative tools.

IS research has already investigated several different determinants of object-based beliefs such as organizational, task, and user characteristics, all of which affect different IS success factors (Petter et al., 2013). Until now, determinants of information quality have not been well understood and consistent antecedents of information quality are still missing (Petter et al., 2013). Thus, our study opens a path to the empirical study of antecedents of information quality and provides some first insights that might help to close this gap in IS success research. In terms of system quality, research has already found support that especially user characteristics, such as their technology experience, self-efficacy, and attitudes toward the technology, are important antecedents (Klein, 2007; Venkatesh & Davis, 1996). Our research extends these insights by proposing and empirically testing a novel model of IT effects that focuses on the relation between technical objects and users. We hypothesize and confirm that communication of meaning and values affect the formation of system quality; however, our findings do not support the effect of FA on system quality.

From the perspective of practice, managers need to pay attention to the relation between the technical objects and the users since the structurational potential of technical objects is shaping beliefs about quality. We demonstrate that functional affordances need not be equally important to the users. In addition, our research model underlines the importance of values and meaning that an IT system directly communicates. Thus, the design and operation of an IT system should directly target and support its general goals; for example, an online shop should provide values such as control, convenience, or trust to attract and retain customers (Grange & Benbasat 2010; Hu et al. 2010). In summary, positive beliefs about a technical object can be developed and achieved by, for example, adapting the feature set of a technical object, highlighting the positive values of a technical object, offering trainings that help users to understand the technical object, and so on.

6.3. Limitations

An obvious limitation of our study pertains to the sample and the IT system that we investigated. Focusing only on the students as the target users of the SIS allowed us to control for extraneous factors such as different use intentions and objectives, different user types, and so forth. Future research should examine the model across different populations and different IT systems, especially where IT use is completely voluntary. For example, applying the model in the context of online banking and shopping might provide additional insights about how the structurational properties affect the formation of beliefs, such as risk or trust (Smith, Diney, & Xu, 2011). The proposed model explains some variance in information quality and system quality in this mandatory setting and, therefore, seems to be applicable to situations where users are more or less forced to use a certain system. In a mandatory setting, the provision of “right” structures (features, values, and meanings) to support a task might even be more important than in a voluntary setting because users do not have a choice to switch to another IT system.

Despite the aforementioned limitations, our research adds to the existing knowledge on IT adoption. The structurational potential of IT systems (symbolic expressions and functional affordances) cannot fully determine the formation of object-based beliefs because IT systems are embedded in an organizational environment that provides different structures such as norms and values. However, Giddens (1984) acknowledges the value of decomposing structuration by taking institutions as a backdrop and by focusing on the structural potential of technical objects that shape and generate social structures. While this "bracketing" may artificially segment the structuration process, it is still admissible and justified for methodological purposes (Poole & DeSanctis, 2003).

The proposed research model explained 32 percent of the variance in information quality and 41 percent of the variance in system quality, which we can regard as moderate R^2 (Hair et al., 2011). However, given the fact that object-based beliefs were only partially affected by IT-related structurational concepts, the R^2 values are quite acceptable. Other sources for structure that were not part of this study, such as social norms, organizational resources, tasks, or user characteristics, also play an important part in the process of belief formation and could explain additional variance in system quality and information quality (Al-Natour & Benbasat, 2009; DeSanctis & Poole, 1994; Lewis et al., 2003).

7. Conclusion

In this paper, we introduce new concepts to research the antecedents of object-based beliefs and show how IS researchers might use these concepts in quantitative studies. To this end, we developed and empirically tested a model of IT effects based on Markus and Silver's (2008) re-conceptualization of adaptive structuration theory. The model links the structurational concepts of functional affordances, communication of values, and meaning to information and system quality. Overall, the results were largely consistent with the hypothesized model and demonstrate the potential to contribute to the formation of object-based beliefs. However, future research should test the model in an organizational setting and should consider social norms and task characteristics as additional sources for structure that will probably explain additional variance in the research model.

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Appendices

Appendix A: Measurement Model

Table A-1. Measurement Model

Construct	Items	Description	Factor loadings
Communication of meaning (COM)	Please rate the following statements concerning the meaning and understanding of the SIS.		
	COM1	Generally, I understand the basic functionality of the system.	0.90***
	COM2	In general, I understand how the system works.	0.92***
	COM3	I know how to use the system and its functionalities.	0.89***
Functional affordance (FA)	To what extent does the SIS promote the following functionalities?		
	FA1	The system offers the possibility to learn about the offered courses.	0.57***
	FA2	The system offers the possibility to download course materials.	0.59***
	FA3	The system offers the possibility to exchange opinions with other students.	0.78***
	FA4	The system provides information about seminars and lectures.	0.58***
	FA5	The system offers the possibility to use a forum.	0.75***
Communication of values (COV)	To what extent does the SIS promote and communicate the following values?		
	COV1	Reliability	0.75***
	COV2	Actuality	0.54***
	COV3	Productivity	0.88***
	COV4	Control	0.75***
Information quality (IQ) (Rai, Lang, & Welker, 2006; Wixom & Todd, 2005)	IQ1	In general, the system provides me with high-quality information.	0.81***
	IQ2	I am satisfied with the quality of the information.	0.84***
	IQ3	Overall, I would give the information from the system a high rating in terms of quality.	0.83***
System quality (SQ) (Rai et al., 2006; Wixom & Todd, 2005)	SQ1	Overall, I would give the quality of the system a high rating.	0.88***
	SQ2	Overall, the system is of high quality.	0.92***
	SQ3	In terms of system quality, I would rate the system highly.	0.93***
Functional range (self-developed)	FR1	The system offers all functions that I need.	0.92***
	FR2	Altogether, all functions are provided by the system that I need.	0.94***
***p<0.001, **p<0.01, *p<0.05			

Table A-2. Reliabilities and Correlation Matrix (Model 1)

Construct	Composite reliabilities	AVE	COM	COV	FA	IQ	SQ
COM	0.93	0.81	0,90				
COV	n/a	n/a	0.471	n/a			
FA	n/a	n/a	0.480	0.422	n/a		
IQ	0.86	0.68	0.460	0.454	0.442	0.82	
SQ	0.93	0.83	0.575	0.493	0.421	0.672	0.91

Diagonal elements represent the square root of the AVE. Off diagonal elements are the correlations among constructs.

Appendix B: Additional Analysis

We first used a reflectively measured construct, "functional range", that captured the extent to which the SIS offered all functionalities that the users required and expected. We measured the construct with two reflective items with significant loadings over 0.9 (cf. items FR1 and FR2 in Table A 1). We expected a positive relationship between the perceived functional affordances on a functional level and the extent to which users perceive a system to provide all the functionalities they need. The relationship between the formatively measured FA construct and functional range (reflectively measured) was significant and consistent with our expectation (Figure B 1).

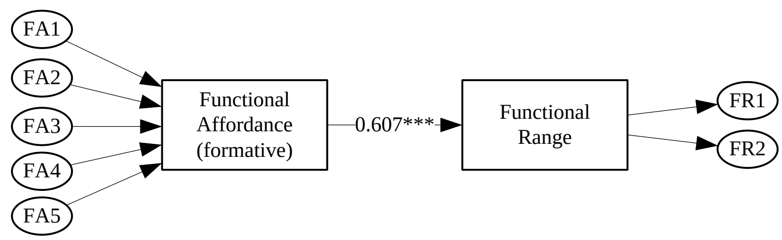
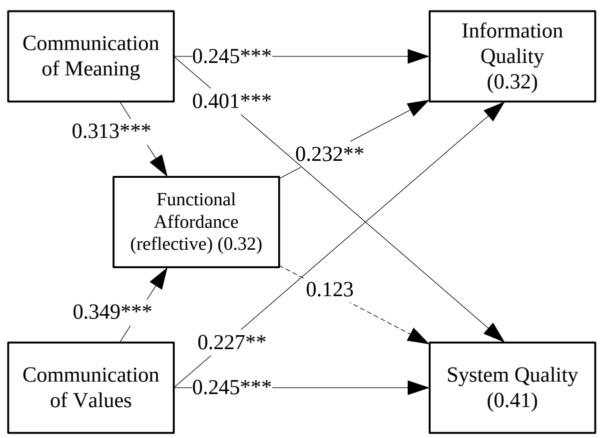


Figure B-1. Two Construct Model (Path Significance: ***p<0.001)

Because of the strong relation found, we used functional range as a proxy for FA in order to test the research model again. Overall, the results from this analysis also support our main findings (Figure B 2).



R^2 are Reported in Parentheses, Path Significance: ***p<0.001, **p<0.01, *p<0.05)

Figure B-2. Structuration and Object-based Beliefs

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