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## Affordances and Information Systems Research: Taking Stock and Moving Forward

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# ***The Data Base for Advances in Information Systems***

## **Affordances and Information Systems Research: Taking Stock and Moving Forward**

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# **Affordances and Information Systems Research: Taking Stock and Moving Forward**

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## Abstract

*The term affordance appears with increasing frequency in the Information Systems (IS) literature. Nevertheless, those who study information technologies/information systems (IT/IS) via the affordance lens often have different views about its origin, meaning, and appropriate application in IS research. In turn, not spelling out the related assumptions and boundaries inherent in these diverse views may have hindered a wider and more cumulative adoption of the affordance lens in IS research. This paper offers a potential solution by (1) synthesizing the ecological psychology literature to suggest five key modules of the affordance concept relevant to IS research and (2) taking stock of IS research that has employed the affordance concept and classifying it according to its focus on three key affordance elements: IT artifact, user, and context. Finally, this paper presents a set of challenges, opportunities, and recommendations regarding how IS researchers can advance affordance-based research in the field.*

**Keywords:** Affordance; Information Systems; Ecological Psychology; IT Artifact; Review.

## Introduction

The idea of technology's agency in producing effects within individual, organizational, and social realms has long been attractive to researchers in different domains. The early work of Woodward (1958), for instance, pointed to how new technologies impose specific organizational and production structures. Subsequent research concerning information technology (IT), in particular, was much more nuanced in advancing or implying varying degrees of the "technology agency" perspective (Orlikowski, 1992, p. 400). Recently, a more radical account of IT's agency has been offered by Baskerville, Myers, and Yoo (2020): the classical view of an information system representing physical reality has become increasingly obsolete; rather, digital technologies are now creating and shaping physical reality.

The agency of IT has often been associated with certain theoretical accounts, namely (socio)materiality (Leonardi, 2011; Orlikowski, 2007, 2010) and affordances (Faraj & Azad, 2012; Majchrzak et al., 2013; Volkoff & Strong, 2013). Affordance theory, in particular, offers a significant contribution to our understanding of the relationship between an IT artifact and its use consequences precisely because the IT artifact's formulation has often been vague or somewhat nominal in the past (Orlikowski & Iacono, 2001). That is, affordance theory enables researchers to explain "why people using the same technology may engage in similar or disparate communication and work practices" (Treem & Leonardi, 2012, p. 146). In addition, many researchers believe that affordances provide a route to develop much more advanced treatments of IT materiality (Bygstad et al., 2016; Faraj & Azad, 2012; Robey et al., 2012). Further, the literature emphasizes that drawing on affordances may overcome the subject-object and agency-structure dichotomies that have beset much of the research at the intersection of technology and organizations (Leonardi, 2011; Markus & Silver, 2008).

Despite its ostensible promise, the affordance lens has been adopted, interpreted, and applied in various—and even inconsistent and confusing—ways by researchers in different communities. For IT research in particular, this muddled treatment of affordance theory among writers and editors/reviewers has hindered the healthy accumulation of knowledge in this research area (Masoudi et al., 2019; Pozzi et al., 2014). Furthermore, most researchers have employed the notion of affordance within a particular empirical frame of reference, with a narrow focus on its utility, only for their own findings. In other words, researchers often have only tangentially addressed the notion's theoretical underpinnings and programmatic applications for research (exceptions include Faraj & Azad, 2012; Groleau & Demers, 2012; Robey et al., 2012).

Against the above backdrop, this study will make three specific contributions. First, it advances an overarching characterization of the concept of affordance, where five conceptual modules are brought together to establish a tenable way forward for the concept's use and application. Second, this study identifies three IS research agendas adopting the affordance lens in distinct ways, thereby shedding light on the ongoing issues concerning the application of the affordance lens in IT/IS research. Third, it draws attention to a set of opportunities, challenges, and recommendations for those interested in pursuing affordance-related research programs in the future.

We begin in the next section with a literature review concerning the notion of affordance as articulated in the ecological psychology literature and beyond. In the third section, we take stock of this review to explain the ongoing turmoil concerning the application of the affordance lens in IT/IS research. Here, we identify three distinct research agendas, each maintaining different motivations for using and interpretations of the concept of affordance. In the last section, the lessons from the three identified research agendas inform our account of

research opportunities, challenges, and recommendations for IS researchers who aim to study affordances and IT/IS.

## The Concept of Affordance in Ecological Psychology and Beyond: Key Conceptual Modules

The concept of affordance is identified by its legacy in the ecological psychology domain where the concept provides a phenomenological perspective into human perception based on the theory of evolution (Chemero, 2003). The psychologist James J. Gibson coined the term affordance in his 1966 book. Affordance is defined as a possibility for action provided to the individual/species by the environment (J. J. Gibson, 1986). Since Gibson's time, however, the concept has undergone significant theoretical and empirical scrutiny both inside and outside the ecological psychology field. Our analysis of scholarly works in this section is primarily concerned with this field's literature on affordances; however, several relevant studies from other fields are also included.

Consistent with conducting integrative literature reviews in management and IS fields, we adopted a concept-driven approach (Elsbach & van Knippenberg, 2020; Webster & Watson, 2002). We conducted a *thematic literature* review to identify the main conceptual elements that constitute the underpinnings of the notion of affordance. These conceptual elements are henceforth called *conceptual modules*. We began the review process with key works on affordances (i.e., E. J. Gibson, 1982; J. J. Gibson, 1986; Greeno, 1994; Michaels, 2003; Turvey, 1992). This initial review allowed us to identify a few conceptual modules, which we adapted further over the course of the literature review by following the backward-forward approach (Webster & Watson, 2002). This process eventually led to five conceptual modules that undergird affordance theory: the real and relational nature of affordances, the direct perception of affordances, exploring/learning affordances, the hierarchical and sequential nature of affordances, and the relation between affordance and intention/action. Table 1 below summarizes these five conceptual modules with a brief description and examples of works in the literature that support each module.

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Insert Table 1 About Here  
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Table 1 further depicts the contents and linkages among the real and relational aspects of an affordance perceived through a process of learning and exploration as well as how affordance perceptions interact with individual goals and objectives leading to action and affordance actualization. In the following subsections, we first provide an overview of the five modules and how they relate to each other before we elaborate on each module separately.

### Overview of Five Conceptual Modules Scheme

We propose that our five modules scheme, visually represented in Figure 1, offers a concise yet comprehensive depiction of the affordance lens because it captures key elements and the linkages among them (e.g., the link between individual perception and behavior that is grounded in the evolutionary theory that constitutes a foundation of ecological psychology).

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Insert Figure 1 About Here  
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The literature holds a general consensus that affordances are distinct from how people perceive them and what people perceive from their environment are the affordances provided to them; accordingly, Figure 1 depicts two distinct spaces labeled affordance and affordance perception. Although affordances are real—independent of human perception—but their enactments emerge from intertwinements among the material object/environment, the individual, and the social context (note that, as will be discussed later, IS research uses specific corollaries of these three concepts: IT artifact, user, and context). We thus distinguish among four conceptual spheres concerning affordances: affordance, affordance learning, affordance perception, and affordance actualization. Affordance is shown as an oval containing the three entwined elements (i.e., the material object/environment, the individual, and the social context). The intertwinement among these three elements is holistic; that is, affordance may be viewed as a system. At the same time, the way any particular individual involved in the affordance system

conceives of the affordance of the material object/environment within a certain social context depends on the affordance learning process that the individual undergoes. In other words, the affordance learning process generates a special image in the mind of the person involved, and this image is not necessarily similar to the image developed for another individual involved in the same affordance system. This image constitutes what we call affordance perception.

As implied in Figure 1, affordance perception is mutuality interrelated with individual goals and intentions. It means, affordance perceptions held by an individual affect, and are simultaneously affected by, the individual's goals and intentions. The figure also shows that the mutual assemblage of affordance perception and goals and intentions triggers affordance actualization. People choose to actualize specific affordances perceived to be available and aligned with their goals and intentions. Ultimately, the figure illustrates a feedback loop where adaptive action may have certain ramifications for how the individual may subsequently perceive affordances.

Next, we discuss the conceptual intricacies and occasional debates over the nature of the five modules constituting the ecological-psychology formulation of the affordance concept.

### **Conceptual Module 1: Real and Relational Nature of Affordances**

Gibson (1986) uses the term “invariant” to refer to the real or perception-independent aspects of affordances (1986, p. 15)<sup>1</sup>. On the one hand, some scholars have pointed out that “affordances *per se* are independent of perception” (Gaver, 1991, p. 80; Turvey, 1992). On the other hand, existing affordances need some specifying information to be perceived by people. In turn, perceived affordances would be selected to be actualized based on many factors, including individual goals, the range of availability, and the amount of effort needed. Distinguishing among the three related notions of affordance, perceived affordance, and actualized affordance may be essential when adopting an affordance-based approach to study any technological phenomena in organizational settings (Bernhard et al., 2013).

At the same time, ecological psychologists consider affordances to be relational for an individual perceiver. In other words, an affordance may be difficult to be enacted independently of an individual user or perceiver. Personal characteristics as well as effectivities may affect the affordances available to people for actualization. For instance, the level of independent mobility influences the extent and type of affordances children have to act on (Marketta, 2004); the farther children can go independently, the more affordances of the environment are available to them to actualize. As such, affordances embody the entwining between the features of the environment and the individual's abilities (Chemero, 2003; Worgan & Moore, 2010). According to Eleanor Gibson (2000, p. 55), “when we perceive the affordance of anything—the layout, objects, other people—we are perceiving the relation between some feature of the layout and its use or value to ourselves.” Indeed, Leonardi (2011, p. 153) concurs: “Although the material properties of a technology are common to each person who encounters them, the affordances of that artifact are not. Affordances are unique to the particular ways in which an actor perceives materiality.”

In general, most researchers agree on the relational nature of affordances and that any definition of affordances should include aspects of both the environment and the individual; however, what relationality implies in practice and how to approach it in empirical research are still debated (Pijpers et al., 2006). Some ecological psychologists prefer to only see affordances as the properties of the environment that necessarily need to be complemented by some individual attributes to be realized (Cordovil et al., 2013; Greeno, 1994; Michaels, 2003; Turvey, 1992). Others, meanwhile, believe that an affordance is a property of neither the individual nor the environment but of the relationship between the two (Chemero, 2003; Cook & Brown, 1999; Lenarčič & Winter, 2013; Sanders, 1997; Stoffregen, 2003). In turn, this relationship between the individual and the environment is mostly viewed as a mutuality or reciprocity, rather than as an interaction.

A question here remains: what aspects of the environment and the individual may be involved in the mutuality to shape affordances? Originally, Gibson (1986) focuses on visual perception and thus limits most of his writings to visible and scale aspects of affordances and how they relate to each other. Following such an approach, Warren (1984) examines the relationship between riser height and an individual's leg length to define the stair-climbing affordance. Costall (1995) argues that if affordance theory is to theorize perception in relation to action, it has to consider more than the spatial relationship between individual and environment. From Costall's (1995) point of view, the relationship between the scales of an individual's hand and an object is only one side of the graspability affordance of an object for an individual. The scale ratio cannot account for the complexity of the relationship between “the individual and things” because this relationship involves skill, power, morality, and other such aspects. Indeed, the physical object is not the only source of providing affordances. Affordances can also be

provided by the object's environment and social context (Mansour et al., 2013; Sergeeva et al., 2013). For instance, a speech is understood not only in terms of the words the speaker utters but also by gestures the speaker makes and other signals in the context (Worgan & Moore, 2010). In another example, the "pen on the desk may be graspable for me, given its diameter in relation to my grip, but because it is resting on the desk of the president of the college, it is not a pen I ought to pick up" (Heft, 2003, p. 158). Ownership of objects and morality of actions are two other aspects of the social context defining the affordances of the environment (i.e., an individual may hardly afford to pick up the pen if another person owns it or if it is morally not acceptable to do so for any reason) (Costall, 1995). For researchers studying IT-induced organizational change, this open question calls them to theorize how and what aspects of the technology, individual user, and organizational features are involved in the mutuality that shapes the affordances.

### **Conceptual Module 2: Direct Perception of Affordances**

Founding the basis for an affordance approach to perception, James Gibson was primarily concerned with establishing the scientific legitimacy of direct perception against the traditional notion of representational/indirect perception (K. S. Jones, 2003). In other words, he wanted ecological psychology to focus on the "meaning within the environment" perspective of perception—namely, the environment is perceived directly without going through cognitive processes. This is a uniting factor among ecological psychologists who defend the direct perception of affordances (Costall, 1995; E. J. Gibson, 1982; Greeno, 1994; Heft, 1996; Turvey, 1992). Eleanor Gibson (1982) explains direct perception as follows: "I perceive [an] affordance quite directly, as directly as I perceive [a] color." Michaels (2000) further clarifies direct perception by adding that there is a 1:1 relationship between properties of the world and the invariant information specifying those properties. That is, unique invariant information represents properties of the world, and "perception of a particular property relies [uniquely] on detection of particular information" (Michaels, 2000, p. 247).

Meanwhile, debates in the field consider the role, if any, cognition plays in the perception of affordances. Gibson (1986) argues that affordances are perceived solely through direct perception and even claims that whatever we perceive is through direct perception and not cognition. Others have argued that cognition plays a role in the perception of certain types of affordances. For instance, Greeno (1994) maintains the cognitive categorization of mental models for learning/perceiving symbols' affordances. Contrary to Gibson, he identifies the mailbox affordance perception as an indirect one: we cognitively categorize a box in a mental model of the mailbox that affords to send letters. In agreement with Greeno, Norman (2002, p. 219) points out, "affordances result from the mental interpretation of things, based on our past knowledge and experience applied to our perception of the things about us." Michaels et al.'s work (2001), however, appears to reconcile many of the conflicting perspectives about the role of cognition. According to Michaels et al. (2001), inferences start where the direct perception of affordances ends. Specifically, people directly perceive affordances and then cognitively infer how they are related or what to do with those available affordances. Accordingly, "there is no doubt that people make inferences; the ecological thesis is simply that inferences are based on perception and not the other way around" (Michaels et al., 2001, p. 237).

We can summarize all of these studies in the following manner: First, different interpretations of the affordance concept often support the fundamental notion of direct perception while still acknowledging that cognitive inferences can be drawn based on direct perceptions. That is, people perceive the action possibilities of the environment and then cognitively categorize the environment according to how it can be used and incorporated in their work based on their existing mental models. Second, the perception of affordances of certain environments may be more dependent on cognitive processes, an idea that needs a more detailed investigation.

### **Conceptual Module 3: Affordance Exploration and Learning**

The direct perception of affordances does not mean they are always available to perception at first glance. In fact, they may or may not be perceived (Turvey, 1992). Sometimes the information needed to perceive an affordance is not available without touching or experimenting with the object. Exploratory activities are useful for gathering the information required for perceiving affordances. "Some movements create or reveal one kind of information, whereas other movements create or reveal other kinds of information" (Stoffregen et al., 2005, p. 76). For instance, head movement can enhance the individual perception of the height of a chair and the suitability affordance provided to the individual (Stoffregen et al., 2005). This is the process that Eleanor Gibson (1988) calls learning the affordances. In a series of studies, Eleanor Gibson and her colleagues looked at how newborn babies learn their environment's affordances through exploration and experimentation. Accordingly, they conclude that the "perception of affordances involves learning" about both the environment and the self (Adolph et al.,

1993, p. 52). Learning changes not only the ability to perceive affordances but also the affordances available to people. At the same time, exploratory behavior links affordances to action, such that people act on an object (e.g., technology) based on their perception of its affordances, and based on their action they learn more about the object's affordances. The process related to using new IT devices over time is a good example of this dynamic. Cook and Brown (1999) call this exploratory behavior "productive inquiry," which triggers a generative dance between perceiving and acting that, in turn, can trigger new perception in action. Thus, learning emerges from oscillating between affordance perception and action. Although learning about affordances of an object is direct perception and not a cognitive process, this learning feeds subsequent cognitive processes like drawing inferences about causal relations and categorizing objects that have shared affordances (E. J. Gibson, 1988).

#### **Conceptual Module 4: Hierarchical and Sequential Nature of Affordances**

Affordances are perceived and learned in a hierarchical fashion because both features of the environment and the events relating those features to each other are structured in a nested manner; thus, action possibilities are nested in the same way (Heft, 1996). For the same reason, researchers have suggested studying the structure of events to examine the structure of affordances (E. J. Gibson, 2000; Michaels, 2003). For instance, the communication affordances of a messaging application may include subordinate affordances of composing messages, managing messages, and managing contacts, which in turn may consist of other lower-level affordances. The perception of two nested affordances could also be interrelated. The more the two affordances have in common regarding their nesting structure, the more likely it is for any individual to perceive the other when perceiving one (Ye et al., 2009). Further, affordances can also be related sequentially (Gaver, 1991; Michaels, 2003). A sequential structure implies that one affordance would be available to perception (and action) only after realizing the other one. As one example, people would never be able to perceive the communication affordances of an email system unless they were signed in to the system.

#### **Conceptual Module 5: Affordance, Intention, and Action**

The entanglement of affordance perception and action is one of the two pillars of Eleanor Gibson's (1982) view of ecological psychology. Specifically, we act based on affordance perceptions and, in turn, perceive affordances based on our actions. Accordingly, affordance perceptions and actions are tightly coupled, and one cannot be studied without the other (Michaels, 2000). People may choose to act on specific perceived affordances based on their goals, the range of available affordances, and the effort it takes to actualize affordances (Bernhard et al., 2013). In organizational settings, consistency with the institutional logic could be crucial to the choice of affordances to act on (Bernardi & Sarker, 2013; Ingram et al., 2013). Besides, intention plays a key role here, and its role is potentially twofold. First, intention affects affordance perception by influencing the information that the individual may pick up from the environment. Individual perception is selective; people ascertain outside information for perception based on their goals and intentions (Michaels, 1988). In addition, people develop certain skills to choose and deploy actions that enable them to reveal and understand information relevant to their purposes (E. J. Gibson, 2003; Stoffregen et al., 2005). Moreover, as a two-way relationship, affordance perceptions may change the intentions people choose to act on (J. J. Gibson, 1986; Heft, 1989; Michaels, 2003). For instance, people may never perceive that a photo viewer application affords photo editing unless they intend to edit photos. Then, when a user notices that the application affords convenient photo editing, editing some photos may become an intention. Finally, intention interacts with affordance perceptions to bring them into action. In other words, individuals choose, based on their intentions, desired affordances to act on (Heft, 1989).

### **Affordances in IS Research: Anatomy of Diverse Scholarly Agendas**

In this section, we take the main components of the affordance concept as framed and perceived in the ecological psychology domain and beyond (see Figure 1) and examine how they have been dealt with and incorporated in IS research.

A review of affordance-based IS research reveals that the utilization of the affordance concept is diverse and at times inconsistent with the perspectives arising from ecological psychology. For example, a specific IS study may emphasize certain aspects of the affordance concept in isolation from other aspects rather than apply the affordance concept holistically. Such narrow applications may, in turn, be attributed to the diversity of affordance-based research agendas in IS. In this section, we classify these agendas according to the main modules of the affordance concept applied in key studies.



We started probing the literature by searching for articles published in *MIS Quarterly*, *Information Systems Research (ISR)*, and *Journal of the Association for Information Systems (JAIS)* that include either “affordance” or “affordances” in their title, abstract, or keywords. This search resulted in 21 studies. After removing the studies that referred to the affordance concept peripherally, our collection contained 14 studies. Next, we followed the backward-forward approach to identify any major IS study adopting the affordance lens. This process extended the article set to 21. We intended for this list not to be exhaustive but rather to be an adequate sample of the most significant works in the field to guide our conversation on the diverse adaptations of the affordance concept in IS research. Here, we draw on the five modules of the affordance concept presented in the previous section (see Figure 1) to examine the adoption and adaptation of the affordance lens in IS research. While Figure 1 shows the material object/environment, the social context, and the individual as the three essential elements of an affordance, in IS studies, researchers commonly employ field-specific corollaries. Specifically, the material object/environment is often an *IT artifact*, the individual is usually considered the *user*, and the social *context* can broadly refer to other users, their interactions, and all the enabling or constraining forces existing in the organizational environment.

Table 2 lists the affordance studies published in the top three IS journals and their adaptations of the main components of the affordance concept. We use an X to specify whether a study focused on affordance itself, affordance learning, affordance perception, or affordance actualization. In addition, we categorize each paper based on whether it focusing on one or more of the above elements simultaneously (i.e., IT artifact, user, and organizational context). Notably, some papers stated a focus on affordances while they actually examined affordance actualizations (i.e., user actions) or affordance perceptions. In line with our classification scheme, we categorize the paper based on its actual use of the affordance concept not its articulated one. In the final section of this paper, we will discuss recommendations to avoid conflating these categories within scholarly research going forward.

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Our investigation of the exemplar affordance studies in IS research, as presented in Table 2, reveals two points about the categorized papers. First, most studies use the affordance lens to examine affordance actualizations rather than affordance perception or learning, focusing more on user action and its outcome rather than the process of learning and exploring affordances. In other words, IS scholars often employ the affordance lens to explain the impact of an IT artifact in less deterministic ways. While this focus has contributed to a more relational understanding of technology outcomes, it has probably resulted in researchers paying less attention to how affordances are perceived through a learning and exploratory process.

Second, various studies focus on different components of the affordance concept to examine their phenomenon of interest. This point leads us to identify at least three distinct research agendas concerning affordances in the literature. Figure 2 shows the particular interpretation of the affordance concept leveraged by these three research agendas to pursue specific goals, along with a few representative studies.

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Insert Figure 2 About Here  
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We distinguish the three research agendas based on their treatment or consideration of the IT artifact, the user, and the context. As shown in Figure 2, the first research agenda is predominantly focused on the relationship between the user and the IT artifact in defining affordances. We label this research stream *technical* because it applies the affordance lens to study the mechanics (or design) of the interaction between the user and the IT artifact. The second agenda is primarily concerned with the relationship between the context (more specifically, organizational routines) and the IT artifact. We refer to this research stream as the *organizational* research agenda because it draws on the notion of affordance to theorize interactions between institutional routines and the IT artifact—and the consequences of those interactions, mainly at the organizational level. Finally, the third agenda focuses on all three elements to study affordances at a more fine-grained level. We label this research stream *socio-behavioral* because it applies the affordance lens to the study of contextual IT use behaviors and their consequences, mainly at the individual and group levels.

## Technical Research Agenda

For those who pursue the technical research agenda, the affordance lens likely refers to a “psychology of materials”; it links the form of technology (“knobs are for turning”) to the consequences it is meant (or designed) to bring about—at least in theory. Norman (1988) argues that the affordances approach to the design of everyday things can help designers understand human behavior better and, in turn, design things in a more readily understandable manner. That is, the affordance lens connects the designed form to the human perception of the designed form. Moreover, since the affordance concept refers to the attributes of both the object and the actor, it offers a “powerful concept for thinking about technologies because it focuses on the interaction between technologies and the people who will use them” (Gaver, 1991, pp. 79–80).

Under the technical research agenda, scholars are primarily concerned with the design of usable systems. They have been among the first to embrace the affordance concept because of their interest in the relationship between the artifact and its use and how form can encourage specific uses of the artifact while discouraging others. The affordance approach is interesting and valuable to these scholars because it offers “a direct link between perception and action” (Gaver, 1991, p. 79). Ultimately, what matters in this research stream is how to design an artifact such that its affordances are readily perceivable to users. For Norman (1988), affordances of objects “convey messages about their possible uses, actions, and functions... affordances can signal how an object can be moved, what it will support, and whether anything will fit into its crevices, over it, or under it” (p. 82). This view of affordances is somewhat akin to the view held by ecological psychologists, for whom affordance is a property of the environment that may become actualized only when it fits an individual's properties (e.g. Turvey, 1992). In other words, affordances are designed into the form of an artifact, and they appear to be relatively free of context. Accordingly, affordances are tightly coupled with the material aspect of the environment; the social aspect and cultural conventions shape the perception of affordances, not the affordances themselves.

Gaver (1991) distinguishes affordance from its perception and proposes a typology of affordances (i.e., hidden, false, perceptible affordances, and the correct rejection). He makes two strong assertions. First, he emphasizes that the ease-of-use of technology refers to the relationship between an affordance and its perception. The more perceptible the affordance, the “easier to use” the technology will be. Second, he asserts that this is what designers are supposed to do—put enough information into the design to make affordances perceivable. In parallel, the relational nature of an affordance “requires the researcher to specify the animal for which an object is an affordance” (Markus & Silver, 2008, p. 619) because the relevant properties of the technological material may differ based on an individual user's characteristics and goals. However, the emphasis on an affordance's relational nature may entail ascribing a limited role to the social context in shaping affordances. For instance, Markus and Silver (2008) appear to assume that affordances emanate from the relationship between structural features and a specific user group's collective goals; therefore, the authors seem to underplay the role context plays in IT-based shaping of phenomenon.

## Organizational Research Agenda

For the organizational research agenda, the main concern is technology's implications at the collective level in terms of organizational routines, practices, and performance. Under this research agenda, affordances may serve as the bridging concept between technology and organizational practices in order to theorize new ways of organizing. Further, focusing on the relationship between a technology artifact and organizational routines through the affordance lens privileges neither the technology nor the organizational features and structures. Thus, the affordance lens enables scholars to theorize the sociomaterial dynamics of technology artifacts rather than their technical features or surrounding social practices (Leonardi, 2011; Majchrzak et al., 2013). Accordingly, the organizational research agenda addresses the consequences of using technology for organizational processes, routines, and practices (Majchrzak et al., 2013; Mathiesen et al., 2013; Sergeeva et al., 2013).

The researchers following this agenda have a distinct perspective on affordances; for them, context and organizational practices, in addition to the material aspect, are essential in shaping affordances. Therefore, an affordance “emerges from the intersection of IT systems and organization systems ... [it is] the result of the confluence or intertwining of IT and organizational features” (Zammuto et al., 2007, p. 752). The organizing affordances provided by technology do not come only from the materiality of the technology but also from many other organizational features, including the routines and procedures, controls, norms, and different institutional capacities existing in the organization.

According to the organizational agenda, it is not meaningful to study technology without considering the social setting in which it operates. Consistent with this approach, Fayard and Weeks (2007), though not in the context of

IT use, demonstrate that the affordances of the organizational environment for informal interaction come from not only the design of the physical space within the organization but also the “social meaning and conventional rules regarding use” (p. 611). This view illustrates how social context influences the affordances provided to people. Affordances are not merely shaped by the organizational context, but, more importantly, they become actualized when consistent with the institutional logic (Ingram et al., 2013). An interesting nuance can be seen in this research stream arising from a focus on organizational processes. Namely, some studies, whether they intend to or not, consider a less prominent role for individual agency in shaping affordances. In addition, in many cases involving enterprise systems (e.g., ERP), the materiality of the technology is so rigidly inscribed in the design that it cannot be easily appropriated very differently by different individuals; therefore, human agency does not appear to play a significant role in shaping affordances (Treem & Leonardi, 2012).

### **Socio-Behavioral Research Agenda**

Last but not least, the socio-behavioral research agenda concerns how individuals use technology within their context and the consequences of technology use for them (Hallerbach et al., 2013; Sergeeva et al., 2013). Here, the analytical focus in the behavioral study of technology changes from *the construction of representations of technology* to *the engagement with the materiality of the artifact*. As one of the pioneers of this agenda, Hutchby (2001) embraces the relational nature of affordances along with their material and contextual influences. He describes affordances as functional and relational properties of the individual-environment system: functional as they refer to some possible action and relational because they are defined in relation to the individual user. For Hutchby (2001), “affordances of an artefact are not things which impose themselves upon humans’ actions with, around, or via that artefact. But they do set limits on what it is possible to do with, around, or via the artefact” (p. 453).

Strong et al. (2014) provide an empirical example of pursuing the socio-behavioral research agenda. The authors consider all three aspects of “EHR [electronic health records] features,” “characteristics of actors,” and “organizational context” in their explication of a set of eight affordances of EHR systems. According to Strong et al. (2014), EHR provides the affordance for “capturing and archiving digital data about patients” as long as the “database” features are available to “individuals who can type and know how to add and update patient data,” and this needs to be supported by the organizational culture that assumes “patient data as a clinic resource, rather than belonging to individuals” (p. 68). This form of argument then allows the authors to consider users’ role in shaping the EHR affordances and use consequences. In another representative study, Bernardi et al. (2019) examine how the actualization of affordances interacts with user identity and contextual change to impact practices. Their approach, however, is slightly different from that of Strong et al. (2014) in that the latter see user characteristics as defining components of affordance actualizations rather than as a separate concept interacting with the affordances.

Notably, the socio-behavioral agenda is distinct from the organizational agenda in two ways: its problems and its level of analysis. First, the socio-behavioral agenda is focused on user behavior and its implications in a given social context; meanwhile, the organizational agenda is focused on the organization and ways of organizing in relation to organizational features, including practices, routines, and institutions. Second, the socio-behavioral agenda examines affordances and their consequences at a lower (i.e., individual or group) level than that of the organizational agenda. While organizational studies may lose sight of how individual characteristics and preferences shape affordances, socio-behavioral studies focus on how users and user groups adapt to an IT artifact in a given context. For example, while the socio-behavioral agenda examines “capturing and archiving digital data about patients” (Strong et al., 2014), the organizational agenda is concerned with “visualizing entire work processes” (Zammuto et al., 2007) as an affordance enabled by a combination of organizational standardization and real-time tracking sensors. The lower level of analysis of the socio-behavioral agenda allows scholars to have a more comprehensive picture of the affordances in the relationship between the user, IT artifact, and context. Table 3 summarizes distinctions between all three agendas.

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Insert Table 3 About Here  
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In summary, this three-way classification scheme of research agendas highlights how researchers’ goals, or school of thought, encourage them to adopt and emphasize different elements of the affordance concept in their study of IT/IS. Each research agenda may also be linked to a set of research motivations, as briefly outlined in Table 4 below. Given the diversity of research agendas and motivations, as explained in this section, we believe

scholars must take steps to reduce the potential ambiguity concerning the concept of affordance within their IS research.

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Insert Table 4 About Here  
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## Future Research: Opportunities and Challenges

The discussion advanced in this study so far provides reasoning as to why authors and editors/reviewers usually struggle to find common ground in their application and comprehension of the affordance concept. Our intention is therefore to raise awareness about the diverse research agendas involving affordances and to encourage authors and editors/reviewers to acknowledge, if not engage with, alternative understandings of affordances and consciously take steps to consider the concept in the broader context of IS and ecological psychology. James J. Gibson himself admitted that he did not elaborate his account of affordance into a full-fledged theory (J. J. Gibson, 1986). Some attribute the subsequent intense debates over the notion of affordance to this lack of a complete theory. Others, however, see this lack as an opportunity to engage in further discussions and conceptualizations about what the affordance concept is (or can be), how it may be perceived, and in what ways it may come to have consequences for human behavior and organizations, especially beyond ecological psychology. We concur with the latter perspective. Specifically, for IS research, generative properties may be realized by engaging in a re-conceptualization of the affordance lens.

In our view, IS research—and organization-technology research in particular—may benefit from an affordance approach grounded in its ecological psychology foundations. Hereafter, this approach will be identified as the *ecological affordance approach*—since ecological psychology covers more than affordances. In what follows, we first discuss opportunities this approach may offer organization-technology inquiries under any of the three research agendas identified earlier (i.e., socio-behavioral, organizational, or technical). Next, we draw attention to two significant challenges studies that aim to employ the affordance lens face.

### Opportunities

To contextualize the opportunities of the affordance lens in the larger body of IS research, we examine it within the long history of theorizing the consequences of technology implementation/use. Early studies took a deterministic approach, giving the technology sole agency. Later on, following an interpretive approach, many studies argued for the primacy of users and explored how their understanding and interpretation of the technology can result in technology outcomes. Cognizant of the limitations of the deterministic and interpretive approaches, a stream of interactionist research offered alternative theories for how user and technology agencies interact. In particular, structuration theory (Giddens, 1984) and its IS-specific variants (AST: DeSanctis & Poole, 1994; SMT: Orlikowski, 1992) were employed to argue that technological and social structures impact and influence each other to produce specific outcomes (Gupta et al., 2010). This approach, however, has been considered inadequate for explaining the role of the material artifact due to the primacy of user agency in producing emerging structures (M. R. Jones & Karsten, 2008; Orlikowski, 2005; Rose et al., 2005). Addressing this inadequacy caused a shift from structuration theory toward critical realism (Khoo & Robey, 2007; Markus & Silver, 2008; Mingers et al., 2013; M. L. Smith, 2006). Critical realism recognizes the real structures consequential to organizations (P. Dobson, 2001). Markus and Silver (2008) suggest that Adaptive Structuration Theory (AST) is more aligned with critical realist thinking than with Giddens' structuration because it embraces the notion of deeply embedded structures, rather than emergent ones, that are designed for faithful use of IT artifacts. Critical realism takes the ontological position to admit the existence of realities independent of human knowledge. Such realities entail mechanisms and structures (real) with enduring properties that have the potential to produce events (actual), some of which may be observed (empirical), thus providing a three-level ontological stratification of real-actual-empirical (Anderson, 2011).

Affordance theory offers a critical realist approach to the study of technology use and its consequences. First, it is consistent with the three-level stratification of real-actual-empirical provided by critical realism (Volkoff & Strong, 2013). The real affordances are potentials that may or may not be actualized depending on the user's goals and intentions. Moreover, only a subset of the actualized affordances may be observed. In addition, the affordance lens is consistent with critical realism in its support for the idea of generative mechanisms, which are viewed as the core structures that bring about technological consequences in organizations (P. Dobson et al., 2013).

Generative mechanisms are the real “causal structures that generate observable events” (Henfridsson & Bygstad, 2013, p. 911). Technology affordances are thus framed as the building blocks of the generative mechanisms that bring about specific outcomes (Volkoff & Strong, 2013).

In addition to research opportunities associated with the critical realist perspective, there are other specific opportunities concerning the three research agendas identified and discussed earlier. The socio-behavioral research agenda, in particular, may benefit from the ecological affordances approach by taking an adaptive view toward user behavior. The diffusion approach, and related approaches such as the technology acceptance model, have produced valuable results pointing to patterns of IT adoption and assimilation (Davis, 1986; Venkatesh et al., 2003). The implicit underpinning of such approaches has been the cognitive representational perspective regarding social action (e.g., the theory of planned behavior’s “intention to”). The ecological affordance approach, meanwhile, focuses on individual adaptation to the environment based on perceptions of objects’ affordances. Although appropriation and adaptation behaviors have been studied in previous research (DeSanctis & Poole, 1994), the cognitive perspective seems to have produced a limited understanding of the phenomenon (Gaver, 1996). Due to its functional perspective on perception, the ecological affordances approach lends itself better to an adaptive view because it ties affordance perception to action: people perceive to act and perceive further while acting. It also removes from the black box the essential part played by “exploratory behavior” (E. J. Gibson, 1988) or “productive inquiry” (Cook & Brown, 1999) in extending individual perception and paving the way for adaptive action.

Further, the ecological affordances approach accounts for the material artifact. Within the IS community, concerns about the materiality of technology and how to appropriately account for it, both theoretically and empirically, are on the rise (Benbasat & Zmud, 2003; Leonardi, 2012; Leonardi & Barley, 2010; Orlikowski & Iacono, 2001). The affordance lens is potentially advantageous here to aid in conceptualizing and accounting for the materiality of technology in IS research. First, the lens may enable researchers to skirt the issue of “repeating decomposition” because affordances are defined in relation to users and within the level that is meaningful to them (Markus & Silver, 2008). Second, the lens avoids the deterministic view of the material artifact, granted sole agency for its consequences. Instead, materiality brings opportunities for action that may or may not be seized—a more nuanced approach to understanding outcomes.

Moreover, the affordance lens enables researchers to account for varying consequences of the same technology. While constructivist approaches explain different consequences of technology through the different social constructions of the meaning of technology, an affordance-driven approach explains these consequences through the multiplicity of affordances (Mansour et al., 2013). In other words, “because materiality can provide multiple affordances, it is possible that one artifact can produce multiple outcomes” (Leonardi, 2011, p. 153). In addition to the multiplicity of affordances, the relational nature of affordances also explains the varied consequences of technology. The same material artifact may provide contrasting affordances in different contexts or to different people (Leonardi, 2011). While Microsoft Excel may afford developing application software with sophisticated automatic forms for someone who knows Visual Basic programming, it does not afford similar action possibilities for ordinary users in the same way. This analogy highlights how we can conduct studies to investigate different consequences of the same technology across groups of users and settings.

Under the technical research agenda, the affordance lens shifts the focus of the analysis to the user-technology relationship. Shifting our focus to this relationship raises a series of new questions that otherwise would have never been raised. For instance, a prior focus on the user perception of system usefulness and how it affects behavior would shift attention to affordances and how users act on them and perceive them when acting. At the same time, researchers would still need to look into the material, social, and individual aspects of affordances to see how they are shaped and changed over time. Positioning affordances front and center enables scholars to consider both the technology and the user at the same time. Affordances in the forefront would also create discipline among researchers in terms of empirical/theoretical rules-of-the-game; that is, studies would require the relationship between the technology and potential users within a particular context to be traced and elaborated as a *modus operandi*.

Finally, and more generally, adopting the affordance lens can significantly help with cross-fertilization among different streams of IS research. The behavioral, technical, and organizational research streams in the IS field usually appear to be more or less isolated from each other, engaging in little knowledge exchange across their boundaries. This situation likely arises from the lack of a theoretical/empirical boundary object. For instance, under the behavioral stream, when researchers contemplate technology acceptance via notions of usefulness and ease of use, technology design researchers have difficulty imagining what being useful and easy-to-use would mean in design terms. In other words, the findings generated by each research stream appear to be siloed with

little potential for knowledge accumulation across boundaries. By adopting the affordance lens, however, researchers enable more possibilities for interaction among different research streams. For instance, the notions of visibility, editability, persistence, and association associated with the affordances of social media (Treem & Leonardi, 2012) may be incorporated into different IS research streams.

## **Challenges and Recommendations**

As with any theoretical lens, the affordance lens also presents some challenges that researchers need to thoughtfully consider before applying it in a research project. We will discuss two crucial challenges and draw on a synthesis of the preceding literature reviews from ecological psychology and IS research to propose remedies to address these challenges.

### ***Towards Greater Conceptual Clarity***

Perhaps the principal challenge regarding the affordance concept is the diverse views on—and even confusion over—what the concept entails. As explained in section “Affordances in IS Research,” various research agendas employ the affordance lens. Arguably, the low level of clarity has made it challenging to accumulate knowledge and build on existing affordance research. Thus, we encourage affordance researchers to acknowledge various perspectives and take steps to clarify and justify their stance on critical aspects of the affordance concept and the research agenda they build on. The research agendas identified in this study can be used to add clarity to affordance research. In addition, we advance three recommendations to enhance conceptual clarity in affordance research.

#### ***Recommendation 1: Differentiate among affordance, affordance learning, affordance perception, and affordance actualization.***

Ambiguity in affordance research arises partly from failing to differentiate among the various aspects associated with the notion of affordance (Bernhard et al., 2013). Because measuring affordances is inherently difficult, as will be discussed later, most scholars study affordances using either affordance perception or actualization as proxies, a practical and valid methodological choice. At times, however, researchers might claim to study affordances while actually studying affordance perception or actualization.

Thus, we encourage researchers to further deliberate over the particular affordance-related concepts they seek to investigate and clearly communicate the focus of their inquiry. Figure 1 can be used to guide researchers' deliberation on their study's focus. For research involving affordances studied in terms of user perception (e.g. Gaver, 1991), studies should be identified as investigations into affordance perception. As shown in Figure 1, however, affordance perception may evolve as users further explore and learn the affordances available to them. Therefore, in many cases, the study of affordances or affordance perception may call for an investigation of the affordance learning process, as well. Still, as Table 2 suggests, limited research exists on the processual element of affordance learning, suggesting an obvious area for future IS research. Finally, studies involving the affordance concept studied through user actions and behavior (e.g. Vaast et al., 2017) should be recognized as research on affordance actualization, which is the part of the available affordances aligned with user goals and intentions.

#### ***Recommendation 2: Specify the elements included in a study (i.e., user/ technology/context).***

Another recommended step to advance affordance-based inquiries in IS research is to specify the conceptual components of the adopted affordance lens. While we recognize the conceptual debates concerning the concept of affordance and how it is related to the diverse research agendas identified earlier, we encourage scholars to address this conceptual ambiguity explicitly and take steps to clarify their position and ground their approach in the research agenda they pursue.

Figure 2 can help researchers clarify the conceptual position of a particular appropriation of the affordance lens. It highlights the relationships between the three components of the affordance concept and the three distinct research agendas. Affordance studies at the intersection of the IT artifact and the user have been a good fit for technical IS research, primarily work in the areas of design and human computer interaction (HCI). These research areas focus on the IT artifact in relation to users, so they are barely interested in the contextuality of affordances. Affordances at the intersection of the IT artifact and its context have been properly studied in organizational IS research. Here, the focus has been on the interplay between the IT artifact and the institutional structures at the group or organizational levels; therefore, the user is not of major interest. Affordances associated with all three aspects have proved helpful in studying the complexities of user behavior concerning the IT artifact

within a social and organizational context. The extended focus of such inquiries requires benefiting from the full conceptual richness of affordances. In outlining these demarcations, the intention is not to categorize all IS research under the three identified agendas but to guide IS researchers to consider these boundaries when approaching the affordance concept. More importantly, researchers may use a tool like Figure 2 to communicate their particular treatment of the affordance concept.

***Recommendation 3: Differentiate affordance from sister concepts such as conventions, IT structure, and functions.***

A third and essential way to add to the conceptual clarity of affordance research is to differentiate the affordance concept from its sister concepts. Regardless of the research agenda, affordances are easily mistaken for other conceptually similar notions. For example, affordances are sometimes conflated with social conventions (Norman, 1999) and conventional rules (Hutchby, 2001), helping us to perceive affordances. Norman (1999) points out that sometimes designers say they are adding an affordance when, in practice, they are adding a button to the user interface, which is not an affordance but a social convention to communicate the affordances the button represents. These conventions are potential associations between affordances and their specific perceptual information, learned cognitively by inferences based on the affordances perceived directly within exploration processes. Further, once such conventional rules are learned, they can be transferred from one domain to another (Fayard & Weeks, 2007; Gattiker, 1992). For instance, users may learn from one webpage a particular convention, say a cursor changing to a hand sign affords clicking. Thereafter, users could apply such knowledge to any other web browsing software application.

In another example, Markus and Silver (2008) rely on the notions of structure and spirit, inspired by DeSanctis and Poole (1994), to extend technology's structure/spirit via the affordance lens. More specifically, they propose that the former is a property of the system while the latter is relational and the property of both the system and the user. Overlooking such subtle but essential differences and equating or associating affordances with earlier notions of system functions or features can potentially keep unclarity persisting and thus undermine future affordance-focused IS research. Consequently, we encourage every researcher to consider the distinction made by Markus and Silver (2008): that affordances are not properties of the technology but relational to the user or context; therefore, no affordance can be defined independently of the user and the context.

***Attempts to Operationalize Affordances***

Another challenge in advancing affordance research concerns ontological and epistemological issues in operationalizing the concept of affordance in empirical research. From an operational measurement point of view, one such issue that often arises concerns how affordances are characterized, whether as real (invariant) or as dependent upon perception. First, the matter is definitional: can affordances be both real and perceived? Here, we concur with Shaw et al. (2019) that this apparent dilemma can be potentially resolved via a dialectical approach, consistent with our ecological perspective as presented in Figure 1. In other words, the distinction between affordances as real, independent of human agency, versus affordances as perceived and agent-dependent can be reconciled by pointing out that we have two levels of description with differences in the level of abstractness (or concreteness). For example, the invariant affordance of "eatability of a fruit" is consistent with the perceptually context-bound eatability affordance of "the peeled, quartered, and ready-to-be-eaten apple on my desk." These statements about affordances are not in contradiction; they are simply referring to the difference between a type and a token (i.e., different levels of abstractness). As an abstract definition, an action possibility may be referred to as an affordance type (fruit eatability), while in a more specific situation with a highly concrete context, a focal action possibility may be labeled an affordance token (eatability of apple on my desk).

Second, a related matter concerns whether affordances of IS functions can be operationalized and then used in survey research relying on an aggregation of individual users' perceived affordances in specific technological and social contexts. Here, we concur with Dong et al. (2016; 2018): such survey use is possible as long as the affordance operational scale and instrument development are consistent with the specified canons of construct operationalization and affordance theory. For instance, Dong et al. (2016) demonstrate how novel social media affordance dimensions and the corresponding scale development can be undertaken, which explicitly considers invariant, perceived, and relational (or reciprocal) views of affordances. They use data from the fast-growing domain of online social commerce, whereby third-party reviewers of footwear and clothing brands monetize their commentary and drive sales for online retailers and manufacturers. In this research context, Dong and colleagues operationalized an affordance—the meta-voicing (construct) of social media within the online social media domain. Meta-voicing is defined as the action possibility that enables users to provide feedback on any content

(Majchrzak et al., 2013); the affordance is relationally entwined with a user's intention of seeking valuable information about target objects, as well as using concrete technology capabilities to post and respond to comments (e.g., like and share buttons). Dong et al. (2016) developed a three-item scale of the meta-voicing construct within the social commerce domain referring to a platform's actions possibilities for the user to (1) comment on products; (2) react to other people's feedback on products; and (3) share shopping experiences with other people.

As the above examples demonstrate, the invariant and perceived character of IS affordances are reconcilable by considering agent-independent aspects as affordance types and perceived aspects or agent-dependent aspects as affordance tokens. Second, performing construct scale development for survey research that remains faithful to the relational and invariant-vs-perceived aspects of a technology affordance is possible as long as the derived scales comply and are consistent with the underlying canons of construct operationalization and affordance theory.

In general, we conclude that there is still significant room for further refinements in devising and applying innovative research methods in this area. Next, we offer a few additional recommendations from the literature on operationalizing affordances, affordance perception, and affordance actualization.

***Recommendation 4: Action boundaries may be used to measure the availability of an affordance.***

Another empirical matter concerns measuring an affordance as a relational phenomenon that may lead to affordance actualization. To do so, some ecological psychologists draw on a concept called action-boundaries to operationalize affordance availability (Barsingerhorn et al., 2012). From this perspective, the availability of an affordance depends on the fit between the characteristics of the individual and the environment. This fit has a range, called the action boundary, that provides the affordance for action. Action boundaries include the range of stimuli in which the response or action is available to the individual (Fajen, 2007). For instance, a stool would afford seating if the ratio of the feet height to stool height holds between 0.3 and 0.9; the closer the ratio is to the lower or the upper boundary, the less available the affordance is to the individual, and the ideal point is somewhere in between. Notably, this measure refers to the affordance itself, not to the perception or actualization of the affordance.

***Recommendation 5: Response/initiation time may be used to measure relative affordance perceivability.***

Ecological psychologists have also been working to measure the relative perceivability of affordances. For example, Micheals (1988) employed stimulus-response theory to measure the availability of affordance perceptions. In a series of experiments, she demonstrated that the more perceivable an affordance is, the faster the individual responds to and acts on it. Smith and Pepping (2010) extended her work by offering evidence that the time it takes to initiate action is a more precise measure of affordance perception than the time it takes to fulfill the action. Either way, the time to react to an affordance has been used to measure the perception of affordance in ecological psychology. IS research may benefit from this measure to quantify IT affordance perception. The measure lends itself well to experimental research methods in which user behavior is examined under different scenarios. Moreover, user trace data could specify how quickly users initiate/actualize particular affordances.

***Recommendation 6: Mixed-method research may be used to measure affordance actualization.***

More recently, Leonardi (2017) offered a set of broad methodological guidelines to study the materiality of an IT artifact. These guidelines rely on coding qualitative data to focus on 1) the material features involved, 2) how the artifact and people's goals enable affordance [actualization], and 3) how affordance actualization and work practices shape and influence each other in a relational manner. Such qualitative methods have been employed to study how people actualize affordances (e.g., Goh et al., 2011; Leonardi, 2011; Strong et al., 2014). The qualitative approach has effectively operationalized and captured the relational nature of affordances, especially within a bounded context. Qualitative data analysis, however, is often limited to smaller datasets, and the findings are thus viewed as less generalizable. Since the affordance lens is consistent with the ontological tenets of critical realism (Markus & Silver, 2008; Volkoff & Strong, 2013), mixed-method approaches suggested for critical realist research (Wynn & Williams, 2012; Zachariadis et al., 2013) seem to also provide beneficial strategies to capture the relational nature of affordances.

Here, we would like to highlight two exemplar uses of mixed qualitative and quantitative data in examining affordance actualizations. In one example, Gaskin et al. (2014) propose a mixed-method approach that automatically codes qualitative organizational routine data and then uses quantitative sequence analysis to explore patterns in affordance actualizations. In another innovative study, Vaast et al. (2017) capture affordance



actualization by analyzing patterns in feature use and then analyzing the qualitative content of user communications to infer the relationship between affordance actualizations and user roles in the Twitter community. Future research, in turn, can look at the characteristics of the users adapting to each affordance actualization and build on their framework by linking user characteristics with affordance actualizations. We encourage affordance researchers to use and extend innovative, mixed forms of qualitative and quantitative data to study affordance actualization at scale.

## Conclusion

Current IT research explores novel theoretical formulations to make sense of how the social and the material entangle. The affordance lens inspired by the work of James Gibson is a strong candidate to enable this sense-making. Affordance theory originated in ecological psychology—a branch of psychology that augments traditional notions of cognitive psychology to explain human perception consistent with Darwin's evolutionary theory. From the ecological point of view, perception is linked with action, and the intertwinement of the two facilitates the selection and adaptation processes of species in the environment. To explain this intertwinement and provide the link between perception and action, James Gibson (1977) coined the term affordance to refer to the action-related perception of the environment and to establish the foundation for affordance theory. For James Gibson (1986), an affordance is a possibility for action provided to an individual by the surrounding environment and, ultimately, the building block of human perception. He believes that what people perceive when looking at the environment is not its substantive qualities and properties but the action possibilities the environment offers the individual perceiver. Therefore, the Gibsonian notion of perception is not representational but both functional and relational with respect to the individual's actual environmental conditions.

While receiving much attention from the IS scholarly community, the affordance lens has been subject to diverse interpretations and adaptations, which may have hindered the accumulation of knowledge in affordance-based IS inquiries. The current study is among the first to provide a forward-looking synthesis of the existing body of IS research that employs the concept of affordance, highlighting differing interpretations and opportunities as well as the challenges the concept presents to researchers and recommendations to address those hurdles. Specifically, the review in this study contributes to the extant literature on affordances in the following manners. First, it selectively takes stock of affordance theory in its parent field of ecological psychology to identify and highlight the main modules of the affordance lens. This work highlights the real and relational nature of affordances and offers a dynamic view of affordances, their perception, and their actualization by users (see Figure 1). Second, this paper offers a three-way classification of how some major IS research studies adapted and employed the three main components (i.e., IT artifact, user, and context) of the affordance lens (see Table 1). In addition, we suggest a related classification scheme based on the research objectives and motivations of the extant research: namely, technical, organizational, and socio-behavioral (see Figure 2). These two classification approaches can help researchers identify their affordance concept foci and their research objectives, thereby enhancing the potential for enhanced knowledge accumulation in affordance-based IS research. Finally, we highlight two main challenges concerning the affordance lens and offer six recommendations to help advance affordance-based IS research. The recommendations ask IS scholars to clarify their adaptation of the affordance lens by 1) deliberately differentiating affordances, their perception, and their actualization; 2) spelling out the main components comprising their adapted affordance concept (i.e., IT artifact, user, and context); and 3) differentiating the affordance concept and its operationalization from sister concepts, such as conventions, IT structure, features, and functions. Moreover, we suggest that the innovative use of mixed-method research can significantly help measure affordances as well as their perception and actualization.

Addressing debates over the adaptation of the affordance lens can put IS research in an excellent position to also potentially contribute back to the parent field of ecological psychology. Gaver (1991) and Norman (1999) have already started a conversation on direct and indirect ways of perceiving affordances in the world of digital objects, a topic less explored in ecological psychology. The increasing prominence of the digital world is making it more important to understand how affordances are being perceived in a world rocked by changing cultural conventions and increasing digital signs. IS research that focuses on technical and design issues can build on ecological psychology's formulations and address how affordances are communicated in the digital world. In addition, some conceptualizations attempt to marry affordances with specific theoretical formulations, effectively extending the reach of affordances and vice versa. For example, Robey et al. (2012) consider what an affordance lens could bring to the table vis-à-vis adaptive structuration theory and organizational routines. Groleau and Demers (2012) similarly look at activity theory and affordances. Faraj and Azad (2012) focus on how affordances can help decenter traditional feature-centric approaches. This research stream can extend the work of Costall (1995), Heft (2007), and others in ecological psychology by helping to explain the role social structures play in shaping

affordances. Further, the innovative mixed-method approaches developed in IS research can potentially benefit the ecological psychology perspective with regard to examining affordance actualization. Such an approach extends experiment-dominant methods in ecological psychology and combines rich qualitative data and the quantitative data that can be collected and analyzed at scale about participant

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## Notes

<sup>i</sup> “All these offerings of nature, these possibilities or opportunities, these *affordances* as I will call them, are invariant. They have been strikingly constant throughout the whole evolution of animal life” (Gibson, 1986, p.15, emphasis in original). Gibson, throughout this book and elsewhere, affirms that affordances both have an independent existence and are perceptual.

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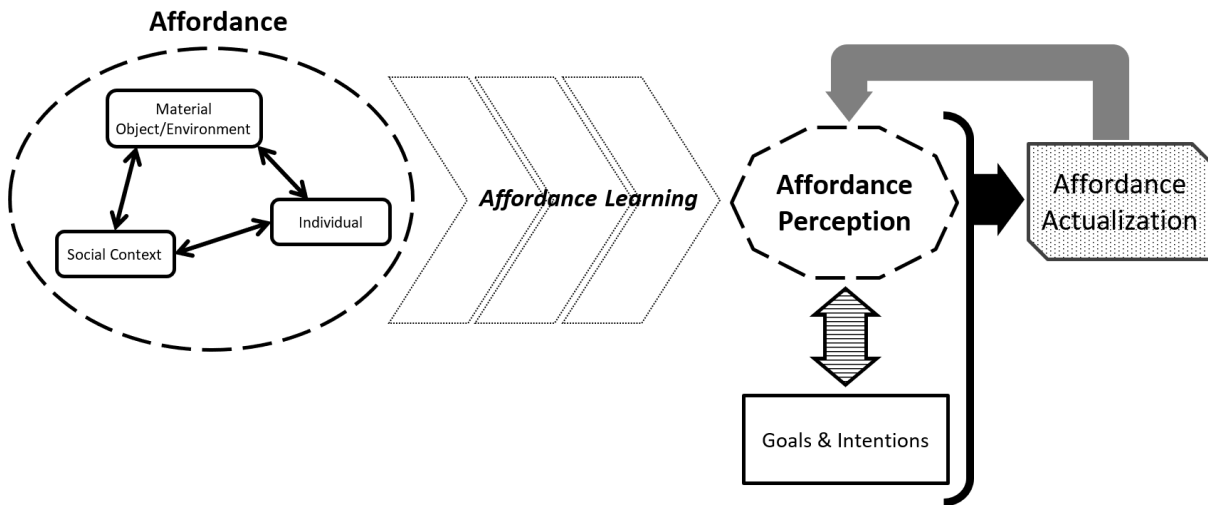
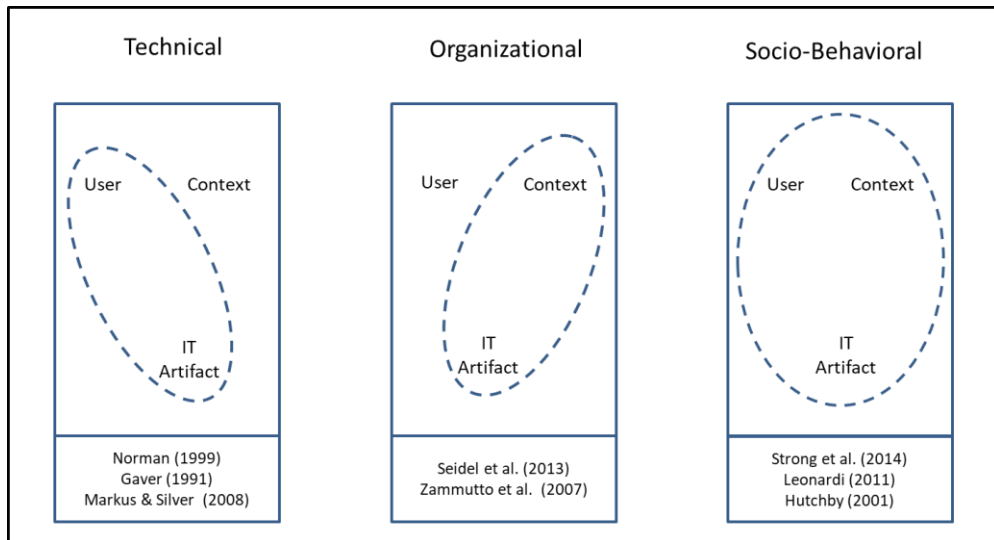


Figure 1. Synthesized from Ecological Psychology, a Map of Relations among Affordance, Affordance Perception, Intentions, and Affordance Actualization



**Figure 2. Three Distinct IS Research Agendas Employing the Affordance Concept**

**Table 1. Five Conceptual Modules Constitute the Affordance Concept**

Conceptual Modules	Descriptions	Supporting Literature
Real and relational nature of affordances	<ul style="list-style-type: none"> <li>Affordances are real, meaning that they exist independent of human perception.</li> <li>Affordances are relational, meaning that their enactment depends on some qualities of both the humans and their environment, and maybe their social context.</li> </ul>	(Adolph et al., 1993; Barsingerhorn et al., 2012; Bernhard et al., 2013; Chemero, 2003; Cook & Brown, 1999; Cordovil et al., 2013; Costall, 1995; Fajen, 2007; Gaver, 1991; E. J. Gibson, 1982, 2000; Greeno, 1994; Lenarčič & Winter, 2013; Leonardi, 2011; Mansour et al., 2013; Marketta, 2004; Michaels, 2003; Pijpers et al., 2006; Sanders, 1997; Sergeeva et al., 2013; J. Smith & Pepping, 2010; Stoffregen, 2003; Turvey, 1992; Warren, 1984; Worgan & Moore, 2010, 2010)
Direct perception of affordances	<ul style="list-style-type: none"> <li>Affordances are perceived through the detection of certain objective information rather than purely mental categorizations.</li> <li>Direct perception complements cognitive perception rather than replacing it.</li> </ul>	(Barsingerhorn et al., 2012; Bootsma et al., 1992; Cordovil et al., 2013; Costall, 1995; Fajen, 2007; Gaver, 1991; E. J. Gibson, 1982; J. J. Gibson, 1986; Greeno, 1994; Heft, 1996; K. S. Jones, 2003; Michaels, 1988, 2000; Michaels et al., 2001; Norman, 2002; Pijpers et al., 2006; J. Smith & Pepping, 2010; Turvey, 1992; Ye et al., 2009)
Affordance exploration and learning	<ul style="list-style-type: none"> <li>Direct perception does not mean affordances are always available to perception.</li> <li>People learn affordances by exploring and experimenting with them.</li> <li>Learning changes not only the ability to perceive affordances but also the affordances available to people.</li> </ul>	(Adolph et al., 1993; Cook & Brown, 1999; E. J. Gibson, 1988; Stoffregen et al., 2005; Turvey, 1992)
Hierarchical and sequential nature of affordances	<ul style="list-style-type: none"> <li>Affordances can be hierarchical, meaning that one affordance may be realized by realizing some lower-level affordances.</li> <li>Affordances can be sequential, meaning that one affordance may be perceived and realized only after the other(s).</li> </ul>	(Gaver, 1991; E. J. Gibson, 2000; Heft, 1996; Michaels, 2003; Ye et al., 2009)
Affordances, intention, and action	<ul style="list-style-type: none"> <li>People act based on affordance perceptions and perceive affordances based on their actions.</li> <li>People's goals and intentions affect their affordance perceptions and vice versa.</li> </ul>	(Bernhard et al., 2013; E. J. Gibson, 1982, 2003; J. J. Gibson, 1986; Heft, 1989; Michaels, 1988, 2000, 2003; Stoffregen et al., 2005)

**Table 2. Exemplar Affordance Studies in IS and Their Approach to Affordances**

Study	Affordance			Affordance Learning	Affordance Perception	Affordance Actualization	Approach to Affordance Concept
	IT Artifact	User	Context				
Jiang and Cameron (2020)	X	X				X	Affordance is a meaningful bundle of functionalities, and it gets actualized depending on user characteristics.
Bernardi et al. (2019)	X	X	X			X	Affordance is relational and requires specific institutional contexts to be actualized, and it interacts with user identity to shape practices.
Karahanna et al. (2018)	X	X				X	Affordance is enabled only by features, and its actualization is motivated by user needs.
Vaast et al. (2017)	X	X				X	Affordance is actualized in relation to user roles.
Gaskin et al. (2014)	X		X			X	Affordance is actualized in relation to organizational routines.
Volkoff and Strong (2013)	X	X	X			X	Affordance is a generative mechanism arising from structures and actors.
Seidel et al. (2013)	X		X				Affordance emerges from material artifacts within the context of organization policies. User goals play a role in the actualization of the emerged affordances.
Leonardi (2013)	X	X				X	Affordance is actualized when a set of features is used by individuals.
Leonardi (2011)	X	X	X				Affordance actualization emerges from the interaction of human and material agencies through changing routines.
Goh et al. (2011)	X	X				X	Affordance interacts with user agency to become actualized and change organizational routines.
Markus and Silver (2008)	X	X					Affordance arises from the relation between technical objects and a specified user group.
Zammuto et al. (2007)	X		X				Affordance emerges at the intersection of technology and organizational features/routines.

Study	Affordance			Affordance Learning	Affordance Perception	Affordance Actualization	Approach to Affordance Concept
	IT Artifact	User	Context				
Norman (1999)	X	X		X	X		Affordance is designed into the artifact, and it is relative to the user, but cultural conventions shape its perception. The conventions are learned and transferred from one context to another.
Gaver (1991)	X	X		X	X		Affordance is designed into the artifact, and it is relative to the user, but its perception is direct and emanates from perceptual information designed in the technology. While affected by cultural conventions learned through experience, it stays distinct.
Hutchby (2001)	X	X	X	X	X	X	Affordance is a functional relationship between an artifact and the user within a particular context.
Deng and Joshi (2016)	X	X					Affordance is actions made possible to users by features.
Lankton et al. (2015)	X	X			X		Affordance is an emergent property of a technology-user system and is perceived by users.
Grgecic et al. (2015)	X	X			X		Affordance perception is the communication of meaning and values by the artifact to the user.
Strong et al. (2014)	X	X	X			X	Affordance arises from IT features and use characteristics, but it needs a particular context to be actualized.
Robey et al. (2013)	X	X					Affordance is the relation between technology and the user.

**Table 3. Key Distinctions among the Three Research Agendas**

<b>Research Agenda</b>	<b>Affordance Elements</b>	<b>Problem of Focus</b>	<b>Level of Analysis</b>
Technical	User, IT artifact	User interaction with technology	Individual
Organizational	IT artifact, Context	Organization routines, practices, institutions, and ways of organizing	Organization
Socio-behavioral	User, IT artifact, Context	User behavior and its consequences in a given context	Individual, Group

**Table 4. An Outline of Exemplar Research Motivations behind Applying the Affordance Lens**

<b>Research Agendas</b>	<b>Research Motivations behind Applying the Affordance Lens</b>
Technical	<ul style="list-style-type: none"><li>• To link user behavior to the designed material</li><li>• To better design readily perceivable affordances</li><li>• To focus on the human-computer interaction phenomenon</li></ul>
Organizational	<ul style="list-style-type: none"><li>• To build a bridge between the social and the material</li><li>• To theorize sociomaterial dynamics and practices</li><li>• To explain the consequences of the sociomaterial phenomenon for organizing</li></ul>
Socio-Behavioral	<ul style="list-style-type: none"><li>• To revive the role of materiality in research on technology use<ul style="list-style-type: none"><li>• To explain user behavior within specific contexts</li></ul></li><li>• To account for distinct contextual consequences of using the same technology</li></ul>