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An Affordances Apparatus for Enterprise Social Media

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Abstract. The current paper addresses one of the core yet complex issues in the study of technology in organizations: the relationship between the social and the material. Many scholars in the field of Information Systems have used the notion of affordance as a lens to investigate and theorize this relationship. However, knowledge contributions in this area are often abstract and impractical, or at least compel further conceptual development. This paper uses a relational view of affordances to study organizational social media affordances based on empirical data collected about the use of the Wiki technology at two large multinational organizations—CCC and IBM. It theorizes four key mechanisms—referring to other affordances (referential), collectively enacting significant affordances (communal), situation-dependent exploitation of affordances (situatedness), and exploiting other opportunities for action (multiplicity), that embody the interaction between the social and the material. These mechanisms make up what is labelled in this paper as 'the affordances apparatus'. The apparatus provides a conceptual structure for the interaction between social and material features that shows operational dynamics and processes underpinning the perception, enactment and exploitation of affordances. This apparatus is the main contribution of the paper in that it gives researchers a conceptual tool for investigating affordances as relational constructs between the social and the material. It also helps in understanding how people navigate the use of technology features relative to their intentions and goals.

Key words: Affordances, Wikis, Social Media, Apparatus, Social, Material

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1 Introduction

Like with any new technology, social media come with a fresh set of opportunities for individuals, societies, and organizations. These opportunities may be partly enabled by new technical features and partly by the ways people perceive these features and leverage them in their everyday lives. Social media, which are defined as internet-based applications that allow for the creation and exchange of user-generated content (Kaplan and Haenlein 2010), have paved the way for novel opportunities for action and emergent forms of organizing (Bailey et al. 2019; Leonardi and Vaast 2017; Vaast et al 2017). Examples of such opportunities from our everyday lives include online activism, crowdsourcing, and collective intelligence. Within organizations, social media are increasingly used and, at times, are drivers for most communications (Leonardi and Vaast 2017). A wiki for instance, is one type of social media, often associated with Wikipedia, that is described as a collaborative authoring tool that affords opportunities for the co-creation and shaping (i.e., editing, reorganizing, linking) of content to improve knowledge reuse in organizations (Majchrzak et al. 2013b). Despite the widespread use of social media and their potential affordances (Karahanna et al. 2018; Leonardi and Vaast 2017; Treem and Leonardi 2013), research on social media especially within organizations is still lacking and their role has not been sufficiently explored so far (Leonardi, and Vaast 2017; Vaast et al. 2017).

One approach to study social media, especially wikis, that has been popular among scholars recently is to use the notion of affordance (e.g., Karahanna et al. 2018; Leonardi and Vaast 2017; Majchrzak et al. 2013a; Mansour et al. 2013; Treem and Leonardi 2012; Vaast et al. 2017; Zheng and Yu 2016). While there are already many various definitions of an affordance, a common view is that affordances are essentially relational. In this view, an affordance is described as "the mutuality of actor intentions and technology capabilities that provide the potential for a particular action" (Faraj and Azad 2012). This understanding has proved useful to understand new opportunities and possibilities of novel technologies such as social media as it offers a good foundation to develop theories about the use of IT (Majchrzak et al. 2016). For instance, in their study of social media affordances for knowledge sharing, Majchrzak et al. (2013a) suggested that using affordances as a lens can provide a force to treat the symbiotic relationship between human action and technological capability as a unit of analysis and thereby provide a language to examine the role and consequences of technology.

Within IS, the potential of affordances is generally characterized by technology-organizing possibilities for the intersection between IT functionality and organizational processes and procedures, controls and social capacities (Zammuto et al. 2007). This is why there is already an abundance of studies that use the concept both theoretically

(Faraj and Azad 2012; Fayard and Weeks 2014; Leonardi 2011; Markus and Silver 2008; Robey et al. 2012; Strong et al. 2014) and empirically (Majchrzak et al. 2013a; Mansour et al. 2013; Thapa and Sein 2018; Treem and Leonardi 2012) to investigate various IS phenomena including organizational use of social media. Originally, the notion of affordance was first introduced by Gibson (1977) in the field of ecological psychology as a way to understand direct perception that is an act through which humans obtain information about objects in their surrounding environment to perceive them. It has later been appropriated in technology studies such as Information Systems (IS) (e.g., Faraj and Azad 2012; Fayard and Weeks 2014; Hultin and Mähring 2014; Leonardi 2013; Mansour et al. 2013; Robey et al. 2013; Zammuto et al. 2007) to study perceptions of technology in contemporary organizational practice that is complex, dynamic, and unpredictable.

Against this background, it is reasonable to say that there is a tendency by scholars of technology and organization to agree on the idea that using affordances can possibly provide a tool to address one of the core yet complex issues that underpins the study of technology in organizations: the relationship between the social (human goals, norms, and practices) and the material (technology functions and features) (see Faraj and Azad 2012; Kallinikos et al. 2012; Leonardi and Barley 2008; Leonardi 2013a; Mansour et al. 2013; Mutch 2013; Orlikowski 2007; 2010; Orlikowski and Scott 2008; Stendal et al. 2016; Zammuto et al. 2007). For the most part, we can see that current studies either focus on identifying affordances of technology and levels of enactment (e.g., macro, micro, and meso) (Leonardi and Vaast 2017; Mansour et al. 2013; Stendal et al. 2016; Treem and Leonardi 2012; Vaast et al. 2017) or developing metaphors in an attempt to explain affordances as a bridge between the social and the material (Leonardi 2011; Markus and Silver 2008; Thapa and Sein 2018; Zammuto et al. 2007). We believe that neither of these approaches provides a sufficient theoretical basis or tool that can be used empirically to investigate how this might happen in practice.

Hence, in order to address this lack of knowledge in IS literature, we seek to answer the following questions: first, what mechanisms allow for the interaction between human capabilities and goals (the social) and technology features (the material or materiality) in using enterprise social media, and second how do these mechanisms mediate the perception, enactment, and exploitation of affordances? Our aim is to conceptualize this interaction through developing a theoretical tool that visualizes the symbiotic relationship between the social and the material. The visualization is done in and through what we call 'an affordance apparatus' which describes the 'machinery' or the operations and working parts of affordances including social properties, technology features, and the space of interaction. In studies of technology and organizing, the term apparatus

has been mentioned by Barad (2003) and Leonardi (2013) in the sense of describing some sort of "machinations of the universe" or in other words how the universe works. Along these lines, the term apparatus is used to explain the "machinery needed for a particular activity or purpose" (Oxford dictionary) which in this paper refers to processes, operations, or dynamics that underlie the perception, enactment, and exploitation of affordances. In order to achieve our aim, we did an empirical investigation and analysis of wiki affordances based on data collected from two large, multinational organizations that use wikis for collaboration and information sharing among professional individuals and communities.

2 Theoretical background

2.1 Gibson's 1977 outline of the Theory of Affordance

The first ideas of affordances were developed by James Gibson (1977), a perceptual psychologist, in an effort to explain how animals perceive their environment. Gibson's theory of affordances is basically a theory of perception that attempts to provide an explanation of the meanings of things in the environment that could be perceived (Gibson 1977). It offers an ecological approach to direct perception in contrast to cognitive approaches that emphasize the role of senses and memories in the mind in perceiving objects in the environment. Gibson explained that direct perception is an act through which animals obtain information about objects in their environment and then allows them to relate their capabilities to the properties of objects to realize and exploit potential affordances.

He defined an affordance as "a specific combination of the properties of its substance and its surfaces taken with reference to an animal" (p. 67). In explaining affordances, he uses various examples donating to surfaces, substances, layouts, detached objects, and other species, and what affordances these can offer. For instance, the vegetable substances that are available in the environment afford eating and ingestion. These substances may afford animals and humans either nutrition or poisoning. A surface like water, he further explained, is fluid and affords special sorts of locomotion like swimming or wading. However, an animal or a human may not necessarily be equipped with skills to exploit such affordances. Then, Gibson also discussed how humans in the environment relate to each other through reciprocal affordances at extremely high levels of behavioural complexity. One human being, for instance, can afford another comfort or injury.

In this respect, although affordances represent a combination of properties uniquely related to an animal being considered, Gibson argued that affordances do not depend on that animal or any other species. He said: "The object offers what it does because it is what it is." (p. 78). Affordances for Gibson are relationships; they are part of nature, they do not have to be visible, known or desirable, and they are yet to be discovered. He made a clear distinction between the affordances and qualities of an object. He explained that when we look at a certain object, what we perceive is the affordances rather than the qualities of that object. He gave an example:

> ... if an object that rests on the ground has a surface that is itself sufficiently rigid, level, flat, and extended, and if this surface is raised approximately at the height of the knees of the human biped, then it affords sitting-on." (p. 68). A chair that affords sitting-on has certain qualities or properties that if individually perceived may not have any meaning, or in other words, cannot possibly be perceived as a chair.

In addition, Gibson discussed the kinds of affordances we perceive. He described the affordances of the environment as "...what it offers animals, what it provides or furnishes for good or ill." (p. 68). This implies both positive and negative affordances as well as the misperception of affordances. A chair for instance can afford sitting-on (positive affordance) but it can also afford falling-off (negative affordance). He explained:

> Positive and negative affordances are properties of things taken with reference to an observer but not properties of the experiences of the observer exclusive of the things. (p. 76)

As for misperceiving affordances, he cited the example of a door made of glass. This kind of door affords humans the possibility to exit a room or a building. However, when this door is closed, misperception may occur since glass may sometimes be invisible to the human eye which results in either getting hit or hindered by the door. Gibson explained such misperception as failure to perceive what is present in the environment and simultaneously perceiving something that is not actually present.

3 Related studies

3.1 Technology and organizing

Recent literature addressing the relationship between technology and organizing, or the social and material, suggests an emphasis on the mutuality of this relationship (Kallinikos et al. 2012; Lanamäki et al. 2016; Leonardi and Barley 2008; Leonardi 2011; Leonardi 2012; Orlikowski 2007; Orlikowski and Scott 2008; Orlikowski 2010; Stendal et al. 2016; Thapa and Sein 2018). The aim is to revive materiality and its role which often fades into the background in studies of technology and organization (Leonardi and Barley 2008; 2010; Orlikowski 2007; Orlikowski and Scott 2008). Leonardi and Barley (2010) discussed that for such aim to be realized emphasis should be placed on understanding how material properties of technology enable and/or constrain technology use. The premise here is that all social action is possible because of some materiality (Leonardi 2012). This is especially true with respect to increasing adoption and use of technologies in contemporary organizations where organizational practices are seen as multiple, emergent, and dynamic sociomaterial configurations (Orlikowski and Scott 2008). It is important to note that there are two competing views concerning the relationship between the social and the material. An agential realism view that suggests there is no ontological distinction between them, hence sociomateriality, and a critical realism view that suggests the social and the material are essentially separate, and they can only appear to be inseparable through human activity occurring overtime. In this paper, we adopt the later view which considers the social as abstract concepts such as human norms, policies, and communication patterns, and the material as the arrangement of an artifact's physical or digital materials into particular forms (e.g., functions and features) (Leonardi 2011; 2013). See Leonardi (2013) and Mutch (2013) for a detailed discussion.

Sociomateriality is one important lens for understanding the inherent inseparability of the social and the material as an entangled relationship in which they are mutually constituted in practice (Orlikowski 2007; Orlikowski and Scott 2008). In this view, Orlikowski (2007) suggested that

> ... all practices are always and everywhere sociomaterial, and that this sociomateriality is constitutive, shaping the contours and possibilities of everyday organizing. (p. 1444)

Others such as Leonardi (2012) explained sociomateriality as the "enactment of a particular set of activities that meld institutions, norms, discourses, and all other phenomenon we typically call social" (p. 38). He stressed that materiality has important consequences for organizing in that it has the power to enable and constrain social actions. Scott and Orlikowski (2012) also argued that social practices are essentially bounded by the material means through which they are performed. Central to these ideas are the unpredictable effects of technology in organizing processes. It is suggested that unpredictable forms of organizing emerge as a result of the combination of IT and organizations features and practices (Zammuto et al. 2007). An important lens that captures such combinations is the affordance lens (Faraj and Azad 2012; Robey et al. 2012; Treem and Leonardi 2012; Zammuto et al. 2007). Zammuto et al. (2007), for instance, discussed affordances for organizing as a generic bridging concept that emerges from the intersection of IT systems and organization systems. They explained that affordances for organizing represent technology-organizing possibilities that

> ... depend not only on the functionality characterizing the information technology, but also on the expertise, organizational processes and procedures, controls, boundary-spanning approaches, and other social capacities present in the organization" (p. 752).

While the concept of affordance maybe similar to that of sociomateriality, there is still a major distinction between the two. Sociomateriality is an extremely theoretical notion that provides an abstract understanding of the relationship between the social and the material (Leonardi 2013). In contrast, the concept of affordance has the potential to provide a factual understanding of this relationship.

3.2 Affordances in studies of technology and organizing

There have been several recent attempts to theorize the relationship between the social and material using an affordance lens (Faraj and Azad 2012; Karahanna et al. 2018; Leonardi 2013; Majchrzak et al. 2013a; Majchrzak et al. 2016; Robey et al. 2013; Thapa and Sein 2018; Treem and Leonardi 2011; Volkoff and Strong 2013; Zammuto et al. 2007). This interest by scholars from the fields of Information Systems and Organization Science is driven by the enduring curiosity about the role of materiality in organizational change. Drawing from the work of Gibson, scholars often use the concept of affordance in theorizing the materiality of IT artifacts. For the most part, it is used in a relational sense (Leonardi 2013), that is, affordances provide a link be-

tween the features of technology and actors' purposes and intentions (Faraj and Azad 2012). Markus and Silver (2008) discussed the use of affordances as a bridge between the analysis of IT properties and the explanation of IT effects. While the concept is yet to be consistently defined and used in the literature, probably due to diverse views in its original field of ecological psychology (for further elaboration, see Chemero 2003; Reed 1992; Stoffregen 2003; Turvey 1986), it seems that most scholars tend to think about it as a useful way to speak of both the social and the material (Leonardi 2012; Mansour et al. 2013; Zammuto et al. 2007) that allows for a better understanding of the consequences of IT in organizations. Faraj and Azad (2012) defined a technology affordance as: "the mutuality of actor intentions and technology capabilities that provide the potential for a particular action." Zammuto et al. (2007) summarizes the use of an affordance lens in studies of technology and organization as follows:

> Using an affordance lens suggests that although IT and organization features may exist independently of each other, their value for explaining organizational form and function comes from how they are enacted together. That is, although IT and organizational features may have their own potentials and constraints, theories are needed that elaborate on the affordances that arise when they are woven together. Understanding these affordances requires that the features of both IT and organization be considered simultaneously. Theorizing about affordances ideally would define them using both IT and organization science language to explain how their combined features interact to create new affordances for organizing. (p. 753).

In this respect, in order to address broader applications of affordances in technology studies, Leonardi (2011) discussed two ways of understanding affordances by Norman (1990) and Hutchby (2001). Norman (1990), often regarded as the first to bring affordances into technology studies specifically Human-Computer Interaction, suggested that affordances are intrinsic properties of artifacts and that a good design means that the affordances of a designed artifact can give strong clues for what its materiality can be used for. One central premise in Norman's understanding of affordances, unlike Gibson, is that affordances do not change across contexts, but they are always there waiting to be perceived. Another discussion of affordances in relation to technology was offered by Hutchby (2001). Hutchby suggested an understanding of affordances that differs from Gibson and Norman. He sought a middle ground which emphasizes a relational character of affordances (Leonardi 2011). A relational view of affordances suggests that affordances are not exclusive properties of people or artifacts, but they are constituted

in relationships between people and the materiality of the things they interact with (Leonardi 2011)—a view that we adopt in this paper. Similar to Gibson, Hutchby also suggested that affordances change across contexts because people come to materiality with diverse goals, so they perceive technology as affording distinct opportunities for action. Leonardi (2011) explained, in this respect,

> ... as people attempt to reconcile their own goals with the materiality of a technology, they actively construct perceptual affordances and constraints. Depending on whether they perceive that a technology affords or constrains their goals, they make choices about how they will imbricate human and material agencies. (p. 154)

Further, there have been a number of attempts to apply affordances on a more general level aiming at developing some kind of a general theory of affordances. Zammuto et al. (2007), for instance, developed a number of general affordances that include visualizing entire work processes, real-time/flexible product and service innovation, virtual collaboration, mass collaboration, and simulation/synthetic reality. They explained that such affordances allow for understanding how the combined features of IT and organization result in new forms of organizing. Leonardi (2011) discussed the construction of affordances and constraints as catalysts for imbricating the human and the material. He explained that people make choices for how to imbricate the human with the material enabling them to realize new intentions or technologies. Volkoff and Strong (2013) attempted to extend the notion of affordance by looking at how affordances arise from complex objects and organizational actors; something they called organizational level affordances—or generic affordances. The set of possible combinations of objects' and actors' characteristics/structures gives rise to various 'high-level' affordances. That is, when an object is itself a high-level emergent structure (e.g., a latent structure such as the embedded control structures of SAP) and the actor is a group (another emergent structure), the result is a higher-level affordance. Such a view emphasizes relationality among several affordances rather than individual affordances. This, as Volkoff and Strong suggested, may be helpful to explore how multiple affordances interact rather than consider them individually like in studies by Majchrzak et al. (2013a), Mansour et al., (2013), and Treem and Leonardi (2012).

With respect to social media, there is a growing number of studies (e.g., Leonardi and Vaast 2017; Majchrzak et al. 2013a; Mansour et al. 2013; Treem and Leonardi 2012; Vaast et al. 2017; Zheng and Yu 2016) that use an affordance lens in order to understand what opportunities for action social media may afford instead of focusing

on what their features can or cannot be used for. Majchrzak et al. (2013a), for instance, studied contradictory influences of social media on knowledge sharing by showing how social media affordances involve tensions that point to a paradox of social media in-use, and that affordances are simultaneously hindering and helping. They made a general comment on using an affordance lens in understanding social media:

> The affordance lens forces the researcher to consider the symbiotic relationship between the action to be taken in the context and the capability of the technology. By treating the entanglement between the human action and the technological capability as a unit of analysis, the affordance perspective provides a language for beginning to examine social media and its role in affecting the process of online knowledge sharing. (p. 2)

Vaast et al. (2017) discussed a new type of social media affordances which they call connective affordances. These, they suggested, are collective-level affordances where social media users are mutually dependent on each other. Connective affordances therefore describe how affordances are actualized as users, in emerging roles, tend to use features of social media in similar ways in the sense of exhibiting shared patterns of using technology features. In a similar vein, Zheng and Yu (2016), used the concept of affordances for practices, which is rooted in in a relational view of affordances, to study social media affordances and their enactment in social practices performed in collective action processes. In their study of enterprise social media, Mansour et al. (2013), developed properties of affordances which represent organizing processes that affect the actualization of affordances. Further, in an attempt to propose generic social media affordances for organizations, Treem and Leonardi (2012) developed a set of organizational social media affordances including editability, visibility, persistence, and association, which are enacted through the intersection of social media features and user behaviours.

Finally, it is worthy to note that many studies on social media (Mansour et al. 2013; Vaast et al. 2017; Zhen and Yu 2016) that use affordances as a theoretical lens often contribute insights into the enactment and actualization of affordances. There seems to be a pattern in these studies in that they both identify specific social media affordances as well as develop insights into how these affordances are enacted and actualized especially since social media are often used for collective action.

4 The empirical inquiry

4.1 Research settings: Wikis at CCC and IBM

Our empirical investigation took place at two large multinational organizations: CCC and IBM. The first research setting is CCC which is short for Consolidated Contractors Company. CCC is one of the largest construction companies in the world with more than 17,0000 employees spread over 120 countries. It uses a central wiki run by the Knowledge Management (KM) department since 2007. The wiki is primarily used by communities of practice as a collaborative platform where community members collaborate together and share professional content mainly obtained in real-life projects. There are eleven communities that use the wiki covering various technical areas and subjects such as piping, hydrotesting, safety, etc. The wiki is fully controlled by the KM department. People who wish to use the wiki need to submit a formal request for membership in one or more communities. It is divided into several spaces and each community has its own space where members can collaborate and share content relevant to their areas of concern. The members of these communities are given certain roles and rights that determine the possibilities they might have in using the wiki. In each community there are a number of community leaders, captains, subject matter experts and many other regular members that make up some sort of a community structure. Usually community leaders and captains are senior employees with many years of experience and enjoy 'privileged' use of the wiki. They often lead the community by suggesting topics, reviewing shared content, inviting new members, and so on. Regular members can be employees who may have interest in specific areas addressed by certain communities. They often use the wiki to learn new knowledge with limited or no rights to edit content. The wiki is only accessible through an internal secure network at CCC.

The other research setting is IBM. It is one of the largest companies in the world and has over 400,000 employees worldwide. The company is primarily specialized in producing software and hardware technologies as well as offering consulting, hosting, and infrastructure services on a global level. In respect of using wikis, IBM has a very different wiki setup compared to CCC. Wikis in IBM are part of a universal system called IBM Connections. This system includes various social media tools and many other tools that support collaboration and interaction among people. The use of wikis at IBM is fluid and flexible. People can freely use the wiki tool in IBM Connections to create wikis and use them for various purposes. A global project team may want to create a wiki to develop project-related information and collaborate and share content with each other. In fact, the data collected in the current study from IBM suggests

that one of the main purposes to use wikis is to develop documentation for software products. So, software engineers, information developers, and many others collaborate to develop documentation on wikis. Further, people at IBM also use wikis to create various communities where people share and discuss common interests. Depending on the purpose, people have the possibility to set up wikis to be public and accessible by a large audience or private and only accessible by a limited number of people like in project wikis.

4.2 Data Collection: A qualitative investigation

The empirical data collection was primarily qualitative. The main vehicle for collecting qualitative empirical data at both CCC and IBM was the semi-structured interview method. It is often considered as a powerful research tool and most useful method to obtain qualitative empirical data (Kvale 2006). The strength of the interview method lies in its potential to engage research participants in a direct conversation with the researcher in their own life settings (e.g., a workplace). It is therefore a useful method to seek and generate "contextual, nuanced and authentic accounts of participants' outer and inner worlds" (Schultze and Avital 2011, p. 35). In this way, obtaining qualitative data using the interview method has helped us to develop a solid empirical foundation to address our aim in this paper by: first, emphasizing the participants' natural work settings, second, providing closer and detailed insights into participants' use of technology that describe the various ways of using the wiki technology, and third, offering the potential to account for and capture deeper aspects of the studied phenomenon that can help in uncovering and theorizing emerging issues in the data.

The total number of interviews was 20. An interview protocol was used to guide the interview process and ensure consistent responses across interviewees (Schultze and Avital 2011). This protocol included a set of questions about wiki use practices, organizational norms and routines, and technology features. However, the interview process was fluid in the sense that new questions maybe asked depending on the flow of the discussion. We conducted 10 interviews in each company in the period between May and October 2011. The participants from CCC were selected in cooperation with the KM department with emphasis on the diversity of their roles, seniority levels, and experience in using the wiki. Four of these participants were seniors with experiences ranging between 20 to 30 years at the company. All of them had senior roles within their communities such as captains and leaders. The other six participants were juniors with experiences ranging between 2 to 10 years. The majority were regular community members with limited roles and rights to read and make comments on wiki content.

All of our CCC participants had an experience in using the wiki since its deployment. Six of the interviews were conducted via Skype due to geographical constraints and the other four were conducted face-to-face at CCC headquarters in Athens. The average interviewing time was about 50 minutes. All interviews were recorded using an audio recording device, transcribed and then sent to the participants for validation.

The participants from IBM represented a diverse group of software developers, information developers, social media evangelists, sales professionals, and project managers. Their work experiences at IBM range between 2 years up to 20 years. The range of their experiences in using wikis was between 1 to 10 years. Most of them used wikis for both professional and non-professional purposes such as developing software documentation, planning and coordination, etc. A few of IBM participants were employed as wiki writers and their main job was to work with wikis (e.g., writing content on behalf of their managers). Five interviews were conducted face-to-face at IBM offices in Copenhagen, two over the phone and three via Skype. The average interviewing time was between 45 minutes to one hour. All interviews were recorded, transcribed and then sent for validation.

4.3 Data analysis: A hermeneutical analysis

Our empirical data analysis is influenced by a relational view of affordances that emphasizes on the symbiotic relationship between the social (e.g., human actions, intentions, and behaviors) and material (e.g., technology characteristics and features) (cf. Leonardi 2013) as a way to understand the consequences of social media use in organizations (cf. Treem and Leonardi 2012). This view helps in addressing the relationship by looking at what combinations of material and human/organization features can be enacted and what opportunities such combinations may afford for people (Leonardi 2011; Treem and Leonardi 2012; Zammuto et al. 2007)

The data analysis process was essentially hermeneutic with the hermeneutic circle as the main vehicle for analyzing qualitative, textual data (Cole and Avison 2007; Klein and Myers 1999). Using this circle allows for a spiral understanding of the empirical text by looking into the meanings of the parts and then establishing relationships with the whole in order to develop an overall understanding of the studied phenomenon. There are three key analytical steps that make up the hermeneutic circle including *understanding, explanation and interpretation* (Cole and Avison 2007). These three steps represent the backbone of our data analysis. They enabled us to move iteratively through the data which allowed for achieving multiple levels of interpretation and developing deeper understanding of meanings embedded in the qualitative text. The application of the three

steps was enabled by analytic induction (Patton 2015) which is a type of analysis that combines both deduction and induction. Analytic induction starts with a deductive analysis of data, mainly done during the first understanding stage in the current study, followed by an inductive analysis that is based on a fresh and direct analysis of the data, which is largely done in the explanation and interpretation stages. The details for each stage are shown below:

First, understanding the empirical data was focused on making sense of the research participants' meanings and practices. This first stage was primarily deductive since our understanding of the data was based on a predetermined theoretical stance which emphasizes a relational view of affordances. It was mainly focused on analyzing and identifying wiki affordances. In order to examine potential wiki affordances, we used the four properties of affordances suggested by Mansour et al. (2013). These properties, shown in Table 1 below, include *referential, situatedness, communal, and multiplicity*. Their importance for our analysis lies in their focus on the relationship between the social and the material as well as their potential for allowing an examination of the enactment of affordances by offering means to look at what opportunities for action (e.g., enabling or constraining) affordances might entail (Mansour et al. 2013).

Properties	*Description*
Referential	Describes referential dynamics between different kinds of affordances and focuses on how people relate affordances to each other and how they make choices about which affordances to exploit
Situatedness	Perceiving different opportunities for action pertaining to certain affordances depending on different situations or contexts.
Communal	Users of technology may have multiple perceptions and flexibly enact various affordances due to the malleable nature of technologies.
Multiplicity	An individual affordance may have multiple enabling and constraining opportunities for action.

Table 1. Properties of affordances (Mansour et al. 2013)

So, based on the relationality implied in these properties, our exploration of affordances comprises an analysis of the features of the wiki (e.g., text editing, linking content)

relative to users' goals and intentions from using the wiki (e.g., reading wiki content, contributing content). Open and axial coding were used across the text in each individual transcript to carry out this analysis. We looked for instances in the data were participants described how they used certain wikis features to achieve certain goals. We coded the features as they are described by the participants. For instance, when a participant says "I click on edit in the wiki" the code 'text editing' is used to describe the feature of text editing. Similarly, we used descriptive codes to label users' behaviors, goals, and intentions such as 'showing off', 'finding contacts' and 'avoiding embarrassing content contributions'. The participants described various goals of using the wiki and codes were given based on our interpretation of these goals. For instance, if a participant described how he avoids editing content made by a senior manager and chose to make a comment instead, codes like 'offensive behavior', 'public embarrassment' are identified. Then, relevant codes for features enabling or constraining certain behaviors/goals were linked together in individual transcripts to conceptualize affordances. The affordance of 'Commentability' for instance is conceptualized as a relationship between features such as 'comment' and behaviors such as 'public embarrassment'.

The interview transcripts from both CCC and IBM were divided and examined separately by the three authors. Each of the authors developed a table (cf. Miles and Huberman 1994) to organize all identified affordances together with several empirical instances that support each affordance. The tables developed by all authors were manually compared and then combined together in one general table to select dominant affordances together with supporting empirical instances. The outcome from this step was focused on understanding the empirical data and identifying key organizational wiki affordances including Commentability, Viewability, Validability, and Accessibility.

Second, explanation is the step which was mainly focused on further and deeper analysis aiming at highlighting the organizing mechanisms involved in the perception, enactment, and exploitation of affordances (Mansour et al. 2013). Here, the purpose, as Cole and Avison (2007) described it, is to do reflection and reconstruction in the sense that a "shared meaning is interpreted anew" (p. 825). So, after identifying four key wiki affordances, we conducted an inductive analytical reinterpretation of the data. In this step, which sustains our circle of understanding, the reinterpretation of the data was done through re-examining empirical instances already identified in the general table of affordances developed in the previous step. Our interest in this step was in reinterpreting relevant empirical instances to see what kind of mechanisms (e.g., what enables an affordance to be enacted) might be involved in the enactment of particular affordances. For example, an empirical instance about the affordance of 'Viewability' which shows how a wiki user thinks that the content is written in a way that does not invite others to

edit it, so he or she makes a choice to just view the content, would be reinterpreted in this second stage of analysis with emphasis on highlighting the choice made to exploit one affordance instead of another. There are two important outcomes from this second analytical step. The first was ensuring that the empirical instances provide sufficient evidence for a relational understanding of wiki affordances and their characteristics. The second was highlighting traces for the organizing mechanisms underlying the enactment of wiki affordances in the data.

Third is, as Cole and Avison (2007) described it, "another stage of interpretation" (p. 826). The aim from this third step was to develop an informed and sophisticated interpretation of the data. It was mainly enabled by continued reexamination and reinterpretation of the data as well as active discussions among the authors. During the actual analysis, this was basically enabled by an open, 'creative', and collaborative interpretive effort among all the authors to make explicit the potentially complex ways by which social and material features become intertwined in the form of enacted affordances. We wanted to do an extended theoretical elaboration, or essentially theorize new insights from the data, by uncovering further details that would be interpreted relative to our research focus on mechanisms, means, or ways that enable the perception, enactment and exploitation of affordances. In other words, we sought to "illuminate and articulate what generally goes unnoticed…" (Cole and Avison 2007, p. 821). This was a complex task mainly due to the intangible and impalpable nature of the relationship between the social and the material. Referring to the empirical instance about the affordance of Viewability discussed in the second stage, our emphasis in the third stage would be on deconstructing the choice made by the wiki user to exploit the affordance of Viewability than Editability. The aim was to achieve a higher level interpretation of such choices or more generally practices that describe how users navigate their ways of using the wiki. In practice, this meant looking for the particular dynamics and processes that enable users to relate their goals to the features of the wiki as they try to make use of it, or in other words, perceive, enact, and exploit its potential affordances. It is important to note however that our analysis in both the second and third stages was not purely inductive, but we would call it semi-inductive since our premise in theorizing directly from the data was influenced by the relationality of affordances. The main outcome from this final analytical step, which builds upon the outcome from the second step, was to model or visualize the mechanisms that make up the affordance apparatus in this paper.

5 Empirical findings

The findings from our empirical investigation are presented in this section. The first part shows key affordances of organizational wikis, while the second part shows and discusses the affordance apparatus.

5.1 Organizational wiki affordances

Commentability

Commentability is an important wiki affordance. It is an affordance that describes peoples' intentional tendency to contribute into the wiki by making comments rather than editing, organizing, or integrating content. It is often enacted in specific situations that compel people to exploit the possibility of making comments in order to be able to share and contribute into the wiki. The affordance of commentability is enacted in situations like when people disagree about content, do not understand the content, think it could be presented in a different way, and see that it belongs to specific individuals or communities. Basically, the enactment of the commentability affordance describes how wiki users maneuver around possibilities afforded by the wiki so that they achieve their aims from using it. A CCC Senior Administrator explained that she uses the possibility to make comments to understand content on the wiki:

> I add comments and I try to understand the content...We definitely comment more than we edit.

An IBM Learning Intelligence Leader described a different perspective by explaining how he exploits the possibility to make comments in contexts where he might not have enough expertise:

> Outside of the team ... I might have the confidence to post a comment, this is my opinion xyz, but I don't think I would have the confidence to go and edit somebody else's work.

Another different perspective was added by a User Experience Specialist from IBM which shows how his group decides about dividing the roles among them in terms of assigning writers, commentators, etc.:

> The whole wiki is open to everybody, but we just have an agreement okay here is the master writer for this one document and Sally is the master for this one and Bob is the master for this one and everybody else just comment.

Commentability affords wiki users possibilities for avoiding conflicts when there is a disagreement about content, when they are concerned about their own limitations in the sense that if you edit you have to be right but if you comment then the author have to make content better, and also when they want to avoid taking responsibility over content. A Civil Engineer at CCC reflected on this:

> [Making comments rather than edits because] the person might get offended; he didn't write the article unless he has certain background and experience and he's ready to defend it so let's give him the opportunity. If I am unsure, will I understand it [content] correctly or will they know more than I do then I would not edit directly I will comment on it.

In addition, possibilities pertaining to the affordance of commentability are also important to tackle professional issues. There are wiki users who may favor commenting on content contributed by their colleagues rather than editing it. This is because of confidence issues about certain subjects besides their desire to avoid offending anyone and be kind to others. An IBM Technical Sales Professional illustrated his view on this:

> I don't personally use the wiki very much for overall discussions, create articles, and such. What I do is that I read articles and comment on them because I am not part of the actual editors for that worldwide public wiki. I can be one of the commentators on that.

Accessibility

In each of the studied organization accessibility was perceived differently and affected how the wiki is used in various ways. As an affordance, accessibility does not only mean the ability to access content, but it also determines ways of using the wiki as well as affects how users may think about the possibilities afforded by it.

Depending on the formal structure and culture of each organization, accessibility determined how employees use the wiki. For instance, the dominance of hierarchical relations at CCC resulted in restrictions to use the wiki in terms of allowing certain

number of users to edit content while others only have the possibility to read or comment on content. There were also concerns raised by the management at CCC about how open and accessible the wiki can be. Because there was only one central wiki used by various communities, only community members were allowed to participate in knowledge sharing and collaboration. These kinds of restrictions on accessibility maybe seen as barriers to exploit the visible and flexible nature of a wiki. Some users at CCC thought that they should not use the wiki because they believed:

> It (the wiki) is not Facebook where it is completely open ... No. You only invite certain number of company employees to share their knowledge. (Plant Group Manager, CCC)

> My problem with the wiki within CCC is that I am only allowed to see certain things...I am limited to mechanical estimation and piping references only...when I needed to do something out of my job, they gave me access for a week. (Estimation Engineer, CCC)

In IBM accessibility was more flexible compared to CCC. Users had the chance to set up their own wikis and determine the level of accessibility in these wikis. But accessibility was a bit different here in the sense that sometimes wiki users in IBM may 'self-organize' and agree on certain accessibility rules that can allow or restrict them from using the wiki in certain ways. For instance, a group may agree to have one or several key content creators who can create and edit content and others can only comment. A User Experience Specialist at IBM explained his experience within his project:

> An example, in one project I might be the master writer for one piece and everybody else would be the commentator and then somebody else would be the master writer for a different piece and I would be commenting on that.

An IBM Software Developer provided an additional view of how he perceives accessibility to the content he shares on the wiki. He believes that anyone interested to do something with his content has to inform him about any possible changes so that he gives them some kind of access and engages them to improve content, he said:

> Putting the information out in the open I feel responsible for it and if someone makes me aware that it could be improved then I would engage that person and find out what he means about it.

Viewability

The affordance of Viewability maybe understood in different ways. It essentially emerges in relation to the various ways and purposes that users use the wiki for as well as other wiki affordances. It can be described as the ability to share, view and make things visible without necessarily implying the ability to make edits or comments. There are a number of dimensions for enacting such an affordance. For instance, employees use a wiki to publish personal stuff and experiences that may not be subject to editing or commenting in the eyes of others. In this case, the contributor uses the wiki to view or share her knowledge, while others are only expected to view or read this content even if it was technically possible to make edits and comments. Another dimension is related to the way content is sometimes shared on a wiki. Certain wiki users tend to format their professional content in a way that implies it is not possible to edit or modify, which discourages others from making any kind of contributions. One of the Project Managers at IBM described her experience with wikis that are often created in a way that does not invite contributions by others. She said:

> Wikis that I have been working with ... are pushing knowledge out, I don't think the format of the frame there is actually inviting people to collaborate.

Also, a User Experience Specialist at IBM provided another example that describes how people sometimes use a wiki for personal purposes:

> My experience is that some people are using the wiki technology as just a simple way to publish things so instead of using a blog or a word document they're actually using wikis not in the Wikipedia sense that says my goal is to create a page and let everybody else to make it better...

In this vein, one of the Software Developers at IBM strongly explained his view the content he shares, he said:

> I definitely think it is personal contribution.

Viewing behavior is also related to other affordances such as accessibility and editability. Wiki users tend to view content when it is shared by their managers, for instance, rather than editing and/or commenting for various reasons. There are also situations when they are 'forced' to view content because they don't have the right to comment or edit content. Further, sometimes users believe that content is not up-to-date and there is no reason for them to contribute into that. An additional dimension that might be related to the visibility of wiki content is that when users see or notice someone frequently contributing content, they tend to view and follow these contributions instead of engaging in dynamic ways of content editing. An Estimation Engineer at CCC commented on this matter by stating that:

> The discussion was old and did not see anyone referring to it. It didn't seem like it was looked at.

Validability

Validability as an affordance describes possibilities related to verifying the authenticity of both content and content contributors. It is often enacted when wiki users try in various ways to validate whether content shared on a wiki is true and whether content contributors possess the right background and level of expertise to make a contribution. This has been observed at both CCC and IBM as we observed a tendency by wiki users to share content that is correct or try to make it so. Some observations from the two organizations include:

> We have many procedures in the precommissiong community so far ... We have four captains to approve these procedures. –Mechanical Manager, CCC.

> Caring about the correctness makes me perhaps a bit protective about it. (Software Developer, IBM)

Wiki users often exploit the possibilities of this affordance in various ways. For instance, verifying content contributed by a specific individual can be done through looking at her profile on the wiki to check for her previous contributions as well as examine the level of her expertise in the contributed subject. A Client Technical Professional at IBM explained:

> I start by looking… do they know anything in this area, have they made any contributions, do they have a job role where I can expect them to know something about it.

Sometimes, wiki users also exploit validation possibilities by doing some kind of content validation before they contribute any content into the wiki. This is partly because they want to share what they believe is true and partly because the visibility of content on a wiki makes them concerned about how others may perceive the originality and authenticity of their contributions. So they often tend to write elegantly, provide references, and most importantly post what looks like a 'final' version of content, which in many cases results in an assumption by others that this content is not subject to editing. Persistence of content also contributes into such behavior in the sense that wiki users realize that their content will be available for others for sometime and they often want to show that their contributions are correct or essentially represent 'facts'. In addition, concerns about the validity of content often shape the way users use the wiki. Most often, wiki users tend to share content only if they believe that they have the 'best' knowledge in the area. This tendency might stifle the dynamic possibilities afforded by a wiki such as editability and encourage other behaviors such as viewability. An IBM Project Manager explained her concerns about the validity of content contributed into a wiki:

> Where does that come from, and what knowledge is true more than others…I think that is, of course, a challenge in that way.

In addition, a Sales Enablement Professional from IBM described how they use the wiki to share facts, he said:

> We're not personally invested in the wikis and the kinds of ideas that we share on the wiki, it is never an opinion, or it is never a discussion it is always facts.

Summary

Affordances	*Technical Features*	*Actions/Behaviors*
Commentability	Asynchronous text-based entries Previous history of comments Responding permissible	Less offensiveness Not taking over authorship responsibilities Making contacts and asking questions around the content
Accessibility	Restriction and availability of access to content Restriction and availability of access to editing	Making group content Securing content access Openness/restrictions of contributions Power related issues
Viewability	Readability Getting notifications about content changes	Viewing content 'in silence' Showing off Written content for specific purposes
Validability	Lock content Check content contributors	Only verified content is useful Reluctance to edit content Avoid public embarrassments

Table 2. Summary of organizational wiki affordances

5.2 The affordances apparatus: Theorizing Interaction Mechanisms

The data collection was aimed at understanding how people use a wiki to collaborate and share knowledge experiences in an organizational setting. The findings in the previous section show a number of key organizational wiki affordances that shed light on the opportunities offered by the wiki to achieve users' goals in sharing their knowledge and expertise with each other. However, using a multi-stage interpretive analysis of the data has given us an opportunity to do theoretical elaboration and theorize the interaction between the material features of the wiki and users' capabilities and goals by making explicit the mechanisms that enable this interaction. This theorization extends the work

done by Mansour et al. (2013) and builds on the relationality between the features of technology and human capabilities and goals. Our aim in this section is to visualize this relationality by illustrating the mechanisms involved in the space between technology and humans.

The mechanisms are visualized using specific illustrations that consist of the features or realm of features (F1, F2 to Fn) of technology on one side and human capabilities connected with goals and intentions or realm of capabilities (C1, C2 to Cn) on the other. Any feature between F1 to Fn could represent one or more different explicit features or characteristics of the technology. For instance, the affordance of wiki editability shown in Table 1 above entails three different specific features that can be represented by a particular Fn in Figure 1. The same applies when it comes to capabilities where a Cn may represent one or more specific capabilities (e.g., skills, expertise, goals). The possible affordances (A1, A2 to An) are viewed as relationships between technology features and human capabilities, and illustrated by the lines in between a particular F1, F2 to Fn and a particular C1, C2 to Cn. If An represents the realm of potential affor-

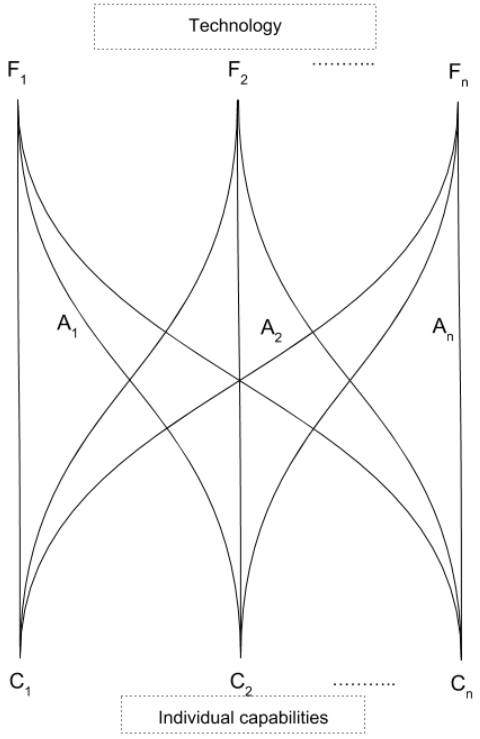

Figure 1. Visualizing the relationality of affordances

dances, there are far less affordances that can be potentially enacted and exploited in practice. This is because enacting and exploiting affordances is ultimately conditioned by the features technology and human capabilities or intentions. In our study, for instance, there were four main enacted wiki affordances, but it is possible that fewer or more affordances can be enacted in other contexts where the setup of technology and organizational structures are different.

Referential: referring to other affordances

The first mechanism in the affordances apparatus is referential. The relationality between technology features and human capabilities and goals usually gives rise to dynamic and flexible realm of opportunities for action associated with one or more affordances. This is illustrated in Figure 2 below which shows the possibility for an infinite number of enactable affordances. However, as stated earlier, the number of enacted affordances is

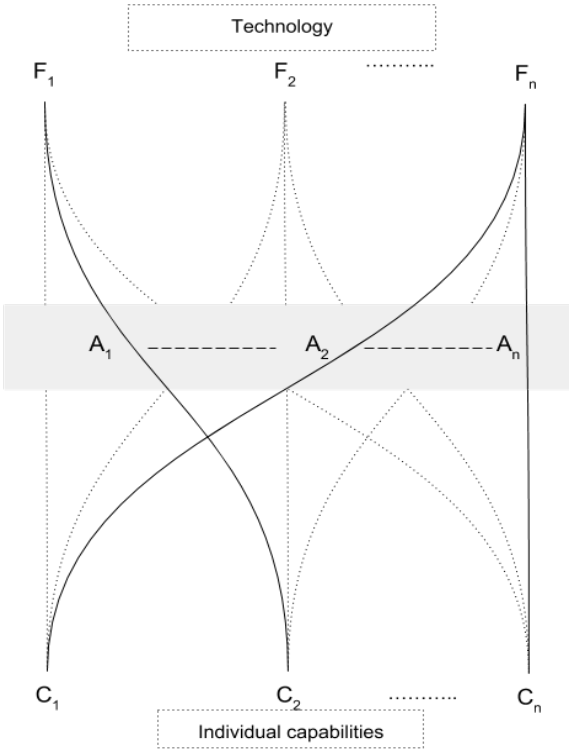

Figure 2. Visualizing the referentiality of affordances

conditioned by technology features and human capabilities and goals which often result in only a certain number of affordances that can be exploited or even considered by an individual user. This argument echoes what Stoffregen (2003) said: "Humans and other animals do only a tiny percentage of the things they can do." (p. 119). In Figure 2, this is illustrated by dark lines representing a handful of affordances A1, A2 and An that are intended by the individual user, and dotted lines in the background representing the majority of other possible affordances. The box cutting across both the dark and dotted lines represents the referentiality space where technology users make choices about, and refer to, certain affordances that offer them exploitable opportunities for action and allow them to achieve their goals. For instance, if A1 represents the affordance of wiki Editability that cannot possibly be exploited, the user can then refer to A2 which represents the affordance of wiki Commentability and become the chosen affordance to be exploited and achieve a specific purpose. To further clarify, our findings show that junior and less experienced employees who had something to say about the content in the wiki, often avoided editing the wiki and chose to make comments instead, hence referring to another affordance, for various reasons such as fear of managers as well as visibility of interaction in front of a large audience. The availability of referential mechanisms and dynamics in contexts like this provides users with the potential and flexibility to navigate around the use of technology by perceiving, enacting, and exploiting other affordances when they are unable to exploit specific affordances so that they achieve certain goals with technology. Such flexibility may therefore suggest that users can always have the opportunity to use the technology in various ways because when one affordance may constrain the use of technology, another may enable it. Classical ideas in Information Systems and Organization Science literature like interpretive flexibility (Orlikowski 1992; Doherty and Coombs 2006), and the use of same technology may result in different consequences (DeSanctis and Poole 1994) seem to provide some theoretical and empirical insight into the referentiality of affordances.

Communal: collectively enacting significant affordances

A mechanim that was unique in the context of understanding wiki affordances is what we call communal. The premise here is that as social human beings we mutually influence and are influenced by each other. This is is already implicit in Gibson's notion of affordance in that humans relate to each other at high levels of behavioral complexity. In their endeavor to exploit wiki affordances, users were affected by others through learning from them, imitating them, or being controlled by them. The communal context can then be understood by these mutual or reciprocal influences among a group

of users relative to their use of technology. Joint or shared perceptions by technology users are the main driving force for the communal enactment of the affordances. This particular way of understanding affordances emphasizes perception by multiple actors rather than one, which is often a common view in studies of affordances. So, a group of users may have certain perceptions of a technological artifact which stimulate the communal enactment of affordances. Communal affordances tend to be more dominant than affordances enacted by individuals because when multiple users jointly enact and then exploit an affordance, the consequences of using the technological artifact are likely to be potent. For instance, the Validability affordance, which is enacted by multiple senior employees, was clearly associated with behaviors such as the reluctance to edit content. In other words, wiki users chose not to exploit the affordance of Editability. This example provides an insight into the argument about the overarching influence of communal affordances such as Validability on the use of technology. In Figure 3

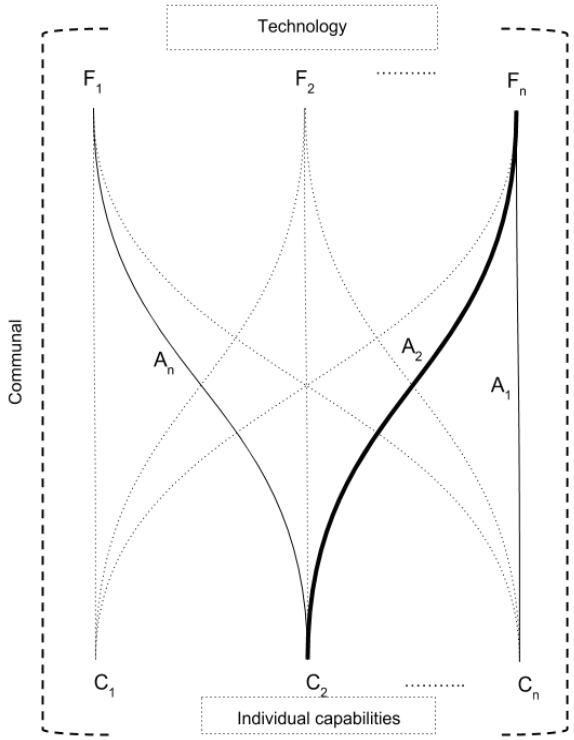

Figure 3. Visualizing communal dynamics of affordances.

below, the communal context is illustrated by the dashed lines around the whole relational sphere. If, for example, A2 represents the affordance of Validability, it will have a significant influence on how prospective users choose to exploit other affordances of technology either positively or negatively. While the individual user may always have a choice to refer to other affordances as we discussed earlier, it may also be the case that these other affordances such as Commentability that can be represented by either A1 or An can be exploited but with less influence (e.g., a user doesn't realize his or her aims from using the technology by only commenting on wiki content) as illustrated with a thin black line.

The rest of possible affordances may in practice, as illustrated by the dotted lines, turn out to be not productive choices within that context. For instance, since the Validation affordance is communally enacted by 'powerful' wiki users, several other users may choose to exploit the affordance of Viewability which is an indirect, less significant way of using the technology. It can therefore be said that communal mechanisms explain why certain uses of technology are more dominant than others.

Situatedness: situation-dependent exploitation of affordances

The third mechanism represents situated dynamics that share similar characteristics with communal dynamics in the sense of demarcating the realm of potential affordances. A variety of situations in practice associated with select uses of technology largely affect the realization of opportunities for action, hence affordances. That is to say, certain affordances maybe enacted in certain situations but not others due to the setup of technology or human and organizational structures. So, the enactment and exploitation of affordances is situation-dependent. But this should not be construed as context-dependent and a distinction must be made. A *situation in practice* represents local settings, circumstances, or 'state of affairs' within a larger context such as a wiki-based public community, a private project wiki-based space, and so on that outlines certain rules or norms (e.g., editing not allowed, comments allowed, members' only editing, etc.) to govern the use of technology. This is why in certain situations the realm of potential affordances within a specific context tends to be demarcated, or in other words, exploiting certain affordances maybe limited. We illustrate these possible situations in Figure 4 below by dashed brackets (left and right) S1, S2 to Sn that affect how individuals perceive, enact, and exploit affordances A1, A2 to An. For each Sn, considered or even potentially exploitable affordances may look different. As shown in Figure 4, in situation S1 the affordance A1 is more dominant or significant, marked by a solid line, while other affordances may be left not perceived or if perceived remain

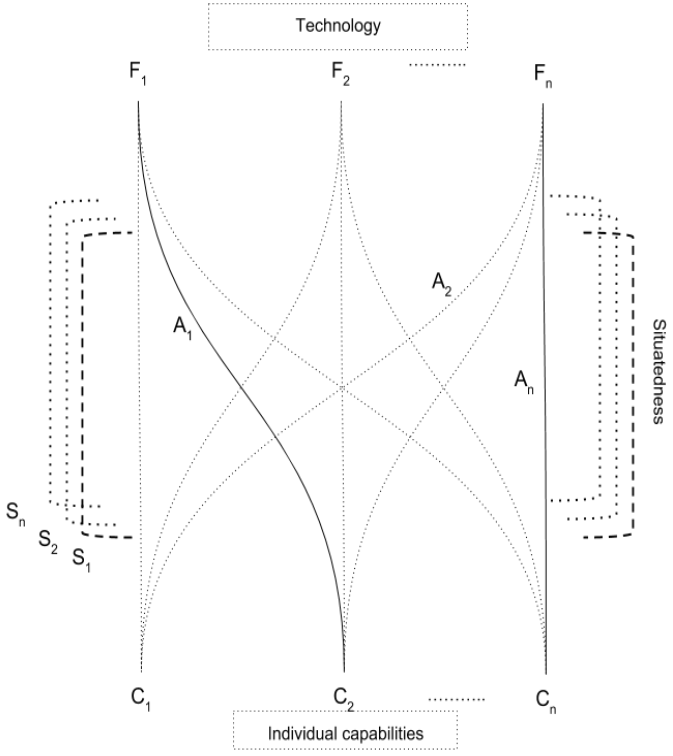

Figure 4. Visualizing situated dynamics of affordances.

either unexploitable or at least insignificant; these are illustrated by dotted lines in the background. In other words, when a certain situation Sn allows for certain affordances to be enacted, the perception of technology features relative to users' capabilities and goals is often implicated by this situation.

The data shows various contexts and situations in both studied organizations. For instance, communities at CCC and private and public wiki-based spaces at IBM represent different kinds of contexts. These contexts involve various situations where affordances are perceived, enacted, and exploited in a variety of ways. At CCC, communities are often specialized, and members tend to share formal content that is expected to be valid and even reviewed. The exploitation of affordances such as Editability or even Commenting in situations where the affordance of Validability is dominant (e.g., community leaders and captains require a formal review of content) is unlikely. Similarly, project teams at IBM using private project wiki-based spaces for software documentation may have situations where there are master writers who are the only ones able to exploit an

affordance like Editability, while others are only able to comment and in doing so exploiting Commentability. There are other situations in this context where users would be unable to exploit the Editability affordance not because there are defined roles in using the wiki but because of unwritten 'rules' among project members that make one user able to exploit the affordance of Editability but not others. In this way, each of these situations that exist in various contexts represents a unique and complex interaction between the materiality of technology and the social organization.

Multiplicity: exploiting other opportunities for action

The multiplicity of an affordance represents the range of opportunities for action pertaining to an individual affordance. Unlike referential mechanisms that allow users to refer to other affordances, the dynamics involved in the multiplicity of affordances allow users to refer to other opportunities for action entailed in an affordance, instead of other affordances. For instance, an affordance like Editability entails various opportunities for action such as changing and editing text, linking text, tagging, etc. In practice, users are exposed to these potentially exploitable opportunities relative to their capabilities and goals. If a wiki user for instance in a specific context such as a public-based wiki space is unable to edit or change content in front of a large audience, he or she has the opportunity to either refer to (referential mechanism) and exploit another affordance such as Commentability (e.g., making a comment) or look what opportunities for action maybe exploitable in the affordance of Editability (multiplicity mechanism) instead of making a comment. There are several instances in the data that show how wiki users organize their exploitation of affordances' opportunities for action via multiplicity mechanisms. A typical example from the data is the hesitation to exploit Editability in the sense of altering or changing the content. This kind of behavior sometimes motivates wiki users to find another way to make a content contribution to the wiki by exploiting other opportunities for action associated with Editability such as adding content, linking content, or even uploading a file. So, despite perceiving and having the potential to exploit the affordance of Editability, the multiplicity of Editability allows wiki users to exploit other opportunities of this affordance. Figure 5 below visualizes these multiplicity mechanisms and dynamics where A1(e1) to A1(en), A2(e1) to A2(en), and An(e1) to An(en) represent the range of opportunities for action associated with a range of affordances A1, A2 to An. Each affordance involves one or more opportunities for action such as A1(e1) to A1(en) of affordance A1, A2(e1) to A2(en) of affordance A2, and An(e1) to An(en) of affordance An. The characters e1 to en represent either enabling or constraining possibilities

pertaining to opportunities for action of a specific affordance. There are two important things to consider enabling and constraining possibilities of affordances. First, if a certain opportunity for action like A2(e1) is enabling, the user is likely to achieve her goals and exploit the affordance (A2) with which e1 is associated. This is illustrated in Figure 5 by showing A2(e1) in a dark, black color. Second, if the opportunity for action is disabling or constraining, the user will be unable to achieve her goals and may refer to another opportunity for action to exploit an affordance to a certain degree. So, let An(e2) be a constraining opportunity for action. The user, then, may be unable to exploit the affordance An and either choose other opportunities for action associated with An or refer to other affordances. An(e2) is illustrated in Figure 5 by a light, grey color. The current understanding of affordance multiplicity shows the dynamic mechanisms involved in exploiting affordances and how users make choices about various

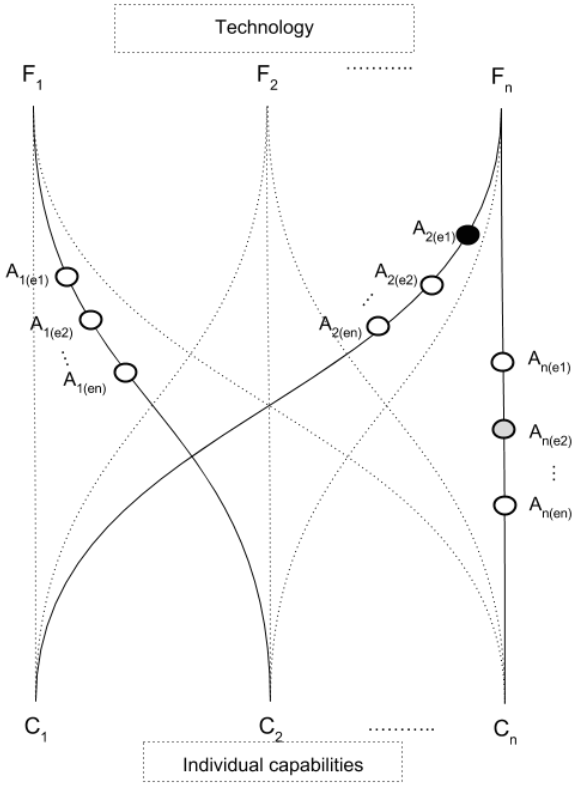

Figure 5. Visualizing the multiplicity of affordances.

opportunities for action pertaining to an affordance to achieve their goals. It also shows an equally important dynamic concerning the exploitation of affordances. While users may be able to perceive an affordance, it is still possible that they fail to exploit it in certain ways to achieve specific outcomes. Perceiving an affordance does not mean that the perceiver can exploit it. Additionally, the dynamics associated with multiplicity have clear links with referential dynamics. If opportunities for action pertaining to one affordance cannot be exploited, the user tends to refer to opportunities for action either pertaining to the same affordance or other different affordances. Referentiality here is therefore a central dynamic. It is worth noting that in cases where the task carried out by a technology user requires more than one opportunity for action of the same affordance, the significance of the affordance with respect to achieving users' goals is likely to become higher especially if opportunities for action are enabling. If the task requires opportunities for action pertaining to a certain affordance but can be both enabling and constraining, the user may still have the possibility to make choices and refer to other relevant affordances. Hence, one may argue that this is an implicit power of the referentiality and multiplicity of affordances which addresses human complex ways of using technology.

6 Discussion and conceptual reflections

The main aim of this paper was also its driving force: investigate the relationship between the social and the material. This is a subject that is at the core of the IS discipline and which has been controversial for ontological and epistemological reasons (Leonardi 2013; Mutch 2013; Orlikowski 2010; Scott and Orlikowski 2012; Strong et al. 2014; Volkoff and Strong 2013). Fortunately, these scholars and others have made several attempts to investigate this relationship and made knowledge contributions aimed at transcending the classic divide between social and material features in understanding technology use in organizations. The affordances apparatus advances these knowledge contributions by theorizing key mechanisms underlying this relationship and displaying the interaction between features of technology and users' goals and intentions using an affordance perspective.

Our theorization of the affordances apparatus might help in answering fundamental questions in the field of information systems such as how do people use technology? why do they use it in certain ways? and most importantly how to understand the use of technology and its impact while acknowledging both social and material features simultaneously? The mechanisms that make up the affordances apparatus embody a dynamic interaction between the social and the material which often results in various uses and

potentials of technology. Each of the four key mechanisms show how this interaction takes place and enables technology users to make various choices about exploiting certain features of technology and opportunities for action relative to their capabilities, intentions, and goals. In this way, the mechanisms essentially represent operational and working dynamics that shape and mediate the perception, enactment and exploitation of affordances and eventually enable different uses of technology. In practice, the affordances apparatus, via its mechanisms, can help to explain the perception and enactment of affordances by showing how goal-oriented users of technology navigate the features of technology relative to their goals. The mechanisms show that users may perceive and enact various affordances that may or may not be exploitable relative to their goals, and that may also be situation dependent (cf. Leonardi 2012; Scott and Orlikowski 2012). They also show that goals may not be achieved by exploiting intended affordances, but users often have the chance to exploit other affordances or other opportunities for action pertaining to other affordances. These operational dynamics of the mechanisms reflect diverse and flexible ways for perceiving, enacting and eventually exploiting affordances in contrast to linear trajectories (cf. Thapa and Sein 2016). In this respect, this kind of understanding may contribute insights into understanding the notion of interpretive flexibility which has been discussed in IS literature (Doherty and Coombs 2006; Orlikowski 1992,). As such, the affordances apparatus can be used to analyze and understand how users organize their ways of using technology. The basic premise here is that such an apparatus conceptualizes the ways by which people navigate through their use of technology in terms of what features they can use, how they can use them, and how can they achieve their goals with technology (cf. Majchrzak et al. 2016). It is important to emphasize at this point the relationality implied in this premise. The relationality of affordances (Karahanna et al. 2019; Leonardi 2011; Zammuto et al. 2007) provides an ontological foundation for the development of the apparatus which characterizes the four key mechanisms in enabling a dynamic interaction between the social and the material.

In addition, the affordances apparatus is represented by four key mechanisms: referring to other affordances (referential), collectively enacting significant affordances (communal), situation-dependent exploitation of affordances (situatedness), and exploiting other opportunities for action (multiplicity). These mechanisms can be used separately (e.g., one or more), individually, or together to make an analysis of affordances or how a certain technology is used depending on the goals of the researcher. There is no standard way that we recommend to use the affordances apparatus but an ontological acknowledgement of relationality is essential for a successful application of the apparatus taking into consideration that the different mechanisms are individually

relational, and are altogether relational in the sense of being interdependent as shown in our discussion above. Further, the development of an affordances apparatus is in no way an attempt to offer a standard model for how we use technology or suggesting that the mechanisms describe standard ways of using social media or technology in general. In contrast, the apparatus is rather an attempt to offer a conceptual and flexible structure that serves as a foundation for a relational understanding of technology that emphasizes equally and simultaneously both the features of technology and the behavior of social users.

7 Conclusions and future research

The main conclusion and contribution in this paper is centered on the affordances apparatus. This apparatus is developed to provide an analytical and conceptual tool for the examination of affordances in contemporary organizational practice. The paper answers the research questions by conceptualizing a number of key mechanisms: referring to other affordances (referential), collectively enacting significant affordances (communal), situation-dependent exploitation of affordances (situatedness), and exploiting other opportunities for action (multiplicity). These mechanisms show and explain the operational dynamics that embody the interaction between the social and the material that enable the perception, exploitation and enactment affordances in the context of using technology. This answers to the second research question in the paper. A key contribution in the paper is that the apparatus can be used by researchers to study specific mechanisms that explain the variations in using technology and the ways by which people achieve their goals with technology. This contribution differs from common conceptual approaches and discussions of affordances in the IS field that are often abstract and impractical. We believe however that there is room for further conceptual development of the affordances apparatus and in general a relational understanding of affordances. This apparatus was developed in the study of organizational social media which are known for their malleable features. We recommend further research on other kinds of technology to examine current mechanisms and explore other potential mechanisms. Another important direction for further research would be to further theorize the relationship between the social and the material to address the relationality of affordances. Finally, we believe that the pervasiveness of technology in our everyday lives makes it necessary not to fall back to the old ways of black-boxing technology and emphasizes a relational understanding of technology use.

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