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Affordances for practice

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ABSTRACT

This paper argues that Gibson's concept of affordance inserts a powerful conceptual lens for the study of sociomateriality as enacted in contemporary organizational practices. Our objective in this paper is to develop a comprehensive view of affordances that builds upon the existing conceptualizations in the psychology, human–computer interaction, sociology and information systems literatures and extend them in three important ways. First, we show that taking an integrative interpretation of affordance as dispositional and relational, rather than the standard unidimensional interpretation, provides a theoretical articulation of how the material and the social influence each other. Second, we propose to broaden the focus from the affordances *of* technology to the affordances *for* practice provided jointly by technology and organizing. This means considering social affordances alongside technological affordances. Finally, we argue that the best way to integrate the study of social and technological affordances is not to stretch Gibson's original concept to include the social but rather to complement it with a sociological concept that fits it neatly: Bourdieu's idea of habitus. Our claim is that the concepts of affordance and habitus complement and complete each other. Affordance offers a useful way of thinking about how practice is patterned by the social and physical construction of technology and the material environment and habitus offers a useful way of thinking about how practice is patterned by social and symbolic structures. We describe how affordances and habitus may be used together to provide a theoretical apparatus to study practice as a sociomaterial entanglement, thus adding to the methodological toolkit of scholars embracing a sociomaterial perspectives.

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1. Introduction

It is no coincidence that as organizations have become more distributed and virtual (DeSanctis & Fulk, 1999; Moon & Sproull, 2002; Orlikowski, 2002; Wiesenfeld, Raghuram, & Garud, 1999), organizational scholars and practitioners alike are paying increasing attention to materiality, the physical properties of organizational infrastructure, tools, and technology. Recent calls by organizational and information system (IS) scholars (Fayard & Weeks, 2007; Leonardi & Barley, 2008; Orlikowski, 2007) for research that takes materiality into account stem from, in part, the way that virtual forms of organizing raise issues of materiality that could otherwise be taken for granted. It is precisely when those physical properties are disrupted and changed that they can no longer be ignored. Thus we have witnessed the emergence of studies in several areas of research that consider the material and social world conjointly. Indeed, studies of organizational practice (Barrett, Oborn, Orlikowski, & Yates, 2012; Fayard & Weeks, 2007; Orlikowski, 2000; Orr, 1996; Pentland, 1992; Rosner, Blanchette, Buechley, Dourish, & Mazmanian, 2012) have shown that practice is always situated in sociomaterial environments and for us to understand organizational processes, we need to take into account how organizational structure, social practice, material context, and physical artifacts are entangled.

The nascent conversation around sociomateriality, or what we might call the "material turn" (e.g. Ashcraft, Kuhn, & Cooren, 2009; Barley, Meyerson, & Grodal, 2011; Leonardi, 2011; Orlikowski & Scott, 2008; Wajcman & Rose, 2011), attempts to articulate and push forward a dialogue about the ways in which social and material agencies configure each other. Scholars in organizational studies and IS who have embraced the material turn typically struggle to find a vocabulary that captures the co-constitutive relations among elements that have been delineated as human, technological, or social, while avoiding the dualities of physical realism versus social constructionism and voluntarism versus determinism.[1] They aim to conceptualize not only ideational elements and social constructions, but also material elements and physical constructions, and in particular how social and material arrangements are entangled and enacted through dynamically emerging practices. This implies conceptualizing how an organization's environment or setting (the work arrangement, including technical systems) at once enables *and* constrains discretionary action. The concept of affordance provides such a conceptual tool. Indeed, an important number of scholars (Gaver, 1996; Hutchby, 2001; Norman, 1988), especially those in IS (Faraj & Azad, 2012; Leonardi, 2011, 2013b; Robey, Raymond, & Anderson, 2012; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007) have drawn upon the concept of affordance as they attempted to study technology – design, adoption, or use – while recognizing social context and agency. However, the concept of affordance is diversely used and understood as unidimensional: Some scholars take a dispositional perspective; others take a relational interpretation, thus reproducing the dualisms mentioned above.

We believe that the concept of affordance can provide a powerful lens for studying the co-constitutive relations between technology and people in organizations and that it can provide a better language for describing how particular practices are shaped and patterned by structure and setting. However, for the concept of affordance to provide such a language, we propose to re-conceptualize it as a dualistic concept — i.e. affordance is *both* dispositional and relational, which we believe is a more difficult, yet potentially more useful interpretation. In particular, it allows us to examine how people's practices and their use of technology in a setting is shaped, but never fully determined, by the setting's physical and social characteristics.

This article has three objectives. The first is to organize the diverse literature on affordances and propose an integrative interpretation of the concept. By reviewing the literature, we highlight two interpretations of affordances – it is either dispositional or relational – each of which limits a full understanding of a setting's physical and social characteristics. This leads us to propose an integrative interpretation of affordance as *both* dispositional *and* relational. The second objective is, in line with Gibson's original focus on action, to propose a shift from technology to practice. When referring to technology's affordances, many studies refer to the "capabilities" of a technology or an object, often interchangeably using features and affordance, thus losing the

[1] It is worth noting that the rejection of dualisms that inspire sociomaterial perspectives is similar to the rejection of dualism by theories of practice. First, physical realism and social constructionism. Practice is embodied. It is the essence of practice that it is undertaken by physical actors in a material environment. Yet practice is a social phenomenon, laden with meaning and regulated by ideas. Thus, a theory of practice must conceptualize not only ideational elements and social constructions but also material elements and physical constructions. Second, voluntarism and determinism. Practice, in its performance, requires agency and permits discretion, but is patterned and constrained by social and physical forces. Thus, a theory of practice must not only concern itself with both the physical and social aspects of the practical environment but must also conceptualize how this environment at once enables and constrains discretionary action.

action orientation that is at the core of the concept of affordance. This paper proposes to abandon such a view and to think of affordances *for* practice (e.g. for communicating, for collaborating), moving to the forefront the activities in which human actors engage with technology. Thirdly, we argue that rather than stretching the concept of affordance to explain all aspects of sociomaterial practices, it is more useful to keep affordance as a middle-range theory (a collection of interrelated propositions that deals with a clearly bounded aspect of social life; see Merton, 1968). We thus propose to complement affordance with a middle range theory of practice that similarly attempts to escape the false dichotomies of voluntarism versus determinism and subjectivism versus and objectivism: Bourdieu's concept of habitus (Bourdieu, 1977, 1990). On the one hand, the concept of affordances allows us to understand how the social and physical construction of technology and the material environment shape practice. On the other hand, the concept of habitus allows us to understand how social and symbolic structures shape practice.

2. Literature review

2.1. Ecological perspective and the theory of affordances

The theory of affordances comes from the work of Gibson, an ecological psychologist whose main interest is the study of visual perception and whose primary methodological tool is the laboratory experiment. Ecological psychology seeks to explain the way that animals and humans perceive an environment as deeply connected to their needs for action. Gibson's stance toward the key dualities of voluntarism and determinism – how practice is shaped – and subjectivism and objectivism – how practice is understood by those enacting it – is aligned with perspectives that, like sociomateriality, reach beyond a dualism between the social and material. We see this in the definition of affordance and how Gibson puts it to conceptual use.

Affordances connect practice with perception. The affordances of an object or environment are the possibilities for action that it calls forth to a perceiving subject. Thus, to humans, handles afford grasping, doors afford entry and exit, and paths afford locomotion. Gibson claims that what we perceive when we look at an object or environment are its affordances, not its physical characteristics. We can distinguish between physical characteristics like substance and surface, color and form if we are prompted to do so, but what we normally pay attention to – and what some developmental studies (Adolph, Bertenthal, Boker, Goldfield, & Gibson, 1997)[2] show that infants notice – is what the object or environment affords us practically. With conscious effort, we may perceive a scene photographically, but Gibson argues that, as we move and act in the environment, our visual system does not typically operate like a motion-picture camera. It does not project a film onto the back of our retinas that a little homunculus in our brain observes. Perception, having evolved to help organisms survive and thrive in their environment, is economical. It readies us for action. There is experimental evidence that the perception of object affordances – the handle of a cup, for example – automatically triggers an action in our mind (Decety & Grèzes, 2006; Tucker & Ellis, 1998, 2004).

Gibson's ecological perspective and the notion of affordances challenge the tendency of psychologists to describe perception in terms of cognitive manipulation of abstract data or information processing. The radical implication of the ecological approach to visual perception is that the world around us is always and already imbued with meaning for the observer. We may be wrong about what an environment affords us (such as when we pull on a door that requires a push to open), but our perceptions are always laden with meaning. Further, this meaning – an environment's affordance – is relative and relational. Affordances always presuppose a perceiving agent, and different agent types may be afforded different behaviors by the same environment. A door with a powerful spring mechanism may afford entry or exit to the average adult but not to a child and not at all to a cat. Gibson (1986, p. 41) explicitly rejects the absolute duality of subjective and objective and argues that considering affordances – which are *real and external* to the perceiver[3] (we can ignore them; we can make mistakes) yet *relative to the perceiver*[4] – allows us to escape this philosophical duality, providing a powerful way to conceptualize the relationship between actor and environment.

[2] Gibson here refers to E. J. Gibson, Gibson's wife, also a psychologist. She explored the relevance of the concept as it relates to children's perception.

[3] What we refer to as the dispositional perspective.

[4] The position referred as relational in this paper.

His theory also refutes the dichotomy between agency and determinism. Central to the concept of affordances is the claim that, when actors enter a setting, they perceive cues about what behaviors it affords and their perceptions shape behavior without determining it. When we see a button – think of a child in an elevator – our mind automatically readies us to push it, but whether we actually do is a matter of will. Thus, while our environment (which, for Gibson, is almost always physical, but which we argue is also always social) affords us possibilities for action, we can always reject, ignore, or simply misinterpret them.

The ontological nature of affordances – are they dispositional or relational? – has led to a debate among ecological psychologists over the years. Turvey (1992), embracing a realist interpretation of the concept of affordance, asserts that affordances are dispositional properties of the environment. He further argues that an affordance manifests when interacting with an animal's complementary property of efficacy or the ability to actualize an object's dispositional property. Stoffregen challenges that interpretation, instead proposing a relational interpretation in which affordances are "properties of the actor–environment system that determine what can be done" (Stoffregen, 2003, p. 124). Chemero (2003) took Stoffregen's line of thinking one step farther by claiming that affordances were not just properties emerging from an animal–environment system, but the relationship itself. He defines affordances as "relations between the abilities of animals and the features of the environment." (Chemero, 2003, p. 181) This debate between the dispositional and relational interpretations of affordances has been replicated in other fields where the notion of affordances has been used; thus, suggesting that an integrative perspective on affordances is both necessary and difficult to conceptualize.

2.2. Translating affordances: from natural environments to technology and sociomaterial contexts

2.2.1. The concept of affordance in the fields of human–computer interaction (HCI) and design

The concept of affordance evolved from describing animal–environment systems to describing sociotechnical systems. For example, Goldring (1991) extended Gibson (1977) perspective on the way that people, not just objects, afford actions to other people, and experimental researchers showed that people play a role in pointing out affordances to one another (Van Leeuwen, Smitsman, & van Leeuwen, 1994). Also, people shape the affordances of objects and environments in the way that they design them. Norman (1988) has studied this extensively in the field of technology design and HCI. He defines affordances as "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used" (Norman, 1988, p. 9). Because of his focus on design, Norman distinguishes between the action possibilities readily perceivable and designed in the object, i.e., "affordances" and the action possibilities perceived by the user or "perceived affordances." Good design should lead to an overlap between affordances and perceived affordances, although this is too infrequently the case, he argues. Indeed, when designing the features of a new product or interface, designers create affordances based on their assumptions of how the user would perceive them. Yet, since users don't always share the same assumptions as the designer, they often do not interpret the intended action possibilities as planned (Norman, 1988, 1999).

Norman (1988, 1993) documents myriad examples of what he sees as bad design, where the designs do not expose their functionality and thus lead to misinterpretation or usage difficulties. For example, we perceive the function of an object such as a door handle from visual cues in its design. Thin, vertical door handles afford pulling, while flat, horizontal plates afford pushing. In contrast, symmetrical door handles that may seem elegant to the designer do not indicate by their shape whether they should be pushed or pulled. In such cases, conscious thought on the part of the user, prompted by signage and other forms of explicit instruction, is required or else unrecognized or unremembered functions go unused. Norman seems to interpret affordances as dispositional, i.e. they are dispositions of the object or technology that can be unseen or misinterpreted by users. Thus, good design is a design that makes the affordances visible to users, thus creating a perfect match between designed affordances and perceived affordances. Norman (1988, 1993) also suggests that, in order to reduce this gap, designers should focus on the users, their needs, and their cognitive models.

When discussing affordances, he considers the "typical" situation to be a person figuring out what to do with a novel object or a recently discovered technology. Affordances are half the answer and constraints are the other half: "Affordances suggest the range of possibilities, constraints limit the number of alternatives" (Norman, 1988, p. 82). Hence, Norman's focus on design led him to depart from Gibson's perspective and to define affordance in opposition to constraint.

2.2.2. The concept of affordance in IS research

In recent years, the concept of affordance has gained popularity among IS researchers in a bid to bring materiality back into our understanding of organizations. These scholars aim to examine the relationship between technological artifacts and interactions in organizations and to show how the materiality of a tool or technology affords different modes of interacting (Faraj & Azad, 2012; Jones & Karsten, 2008; Leonardi, 2011, 2013b; Majchrzak, Wagner, & Yates, 2013; Markus & Silver, 2008; Volkoff & Strong, 2013; Zammuto et al., 2007). The 2007 paper by Zammuto et al. is particularly interesting. In it, they argue that, "an affordance perspective recognizes how the materiality of an object favors, shapes, or invites, and at the same time constrains, a set of specific uses" (p. 752). They explain how enterprise–resource planning (ERP) systems (understood both as hardware and software) can lead to different practices depending on the organization, e.g., a leading-edge manufacturing company versus a small business with scarce resources and little experience with IT, in which they are implemented. In this case, the ERP organizing possibilities, or what Zammuto et al. (2007) call affordances of organizing, emerge from the connections between IT functionalities and organizational context (i.e., expertise, processes, work practices). In fact, rather than talking about ERP affordances, they talk about affordances for visualizing entire work processes that might arise from the implementation and use of an ERP system in an organization.

However, most studies that use affordances as a conceptual lens for understanding the relationship between technology and organization have focused on technological affordances even as they highlight the relational nature of affordance (Leonardi, 2011; Markus & Silver, 2008). Similarly to Zammuto et al. (2007), Leonardi (2011) adopts a relational approach to affordances, where affordances exist "between people and an artifact's materiality — artifacts can be used in myriad ways and have multiple effects on the organization of work" (p. 153). He contrasts affordances with constraints, viewing them as opposite sides of technology's perceived capabilities in light of people's goals and specific contexts. Leonardi's theoretical focus is not the concept of affordances, but the concept of imbrication between human and material agencies enacted in routines and technology. He proposes affordance as an intermediary concept to explain how people who have certain goals might actively reconfigure the material and human agencies in their work practices. Leonardi (2011) argues that, "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). Leonardi, by theoretically defining affordances as actively constructed, departs from Gibson's original attempt to define affordances as directly perceived, and does not provide an empirical illustration of how people might construct affordances or constraints.

Despite the general interpretation of affordances as relational, Robey et al. (2012), in a recent review of the concept and its uses in IS research, stress the need to take a clear ontological stance vis-à-vis affordances, reminding us that they could be understood as real *or* relational. They argue that, while affordances offer a relevant concept for theorizing IT as a material artifact in IT impact studies, taking a realist or relational interpretation of the concept has important consequences for defining technology. They discuss the two interpretations, highlighting the advantages and shortcomings of each. Taking a dispositional (their term is "realist") perspective on affordance implies that technology and human actors are distinct. This view releases researchers from the task of defining what would be a completely imbricated sociomaterial assemblage, but it also seems to necessitate the classification of all possible affordances associated with different types of technology. "Taken to an extreme, IS researchers would need to develop descriptions of features at a highly detailed level, effectively assuming the essentialist position that specific technologies provide specific affordances and not others" (Robey et al., 2012: 224). The alternative that many IS researchers choose is a relational perspective where affordances are "properties of the relationship between actors and their environment" (Robey et al., 2012: 225). While that viewpoint might seem more fruitful when seeking to understand how technology shapes social practices, it requires a higher level of abstraction and does not provide clear guidelines on how one might recognize an affordance. Robey et al. (2012) argue that researchers who aim to restore materiality in IS studies must clarify their ontological beliefs regarding affordances because these beliefs inform their epistemological stance (e.g., What phenomenon to study? How to recognize an affordance?).

Faraj and Azad (2012) in the same volume answer Robey et al.'s call and take a relational stance on affordances. They define affordance as a "*multifaceted relational structure*, not just a single attribute or property or functionality of the technology artifact or the actor" (Faraj & Azad, 2012: 254). They emphasize the

multiplicity of relations or what they call "mutuality relations" between the technology (as an artifact material and a bundle of features) and the actor (her role, line-of-action, intent, abilities, practice, and routines). Faraj and Azad (2012) show that to embrace fully a relational interpretation one needs to acknowledge the multiplicity of possible interpretations of the technology. More importantly, they take a practice lens, understanding technology-in-practice (Orlikowski, 2000), where affordances are not about "technology as an object" but about "actions in the world that involve technology" (Faraj & Azad, 2012: 255). They rightly highlight the importance of focusing on practices and actions that involve technology, rather than on technology in isolation. In that sense, their approach is closer to Gibson's original interpretation than they seem to think. Their relational interpretation allows them to highlight the multiple relations existing between a technology and a user, as well as the multiple interpretations and related affordances of a technology that depends on the users, their goals, and the organizational context. Yet, because of their focus on the relational interpretation of affordances, Faraj and Azad do not acknowledge the material constraints that limit the realm of possibilities and interpretations. For example, a smart phone might be used in various ways, affording freedom to some, control or dependence to others (Mazmanian, 2013; Mazmanian, Orlikowski, & Yates, 2013). However, when it comes to affording communication, the features of the technology – a small screen or a tiny keyboard or touch screen – limits the type of messages that people can write vis-à-vis other technologies, e.g., paper, laptop, desktop (Fayard & Metiu, 2014).

In the following sections, we develop an integrative practice-based interpretation of the concept of affordance: a perspective on affordances that is *both* dispositional and relational and that focuses on the practice in which technology is used rather than on technology features. Such a perspective takes seriously Orlikowski and Scott's (2008) admonition that we treat organization and materiality as mutually constitutive instead of as separate entities that are interrelated. It is worth noting that in their 2008 chapter on Sociomateriality in *The Academy of Management Annals* Orlikowski and Scott categorize the concept of affordance (specifically affordances of organizing as used by Zammuto et al., 2007) as a theory that treats organization and technology as mutually dependent ensembles as opposed to sociomaterial assemblages. According to them, Zammuto and his coauthors do not go far enough in theorizing the co-constitutive relationship between organizations and technology as they consider IT and organizations as enacted together, yet two separate domains. The limitation is overcome by taking an integrative perspective that allows us to theorize further the co-constitutive relation between the material and the social.

3. An integrative practice-based view on affordance

Our review of the literature on affordance in the fields of psychology, HCI, and IS shows how much traction the concept of affordance has for understanding practice as involving actors and a material environment. It also highlights how most interpretations of affordance take a unidimensional approach, emphasizing either the dispositional or the relational nature of affordances. But the concept of affordance, as originally defined by Gibson, has at its heart a dualistic nature, i.e., it enables us to think of actions as always materially situated yet constantly imbued with meaning and interpretation. However, in our field, it is difficult to simultaneously hold as true "incompatible concepts" (Thompson, 1967, p. 10) or "dialectical concepts" (Orton & Weick, 1990), i.e., theories that hold opposite ideas, such as rationality and indeterminateness in the case of loose coupled systems (Orton & Weick, 1990). Today's conversations about sociomateriality reflect a similar impediment: At the phenomenological level, we experience the "entanglement" (Orlikowski & Scott, 2008) between the social and the material; yet, at the analytical level, thinking of the social and material *simultaneously*, as entangled, is arduous. Some scholars have engaged in efforts to develop a theoretical language that allows to describe sociomaterial practices as mutually constituted of social and material arrangements. Hence, concepts such as "assemblage" (Suchman, 2007), "entanglement" e.g. (Orlikowski & Scott, 2008), "imbrication" (Leonardi, 2011), "mangling" (Venters, Oborn, & Barrett, 2014), or "configuration" (Mazmanian, Cohn, & Dourish, 2014), have been proposed. They provide labels for the "thoroughgoing mutual constituency of social and material arrangements" (Mazmanian et al., 2014, p. 332), but we argue that a language to unpack *how* specifically the material is enacted in these constant reconfigurations and for developing a fully integrative perspective on practice and activities involving technology is still missing.

We find that nurturing an integrative understanding of affordances allows us to develop a sociomaterial explanation that encompasses both material and social dimensions as they are enacted together in practice.

In this paper, we sidestep ontological debates regarding the relevance of critical realist and agential realist approaches to sociomateriality (Leonardi, 2013a; Mutch, 2013) to propose the concept of affordance as a theoretical apparatus to empirically explore organizational practices and the role of technology while embracing a sociomaterial perspective.

3.1. Holistic perspectives on affordances

There are two existing efforts to develop a holistic approach to the concept of affordance that are a point of departure for us: those of Hutchby and Gaver. Hutchby, a sociologist, argues that the concept of affordance proposes "a way of analyzing the technological shaping of sociality" (Hutchby, 2001, p. 444). His proposal reacts to anti-essentialist positions proposed by extreme constructivist views on technology that describe technology as a text that can be interpreted in multiple and infinite ways (Grint & Woolgar, 1997). This constructivist view was developed in reaction to determinist perspectives on technology in sociology (Ellul, 1964; Poster, 1995; Toffler, 1981).

Hutchby (2001) proposes a "third way" between determinism and constructionism, arguing that the concept of affordance is a fruitful analytical tool for developing that third way. He grounds his interpretation on Gibson (1986) work, which, he argues, has often been misread. In particular, Hutchby stresses the dual nature of affordances: They are *functional*,[5] i.e., the materiality of technology both enables and constrains action, and affordances exist even when they are not perceived. They are, at the same time, *relational*, i.e., affordances are specific to the perceiver and the context, thus allowing multiple interpretations of the same technology. While embracing Gibson's definition, Hutchby (2001) also emphasizes the amount of translation and adaptation needed to use Gibson's theory, which originally focused on visual perception mostly in a natural environment, to understand organizational practices involving technology. As we argue later on, it also requires complementing it with other concepts.

In organizational contexts, affordances associated with artifacts and technology are linked to a complex web of cultural knowledge and conventional rules regarding use (Hutchby, 2001). These cultural knowledge and rules allow us to understand and interpret the actions that are possible through an object. Nevertheless, Hutchby refutes the possibility of infinite interpretations of an object. While there are multiple possible interpretations of technology and thus multiple affordances for practice, the interpretations are always situated and bounded by the materiality of the technology. The material properties of an object constrain possible actions, thus limiting an individual–object relationship to a finite number of action possibilities. In other words, Hutchby embraces a relational interpretation of affordances while *simultaneously* recognizing that social action is shaped by technology, which limits what is possible.

When applied to social phenomena, the concept of affordance challenges the tendency that many social scientists have to restrict their gaze to sociological and anthropological concepts "rather than recognizing the degree to which social activities are embedded in and shaped by the material environment" (Gaver, 1996, p. 111). Gaver, originally trained as a psychologist and now a designer, argues that the concept of affordance is a powerful one for understanding and designing for social interactions. Using affordances as an analytical lens allows us to explain situations where "seemingly different social behaviors" take place in "seemingly similar material conditions" (Gaver, 1996, p. 112) without referring to social conventions and interpretations. To illustrate his argument, Gaver reinterprets an example given by Brown and Duguid (1994) on the role of material dimensions: the company's location in a building affects the public's perception of the business. A constructivist viewpoint would hold that interpretations about the floor on which a company is located depend upon the type of business it is and are associated with different statuses (e.g., higher floors have higher status; thus, offices, unlike retailers, tend to be on higher floors.). Gaver contrasts this interpretation to an ecological one that highlights the "inherent meaning" of elevation as embodied beings like us: "increasing height implies decreasing accessibility" (Gaver, 1996, p. 113). Hence, offices, which seek privacy, tend to be on higher floors, whereas retail establishments, which benefit from foot and car traffic, tend to be located on accessible or lower levels.

Moreover, Gaver emphasizes how research on affordances has focused mostly on individual actions, and when studying "social affordances" (Still & Good, 1991) researchers have focused on how the actions of an

[5] Another way of describing affordances as dispositional.

individual may be afforded by other people. In contrast, Gaver claims that affordances such as accessibility open avenues for investigating affordances for sociality, i.e., the "possibilities offered by the physical environment for social interaction" (1996, p. 114). In this case, the physical environment is understood in a broad sense; it encompasses organizational settings and practices involving technology. In fact, the examples discussed by Gaver are examples of communication technology such as digital documents, emails, and mediaspaces.[6] For example, he explains the different practices and subcultures that emerged around email usage (in particular in the early age of email) not as arbitrarily associated with differences in local cultures, but as reflective of the material properties of different email systems showing how the practices could not be disentangled from the materiality of the system. A system that is fast, easy to use, ubiquitous, and reliable affords a pattern of communication that shapes interpretations and expectations of communication practices. In an environment with continuous high bandwidth email, people rely extensively on their email for internal as well as external communication, constantly monitoring their email and expecting others to read and reply almost immediately. In contrast, in settings where email access is limited or cumbersome, not only will email be used less but expectations of prompt replies won't develop. He reports the story of a person receiving an email from a colleague asking her to call him regarding an urgent issue. Noticing that the email has just been sent, she immediately emailed her response — interpreting email as "fast" and therefore affording a similar interaction as telephone. A few hours later, she received a call from her colleague complaining that she had not replied: the angry colleague had expected a phone call from her as he checked email only sporadically and, had not seen her reply, and considered email as a replacement for the telephone answering machine. Gaver also suggests that when using, deciding to use, or interpreting others' uses of a technology, people constantly compare the possibilities of its action with other technologies (email vis-à-vis a text message, written letter, telephone call or face-to-face meeting). This highlights an important aspect of the relational dimension of affordance, especially when the concept is applied to social and organizational environments with a multiplicity of technological options.

3.2. Affordance for practice: shifting the analytical focus from technology to practice

Building upon the perspectives developed by Hutchby (2001) and Gaver (1996), we propose an integrative interpretation of the concept of affordances as both dispositional and relational because such an interpretation allows us to describe organizational practices in a way that cuts across traditional subject–object dualities. On the one hand, affordances are dispositional: They are visible and directly linked to practice when perceived, but as suggested by Gibson (1986) there are cases when an affordance is misperceived or not perceived at all. Moreover, "we live in a physical world that has causal effects in the sense that you just can't walk straight through a wall" (Giddens in Giddens & Pierson, 1998, p. 821). Affordances channel behavior in a specific direction yet they never determine it. Hence, on the other hand, affordances are relational: they arise from the encounter that a person, characterized by certain physical attributes and certain social and biological needs, desires, and intentions, has with a socially and physically constructed material environment. In other words, affordances are also relational: they depend on the relation between an individual's goals, the material properties of a technology, and the organizational context in which the technology is used.

As shown by Fayard and Weeks (2007), the affordances of an environment arise from its social meaning and conventional rules regarding use (i.e., its social construction) as well as its physical properties. Drawing upon a study of informal interactions in photocopier rooms in three different organizations, Fayard and Weeks (2007) claim that informal interactions were shaped by what was physically possible and socially appropriate. They show that, while space has traditionally been defined in terms of its structural and geometrical properties and as a passive host for the interactions occurring in it, the social meaning of the physical environment must also be recognized. That is, space needs to be explained as a place where certain things are expected to happen (Buttimer & Seamon, 1980; Gieryn, 2000). By acknowledging the social meaning of space in affording interactions, Fayard and Weeks (2007) are able to provide a more complete account than had previous studies concerned with how office environments shape informal interaction.

[6] Mediaspaces are "computer-controllable networks of audio and video equipment used to support synchronous collaboration" (Gaver, 1992). See also Mantei et al. (1991). *Experiences in the use of a media space*. Proceedings of the SIGCHI conference on human factors in computing systems, ACM. Mantei et al. (1991), Stults (1988). *Experimental uses of video to support design activities*. Xerox PARC, Palo Alto, California (remote meetings, virtual worlds, video). This report provides the origins and description of four projects that used video to support design activity. These are: a) the distributed design studio. Dourish, Adler, Bellotti, and Henderson, 1996.

More importantly, instead of limiting their study on the affordance of space, Fayard and Weeks (2007) take a practice perspective and focused on informal interactions. Their aim is to understand why people interact informally in some organizational spaces but not in others. To understand the variation, Fayard and Weeks define the affordance of informal interactions as having three dimensions: privacy, propinquity, and social designation. The dimensions are enacted through the material constraints of the space, as well as through social and cultural meanings that members of a specific organization develop.

In a similar fashion to Gaver (1996), Fayard and Weeks' study of informal interactions also suggests, that affordances are always perceived – at least in organizational contexts – *in relation to*, or in comparison with, other technologies or environments (i.e. chat, Facebook, coffee machine, going out to smoke, going to a coffee shop at the corner). Hence, affordances for practice, especially in the context of sociotechnical environments, are always perceived through implicit or explicit comparisons to other contexts. This is well-illustrated by Jung and Lyytinen's recent study of media affordance. Instead of focusing on the affordances of specific media, Jung and Lyytinen (2013) aimed to understand how "a user explores her or his surroundings – a niche – as to establish media affordances that will then help her or him achieve a communication goal" (p. 2). Moreover, they understand each user's needs within her or his "niche," i.e., all the different media available to them. Jung and Lyytinen therefore suggest, as stressed earlier by Faraj and Azad (2012), that the concept of affordance is powerful as long as we consider a specific user with certain needs and practices within a certain sociocultural context rather than a "generic user." Affordance for communication does not emerge only in the relationship between a user and a specific technology, but in the relationship between a user and a bundle of available technologies, which the user (explicitly or implicitly) compares when choosing one medium over another. This approach allows Jung and Lyytinen to establish "five relational patterns of interactions" (p. 1) – similar to the three dimensions that Fayard and Weeks (2007) developed in defining affordance for informal interactions – that shape affordances for communication.

Taking an integrative practice-based perspective on affordance is particularly powerful when it comes to designing new technologies. For example, Mackay, Fayard, Frobert, and Médini (1998), when prototyping new tools for air traffic controllers, didn't focus on a specific tool such as paper flight strips and try to replace them, as previous projects had done. Instead, they aimed to understand how the current work environment (understood as sociomaterial) supported the work of air traffic controllers. Previous projects had recommended replacing paper flight strips by displaying the information printed on them on screens (see Mackay, 1999 for a review of previous projects). Mackay and her collaborators (Mackay, 1999; Mackay & Fayard, 1997a,b; Mackay et al., 1998) found in their ethnographic study of air traffic controllers' work that while the content on the paper flight strips mattered, it was not what made flight strips so crucial to controllers' work. Paper flight strips' material characteristics, they found, afforded individual memory. Controllers jotted down extra information on the strips, they held the strips in their hand to help keep a particular airplane in mind, they positioned them on the flight strip board in a certain way that had meaning for them and those around them. Paper flight strips afforded collaboration as other controllers could see at a glance what the directions given were and whether something is needed to be done by looking at the strip and what position it was in. Observations also showed air traffic controllers pointing at strips, moving them or writing together on the same strip.

Mackay et al. (1998) embraced both a dispositional and relational interpretation of affordances (see also Mackay & Fayard, 1997a,b). They highlighted how the material dimensions of the flight strips – pieces of paper that could be written on, handled, moved around and shown to others – afforded memory support and collaboration. Yet, they also recognized the relational nature of paper flight strips, as they highlighted the variations in practice across individual controllers, teams and control rooms, variations that paper flight strips supported because of the flexibility of paper. Air traffic controllers were very articulate about their use of paper flight strips and constantly compared them to other tools that had been prototyped or were proposed to them, thus stressing another aspect of the relational nature of affordance.

These observations led Mackay and her collaborators (Mackay et al., 1998; Mackay & Fayard, 1997a,b; Mackay, 1999) to investigate how new technical possibilities, while changing the work practices, might still afford memory, communication and coordination. While their particular project focused on augmented reality solutions, they considered that technical solutions were not fixed, and that other systems could be more effective and may be used in the future. If one can develop an understanding of a work practice such as air traffic control practice and how it is enacted through various material artifacts and technologies and social contexts, one can then define the dimensions of affordance for this particular work practice that may be enacted in multiple ways depending on the available technical solutions, as well as the different socio-

cultural and organizational contexts. In order to develop a deep understanding of the use of paper flight strips and how they supported air traffic controllers' work practices, it is crucial to understand the entanglement of the material and the social. In this endeavor, the analytical purchase of the concept of affordance is undeniable. Yet, there are aspects of the impact of the social context on practice that cannot be explained by affordance without stretching the concept beyond its limits. This is why we argue that it is useful to pair affordance with a complementary theory of practice to get a complete picture, a theory that, like affordance, integrates dispositional and relational perspectives, but that, is better suited to explain how practice is patterned by social and symbolic structures. Bourdieu's (1977, 1990) concept of habitus is such a theory.

3.3. Complementing the theory of affordance with another middle-ground theory

Our aim is to explain how practice is patterned by what is physically possible and socially acceptable. Our claim is that affordances get us most of the way there theoretically but that missing in the application of affordances has been what we might call social affordances: an explanation of how the social construction of a technology impacts the practices afforded by that environment. It is true that the idea of affordances can be stretched to include social affordances, such as the affordance of social designation that Fayard and Weeks (2007) identified. However, we argue that other concepts are better designed to help us more fully examine how social and cultural factors impact the affordances of physical environments and objects, in particular the impact of what Bourdieu (Bourdieu & Wacquant, 1992) calls the broader field, the network of relationships and structures in a group and society that create the conditions for practice. Specifically, Bourdieu's (1977, 1990) concept of habitus complements affordance well as a theory of the middle-range that explains the social aspects of practice, while recognizing its materiality.[7] When affordance and habitus are combined, we believe that they provide a vocabulary that allows us to describe how structure and setting jointly govern organizational practice.

Habitus is a way of conceptualizing how social structures influence practice without reifying those structures or falling into the traps of voluntarism, determinism, subjectivism, and objectivism. Habitus is an acquired system of generative schemes of perception, thought, and action that tend to guarantee the "correctness" of practices and their constancy over time (Bourdieu, 1990: 53). It is acquired over the lifetime of an individual by virtue of the objective economic and social conditions of his or her existence. It is individual because no two people have exactly the same biography; the habitus of people who live in the same context and share a similar social class will be homologous, though never identical. Habitus tends to generate practices that are positively sanctioned as reasonable and commonsense. Such practices are likely, Bourdieu argues, to be adjusted to the objective conditions of existence. Conversely, habitus tends to exclude, without resort to argument or violence, those practices that are negatively sanctioned; that is, those practices incompatible with objective conditions. In his studies of class, taste, and lifestyles, Bourdieu illustrated how habitus shapes taste in ways that make a virtue out of necessity. Working-class people are not only forced by their economic circumstances to make do without luxury items, but to develop a taste for sensible, plain food, furnishings, and clothes, as well as to eschew fancy extravagances (Bourdieu, 1984: 372–4). Thus, habitus leads to what Bourdieu calls the choice of the necessary and, in so doing, tends to generate practices that ultimately reproduce the original objective conditions and so functions as structure.

Through habitus, then, the objective economic and social conditions that positivist sociologists study have their impact. Significantly, however, social structure shapes behavior without determining it. Habitus regulates behavior by making "possible the free production of all the thoughts, perceptions and actions inherent in the particular conditions of its production — and only those" (Bourdieu, 1990: 55). Thus, given a set of conditions, habitus affords an actor some thoughts and behaviors and not others, making those thoughts and behaviors seem more appropriate, attractive, and authentic than others. Ultimately, however, that actor decides what to do. Often the decision occupies no conscious thought, but Bourdieu (1990: 53) makes clear that it is "never ruled out that the responses of the habitus may be accompanied by strategic calculation tending to perform in a conscious mode." There are working-class people with the same taste for luxury as their aspiring

[7] We chose in this paper to use habitus as the middle-range theory to help us, but it is not the only possibility. For example, Giddens (1986) theory of structuration shares with habitus the characteristic of explaining how structure shapes action that, in turn, enacts structure. Bourdieu's work, though, is more directly a theory of practice and, we feel, complements Gibson's work more tightly.

middle-class counterparts with a habitus inconsistent with the conditions in which it arose; Bourdieu (1984) shows that such people are a statistical improbability.

Let us consider three brief examples from research in organizations and IS to help demonstrate the value of pairing habitus to affordance. It is worth noting that none of the authors explicitly use the concept of habitus, but they all implicitly refer to a variation of what Bourdieu called habitus. First, let us reconsider the study of Fayard and Weeks (2007). While they don't refer explicitly to Bourdieu, their idea of social affordance – the term that they use to describe the influence of the social designation of a space – is better recognized as habitus. They show that a full explanation of practice requires both an analysis of the affordances of the environment and of social and cultural factors and so took the notion of affordance and added to it the dimension of the social significance of space, the set of generative principles that govern what is appropriate to happen in a given space for a given group of people, the habitus.

Second, Jung and Lyytinen (2013) show how, when choosing a medium to communicate, users contrast the properties of a specific medium with those of other possible media. They claim that to understand media choice we need to complement the analysis of the media properties with an understanding of what they call localized agency, the cultural and task constraints on communication. Localized agency is well-described by one of the users that they studied: "I am such a creature of habit. It may not be the best way, but the only way, my habit that I formed and developed … Giving me confidence appropriately, my own judgment." (Jung & Lyytinen, 2013: 11). Jung and Lyytinen explain that his practices are individual but patterned by, and reproduce, norms that emerge from the expectations of his clients about privacy and their understanding of professionalism when it comes to investment and finance. Localized agency, in other words, can be explained as habitus. By considering the physical affordances of media and the cultural and social dimensions of localized agency, or habitus, that shape communication practices and media choices, Jung and Lyytinen (2013) are able to develop a rich and novel theory of media choice while escaping the familiar dichotomies of subjectivism and objectivism, voluntarism and determinism.

Third, in interpreting the affordances of paper flight strips, Mackay et al. (1998) emphasize that affordances are not purely material, but deeply intertwined in the practice of air traffic control. First and foremost, paper flight strips have an important symbolic value as they represent the planes in the sky that controllers (except those in the control tower) cannot see (Poirot-Delpech, 1995). Learning how to annotate the strips and organize them on the board was part of a long apprenticeship. They also played an essential accountability role vis-à-vis air traffic authorities and the public: they were kept as a proof of air traffic controllers' actions in the case of any incident with a plane (Mackay, 1999; Poirot-Delpech, 1995). All these dimensions are central to the understanding of how paper flight strips afforded collaboration. Yet, affordance cannot explain these elements. By bringing in the larger social context, Mackay et al. (1998) implicitly refer to the habitus of controllers as an occupation, who differentiate themselves from pilots through the symbolic use of paper flight strips, are proud of the safety that they provide to travelers as well as of their expertise reflected in their long and complex apprenticeship. Understanding the habitus of the controllers was key in complementing the insights provided by the articulation of how paper flight strips afforded memory and collaboration.

By combining affordance and habitus as two complementary concepts we propose a language for the material and the social aspects of organizational practices and technology, answering concerns raised about sociomaterial perspectives (Mutch, 2013). Habitus and affordance operate the same way: they channel behavior in a certain direction without ever determining it. The conditions that generate them, however, are very different. Affordance arises from the encounter of a person characterized by certain physical attributes and certain social and biological needs, desires, and intentions with a socially and physically constructed material environment. Habitus arises from the encounter of history embodied by a person as second nature with a field. In any given situation, then, the material environment will afford an infinite, but strictly limited, set of thoughts and behaviors, as will the field. These will be the possibilities for action that arise – either consciously or unconsciously – for the actor.

Bourdieu is clear that habitus is not merely cognitive, but literally embodied in our movements, gestures, and posture (Bourdieu, 1990: 70), but his work tends to exclude an environment's physical reality, typically explaining the physical world primarily in terms of its symbolic meaning. Empirically, Bourdieu is most interested in ideas and language: he studies taste, classification, time, and the calendar, how people talk about relationships, kinship, and gift-giving. Where physical artifacts appear in his research, it is their symbolic aspect that fascinates him. When Bourdieu highlights the importance of the body and the role of the environment

(e.g., he argues that habitus takes the objective conditions of existence directly into account), what he has in mind are structural issues, objective conditions of society such as status, power, wealth, etc. Physical conditions, as opposed to the symbolic importance of physical objects, fit uneasily within the concept of habitus, which was designed to describe social structures. On the other hand, consistent with its psychological origins, the theory of affordances focuses on the individual perceiver and, in his writings, Gibson tends to conceptualize social interaction in terms of the affordances of other people as perceived by an individual actor. When we perceive other people, just as when we note any element of our environment – space, artifacts, technology, etc. – what we first observe are the opportunities and threats that they afford: physical harm, sexual availability, cooperation, communication, and so on (Zebrowitz & Collins, 1997).

Thus, affordance and habitus complete each other. Together they offer a better way of explaining how social and symbolic structures shape practice than the ideas we have now of how the material, as it is socially and physically constructed, informs practice. Together, affordance and habitus allow an approach to practice that takes seriously the notion that practice is embodied and shaped by the material environment, including physical artifacts and technology, that avoids the traps of physical realism and social constructionism and does so without resorting to a grand theory that attempts to explain everything.

4. Conclusion

In conclusion, the theory of affordances offers IS and organizational researchers a framework for studying the influence of technology and environment on behaviors and practices in a nondeterministic way that takes into account the importance of both its material and social construction. In association with the concept of habitus, it provides a conceptual vocabulary that can make it easier for scholars sensitized to a sociomaterial explanation of organizational practices, and the technology, artifacts, and environments that they involve, to do empirical work in this area. We make three proposals for future research. First, we acknowledge two perspectives on affordances: dispositional and relational. Yet, rather than choosing one over the other, we contend that taking a truly integrative perspective allows researchers to explain how the material shapes practice without determining it and to acknowledge how the material both constrains yet is flexible and socially interpreted, related to a user's needs, practice, and organizational context. Second, we propose to shift the focus of affordance from the technology's features or environment's characteristics to the practice enacted through technology or within an environment. Thus, rather than the affordance of email, CAD, or open plan offices, one should focus on affordance for practice — e.g., for communication, collaboration, or informal interaction. Third, we argue for the power in middle-ground theories (Merton, 1968). The temptation to extend affordances to encompass concepts such as habitus should be resisted. How affordance and habitus complement one another is not that one is about the physical and the other about the social. It is that affordance offers a useful way of thinking about how practice is patterned by the social and physical construction of technology and the material environment and habitus offers a useful way of thinking about how practice is patterned by social and symbolic structures. Together, affordances and habitus shape the possibilities for action that show up, either consciously or unconsciously, for the actor. These two concepts that have traction in empirically-based studies, yet have only ever been used separately, yield a rich and subtle language to describe organizational practices as always and everywhere enacted through social and material entanglements, a crucial, yet challenging task for researchers embracing a sociomaterial perspective.

References

Adolph, K.E., Bertenthal, B.I., Boker, S.M., Goldfield, E.C., & Gibson, E.J. (1997). Learning in the development of infant locomotion. *Monographs of the Society for Research in Child Development, 62*(3).
Ashcraft, K.L., Kuhn, T.R., & Cooren, F. (2009). 1 Constitutional Amendments:"Materializing" organizational communication. *The Academy of Management Annals, 3*(1), 1–64.
Barley, S.R., Meyerson, D.E., & Grodal, S. (2011). E-mail as a source and symbol of stress. *Organization Science, 22*(4), 887–906.
Barrett, M., Oborn, E., Orlikowski, W.J., & Yates, J. (2012). Reconfiguring boundary relations: Robotic innovations in pharmacy work. *Organization Science, 23*(5), 1448–1466.
Bourdieu, P. (1977). *Outline of a theory of practice.* Cambridge: Cambridge University Press.
Bourdieu, P. (1984). *Distinction: A social critique of the judgment of taste.* Cambridge: Harvard University Press.
Bourdieu, P. (1990). *The logic of practice.* Stanford: Stanford University Press.
Bourdieu, P., & Wacquant, L.J.D. (1992). *An invitation to reflexive sociology.* Chicago: University of Chicago Press.
Brown, J.S., & Duguid, P. (1994). Borderline issues: Social and material aspects of design. *Human Computer Interaction, 9*(1), 3–36.
Buttimer, A., & Seamon, D. (1980). *The human experience of space and place.* Croom Helm London.

Chemero, A. (2003). An outline of a theory of affordances. *Ecological Psychology*, *15*(2), 181–195.
Decety, J., & Grèzes, J. (2006). The power of simulation: imagining one's own and other's behavior. *Brain Research*, *1079*(1), 4–14.
DeSanctis, G., & Fulk, J. (1999). *Shaping organization form: Communication, connection, and community.* Sage.
Ellul, J. (1964). *The technological society.* New York: Alfred A. Knopf.
Dourish, P., Adler, A., Bellotti, V., & Henderson, A. (1996). Your Place or Mine? Learning from Long-Term Use of Audio-Video Communication. *Computer-Supported Cooperative Work*, *5*(1), 33–62.
Faraj, S., & Azad, B. (2012). *The materiality of technology: An affordance perspective.* Oxford: Oxford University Press.
Fayard, A. -L., & Metiu, A. (2014). The role of writing in distributed collaboration. *Organization Science*, *25*(5), 1391–1413.
Fayard, A. -L., & Weeks, J. (2007). Photocopiers and water-coolers: The affordances of informal interaction. *Organization Studies*, *28*(5), 605–634.
Gaver, W.W. (1992). The affordances of media spaces for collaboration. *Paper presented at the Proceedings of the 1992 ACM conference on computer-supported cooperative work*.
Gaver, W.W. (1996). Affordances for interaction: The social is material for design. *Ecological Psychology*, *8*(2), 111–129.
Gibson, J. J. (1977). *The Theory of Affordances. InPerceiving, Acting, and Knowing, edited by Robert Shaw and John Bransford.* (pp. 67-82). Hillsdale, NJ: Erlbaum.
Gibson, J.J. (1986). *The ecological approach to visual perception.* Hillsdale, NJ: Lawrence Erlbaum Associates.
Giddens, A., & Pierson, C. (1998). *Conversations with Anthony Giddens: Making sense of modernity.* Stanford University Press.
Gieryn, T.F. (2000). A space for place in sociology. *Annual Review of Sociology*, *26*(1), 463–496.
Goldring, P. (1991, August 25–30). Early steps towards language: How social affordances educate attention. *Paper presented at the Sixth International Conference on Perception and Action, Amsterdam*.
Grint, K., & Woolgar, S. (1997). *The machine at work: Technology, work and society.* Cambridge: Polity Press.
Hutchby, I. (2001). Technologies, texts and affordances. *Sociology*, *35*(2), 441–456.
Jones, M.R., & Karsten, H. (2008). Giddens's structuration theory and information systems research. *MIS Quarterly*, *32*(1), 127–157.
Jung, Y., & Lyytinen, K. (2013). Towards an ecological account of media choice: A case study on pluralistic reasoning while choosing email. *Information Systems Journal*, *24*(3), 271–293.
Leonardi, P.M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly*, *35*(1), 147–168.
Leonardi, P.M. (2013a). Theoretical foundations for the study of sociomateriality. *Information and Organization*, *23*(2), 59–76.
Leonardi, P.M. (2013b). When does technology use enable network change in organization? A comparative study of feature use and shared affordances. *MIS Quarterly*, *37*(3), 749–775.
Leonardi, P.M., & Barley, S. (2008). Materiality and change: Challenges to building better theory about technology and organizing. *Information and Organization*, *18*(3), 159–176.
Mackay, W. (1999). Is paper safer? The role of paper flight strips in air traffic control. *ACM Transactions on Computer–Human Interaction (TOCHI)*, *6*(4), 311–340.
Mackay, W., & Fayard, A. -L. (1997a). Radicalement nouveau et néanmoins familier: les strips papiers revus par la réalité augmentée. *Actes des Journées IHM Interaction Homme-Machine*, *105–112*.
Mackay, W., & Fayard, A. -L. (1997b). HCI, natural science and design: A framework for triangulation across disciplines. *Paper presented at the Proceedings of the 2nd conference on designing interactive systems: Processes, practices, methods, and techniques*.
Mackay, W., Fayard, A. -L., Frobert, L., & Médini, L. (1998). Reinventing the familiar: Exploring an augmented reality design space for air traffic control. *Paper presented at the proceedings of the SIGCHI conference on human factors in computing systems*.
Majchrzak, A., Wagner, C., & Yates, D. (2013). The impact of shaping on knowledge reuse for organizational improvement with Wikis. *MIS Quarterly*, *37*(2), 455-A412.
Mantei, M.M., Baecker, R.M., Sellen, A.J., Buxton, W.A., Milligan, T., & Wellman, B. (1991). Experiences in the use of a media space. *Paper presented at the proceedings of the SIGCHI conference on human factors in computing systems*.
Markus, M.L., & Silver, M.S. (2008). A foundation for the study of IT effects: A new look at DeSanctis and Poole's concepts of structural features and spirit. *Journal of the Association for Information Systems*, *9*(10).
Mazmanian, M. (2013). Avoiding the trap of constant connectivity: When congruent frames allow for heterogeneous practices. *Academy of Management Journal*, *56*(5), 1225–1250.
Mazmanian, M., Cohn, M., & Dourish, P. (2014). Dynamic reconfiguration in planetary exploration: A sociomaterial ethnography. *MIS Quarterly Special Issue on Sociomateriality*, *38*(3), 831–848.
Mazmanian, M., Orlikowski, W.J., & Yates, J. (2013). The autonomy paradox: The implications of mobile email devices for knowledge professionals. *Organization Science*, *24*(5), 1337–1357.
Merton, R.K. (1968). *Social theory and social structure.* Simon and Schuster.
Moon, J.Y., & Sproull, L. (2002). Essence of distributed work: The case of the Linux kernel. In P. Hinds, & S. Kiesler (Eds.), *Distributed work* (pp. 381–404). Cambridge, MA: The MIT Press.
Mutch, A. (2013). Sociomateriality—Taking the wrong turning? *Information and Organization*, *23*(1), 28–40.
Norman, D.A. (1988). *The psychology of everyday things.* Basic books.
Norman, D.A. (1993). *Things that make us smart: Defending human attributes in the age of the machine. (1993)*Basic Books.
Norman, D.A. (1999). Affordance, conventions, and design. *Interactions*, *6*(3), 38–43.
Orlikowski, W.J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, *11*(4), 404–428.
Orlikowski, W.J. (2002). Knowing in practice: Enacting a collective capability in distributed organizing. *Organization Science*, *13*(3), 249–273.
Orlikowski, W.J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies*, *28*(9), 1435–1448. http://dx.doi.org/10.1177/0170840607081138.
Orlikowski, W.J., & Scott, S.V. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *The Academy of Management Annals*, *2*(1), 433–474.
Orr, J. (1996). *Talking about machines: An ethnography of a modern job.* Cornell University Press.
Orton, J.D., & Weick, K.E. (1990). Loosely coupled systems: A reconceptualization. *Academy of Management Review*, *15*(2), 203–223.
Pentland, B.T. (1992). Organizing moves in software support hot lines. *Administrative Science Quarterly*, *37*(4), 527–548.
Poirot-Delpech, S. (1995). *Biographie du CAUTRA: naissance et développement d'un système d'informations pour la circulation aérienne.* (Paris 1).
Poster, M. (1995). *The second media age.*

Robey, D., Raymond, B., & Anderson, C. (2012). Theorizing information technology as a material artifact in information systems research. *Materiality and organizing: Social Interaction in a Technological World*, 217–236.
Rosner, D., Blanchette, J. -F., Buechley, L., Dourish, P., & Mazmanian, M. (2012). From materials to materiality: Connecting practice and theory in hc. *Paper presented at the CHI'12 extended abstracts on human factors in computing systems*.
Still, A.W., & Good, J.M.M. (1991, August 25–30). Beyond social affordances: The flow of information in social kinesthesis. *Paper presented at the Sixth International Conference on Perception and Action, Amsterdam*.
Stoffregen, T.A. (2003). Affordances as properties of the animal–environment system. *Ecological Psychology*, *15*(2), 115–134.
Stults, R. (1988). *Experimental uses of video to support design activities. Paper presented at the Xerox PARC, Palo Alto, California.* ((remote meetings, virtual worlds, video) This report provides the origins and description of four projects that used video to support design activity. These are: a) the distributed design studio).
Suchman, L. (2007). *Human–machine reconfigurations: Plans and situated actions.* Cambridge University Press.
Thompson, J. D. (1967). *Organizations in action: Social sci-ence bases of administrative theory.* New York: McGraw- Hill.
Toffler, A. (1981). *The third wave.* London: Collins.
Tucker, M., & Ellis, R. (1998). On the relations between seen objects and components of potential actions. *Journal of Experimental Psychology: Human Perception and Performance*, *24*(3), 830.
Tucker, M., & Ellis, R. (2004). Action priming by briefly presented objects. *Acta Psychologica*, *116*(2), 185–203.
Turvey, M.T. (1992). Affordances and prospective control: An outline of the ontology. *Ecological Psychology*, *4*(3), 173–187.
Van Leeuwen, L., Smitsman, A., & van Leeuwen, C. (1994). Affordances, perceptual complexity, and the development of tool use. *Journal of Experimental Psychology: Human Perception and Performance*, *20*(1), 174.
Venters, W., Oborn, E., & Barrett, M. (2014). A trichordal temporal approach to digital coordination: The sociomaterial mangling of the CERN grid. *MIS Quarterly*, *38*, 927–949.
Volkoff, O., & Strong, D.M. (2013). Critical realism and affordances: Theorizing it—Associated organizational change processes. *MIS Quarterly*, *37*(3), 819–834.
Wajcman, J., & Rose, E. (2011). Constant connectivity: Rethinking interruptions at work. *Organization Studies*, *32*(7), 941–961.
Wiesenfeld, B.M., Raghuram, S., & Garud, R. (1999). Communication patterns as determinants of organizational identification in a virtual organization. *Organization Science*, *10*(6), 777–790.
Zammuto, R.F., Griffith, T.L., Majchrzak, A., Dougherty, D.J., & Faraj, S. (2007). Information technology and the changing fabric of organization. *Organization Science*, *18*(5), 749–762.
Zebrowitz, L.A., & Collins, M.A. (1997). Accurate social perception at zero acquaintance: The affordances of Gibsonian approach. *Personality and Social Psychology Review*, *1*(3), 204–223.