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Organizational Media Affordances:
Operationalization and Associations with Media Use

Abstract

The concept of affordances has been increasingly applied to the study of ICTs in organizational contexts. However, almost no research operationalizes affordances, limiting comparisons and programmatic research. This paper briefly reviews conceptualizations and possibilities of affordances in general and for media, then introduces the concept of organizational media affordances as organizational resources. Analysis of survey data from a large Nordic media organization identified six reliable and valid organizational media affordances: pervasiveness, editability, self-presentation, searchability, visibility, and awareness. Eight media scales based on frequency of use of 10 media within each of three organization levels were differentially associated with these affordances. The conceptualization, measurement approach, and results from this study provide the foundation for considerable future organizational communication and ICT research.

keywords: affordances, organizations, ICTs, media use, operationalization

Organizational Media Affordances:
Operationalization and Associations with Media Use

With the introduction of computers and digital transmission networks, new forms of organizational and personal information and communication technologies (ICTs) have arisen, diffused, and been incorporated into organizations' and people's lives. These include computer conferencing systems, online bulletin boards, email, group support systems, voice mail, intranets, videoconferencing, virtual collaboration, texting, mobile phones, and social media. Recently, scholars have considered how the *affordances* of ICTs can provide a useful framework to understand organizational media use and implications. In these studies, researchers evaluate the relationship *between* users and technology to understand the various ways ICTs are adopted, appropriated, and reinvented by users, as well as how specific affordances of ICTs are associated with social and communicative outcomes. These studies may be especially beneficial to organizational communication research because they provide new insights into how technology use shapes members' work processes and interactions, and how technology use is shaped by members' perceptions and needs.

The present study extends communication scholarship by adopting an affordances perspective, and contributes to theory, by explicating the conceptual foundations of organizational media affordances, considering them as organizational resources rather

than assessing each affordance in a 1-to-1 relation to a specific medium, developing operationalizations of a central set of affordances useful for surveys and interviews, and assessing how use of various organizational media at three organizational levels—interpersonal, group, and organizational—is associated with those affordances.

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Problem Statement, Review and Research Questions

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The Nature of Media

Major theoretical approaches to understanding the nature of media include media ecology (McLuhan, 1964), educational media typologies (Bretz, 1971), media symbol systems and cognitive processing (Salomon, 1979), social presence (Short, Williams & Christie, 1976; Rice, 1993), media richness (Daft & Lengel, 1986), media attributes (Rice, 1987), task-technology attributes (Nass & Mason, 1990), social construction of technology (Bijker, Hughes, Pinch & Douglas, 2012; Fulk, 1993), adaptive structuration (DeSanctis & Poole, 1994), and uses and gratifications (Flanagin & Metzger, 2001; Sundar & Limperos, 2013). Each of these approaches has extended our understanding of how and why individuals use particular media and how and why different media may be associated with particular outcomes, recognizing the ways media use may be differentially shaped by material aspects of technologies (i.e., features), and users' perceptions and motivations. However, even among theoretical approaches that aim to balance the role of technologies' features and users' perceptions and uses, scholars often privilege one side of the technology-user relationship or conflate the two (as Faraj & Azad, 2012, and Leonardi & Barley, 2008, note). A focus on *media affordances* offers a theoretical grounding in the relationships *between* users and technology, and therefore a middle path between deterministic and constructivist stances. Yet the conceptualization of affordances is inconsistent (Evans, Pearce, Vitak, & Treem, in press), and operationalization of affordances is rare, making it difficult to compare studies and understand results.

Thus this study provides an initial attempt to operationalize media affordances in organizational contexts. Our construct measurement and validation process follows Mackenzie, Podsakoff, and Podsakoff's (2001) 10 recommendations including: 1) develop the conceptualization, 2) generate items to represent the construct, 3) assess the content validity of the items, 4) specify the measurement model, 5) collect and analyze data, 6) purify and refine scales, and 8) reassess scale validity (groups comparisons and predictive associations). For this case study we did not use steps 7 and 9, which require obtaining additional samples, nor step 10, which proposes obtaining norms for the scales for relevant populations, deemed inappropriate for the concept of affordances.

Conceptualizing Affordances (step #1)

The concept of affordances was first defined by Gibson (1979) in the context of the natural environment. Gibson intended *affordance* to mean an "action possibility available in the environment" (McGrenere & Ho, 2000, p. 1). For Gibson, affordances exist as an action possibility independent of an actor's perception and experiences; do not change when an actor's needs and goals change, but they are relative to each actor's perceptions and capabilities for action; exist or do not, without distinctions of degree or extent; and can be nested (comprising other action possibilities). Later, Norman (1988) developed a human-centered design perspective on affordances. Affordances are perceived, not actual; vary in degree or extent; and may be shaped by users through

applying functional affordances that may be nested within more general affordances (McGrenere & Ho, 2000).

Excellent reviews, explications, and comparisons of the affordance concept indicate varying and even opposing uses of the term (Bonderup-Dohn, 2009; Burlamaqui & Dong, 2015; Chemero, 2011; Faraj & Azad, 2012; McGrenere & Ho, 2000; Oliver, 2005; Rietveld & Kiverstein, 2014). Debates include whether affordances exist independently of the actor's perceptions (or capability for becoming aware of the affordance) and effectivities (dispositions for actualizing the affordance); whether the core relation is between actor properties and environment properties, or between actor properties and situation aspects; and whether affordances are properties of the object/environment, a latent capability emerging in a particular context, or specific to the actor/species. This ambiguity has, however, also allowed for the evolution of the concept in a range of disciplines (Evans et al., in press; Treem et al., 2016).

For many researchers, a particular role of an affordance depends on whether and how the agent perceives the affordance, and thus how the agent applies it. Thus, we need measures of those perceptions. For example, Gaver (1991; see also McGrenere & Ho, 2000) distinguished between information in the affordance itself (usefulness), and mediating information about the affordances (usability, such as labels, implementer or other user suggestions, the context), giving rise to four kinds of affordances: correct rejections, perceptible, hidden, and false affordances. Further, the same object may offer different affordances to different contexts and actor groups (Faraj & Azad, 2012; Oliver, 2005; Oostervink, Agterberg, & Huysman, 2016). An affordance can have both positive and negative, intended and unintended, and short-term and long-term connotations; it may both enable and constrain action (Conole & Dyke, 2004; Majchrzak, Faraj, Kane, & Azad, 2013; Oostervink, Agterberg, & Huysman, 2016). Affordances may be nested, temporally or spatially interdependent, and bundled into sets of interrelating affordances and outcomes (Strong et al., 2014).

Emphasizing a design perspective on affordances, Burlamaqui and Dong's review (2015) generates five common foundational elements: artefact, agent, environment, perception, and potential use. Pozzi, Pigni and Vitari (2014) distinguish and summarize four main aspects of affordances: their existence, perception, actualization, and effect. Other researchers are now attending to the importance of *actualization* of affordances (Strong et al. 2014; Volkoff & Strong, 2013), which may depend on a wide variety of conditions, agents, and goals.

Media affordances. Affordances inherently involve communication. From Norman's perspective, a designer attempts to communicate to the user about capabilities of the artefact through affordances, both inherent in the artefact, and through information in or on the artefact about the affordances (Burlamaqui & Dong, 2015**;** Gaver, 1991). Of course, media afford co-construction and sharing of intersubjective meaning (Suthers, 2006), such as between organizational members. Organizational researchers have more recently begun applying the concept of affordances to explain uses, context, and implications of organizational media (i.e., Goh, Gao & Agarwal, 2011; Leonardi, 2013; Majchrzak et al., 2013; Pozi, Pigni, & Vitari, 2014; Treem & Leonardi, 2012; Volkoff & Strong, 2013). Results describe a wide range of possible and overlapping affordances; in just the case of mobile phones, over 50 (see, for example, Sheer & Rice, 2016, Table 1). Typically, affordances are measured in relation to a specific ICT, at the individual level

(Ellison, Gibbs, & Weber, 2015) and, with some exceptions, at a single point in time (Ellison & boyd, 2013; Ellison & Vitak, 2015). Others propose general affordances, unrelated to specific media. For example, Sundar's (2008) MAIN model proposes four broad media affordances: modality, agency, interactivity and navigability, which cue cognitive heuristics about credibility assessments. Thus *media affordances are relationships among action possibilities to which agents perceive they could apply a medium, within its potential features/capabilities/constraints, relative to the agent's needs or purposes, within a given context*.

Organizational media affordances. Some have suggested higher-order categories of affordances. Leonardi (2013) proposed *individualized* (one person's engagement of an affordance), *collective* (enacted by a group, whether pooled or interdependent), and *shared* (a group perceives and appropriates a new technology's features in a similar way) affordances. Bardner (2001) proposed the concept of *social affordances*, whereby a group's social aspects and norms interact with an object's properties to facilitate specific kinds of group relations. At an organizational level, Zammuto, Griffith, Majchrzak, Dougherty, and Faraj (2007) introduced *affordances for organizing* to describe how the relationship or "intertwining" between IT and organizational systems impacted organizations, an argument that echoes Orlikowski and Scott's (2008) claim that the social and material are "constitutively entangled" (p. 752).

We propose the concept of *organizational media affordances:* relationships among action possibilities to which agents perceive they could apply a medium, within its potential features/capabilities/constraints, relative to the agents' needs or purposes, aggregated within or across media contexts, and within or across organizational contexts. This concept makes three central assumptions. First, *agents perceive the extent to which a salient affordance is available within organizational contexts* to accomplish their work through use of different available media. Thus, organizational media affordances are organizational resources. Second, rather than a 1-to-1 linkage between a single technology (platform or medium) and a single affordance, organizational media affordances can be associated with a *single*, *multiple,* or *groups of organizational media*. Organizational members increasingly use multiple communication media during the workday, sometimes simultaneously or sequentially, and choose different media depending upon both communication goals and relational partners (Leonardi, Neeley, & Gerber, 2012; Stephens, Sørnes, Rice, & Browning, 2008). Third, relations between affordances and media use occur within at least three *organizational communication contexts* (Rice & Leonardi, 2013): interpersonal, group, and organizational levels. Some media use—and thus affordances—vary across these levels due to contextual needs for collaboration and interdependence, physical and temporal proximity, number of interaction partners, commonness of activities, and formal reporting relationships, while other use may be relevant to multiple levels throughout the organization.

Interpersonal level. Organizational members frequently engage in dyadic or small group communication (e.g., supervisor-subordinate). Mediated communication with a supervisor may overcome constraints of time, location, and knowledge, enabling more resources (Kubicek, Korunka, Paškvan, Prem, & Gerdenitsch, 2014).

Group level. The group level can relate to work groups, teams, or departments. For example, Bradner, Kellogg, and Erickson (1999) define affordances as "the relationship between the properties of an object and the social characteristics of a group

that enable particular kinds of interaction among members of that group" (p. 154), moving beyond the common dyadic actor-object relationship at the interpersonal level.

Organizational level. Gibbs, Rozaidi, and Eisenberg (2013) explored affordances at the organizational level by assessing dialectical tensions emerging from interview data about social media use in a technology organization. Treem and Leonardi (2012) explicated the role of four affordances—visibility, persistence, editability, and association—as potentially significant influences on central organizational communication processes, such as socialization, knowledge sharing, and power relations.

Operationalizing Organizational Media Affordances

The value in operationalizing organizational media affordances lies in the potential for measuring and analyzing them across multiple contexts and including affordances in multivariate models of ICT adoption, use, and outcomes. Despite the growing analysis of ICT affordances in organizational contexts noted above, little research has attempted to measure a consistent and broad set of affordances. Respondents typically do not themselves identify affordances, instead reporting their motivations for, purposes of, or particular uses of a medium, to which researchers then apply affordance labels. An analysis of 120 articles at least mentioning media affordances (table available from the authors) identified only three studies quantitatively measuring affordances (Kuo, Tseng, Tseng, & Lin, 2013; McEwan & Fox, 2015; Wang et al., 2015), and these involved a small number of affordances, media, and/or contexts.

Research Questions

Thus we ask: RQ1: How might we measure organizational media affordances? RQ2: What reliable, valid, and primary organizational media affordances emerge from those measures? RQW3: How do organizational media affordances associate with use of different or separate sets of media in different organizational contexts?

Method

Measures (steps #2 and #3)

Organizational media affordances. Consistent with our goal of developing a better understanding of affordances as a construct, our process of identifying and creating appropriate items reflecting organizational media affordances was initially grounded in the espoused findings of extant literature. We were then guided by an iterative, and abductive logic in which we developed constructs from these findings, and reflexively considered, reconsidered, and adjusted labels to test our assumptions and arrive at a plausible and appropriate representation of the material (Charmaz, 2006). Thus this approach is a mix of *a priori* and emergent coding. The concept of affordance is an existing coding domain, but the specific affordances and their groupings are emergent.

Before discussions with the organizational contact, to identify and create appropriate items reflecting organizational media affordances, we identified 79 terms in prior literature that referred to, or were named as, a media/ICT affordance. Based on their use, we converted those terms into phrases (e.g., "find out about new information through links with information you do know"). Using iterative discussion among three project researchers, we grouped these phrases into 13 tentatively labeled common affordances— association, awareness, content mode, editability, multitasking, persistence, personalization, pervasiveness, scalability, searchability, sharing, value, visibility. The survey did not include these tentative affordance categories; they were used only to group and distinguish the phrases for comparison. Reviewing the items and categories, we

decided that several were not affordances (content mode, multitasking), were not widely relevant or were represented in another category (scalability), or were better conceptualized as an aspect of another affordance (sharing). We also added a new category (signaling) to distinguish several items from visibility and reworded some items for consistency and clarity. For the survey, we sought maximum variation in a small number of meaningful and clear items, consistent with the qualitative design approach of maximizing theoretical variance (Charmaz, 2006), given limits on the survey length. Therefore, each researcher, within each category, ranked the item most representative of the category and the two items most different from that one and from each other. We reviewed these rankings and reached consensus on two to five items for each category, resulting in a final set of 31 items. Items were reworded into a consistent format, beginning with the opportunity for action and emphasizing the essential affordance (e.g., "be aware of activities, opinions, or locations of others") (see Table 1). We then added a 7-point response scale (1=strongly disagree to 7=strongly agree) to reflect the idea that perceptions of affordances reflect degree or extent, rather than simple existence or non-existence.

--- Table 1 goes about here ---

Media use. Based on prior studies and discussions with the organizational contact to insure we included available and relevant media, we developed measures indicating frequency (1=never to 9=many times a day) of using 10 media available within the organization, each within three increasingly narrow contexts: employees outside of department but *within the organization*, employees *within one's department*, and *interpersonally with one's supervisor*. Media included face-to-face one-on-one, face-to-face meetings, send/receiving email, telephone calls, short messages (including text messages, Google Hangout chat, other chat programs), conference calls without video, conference calls with video, the organization's intranet, WhatsApp, and external social media for work-related matters.

Data (step #5)

Case site. We conducted the study in a Nordic public sector broadcasting company (NPB) employing more than 3300 people. NPB is distributed across 25 locations nationally. It operates several television and radio channels and produces news and current affair programs, documentaries, and educational and children's programming.

Collection. The survey was sent from one researcher's email address as a web link to all NPB employees. The message included an invitation letter to participate in the study, contact information for NPB's contact person, and a link to NPB's intranet site for a detailed description of the study. The survey was open for two weeks. We also sent two reminders via email to all participants who had not yet responded to the study.

Sample. We received 461 surveys (450 usable) out of 3394 invitations (response rate: 13.6%). Of those, over half (54.2%) were female; 23.5% had upper secondary or vocational education, 27.1% university-applied sciences, and 49.6% university; the mean age was 49.1 (SD=9.2); 17.8% were supervisors; they worked in six organizational units, 24 professions, and 37 departments; and they worked away from the office 18.1% of the time (SD=20.3). Thus they are not statistically representative, but do provide good diversity across the organization.

Results (steps #4, #5, #6, #8)

Organizational Media Affordances

Table 2 provides the item descriptives, principal components (EFA) results, mean scale descriptives and Cronbach reliabilities of the affordances measures. EFA criteria included eigenvalues over 1.0, loadings at least .60 (or close if there is conceptual grounding for including the item) on one component and less than .40 on any other component.

--- Table 2 goes about here ---

Six affordances emerged, ranked by decreasing mean agreement: *pervasiveness*, *editability*, *self-presentation*, *searchability*, *visibility*, and *awareness*. Though the items for editability and self-presentation loaded on one component, we distinguished the two concepts (supported by the CFA, noted below), based upon the first three and the last four items, respectively. The respondents perceived distinct sets of affordances, they agreed that these are all possible actions, and they perceived some as more possible than others. We can therefore view these as organizational resources. A second-order principal components analysis of the six scales indicated one underlying factor, explaining 58.0% of the variance (eigenvalue = 3.48), with a resulting overall Cronbach's α of 0.85.

To verify the EFA results, we conducted a measurement model (using AMOS 22), with each of the items included as reflective indicators of their respective six unobserved constructs, and the six constructs indicating one underlying common construct. All item loadings in Model 1 were significant ($p<.001$), and the overall model fit was marginally acceptable ($X^2(df269) = 1121.3$, $p<.001$; CMIN/df = 4.27, TLI = .88, CFI = .90, RMSEA = .08, AIC = 1283.3). Model 2 removed four low-loading items while retaining at least three items for each affordance. Model 2 provided an acceptable fit ($X^2(df183) = 578.4$, $p<.001$; CMIN/df = 3.16, TLI = .93, CFI = .94, RMSEA = .07, AIC = 716.4), and was significantly better than Model 1 ($X^2(df86)$ difference = 542.9, $p<.001$).

To evaluate whether there is one underlying affordance concept as indicated from the exploratory second-order factor analysis and Model 2, Model 3 used only the six first-order affordances. This model was a good fit ($X^2(df174) = 513.8$, $p<.001$; CMIN/df = 2.95, TLI = .93, CFI = .95, RMSEA = .065, AIC = 669.84), and significantly better than Model 2 ($X^2(df9)$ difference = 64.6, $p<.001$). Thus the six affordances are conceptually and empirically distinct, but interrelated, concepts. Figure 1 shows this final model, with the standardized regression weights; all entries are significant at $p<.001$. All affordance means are significantly ($p <.001$) higher than the middle response choice of 4.0.

--- Figure 1 and Table 3 go about here ---

All factor loadings in the CFA measurement model exceed the recommended minimal value of 0.7. Table 3 shows that Cronbach's alpha and composite reliabilities range from 0.82 to 0.96, the average variance extracted (AVE) ranges from .63 to .77, and the square roots of the construct AVEs are all greater than the cross-correlations. These results provide evidence of scale reliability and convergent and discriminant validity.

Organizational Media Use

Table 4 provides the descriptives, EFA results, mean scale descriptives, and reliabilities for the media use items. Several resulting components reflect media use within separate organizational levels, while others reflect media use across levels. Each of the three levels had its own *basic* set of media: face-to-face, meeting, email, and

phone. For department-level items, though the first two and second two media loaded on separate components, we combined them for comparability to the other levels, resulting in a higher alpha than for either pair of items. Five less traditional sets of media used across all three levels emerged: conferencing, external social media, WhatsApp, intranet, and texting. Communication was frequent across the three levels of *basic* media (M=6.22, 7.04, and 5.34), less frequent for texting (M=4.85), and low for external social media (3.23), conferencing without video (2.25), conferencing with video (2.25), organizational intranet (2.07), and WhatsApp (1.77). Thus perceptions of affordances associated with these last media may not be based on much experience.

--- Table 4 goes about here ---

We could not find a confirmatory factor analysis measurement model to fit the media use items, both with and without a second order common factor. Thus we consider each media scale as an index of the respective media use, identified through EFA.

Additional Tests (#5 & #8)

Common method bias. Using the minimal tests of Harman's single factor test and multicollinearity (Bagozzi et al., 1991; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), we found no evidence of common method bias.

Known-groups comparisons. We conducted independent samples t-tests of mean differences for the six affordances scales for two groupings: supervisory position (82.2% no, 17.8% yes), and percent of time working away from the office (dichotomized into 50% did so <=14% of the time, 50% did so > 14%). There is no strong theoretical reason why affordances should vary by supervisory role, but we might expect differences between low and high levels of working away from the office because of the relationships between varying media affordances and user needs related to communicating and accomplishing work when away from the office. Indeed, there were no significant differences between supervisors and non-supervisors. There were, however, two significant differences by working away from the office, with those doing so more agreeing more about the possibility of the self-presentation affordance ($t(399) = -2.2$, $p< .05$) and of the pervasiveness affordance ($t(407) = -2.6$, $p< .05$). So the affordances seem fairly robust across two main organizational roles, but with some reasonable variations across work contexts.

Predictive associations. Table 5 presents correlations between the media affordances and media use scales. Because of the lack of CFA model fit for the media use measures, we cannot use an overall SEM model; therefore, we used the mean scales of each of the CFA construct affordance items and EFA component media use items. Over half (26) were significant, all positive.

--- Table 5 goes about here ---

Affordances. All affordances are positively associated with texting, and all are positively associated with at least three media. Specific affordances exhibit different relational patterns. Visibility is afforded through conferencing, external social media, the intranet, and texting. Editability is afforded through conferencing, the basic set of media at the organizational and departmental level, and texting. Self-presentation correlates with conferencing, external social media, and texting. Awareness is similarly associated with conferencing, external social media, and texting, but also basic media at the supervisor level, and the intranet. Pervasiveness is afforded through conferencing, basic media at the

organizational and supervisor levels, external social media, texting, and WhatsApp. Finally, searchability is correlated with external social media, the intranet, and texting.

Media use. As noted above, it is difficult to know how the low use of external social media, conferencing, the intranet, and WhatsApp reflect perceptions of their affordances. The correlations, however, show consistent relationships between texting and all affordances, conferencing with all but searchability, and external social media with all but editability. The intranet and WhatsApp were less associated with affordances. The basic set of media scale was differentially associated with affordances at each organizational context. The organization-wide basic media scale was significantly correlated with editability, awareness, and pervasiveness; within-department basic media with editability and pervasiveness; and basic media use with one's supervisor with awareness.

Discussion

Contributions, Implications, and Future Research

This study makes several contributions to affordances research in organizational settings. The survey instrument provides a large set of items for assessing organizational media affordances. Survey items elicited respondents' perceived affordances in a quantitative manner, and in a way that was not tied to a single medium. We assessed different levels and types of media use, from basic communication within three levels to social media organization-wide. The sample involved experienced ICT users across a broad array of professions and departments in a major media organization.

Concerning RQ1, these findings indicate that possible actions with media can be distinctly, reliably, and validly associated with a primary set of affordance types within an organizational context. These results also provide support for the notion of affordances as organizational resources. Empirically deriving reliable measures of affordances within an organizational context allows researchers to ask when or how affordances vary across different organizational media and organizational contexts while retaining ecological validity that they are representing the views of organizational members. Analyzing the affordance perceptions of individual media users, as opposed to inferring affordances from observed or presumed behaviors, is consistent with both Gibson's and Norman's conceptualizations of affordances as perceived by actors confronting objects in an environment.

RQ2 asked about types of organizational media affordances. From a large pool of items based on prior literature, our investigation identified six organizational media affordances: visibility, editability, self-presentation, awareness, pervasiveness, and searchability. However, there were at least four media affordance categories referenced in previous research that did not emerge as unique affordances from responses by the workers at NPB: association, evaluatability, sharing, and signaling. Also, based on the CFA analyses, the resulting scales did not include some affordance survey items. The two *association* items nearly equally load on both *awareness* and *pervasiveness*. One *persistence* item (find information about prior NPB projects) nearly loaded high enough to be included with the awareness scale or the searchability scale. The three *sharing* items loaded about equally on the visibility, and editability/self-presentation scales. All of these items could be included in the respective scale of their highest loading with no decrease and in some cases a small increase in the respective scale reliability. Because of their minimal loadings and cross-loadings, we did not include these.

These and other affordances might emerge from a different, more distinct, and larger set of items (e.g., we did not include items for the initial affordances of scalability and multitasking). Future research could consider more distinct items representing these affordances, either allowing those affordances to emerge as separate measures, or showing that while identified in qualitative studies of a few affordances, may not be as conceptually or empirically distinct as presumed. Because human capabilities are broad, diverse, and changing, affordances will improve and increase, in turn affecting the environment, generating new affordances and action possibilities (Rieteveld & Kiverstein, 2014). Indeed, "every artefact has an uncountable number of affordances" (Burlamaqui & Dong, 2015, p. 306); thus, there can be no final, exhaustive set of affordances (Oliver, 2005). We also note that affordance perceptions may become so routinized and instinctual (Burlamaqui & Dong, 2015) that they become "invisible" (Ortmann & Kuhn, 2010). Thus no measure (perceptual, observed, reported, or inferred) can capture all potential affordances.

Future research should obtain additional samples to re-assess and cross-validate the media use and affordance constructs (#7, #8, #9 in Mackenzie, Podsakoff, and Podsakoff's (2011) process). However, given the large number of items included, it may be difficult to replicate these within other studies, especially if they include a variety of other measures.

The initial tentative 11 affordances correspond with much of the literature. The emergence of the six affordances from respondents' perceptions, and their overlap with at least four others in the literature, show good correspondence between the literature and our data. Further, the results suggest affordances can be shared by individuals in an organization—workers largely agree on what actions technologies can, and cannot, support (Leonardi, 2013). They also suggest that, in addition to the traditional research approach of assessing affordances of each specific communication channel, affordances can also be conceptualized as organizational resources, fostered by an array of available communication channels, with multiple media associated with the same affordance, and multiple affordances associated with the same medium.

By operationalizing affordances in this manner, and proposing reliable and valid measures for them, scholars can develop mid-range theories regarding the affordances of organizational media across organizational contexts, allowing future work to test the scope and applicability of affordances as media and the environments of users change. Showing that affordances are not limited to specific technologies could make empirical research even more valid and generalizable across organizational contexts and changing media platforms and technologies (Ellison & Vitak, 2015).

Further, the boundaries of affordances are permeable, as indicated by their inter-correlation, reinforcing the view that affordances of media may occur in conjunction with, or even facilitate or constrain, other affordances (Schrock, 2015; Treem & Leonardi, 2012). Future work should continue to explore additional affordances, their inter-relationships, and their relationships with media. A comprehensive organizational media affordances approach should analyze media affordances over time, since the relationships between people, media, context, and purposes are inherently dynamic.

Regarding RQ3, affordances are differentially associated with a variety of media used across organizational levels, and differentially associated with a set of basic media within supervisory, departmental, and organizational levels. One implication is that just

as affordances can be considered an interrelated set of organizational resources, so too can media. Rather than considering each medium as providing distinct uses and affordances, similarly used media may provide related affordances, depending on the context, user, and purpose. One way to interpret this is that organizational media are flexible in how they support various actions. Rarely was a medium associated with only one affordance. This is consistent with Treem and Leonardi's (2012, Table 7.1, p. 149) view that an organizational medium vary from high to low in media affordances, and with Norman's view that affordances involve degree or extent. As affordances are conceptualized as *action possibilities*, non-significant correlations may reflect lack of actualization of some possibilities for some media. People may perceive an affordance, but choose or are constrained not to actualize it, for a variety of reasons, including the specific nature of the affordance in a given context (Strong et al., 2014).

Finally, future research should develop more comprehensive models of the shaping of affordance perceptions and actions (as has been done in much of the media theories noted earlier), and how affordances enable or constrain salient outcomes, such as knowledge sharing (Ellison et al., 2015; Leonardi, 2011; Majchrzak et al., 2013). For example, studies could incorporate organizational media affordance measures in one of the several more complete frameworks summarized above (Burlamaqui & Dong, 2015; Pozzi, Pigni & Vitari, 2014). Such analyses will help build new theories to predict and explain the relationship between people and organizational ICTs in the digital age.

Limitations

Although the sample is large and diverse, it consists of a small percentage of respondents from a single Nordic media organization. Thus, there are many sources of non-representation and contingency, such as generalizability to the organization, to types of work, and to organizational and national cultures.

Nearly all prior ICT affordance studies involve researchers qualitatively interpreting participants' observed or reported behaviors or discourse as a limited set of researcher-labeled affordances. Even in this study, though the affordance labels correspond to those in the literature, the researchers are labeling the six affordances, some of which include items initially associated with other tentative affordance labels, and some of which could be labeled differently. For example, "self-presentation" might also be labeled "identity management."

Some might reject, on epistemological grounds, that affordances should or can be assessed quantitatively and as distinct from specific technology-user-environment relations. For example, Bygstad, Munkvold, and Volkoff (2016) insist that affordances cannot be studied directly, but only through qualitative understanding of the associated events and issues. Some implication of their position is that it is very difficult to identify or predict all affordances, and it is not clear who should be defining or labeling the affordance, or even what the best label is (Stendal, Thapa, & Lanamaki, 2016).

We suggest three justifications for our approach. First, relying on self-reports of perceived affordances is a common practice in studies of communication technology use. For instance, Gibbs et al. (2013) and Leonardi (2013) use interviews to evaluate and operationalize affordances in organizational settings. Using the survey measures to operationalize affordances, and to do so through perceptions, shares this focus on individuals' perceptions of technologies. As Norman and other researchers reject the assumption that affordances either exist or do not exist (Gibson's position), it is

appropriate to consider the extent to which agents perceive the degree or extent of affordance possibilities.

Second, scholars have noted the need to explore different ways of measuring affordances, including the potential for developing quantitative methods (Wang et al., 2015). By creating a uniform way of gaining knowledge into the perceived possibilities of action across a large group of employees and media, we can develop more reliable representations of the breadth of affordances in an environment.

Third, taking a quantitative approach addresses some limitations of qualitative methods, such as the difficulty of 1) gathering qualitative data about a large number of individuals, 2) comparing within or across organizations, 3) working toward generalizations and facilitating hypothesis testing, and 4) replication and comparisons with other studies. Nonetheless, without engaging paradigm issues or mixed-methods design perspectives, certainly quantitative and qualitative approaches to understanding affordances complement each other. Indeed, future research may complement this framework with more in-depth and qualitative understanding of each of the affordances and their relation to various media, as Leonardi (2014) has done with visibility.

Conclusion

With the increasing pervasiveness of organizational ICTs across all aspects of our lives, it is critical to empirically evaluate users' relationships with these technologies in ways that account for the attributes and affordances in mediated spaces. Within organizations, we have seen dramatic shifts over the last few decades in communication, collaboration, and information processes, thanks in part to new technologies bridging geospatial and temporal boundaries. This study highlights the powerful role of an affordance framework for analyses of media use in organizations. We extend existing research in this space with the creation and evaluation of valid and reliable organizational media affordance scales, and show how these affordances differentially associate with 10 types of media use across and within three organizational levels.

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Table 1
Final List of Survey Items, with Tentative Media Affordance Labels

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Association: 1. use (web)links from information I know or am aware of, to find new information I did not know or wasn't aware of; 2. use (web)links from people I know or am aware of, to find new people I did not know or wasn't aware of
Awareness: 3. be aware of the information others in my department have; 4. be aware of the information others outside of my department have; 5. be aware of activities, opinions, or locations of others; 6. keep up-to-date with the progress of projects; 7. keep up-to-date with organizational policies and norms
Editability: 8. edit others' information after they have posted it; 9. edit my information after I have posted it; 10. create or edit a document collaboratively
Persistence: 11. find information about prior NPB projects; 12. maintain relations with others at NPB despite changes in activities, work, or location; 13. have my information or comments stay available after I post them
Personalization: 14. include the information, photos, and other content on NPB media that present my personal identity; 15. adjust my NPB media profile to my preferences
Pervasiveness: 16. get responses to my requests from others quickly; 17. communicate with others while moving, commuting, traveling; 18. communicate with infrequent or less important work relationships
Searchability: 19. search for information or people by entering search words; 20. search for information or people by following links between contents; 21. search for tags or keywords that someone else has added to content
Sharing: 22. create groups for sharing information about specific projects, departments, or teams; 23. obtain and use others' files, documents, photos, other information; 24. share my files, documents, photos, other information with other NPB employees
Evaluatability: 25. evaluate other people's information by providing my recommendations, comments, liking, or tagging; 26. see other people's evaluation of information through their recommendations, comments, liking, or tagging
Visibility: 27. see other people's answers to other people's questions; 28. see who has interactions or links with particular employees or their information; 29. see the number of others who have "liked" or linked to the same content
Signaling: 30. receive notifications about other information or updates that are similar to what I have just been looking at; 31. receive notifications about other people's information or updates
==
Note: "Think about the extent to which you agree that these activities are <u>currently possible</u> (whether you actually do them or not), using the various media (email, phones, instant messaging, intranet, social media, etc.) available at NPB. Throughout, 'others' and 'people' refer to <u>current employees</u> of NPB." Then, "To what extent do you agree with the following statements? It is currently possible for me to…" Response choices for each item were 1 Strongly disagree, through 4 neither agree or disagree, to 7 strongly agree, and 8 do not know (recoded as missing). The tentative affordance labels here were used only for initial grouping; they were not included on the survey.

Table 2
Media Affordances Descriptives, Components, and Loadings

Item	N	M	SD	Visibility	Editability; Self-Presentation[a]	Awareness	Pervasiveness	Searchability
links info new info	435	5.3	1.40	.19	.22	.46	.58	.03
links people new people	435	5.1	1.38	.19	.33	.43	.53	.06
info others in dept	435	4.9	1.44	.11	.23	**.74**	.34	.08
info others outside dept	428	4.5	1.45	.23	.13	**.75**	.30	.12
activities, opinion, locations of others	436	4.6	1.39	.32	.22	**.69**	.16	-.01
keep up-to-date progress of projects	433	4.5	1.48	.17	.13	**.78**	.08	.26
keep up-to-date org policies & norms	436	4.5	1.50	.25	.19	**.64**	.02	.33
edit others' info after they post	420	4.7	1.44	.18	[**.59**	.30	.10	.26
edit my info after I post	418	5.2	1.32	.22	**.71**	.20	.16	.15
edit document collaboratively	415	5.8	1.26	.21	**.75**]	.17	.33	.00
find info prior NPB projects	423	4.3	1.52	.16	.29	.52	-.05	.55
maintain relations w/others at org	424	5.2	1.29	.17	[**.56**	.39	.13	.32
my info comments stay available	417	5.3	1.34	.23	**.67**	.33	.14	.23
include info present my identity	419	5.0	1.51	.33	**.69**	.18	.26	.11
adjust media profile my preferences	416	5.1	1.48	.27	**.72**]	.18	.27	.11
get responses quickly	448	5.6	1.17	.15	.26	.17	**.65**	.33
comm while moving	442	5.9	1.08	.21	.39	.09	**.70**	.21
comm infrequent work relations	428	5.5	1.20	.18	.27	.22	**.76**	.20
search words	433	5.2	1.48	.24	.20	.27	.42	**.67**
follow links	410	5.0	1.46	.26	.29	.27	.30	**.71**
tags keywords others have added	407	4.6	1.50	.48	.15	.14	.33	**.66**
create groups	416	5.3	1.37	.48	.50	.03	.34	.30
obtain others' info	416	5.0	1.46	.44	.42	.11	.22	.43
my info with other employees	426	5.6	1.30	.44	.63	-.07	.38	.15
provide my recommendations & comments	394	4.8	1.52	**.78**	.29	.18	.14	.26
see others' evaluations	393	4.6	1.47	**.83**	.23	.22	.14	.24
see others' answers to others' questions	406	5.0	1.37	**.72**	.31	.16	.23	.17
see interactions among employees	372	4.3	1.48	**.77**	.18	.31	.10	.18
see number others liked or linked	379	4.5	1.54	**.84**	.24	.23	.13	.05
receive notifications about similar info	362	4.3	1.48	**.85**	.14	.22	.09	.18
receive notifications about others' info	390	4.6	1.50	**.85**	.27	.14	.18	.04
Eigenvalue				6.4	5.3	4.3	3.5	2.9
Variance explained				20.5%	16.9	14.0	11.3	9.2
α				.96	.89 [.83, .89]	.87	.84	.89
M				4.70	5.21	4.60	5.70	4.94

			[5.24, 5.18]			
SD		1.3	1.05	1.17	.99	1.36
			[1.16, 1.18]			

Note:

Principal components analysis, varimax rotation.

The loadings and scale descriptives are based on the exploratory principal components analysis results. As noted in the text, based on the confirmatory factor analysis measurement model, four items were removed, and the revised mean scales were used in the analyses.

a. The second component included loadings that correspond to the distinct concepts of editability and self-presentation, so the table shows the means, SDs, and alpha reliabilities for the full component scale as well as the two separate scales. Analyses use these two separate affordances.

Table 3

Reliability and Convergent and Discriminant Validity of Affordance Constructs

Affordance	α	CR	AVE	Visibility	Editability	Self-presentation	Awareness	Pervasiveness	Searchability
Visibility	.96	.95	**.77**	**.88**	--	--	--	--	--
Editability	.83	.84	.63	.48	**.79**	--	--	--	--
Self-presentation	.89	.85	.66	.57	.65	**.81**	--	--	--
Awareness	.87	.85	.65	.34	.44	.44	**.81**	--	--
Pervasiveness	.84	.82	.60	.56	.55	.60	.37	**.77**	--
Searchability	.89	.85	.70	.66	.49	.53	.53	.66	**.84**

Note: α: Cronbach alpha; CR: composite reliability; AVE: average variance extracted; Diagonals: square root of AVE; Off-diagonals: correlations

Table 4

Organizational Media Use Descriptives, Components, and Loadings

Item	N	M	SD	Conf	Basic Out	Ext Soc Med	Basic Sup	Whats App	Intra net	Basic In 1	Basic In 2	Text ing
Within Organization												
Face-to-face	460	6.5	2.28	.07	**.79**	.11	-.05	-.03	.06	.00	.04	-.16
FtF Meeting	455	4.5	2.07	.29	**.72**	.10	.10	.05	.01	.26	-.02	-.04
Email	461	7.6	1.91	.07	**.81**	.01	.10	.11	.12	.07	.14	.07
Phone	460	6.3	2.03	.02	**.79**	-.03	.14	.08	.07	.02	.33	.09
Short text	461	5.2	2.49	.18	.60	.17	.04	.19	.07	.07	.02	**.57**
Conferencing no video	460	2.5	1.70	**.59**	.44	-.05	.07	.15	.01	.12	-.01	.19
Conferencing video	461	2.5	1.65	**.65**	.46	.01	.12	.07	.05	.12	-.16	.15
Intranet	458	2.3	1.86	.07	.31	.03	-.01	.10	**.70**	-.08	-.03	.16
WhatsApp	453	2.5	2.39	.01	.23	.13	-.04	**.84**	.08	-.02	.02	.05
External social media	460	4.0	2.71	.09	.21	**.79**	-.02	.21	.12	.03	-.06	.15
Within Department												
Face-to-face	458	8.4	1.29	-.10	.13	-.09	.09	.02	.04	**.74**	.10	.09
FtF Meeting	457	5.7	1.76	.24	.10	.21	.20	.04	-.01	**.76**	.09	.08
Email	457	7.8	1.50	.14	.10	.08	.11	.09	.18	.41	**.50**	.16
Phone	457	6.3	1.91	.11	.19	.02	.03	.02	.05	.14	**.86**	.06
Short text	457	5.6	2.69	.25	-.03	.21	-.03	.01	.04	.23	.19	**.80**
Conferencing no video	453	2.4	1.85	**.78**	.10	.03	-.08	.09	.10	.14	.17	.10
Conferencing video	455	2.4	1.75	**.81**	.10	.08	.01	.01	.05	.12	.06	.06
Intranet	457	1.7	1.39	.12	.02	.03	.00	-.01	**.88**	.07	.11	-.02
WhatsApp	456	2.3	2.21	.04	.02	.24	-.03	**.84**	-.05	.09	.11	.02
External social media	456	3.5	2.72	.05	.02	**.89**	-.02	.18	.04	.09	.10	.09
With Supervisor												
Face-to-face	458	6.0	2.03	-.09	.06	-.03	**.82**	-.01	.07	.29	-.08	.03
FtF Meeting	457	4.8	1.55	.17	.05	.07	**.60**	-.02	-.06	.57	-.02	.03
Email	456	6.1	1.61	.09	.14	.13	**.77**	.10	.09	.08	.32	.14
Phone	455	4.5	1.87	.09	.18	.14	**.56**	.10	-.03	-.12	.59	.09
Short text	455	3.7	2.32	.28	-.04	.21	.42	.09	.03	.02	.03	**.71**
Conferencing no video	456	1.8	1.39	**.79**	.00	.09	.04	.10	.16	-.10	.10	.13
Conferencing video	457	1.8	1.44	**.81**	.03	.12	.08	-.03	.14	-.06	.04	.05
Intranet	457	1.3	0.87	.22	-.01	.13	.09	-.06	**.75**	.05	.05	-.04
WhatsApp	455	1.5	1.57	.18	.01	.17	.18	**.78**	-.02	.02	-.01	.06
External social media	457	2.2	1.93	.12	-.01	**.76**	.24	.21	.06	.00	.08	.13
Eigenvalue				3.9	3.5	2.4	2.3	2.3	2.0	2.0	1.8	1.7
% Variance explained				12.8	11.8	7.9	7.8	7.7	6.7	6.5	5.9	5.8
α				.88	.84	.83	.77	.81	.69	.57	.60	.75
M				2.25	6.22	3.23	5.34	1.77	2.07	7.04	7.04	4.85
SD				1.30	1.71	2.15	1.38	1.12	1.77	1.29	1.45	2.04

Combining Basic within Department 1 and 2	**Basic In**
α	.64
M	7.04
SD	1.13

Note: Principal components analysis, varimax rotation
Scale: 1 Never, 2 a few times a year or less, 3 once a month or less, 4 a few times a month, 5 once a week, 6 a few times a week, 7 every day, 8 a few times a day, 9 many times a day.
Media and usage measures adapted from Boswell and Olson-Buchanan (2007) and specified through discussions with the organizational contact.

Table 5
Correlations between Organizational Media Use and Affordances

	Affordances					
Media Use	**Visibility**	**Edit ability**	**Self-presentation**	**Aware ness**	**Pervasive ness**	**Search ability**
Conferencing	.11**	.12*	.17***	.19***	.17*	.08
Basic organizational	.03	.11*	.08	.11*	.12*	-.00
External social media	.12**	.09	.12**	.17***	.12**	.10*
Basic supervisor	-.06	.04	.00	.14***	.07	.02
Intranet	.10*	.04	.08	.14***	.03	.11*
WhatsApp	.07	-.02	.05	.07	.12*	.01
Basic department	.02	.09*	.07	.10*	.17***	.08
Texting	.17***	.22***	.25***	.22***	.27***	.15***

N=429 – 449
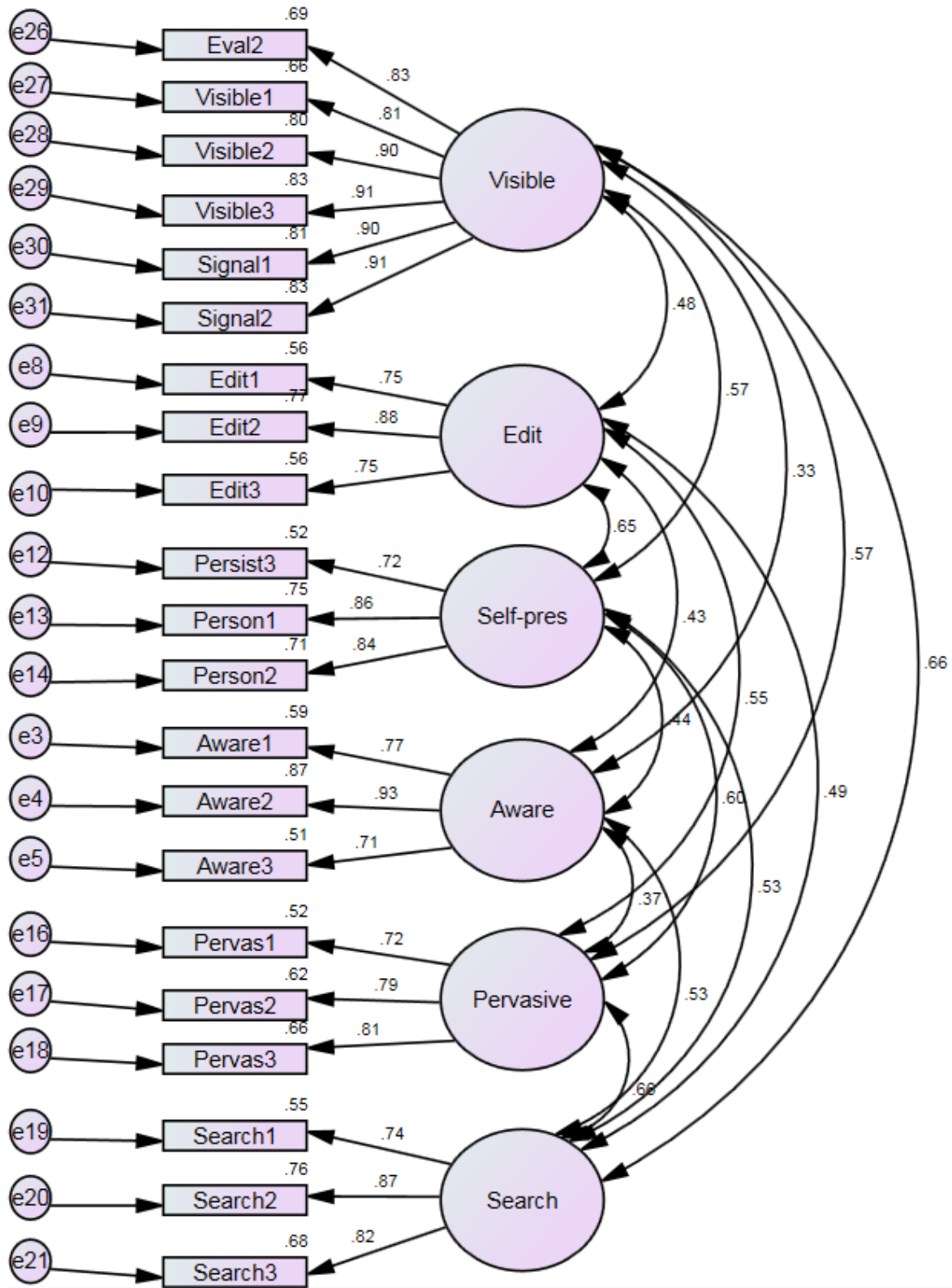Pearson correlations; two-tailed significance tests
* $p < .05$; ** $p < .01$; *** $p < .001$

Figure 1. Revised affordances measurement model.