When Is an Affordance? Outlining Four Stances

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Abstract. *Affordance* has emerged as a core concept in information systems (IS) research during the last decade. This relational concept is applied to understand and theorize the relationship between the social and the technical. In the works of the concept originator James Gibson, the relation was mainly portrayed as an ever-existing fact between the natural environment and an animal. In contrast, IS research focuses on relationships in-the-making between artificial things and human beings. In the IS context, we have identified vagueness in temporal and relational ontology: *when* do affordances exist and between whom or what? In this paper, we delve into the temporal and relational questions that have been omitted in much of the IS literature. What kind of a relationship is an affordance and when does it occur? Based on our hermeneutic understanding, we identify four stances from the existing literature. We classify those stances as *canonical affordance*, *designed affordance*, *potential affordance*, and *affordance as completed action*. We further argue that each stance has its own assumptions, consequences, and thus strengths and weaknesses.

Keywords: Affordances · Ontology · Relational · Temporal · Information systems

1 Introduction

> The central question for the theory of affordances is not whether they exist but whether information is available in ambient light for perceiving them (Gibson [1], p. 140).

Affordance is a highly influential yet controversial concept [2]. It originates from the writings of James J. Gibson and has been a source for inspiration in many fields of research [3]. It has also found its way into our field of information systems (IS) [4, 5]. As a *relational* concept, it has provided a promise of a middle ground between technological determinism and voluntarism/constructionism [6]. For example, Majchrzak, Markus, and Wareham [7] recently positioned affordance theory as "a lens that is particularly well suited to help IS scholars build theory about ICT use" (p. 272).

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The trouble of affordances as "relational" is that a "relation" has many different meanings [8, 9]. For example, is affordance a relation between the natural environment and animal, artifact and designers, designers and users, artifact and artifact, artifact and users, or among everything in a particular context? And how does that relationship emerge, when does it expire, or is it always present?

Proponents of the "relational turn" in many disciplines [10, 11] would argue that everything is relational. In an everyday sense, talking about anything requires a relationship to what we are talking about. We must be able to see it, feel it, hear about it, or at least think about it – not to mention that *talking about* is already one kind of a relationship between the talker and the talked about. For Gibson, that relationship was perceptual [12], although his notion of perception went far beyond visually seeing things [13]. In fact, Gibson "never explicated fully what he meant by perceiving things with reference to an animal" [14] (p. 112).

For the advancement of affordance theory in general and for IS research in particular, it is crucial to address *what* kind of a relationship is an affordance and *when* does it occur? These are the questions we address in this paper. An affordance's existence – its ontology, including its relational and temporal definition – is of the highest importance for further application and advancement of this concept. We researchers should share an understanding about the conditions under which this seemingly familiar concept we so often talk about does or does not exist.

In this paper, we outline four different stances from the research literature. All of these stances are consistent with Gibson, at least as much as Gibson is consistent with himself. Yet, each stance differs in its emphasis. We do not claim that any of these stances is better than the other, nor do we intend to create the proper ontological status for affordances. Instead, we aim to record the circulation of different ontologies in the IS community and build an argument for the situations in which each has its strength. The four stances are: canonical affordance, designed affordance, potential affordance, and affordance as completed action. Before going into those stances, we offer a short overview to how ontological aspects of the affordance theory were treated by James Gibson and his followers.

2 James J. Gibson: Affordances for Good or Ill

> The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill. The verb *to afford* is found in the dictionary, but the noun *affordance* is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment (Gibson [1], p. 127, emphasis in original).

The concept 'affordance' originates in the work of ecological psychologist James J. Gibson. The concept has been highly influential [15] while also remarkably controversial [2, 16]. The word "affordance" was first mentioned in Gibson's 1966 book *The Senses Considered as Perceptual Systems* [17], yet it is most popularly known from his 1979 book *The Ecological Approach to Visual Perception* [1]. Some differences exist between the earlier and later formulations. Jones [14] has observed how early Gibson claimed

"when an object's properties are perceived, one can detect the affordances of that object", while later Gibson insisted that "perceiving an object's properties and its affordances are quite different" [14] (p. 112).

A look into Gibson's above definition reveals how it is purposely vague [14]. The definition starts with "affordances of the environment" – hinting that affordances are, indeed, solely *of* the environment. The later part of the definition emphasizes complementarity. Gibson [1] elaborated that an affordance is "neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. … An affordance points both ways, to the environment and to the observer" (p. 129).

This is the level of specificity that Gibson provides. He points to interesting directions but leaves open where affordances come from and how long they persist. For Gibson, affordances simply exist. That's it. In fact, Gibson tackled further ontological inquiries by claiming that whether affordances exist or not is "not a central question" [1] (p. 140). This dodging of ontology has attracted many critics. In particular, Costall [18] has called the omission of existence as "self-defeating": "How could something that did not exist be 'directly perceived'?!" (p. 48). Costall [19] has also attacked that "by foregrounding the issue of perception Gibson put the epistemological cart before the ontological horse" (p. 89).

In this paper, we dive into the *existence* of affordances. We are not the first in this task [20–23], but our niche is in articulating a contribution to IS research specifically. We argue that an affordance's ontology – particularly its relational and temporal definition – is of the highest importance for the advancement of affordance theory. The difference between this paper and most previous approaches is that we argue against a single affordance theory. Instead, we promote multiple stances.

In the next section, we outline four stances from the literature. All of these stances are consistent with Gibson but they differ in their emphasis. We do not claim that any of these stances is better than the other. The stances are: canonical affordance, designed affordance, potential affordance, and affordance as completed action.

3 Four Stances for Affordances

In this section, we formulate four stances to clarify the various relational and temporal aspects scholars are attributing to the affordance concept. Table 1 summarizes the hermeneutic understanding developed through retrospective and prospective analysis of the literature of affordances. The table briefly describes the four stances, their relational and temporal ontologies, assumptions, and corresponding examples. The following subsections describe the four stances in detail.

Table 1. Four stances for affordances

	Canonical affordance	Designed affordances	Potential affordances	Affordances as completed actions
Relational ontology	Relation between artifact class and social convention	Relation between designer, artifact, and imagined users	Relation between artifact and actual users	Relation between artifact and actual users
Origin	Social convention leads to canons of affordances	Through design process designers can embed affordances in the artifact	Designed affordances were perceived and actualized. Affordances can be appropriated based on users' perceptions	Affordances actualized as a completed action in a particular context
Role of agency	Shared cultural understanding	Anticipated perception: intuitive design within shared cultural understanding	Perception and action: action is guided by visual cues	Action (including creativity and "unfaithful" use)
Who names	Cultural ancestors	Designer or sponsor	Users and designer	Users who completed an action
Who receives	Anyone	Imagined or actual user	Actual user	Affordances are not received but emerge in performances
When expire	Affordances do not expire (reification)	Affordances do not expire but are either actualized or not	Affordances do not expire but are either actualized or not	Affordances expire after action is completed
Location of affordance	Impersonal, in environment: affordances are universal, defined at the level of a species	Latent in artifacts: potentially cross-contextual, virtually situated in context	Latent in artifacts: potentially cross-contextual, actually situated in context	In active relationships: situated in context
Examples	"Chairs are for sitting"	"I designed this artifact for you to act in a particular way"	"I used an artifact to do a task it is made for"	"I accomplished a task with the help of one or several artifacts"

3.1 Canonical Affordances

Everyday examples of affordances tend to rely on familiar well-established meanings rather than the novel. This tendency can also be found in Gibson [1]:

> If a surface … is … knee-high above the ground, it affords sitting on. We call it a seat in general, or a stool, bench, chair, and so on, in particular. It may be natural like a ledge or artificial like a couch. … Knee-high for a child is not the same as knee-high for an adult, so the affordance is relative to the size of the individual (p. 128).

What is visible in this example is the reliance on a canon. The meaning of a seat, a stool, or a bench is understandable in a relatively similar way by Gibson when he was writing this in the 1970s, by his readers back then, and by us readers now in 2016 and beyond. This refers to Costall's notion of canonical affordances [18, 24].

In the IS context, there are several such canons. For example *email*, *keyboard*, and *spreadsheet*, all provide a sense of affordances. This understanding is not related to a particular artifact, but to the class of artifacts within a shared sociocultural canon.

The strength of this approach is the acknowledgment that certain established sociocultural and organizational meanings remain relatively unchanged over time and space: a car is for driving, a guitar is for playing, an airplane is for flying, and a keyboard for typing. The most commonly used example is that a chair is for sitting [25]. Yet, it is not the contemporary designer of the chair who invented sitting. It is not the clever user who repurposed the tool for her needs. Canonical meanings and purposes have existed long before design and use. In fact, chairs and sitting have a history of several thousands of years [26]. A designer of an instance of a chair merely adopts the already-existing canonical meaning. In this way, the meaning is impersonal [27]. In the context of IT applications, a similar case is with email applications. These afford sending and receiving emails *in general*. It is neither the designer nor the user who established this meaning.

The canonical view adopts normative rhetoric and equates an entity with a canonical action. The affordance *of* stove is that it is *for* cooking. Similarly, boots are made for walking (and in the canonical sense, it is boots in general, not *these* boots).[1]

This correspondent logic is not all that different from the children's play of equating an animal with a sound: a cat says meow, dogs say woof-woof. Canonical affordance directs us to acknowledge the time prior to design *and* action. This point has been articulated by Bloomfield, Latham, and Vurdubakis [22]:

> The 'affordances' of, say, a chair, a post-box or a cigarette are not reducible to their material constitution but are inextricably bound with specific, historically variable, ways of life. We therefore need to better acknowledge what lies beyond the here-and-now timeframe adopted by most analyses conducted in terms of affordances (p. 427).

One consequence of the notion of canonical affordances is its unfalsifiability. It is not a particular person but *one* who sits on chairs [19] or writes letters through email. This makes the affordance objectified and canonical, and thus it cannot be falsified – or at least falsification is extremely improbable. How can one claim that chairs are not for sitting? You can prove that *a* chair is un-sit-able for you, for example, that sitting for

[1] See https://en.wikipedia.org/wiki/These_Boots_Are_Made_for_Walkin'.

extended periods causes you back pain. You cannot say that chairs *in general* are not for sitting. No matter how many instances of chairs you take and prove that you cannot sit on them comfortably, you could spend your whole lifetime trying to prove differently, and still you would not untie the union between chairs and sitting. The artifact and affordances are chained together as Latour [28] stated: "[a] network element with strong properties of irreversibility and effects that transcend time and place."

It is exactly this fixed affordance–object union that critics tend to target. For instance, Jarzabkowski and Pinch [29] note that:

> a chair affords more activities than the designed purpose of sitting, such as being repurposed as a step for reaching a high object, as a lock under a door handle, as firewood when broken, or even, imaginatively, as a shield for modesty, as so aptly illustrated in Lewis Morley's iconic 1963 photo of Christine Keeler in the aftermath of the Profumo affair. Yet, such repurposing, while enabled by the many creative impulses of human action, is not infinite (p. 582).

In summary, this stance attributes the relationship between a class of artifacts and a sociocultural convention. From a temporality view, social convention leads to canonical use of affordances, it rarely expires, and it is relatively universal. Users share the cultural understanding of the affordances that have been established for a long time – in some cases already by our ancestors. Many of the previous studies in IS consider a similar stance where affordances of technology are taken for granted, in other words, affordances are canonical by nature. The main limitation of this stance is when affordance is defined prior to design and action, residing in the objective world, it tends to lose human agency from the analysis.

3.2 Designed Affordances

The second stance, designed affordances, attributes the origin of an affordance to the design process. This stance is prevalent in the human–computer interaction (HCI) field; however, some works within IS also attribute to this stance.

One appeal of the affordance concept has been in its possibility to theorize design. The theory of affordances was adopted into the design field specifically by the HCI community and was introduced by Norman [30]. Gaver [31] formulated that affordances are "special configuration of properties", implying that "the physical attributes of the thing to be acted upon are compatible with those of the actor, that information about those attributes is available in a form compatible with a perceptual system, and (implicitly) that these attributes and the action they make possible are relevant to a culture and a perceiver" (p. 81).

While agreeing that affordances are relational, the HCI community deviated from the Gibsonian concept of the independent existence of affordances by asserting that affordances can be designed into an IT artifact [30]. The concept of "spirit" in adaptive structuration theory – "the general intent with regard to values and goals underlying a given set of structural features" [32] (p. 126) – bears similarities with this stance. In related terms, Redström [33] refers to "*defining use through design*" (p. 413).

Designed affordances have a similar feature (or a problem) as with the previous stance. It has the tendency to unite objects with actions a priori. Any attempt to escape such conceptual marriage tends to result in the generation of "laundry lists of the possible

affordances in objects" [29] (p. 583). For instance, Czarniawska [34] provided eighteen items in a "tentative list of the uses of computers in the workplace" (p. 20), that includes "elements of decoration", "desktop publishing," "scheduling (calendars)", and "objects for unloading aggressive feelings". This laundry-list problem was foreseen by Gibson [1], who stated that "to perceive an affordance is not to classify an object" (p. 134). Citing Wittgenstein, he formulated that "you cannot specify the necessary and sufficient features of the class of things to which a name is given. … You do not have to classify and label things in order to perceive what they afford" (p. 134).

In summary, this stance emphasizes the relationship between designers, artifact, and imagined users. With imagined users we refer to users the designer has had in his or her mind. It therefore refers to a decontextualized environment. From a temporality view, designers embed affordances in the artifact. The affordances exist independent of actual users and never expire, but this is not universal. The affordances can be utilized in a particular situation; however, users should be able to perceive, and the cultural background can influence the perception. Furthermore, the affordances are named by designers in most cases. There are several studies in IS that implicitly fall in this category, although the scholars advocate for perception and actualization of affordances in situ. The main limitation of this stance is when affordance is defined prior to action it discards the possibilities of the emergence of new affordances in practice. The emergent affordances are either named "false affordances" [31] or "unfaithful use" [32]. The third stance described in the next section attempts to address the issues of a priori vs emergence; the third stance somehow reconciles designers' and users' perspective.

3.3 Potential Affordances

Affordances are an ever-present potential for action in the 'potential affordances' stance [35]. The details of its actualization in a specific instance are contingent on aspects of the techno-organizational context, and thus the outcome is indeterminate [36, 37].

Thus, affordances are a type or subset of generative mechanisms. When the object of study is information technology, and the question relates to how the introduction of that technology affects an organization, the more focused nature of the affordance concept is suggested. Affordance exists at what critical realists refer to as the domain of the real. Someone who is capable of performing the actualization must exist for the affordance to have any meaning, but that person need not be identified. "The affordance will not be actualized (brought into the domain of the actual) unless there exists someone who in addition to having the necessary capability also has an intention or goal that is served actualizing the affordance" [37] (p. 822).

One ontological view that supports the potential affordances stance is critical realism [37]. From a critical realist perspective, understanding the organizational effects/outcomes associated with introducing new structures (e.g. new information systems) and how they occur can be viewed as understanding the generative mechanism associated with those structures [38]. These mechanisms are uncovered through *retroduction* [39], a process of working backward from the empirical events we observe to the underlying mechanisms that could logically have produced those events. From a critical realism perspective, affordances arise from the relation between a structure or object

and a goal-directed actor or actors. In IS, critical realism defines affordance as the potential for behaviours associated with achieving an immediate concrete outcome and arising from the relation between the material object and a goal-oriented actor or actors [37].

From the three layers of critical realism, an affordance can be categorized as possessed but unexercised, exercised but un-actualized (or partly actualized), and actualized but not necessarily empirically observed. The critical realism stance tries to find a trade-off between a realist view that affordances exist independent of users and an idealist view that affordances exist in the mind of users [36, 38].

In summary, this stance follows a relational ontology between artifact and actual users (individual or collective). From a temporality view, affordances remain latent until they are perceived and actualized by an individual or group of users, and the affordances can be realized time and time again.

Majchrzak and Markus [35] provided a formulation of the Technology Affordances and Constraints Theory (TACT) in this way:

> One TACT researcher may describe how an organization uses the affordances of electronic communication technology to keep projects going non-stop: At the end of a work day, one co-located team "passes" the project to another co-located team just starting its workday elsewhere in the world. Another TACT researcher may determine that electronic communication technology affords development of shared identity in some virtual teams, while affording the development of enhanced individual self-efficacy in another.

The perception of affordances is influenced by the sociocultural or organizational contexts. Affordances do not expire and they exist in a particular context. Other assumptions are as follows: users have a shared cultural understanding, the affordances are named by actual users and designers, and perceived affordances can be different than the designed ones. This stance seems to be prevalent in the IS context [37, 39, 40].

A counterview for this stance would be that of an ever-changing world. For example, in their book *Sociomaterial-Design*, Bjørn & Østerlund [41] argued that "it doesn't make sense to talk about specific affordances and constraints associated with particular types of artefacts" (p. 93). Instead, their approach emphasizes the entanglement and bounding of objects in human practices. They argue that "any artefact is part of larger and smaller entanglements, and thus bounding, shifting – and sometimes conflicting – affordances and constraints may be associated with the same artefact. This means that there is no direct causal link between the artefact and particular affordances and constraints". This stance counts potential action as affordances; on the other hand, the fourth stance discussed in the next section regards affordances as a completed action and doesn't consider perceived or latent affordances in its valid list.

3.4 Affordances as Completed Actions

The fourth stance takes an enactive approach [42], which understands affordances as completed actions within social practices. This view can be seen as rooted in pragmatism and builds on Shotter's [43] definition that "an affordance is only completely specified as the affordance it *is* when the activity it affords is complete" (p. 27). A consequence

and a major advantage of this approach is that it is by far the most relational and co-constructive of all these stances. A focus on completed actions includes the conventional and the novel, the routinized and the experimental [44]. Costall and Richards [45] referred to this type is the following way (p. 91):

> In such cases, affordances are not simply discovered, but nor are they mentally projected upon inherently meaningless things. They are negotiated. In such cases, the verb "affording" rather than the noun "affordance" is, therefore, by far the more appropriate term.

Therefore, a major deviation from other stances here is the rejection of realism – in other words, the idea that affordances are "out there". While realists would argue that affordances are *seen*, in the pragmatist and enactivist perspective affordances are *seen as* [42]. Flint and Turner [42] argued that this view attributes a "tight coupling between perception and action" (p. 48), so that "perception involves active exploration of the world rather than interpreting the patterns of light falling on the eyes" (p. 47).

When Gibson was in his early twenties, he was influenced by "two of the most radical intellectual movements of the early twentieth century, … pragmatism and Gestalt-phenomenology" [46] (p. 51). Of these two streams of thought, the American pragmatism of William James promoted antidualism – a central idea later adopted in the theory of affordances. William James was one of the central sources of inspiration for Gibson [46–48]. However, Noble [49] observed that Gibson was "impatient with philosophy" (p. 65). Hence, Gibson "neglected (rather than overlooked) the pragmatist perspective", causing pragmatism to be a "*tacit* … not *reflexive*" aspect of affordance theory (p. 66).

We can take the example from Jarzabkowski and Pinch [29] of a chair that is used as "a shield for modesty" (p. 582). Using a chair in this way is not a canonical affordance. Chairs are canonically made for sitting, not shielding for modesty. It also was not designer Arne Jacobsen's "spirit" that made this affordance the affordance it is. The chair was used creatively in a photographic shoot. This photograph helped in journalistic purposes to visualize the sexual scandal story between the 19-year model Keeler and a high-profile politician and is said to be a major contributor to the financial success for Arne Jacobsen's model 3170 chair. In the photo, the chair was part of the affordance relationship but not as a readymade affordance that was *seen*. It was *seen as* [42]. It was a co-constitutive element in the process of affording.

As another example, we can take practice-oriented studies of paper use in the office environment [50]. Yli-Kauhaluoma, Pantzar, and Toyoki [51] identified how paper affords six practices: social coordination, remembering, anticipation, sketching, modeling, verifying, and back-up practices. But where do these originate from? Is it the inventor of paper who prescribed that paper affords to "get ready for a particular task in the very near future" (p. 72) in an office setting? Unlikely. Such aspect is not a canonical feature of paper either. These affordances are results of creative co-construction between the paper and its users. It requires the *seeing* of paper *as* something meaningful within a social practice.

Researchers who seek explanatory and predictive theories (e.g. [52]) may see the completed action stance as limiting. This is due to the research focus that is put on actions already completed, as the name suggests. It is therefore in tune with Kierkegaard's famous proverb: "Life can only be understood backwards; but it must be lived forwards".

Researchers aligning with this stance will adopt the affordance concept as a sensitizing device in constructing how particular people in a particular setting are able to accomplish what they do.

In summary, this stance sees the ontological relationship between an actual artifact and actual users (individual/collective) in a particular context. The artifact is embedded in social practices in which the affordance is achieved through action. From a temporality view, affordances emerged in practice and cannot exist independent of users. However, the affordances are not just about perception or emergence but should be a completed action. The affordances in this stance expire after the completion of the task. Furthermore, users name the affordances. There are few studies in IS that fall into this category. The main limitation of this stance is not considering the perceived affordances as affordances. In reality, a perceived affordance can be realized in the future. Likewise, it does not give a proper account to the designer's intention and material properties.

4 Concluding Discussion

The concept of affordance has entered IS research in many ways and has mostly been used to help understand and theorize some types of sociotechnical phenomena [4–6, 37]. Recently, Majchrzak et al. [7] stated that affordance theory is "particularly well suited to help IS scholars build theory about ICT use" (p. 272). Some researchers have developed theoretical affordance models [37], while others have studied associated affordances with various types of IT solutions [40, 53]. Yet others have taken the affordance concept as casual vocabulary, seeing no need to refer to Gibson or others [54].

In this paper, we have reflected on the uses of the affordance concept in IS research. This quest fits Czarniawska's [55] recent call for reflexivity in research, a task that often requires "conceptual cleaning" (p. 4). She argued that our analytical concepts often have "ceased to do their analytical work and became blunt tools" (p. 3). We suspected that the affordance concept has become a blunt tool with it referring to various types of phenomena that are seemingly similar yet different.

Affordance is a relational concept, but it is not clear what this "relation" is. We have demonstrated this through the four stances presented in this paper. Affordance theory promises to be of great value for the field of information systems. What are the implications of the four stances for future research applying this concept? We assume the concept will endure and evolve together with the developments within our field. Compared to the HCI and socio-technical perspective, affordance theory addresses another aspect surrounding the use of technology. Affordance theory aims to understand the relationship between the object/technology and the human actor using it. By focusing on this relationship, shown in Fig. 1, affordance theory may help us create a nuanced picture of how technology affects the human actor and the usage of technology.

When the IS community adopted the concept of affordances, it retained its relational characteristic. In the IS literature, there is considerable debate on the ontological understanding of affordances [56]. The debate centres around the question: are affordances embedded in the artifact or do they emerge in practice. As indicated above, the relational ontology from the design perspective claims that affordances

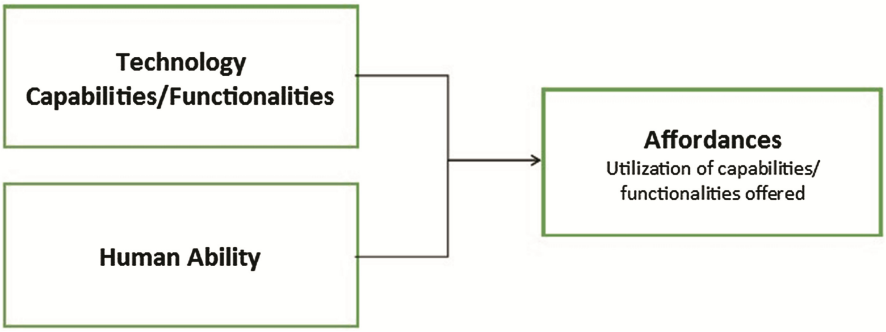

Fig. 1. Existing IS stance on affordances (adapted from [59]).

can be designed [57]. In designing an IT artifact, designers keep an imagined user in their mind, although the context might be blurry [47]. Thus, affordances are embedded and exist independent of the user, but affordances have an impact only if the user perceives and actualizes them. By contrast, a use perspective of the relational ontology suggests that affordances emerge in practice in a particular context [58].

We argue that the third stance is the most popular stance in IS research thus far (e.g. [37, 39]). However, the perspective on "relational and temporal" ontology is singular. Singular in this context means, as shown in Fig. 1, material properties (or technology capabilities/functionalities) exist together with goal-directed actors with abilities, and affordances emerge out of their relationship. Looking at the boxes of "relationship" and "affordances", it seems that the nature of relationship and affordances is singular.

Our study reveals that the conception of a "relationship" is rather complicated in affordance theory. For example, the relationship can be between a class of an artifact and a social convention; among designer, artifact and imagined users; between artifact and actual users; or between an artifact and another artifact. Furthermore, we realize that the temporality of affordances is rarely discussed in IS literature. The questions need clarification: Do affordances already exist "out there" and are actualized? Do they emerge in a sequence of perception and actualization? Or is affordance a result of a negotiated action that is successfully completed? This paper contributes by digging deeper into these issues and provides four stances to illustrate the multiple natures of that relationship and temporality of affordances. As mentioned earlier, we have not aimed to identify the "proper" stance when using affordance theory. However, we do stress the importance of being aware of the consequences of making a choice of stances when applying affordance theory in research.

Fifteen years ago, Orlikowski and Iacono's [60] study unfolded the singular view of the IT artifact and suggested multiple views: tool, proxy, ensemble, computational, and nominal. Our study took a similar approach in revealing multiple stances of affordances. In this paper, however, we haven't considered how multiple views of the IT artifact relate to multiple stances of affordances. This study is more focused on clarifying the relational and temporal ontology of affordances. We realize that the discussion of affordances without taking the IT artifact into account might not present the whole story.

Therefore, exploring the link between different views of the IT artifact and four stances of affordances may be worthwhile to investigate in the future.

The implications of the four stances of affordances for further research are as follows. With regard to the first stance, it is worthwhile to explore the sociocultural setting preceding the current time of design and action. The notion of canonical affordances also requires us to explore how something *canonizes*. How does the artifact–action relationship become a canon? And how to break away from it if the canon has become a burden? In the second stance, researchers can explore how designers embed affordances in material properties and how their intention becomes appropriated in use. From the perspective of the third stance, researchers can study the process by which affordances have been perceived and actualized, and how multiple affordances emerged. The perception/actualization of affordances by individuals or collectives will also be a topic of interest. Based on our observations, most of the existing studies in IS fall in the third stance. Similarly, researchers in the fourth stance can look into how affordances occur in situated completed actions; there is a lack of such studies in IS.

Finally, temporality is an important avenue for future investigation. Involving time in the analysis will help us notice the "different *moments* in the unfolding biography of the artefact" [22] (p. 429). Taking a dynamic affordance perspective will probably require both longitudinal and comparative research designs in empirical studies [61, 62]. Temporally and contextually sensitive analysing includes *actors* and *artifacts* in a process of *affording* [45] (p. 91). It is also important to maintain all these components throughout the period of investigation and in reporting [63].

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