Technology Materiality and Individual Sensemaking

Completed Research

Sampath Bemgal
Ivey Business School, Western University
sbemgal.phd@ivey.ca

Abstract

Individuals rely on sensemaking process to clarify ambiguities in their work environment by extracting cues and acting on them to bring order. As technologies are deeply embedded in organizations, the form and functionalities of technology materiality can also generate cues during interactions with them leading to individual sensemaking. Using the ontological perspective of sociomateriality, it is proposed that technology materiality, through its affordances, can result in generating conditions that switches the cognition of an individual from automatic processing towards active thinking during interactions. More specifically, the conceptual model advanced here proposes that four types of affordances - cognitive, physical, sensory and functional, trigger cognitive switching conditions of – novel, discrepant and deliberate thinking, leading to individual sensemaking. The proposed conceptualization also contributes to the important notion that sensemaking should be considered as an embodied process in addition to considering it as a rational intellectual process.

Keywords

Materiality, Sociomateriality, Individual Sensemaking, Affordances, Cognitive Switching Conditions.

Introduction

Individuals in organizations deal with many complexities surrounding their work environment. In order to deal with uncertainties in work environment and perform their task activities, individuals rely on sensemaking to understand novel, unexpected, or confusing events (Maitlis and Christianson, 2014). During moments of ambiguity or uncertainty, individuals seek to clarify what is going on by extracting and interpreting cues from their work context, make-sense of what has occurred and through which they try to re-enact the work environment (Weick, 1995; Weick, Sutcliffe and Obstfeld, 2005). Additionally, in order to help individuals handle complex scenarios, organizations adopt and rely on various technologies with new features and functionalities that can assist in handling complex task activities. Because of this, technology materiality is becoming more and more embedded in an organizational environment. The ontology of sociomateriality further suggests that humans and materiality are either - entangled (Orlikowski and Scott, 2008) or interlocked (Leonardi, 2011) and that interactions with technologies results in accomplishing various objectives in new ways. Such perspectives also advance a notion that felt senses and the physicality of a technology can also assist in sensemaking by individuals as they accomplish their task activities. This thinking also supports the notion that sensemaking is an embodied process besides being a rational, intellectual process (Maitlis and Christianson, 2014).

Further, reflecting on the concept of technology, Weick (1990) suggests that technologies are equivocal in nature in the sense that they can lead to several interpretations among individuals. Such mixed effects of technologies suggest that interactions with technologies triggers conditions which makes individuals to stop and reflect on the nature of interactions. Such reflection can further lead to making sense of both technologies and the surrounding environment when dealing with uncertainties. Identifying the
importance of technology materiality, Griffith (1999) in her research, shows how different types of
technology features enable individual sensemaking when they interact with technologies and propose a
feature-based theory of triggers for sensemaking. However, what is lacking is an explanation on how exactly
does a technology materiality enables sensemaking in individuals i.e., the role of technology’s form and
functionality in the process of sensemaking. One way to explore this phenomenon is by closely
understanding the relationship between social and material using the concept of affordances by relying on
the ontology of sociomateriality. This paper sets out to accomplish this purpose.

More specifically, the goal of this paper is to provide the link between materiality affordances and how
perceiving such affordances by individuals can generate scenarios, where individuals switch their cognition
from automatic processing to an active purposeful thinking. Understanding these mechanisms helps in
better understanding the nature of technology equivocality, different technological frames (Orlikowski and
Gash, 1994) and different usage patterns among individuals. Further, focusing on the cognitive aspect of
socio-material interaction, in a way focuses on the ‘being’ of interaction while research mostly focuses on
‘been’ of interaction emphasizing the impacts of interaction.

In the next section, a brief overview is provided on the concepts of sensemaking and affordances. Later, a
theoretical model is proposed explaining how various types of technology affordances enables sensemaking
among individuals along with suggestion of few propositions. This model explains the mechanisms of
cognitive shift in individuals, due to cues generated by technology materiality. Finally, the article ends with
discussing the importance of materiality in the context of sensemaking and why sensemaking becomes an
embodied process when surrounded by technology materiality. Additionally, various implications of this
study are also discussed.

Related Background

Sensemaking Process

Individuals respond to cues that appear to shift their flow of experience and suggest a gap in their
expectations (Barr, 1998). These cues trigger cognition as they attempt to interpret unexpected occurrences
retrospectively, and make sense of ambiguous realities to reduce equivocality by bringing order (Stigliani
and Ravasi, 2012). The noticed cues further play a central role in shaping sensemaking process as it unfolds
(Maitlis and Christianson, 2014). The iterative process of connecting cues to interpretations and back to
cues is important in proper organizing of equivocal circumstances (Weick, 2012). Overall, sensemaking can
be triggered by varied factors such as language, materiality, a building roof, crisis or governmental
regulations (See Maitlis and Christianson, 2014 for a thorough review). The focus here is on technology
materiality and understanding how it can trigger sensemaking among individuals.

Many researchers depict sensemaking as either a cognitive process occurring in individual heads (Klein,
Moon and Hoffman, 2006; Louis, 1980; Starbuck and Milliken, 1988) or as a social process (Maitlis, 2005;
Weick, 1995; Weick et al, 2005). Further, collective sensemaking occurs when individuals exchange their
interpretations of the environment, and by engaging in interactions as a group, they try to construct
counts that would allow them to comprehend the environment and agree on a course of action collectively
(Weick, Sutcliffe and Obstfeld, 2005; Maitlis, 2005). As the focus here is on individual interactions with
 technologies, the cognitive changes resulting from such interactions will be explored here. Researchers
however agree that there is a relationship between individual and group level sensemaking processes where
individual interpretive efforts drives collective efforts (Weick, 1995; Weick et al, 2005). As a result,
understanding the linkages between technology materiality and individual sensemaking can further help in
explaining the importance of materiality when studying sensemaking at a collective level.

Louis (1980), explaining the role of cognitive thought, further summarizes that in familiar, non-surprising
situations, individuals operate in a nonconscious way guided by cognitive scripts and that the cognitive
thought is provoked only when individual senses something out of the ordinary. Extending this observation,
the switch in cognition indicates that individuals start to take notice of cues from such out of the ordinary
situations. Louis and Sutton (1991) explicitly provide conditions under which cognitive gears shift from
automatic to active thinking. Authors identify three conditions that trigger the change in individual
cognition leading to transition from habits of mind towards active thinking. The three situational conditions
include: a) experiences of a situation that is unusual or novel i.e., when something “stands out of ordinary”,

Technology Materiality and Individual Sensemaking
The concept of affordances, with origins in the research studies of ecological psychology (Chemero, 2003; Gibson, 1977), explains the relationship between materiality and the way individuals utilize the material features during their interactions. Affordances are conceptualized to be relational (Hutchby 2001; Zammuto, Griffith, Majchrzak, Dougherty and Faraj, 2007) indicating that they are neither the property of a material artifact or the individual alone but exists in the relationship. The concept of affordances has been studied by scholars in IS research from the perspective of usage of materiality properties in a particular context. Most of the time when referring to affordances, researchers imply ‘functional affordances’ which are the possibilities (due to material functionalities) for goal-oriented actions afforded to specific users by technical objects (Markus and Silver, 2008).

Harton (2003) however suggests that four types of affordances are possible by a technical artifact. These four types include a) cognitive affordances – design features that allows users in knowing something and makes them think b) physical affordances – design features that allows users in doing a physical action with the artifact c) sensory affordances - design features that allows users sense something in relation with cognitive affordances and physical affordances and d) functional affordances - design features that allows users accomplish work (i.e., the usefulness of a system function) which is most widely used in IS research. These affordances can be perceived at any point during individual-material interactions impacting cognition and actions of the individual. Additionally, in an organizational work setting, individuals rely on several technologies to perform their daily work activities. Since most of the interactions are work driven with the goal of completing tasks, perceiving varied affordances that can assist with task completion is highly possible.

Technology Affordances and Individual Sensemaking

As mentioned earlier, sensemaking process begins with individuals noticing the cues from an out of ordinary experience. As technologies are designed in such a way that individuals can appropriate them to achieve their goals, the inclusion of various design elements in the technology form suggests some kind of intent with functionality for each design element. During interactions with technologies, individuals can experience out of ordinary scenarios when utilizing some of the features. The affordances perceived during such interactions have the potential to trigger a change in cognition. More specifically, the four types of affordances (Harton, 2003) resulting from such technology design elements are considered as sources that
generate cognitive switching conditions for individual sensemaking. The conceptual process model of sensemaking process from technology interactions is shown in Figure 1.

![Figure 1. Individual Sensemaking Process from Technology Interactions](image)

The above process model (Figure 1) explains how the interaction with a technology can result in perceiving various affordances which may request the user to perform momentary actions to gain more insights. Such actions result in outcomes which could be equivocal in nature from where cues could be noticed. These momentary actions could be undertaken by individuals to help bring order in their context. Additionally, perception of affordances or momentary actions can further directly result in generation of relevant cues thereby triggering individual sensemaking, since not all outcomes may be equivocal in nature. This intermediate flow from affordances to cognitive switching conditions depends on the existing contextual environment and is considered to be experiential to an individual. Further, this intermediate flow of experience may also depend on the individual and task characteristics. Nevertheless, the technology affordances form a necessary starting point in the whole iterative process of sensemaking.

In order to illustrate the process, let’s consider a customer service application system (CSAS) technology artifact that supports customer service interaction. Building on Hartman’s (2003) example of ‘button’ design element, the application would have various types of buttons in the interface that perform different functionalities such as creating reports, posting on the internal forum or re-assigning the customer ticket. When a ‘button’ is designed, it also communicates its meaning (in terms of its underlying functionality) unambiguously by capturing the intent in label wording. This would help the representative know what type of action is undertaken by the CSAS upon clicking the button and would also signify its appropriateness in the context of the goal-oriented task – which, in this example is resolving the ticket issue. Such perception by an individual indicates that this particular technology CSAS, supports cognitive affordances as it makes the user think. As cognitive affordances are perceived, additional insights are generated that demands a request for thinking by customer service rep about the characteristics of the feature and how it can support the current flow of experience. Such request for additional thinking during the flow of experience triggers a sensemaking process (Louis and Sutton, 1991) in the customer service rep making the person take an organized approach for resolving the ticket. Additionally, the representative could also perform in between actions during this flow of experience and study outcomes to understand more about the issue at hand. As
this intermediate flow of experience is contextual, a more direct proposition can be suggested signifying the influence of cognitive affordances on sensemaking as follows.

**Proposition 1:** Perception of technology supported cognitive affordances by an individual can trigger a conscious deliberation (request to think) condition eventually leading to individual sensemaking during the flow of an experience.

In the same way, if the button itself is located near the features which are interrelated and also if the size of the button is large enough, this would allow users (in our example – customer service reps) to think about the action of clicking on the button if necessary. Such physical affordances by a technology allows easy manipulation and enables physically doing something when needed. In general, physical affordances follow cognitive affordances and are always perceived in task-oriented contexts to achieve a goal. For instance, the customer service rep during a call with the customer can perceive the utility of internal chat window feature’s resizing option, and can use it beside the customer information page to simultaneously seek expert advice from fellow team members during the call flow. Such possibilities for action could result in novel conditions or discrepant conditions (Louis and Sutton, 1991) leading to individual sensemaking. Again, the following possible propositions can result showing the influence of physical affordances on individual sensemaking when intermediate contextual flow of experience i.e., actions, outcomes, cues is recognized to be subsumed in the overall flow of experience.

**Proposition 2a:** Cognitive affordances precede and contribute towards the development of physical affordances.

**Proposition 2b:** Perception of technology supported physical affordances by an individual can trigger either a novel or discrepant condition eventually leading to individual sensemaking during the flow of an experience.

The primary role of any technology is to support a user in carrying out the tasks. As identified earlier, a physical affordance perception results in performing an action on an artifact. Such physical affordances gives access to actual functionality of the artifact i.e., its purpose. Such functionality allows a user to accomplish a task in the work domain. In our scenario, clicking on a button that describes ‘create a report’ will allow a customer service rep to actually create a service report. The focus can then be said to move away from the appearance of the feature to its actual utility. Such affordances are termed as functional affordances. Functional affordances result in outcomes which signifies the usefulness of the artifact. Functional affordances can be considered as an extension of physical affordances when an ‘intent’ or ‘purpose’ is added to the description. Continuing with the previous scenario of button click by a customer service rep, the functionality of button could result in an outcome which can either support the current flow of experience or constrain the experience. Perception of such affordances by the user can result in either novel experience or discrepant experience or can request conscious deliberation from the user (Louis and Sutton, 1991) further leading to sensemaking. As a result, the following propositions can be suggested.

**Proposition 3a:** Physical affordances precede and contribute towards the development of functional affordances.

**Proposition 3b:** Perception of technology supported functional affordances by an individual can trigger either a novel, discrepant experience or conscious deliberation depending on the resulting affording or constraining outcomes, eventually leading to individual sensemaking during the flow of an experience.

When technology materiality helps an individual in sensing, such affordances are termed as sensory affordances. Sensory affordances can be considered as an antecedent to cognitive and physical affordances where it plays an extremely useful supporting role depending on type of features. Users, while interacting with the technology, should be able to sense cognitive and physical affordances so that the actual cognitive and physical actions are performed. Sensing cognitive affordances is essential for initial understanding, and sensing physical affordances is essential for acting upon such cognitive affordances. Sensory affordances can include legibility for text, noticeability of feature or audibility for sound among others that allows users to become aware of or feel the features characteristics. In our example scenario, button label text should be legible enough so that the customer service representative can learn of its use and move the pointer towards it soon or a notification sound on a pop-up window should be present for perceiving the physical affordance of opening/closing it. Sensory affordances by themselves may not directly trigger the cognitive switching conditions but would do so indirectly via cognitive and physical affordances.
Proposition 4a: Sensory affordances precede and contribute towards the development of cognitive and physical affordances.

Proposition 4b: Perception of technology supported sensory affordances by an individual can trigger either a novel, discrepant experience or conscious deliberation indirectly through cognitive and physical affordances, thereby eventually contributing towards individual sensemaking during the flow of an experience.

Summary

Based on the above propositions, technology materiality, through its support for various types of affordances can generate conditions that leads to individual sensemaking as shown in Figure 2. Of the four types of affordances, physical and functional affordances are entwined in the sense that perception of physical affordances could lead to actualization of the purpose of the technology or its features i.e., functional affordances. Additionally, sensory affordances forms the antecedent and contribute towards development of cognitive and physical affordances depending on the type of features available. All the technology supported affordances manifest only upon interaction of user with the materiality and its features. The propositions also show that individual’s perception of technology affordances forms the first step before sensemaking process begins with technologies, indicating that experiences with materiality is subsumed in the sensemaking process. These affordances in turn lead to generation of cognitive switching conditions. Although the Figure 2 does not explicate momentary actions and equivocal outcomes, they are indeed a crucial aspect which lead to cognitive switching conditions. As these are highly experiential to an individual and context (and task) dependent, these are not depicted explicitly here and considered to be embodied in the flow of cognitive switching conditional experiences. Similar to the notion of ecological sensemaking (Whiteman and Cooper, 2011) where the context is natural environment, the context here involves organizational processes, individual practices and task activities embedded with technologies.

Figure 2. Individual Sensemaking from Technology Affordances

Discussion

Sensemaking is a phenomenon through which individuals try to solve discrepancies occurring around them. Although it is established as a rational intellectually driven process, the ubiquitous presence of several technologies in today’s organizations makes sensemaking an embodied process. As such, studying sensemaking requires a different ontological view where the nature of technology materiality is taken into account. The proposed research model advances this notion by explaining how technology materiality triggers conditions that generate individual sensemaking during a normal flow of experience. Mainly, the study conceptualizes that as individuals interact with technologies, many possible affordances such as sensory, cognitive, physical and functional are perceived by individuals. Such perceptions provides cues
that can further help to make sense of the tasks by triggering cognitive switching conditions. Recognizing the importance of materiality and its ubiquitous nature in organizations opens doors for new approaches to theorizing organizational phenomenon. The sociomaterial approach to sensemaking further allows to study practices and processes that enables sensemaking from technologies.

The conceptualization advanced in this article surrounding the process of sensemaking from technology interactions can further be compared to that of dual processing theory (Kahneman, 2011). Building on this, the interactions with technologies starts with an individual using only ‘System 1’ thinking realizing few obvious affordances with less cognitive effort. However, constant interactions could result in realization of the existence of multiple affordances. This could in turn lead to an individual switching towards ‘System 2’ thinking, which requires deeper cognitive effort to reflect on the cues that gets generated in the process. Future research can further explore the proposed conceptual model utilizing this theory.

The intention of this article is to provide an understanding of what does it mean when an individual interacts with a technology and what type of cognitive changes a person experiences during such interactions. This becomes important since individual’s cognitive frame forms the basis for performing subsequent actions. The conceptual model advanced in this paper emphasizes the ‘being’ of an individual cognitive frame when a technology is added into an individual’s environment. This has further implications at a collective level as well. If multiple individuals utilize the same technologies to accomplish a group level activity, the different cognitive frames of individuals will shape the collective sensemaking process. Future research can investigate how the collective sensemaking is influenced by technologies. Further, if the group members use multiple technologies simultaneously, then understanding the interactions among different technologies and corresponding individual level interactions could be further insightful as organizations become more technology or digitally driven.

Another implication of the proposed model is on DeSanctis and Poole’s (1994) notion of faithful and unfaithful appropriation. If the interaction pattern triggers cognitive conditions that deviates away from faithful appropriation of the artifact, then organizations can take steps to ensure individuals make sense of a technology as required for goal achievement. However, if the desired goal is to achieve organizational innovation, then having multiple interpretations of technologies (Orlikowski and Gash, 1994) could be helpful. To support this, organizations can focus on having practices that enables individuals to develop different interactional behaviors. Future research exploring the type of organizational interventions that supports individual sensemaking leading to faithful appropriation of a technology will be further insightful. Although the conceptualized model looks into the cognitive mindset of individuals surrounding technologies for sensemaking process, nevertheless, many other environmental factors such as – structural properties, power, group culture also play an important role on individual work activities. As such, future research should focus on how multiple environmental factors influence technology interactions, and subsequently explain how such deeply embedded context shapes individual sensemaking. As technology usage becomes experiential (Yoo, 2010), it becomes difficult to rationalize the process of sensemaking at a more micro level. This further indicates that, at least in the purview of technology usage, sensemaking becomes an embodied process rather than a purely rational process. Additionally, future research can also build on the propositions advanced here to develop more suitable testable hypotheses depending on the context.

The conceptual model proposed here also has several practical implications. Organizations which are adopting new technologies with innovative features can focus on empowering individuals to sense important cues from their interactions with technologies such that innovative usage occurs. Individuals working in a group can bring their own interpretations of the technology usage which can further improve the technology acceptance rate among group members. Since social influence plays a significant role in technology acceptance, in-depth understanding of technology materiality properties by key individuals will become a major contributing factor to widen technology usage across the organization. Another useful implication is for technology designers, who can utilize the feedback from users and develop design features that can further improve individual productivity.

Overall, besides the outcomes of wide acceptance of technologies and using technologies in new ways to support innovation, there could be many other organizational outcomes that can result from the form and functionality of technology materiality, indicating the far-reaching importance of socio-materiality thinking.
Conclusion

The theoretical conceptualization advanced in this paper aims to provide detailed mechanisms through which technology materiality leads to individual sensemaking. By adopting the lens of affordances, the research model explains how different affordances possible by materiality during individual interactions, triggers conditions that demand individuals cognition to switch from automatic processing towards active purposeful thinking. This switch in cognition leads to individual sensemaking process allowing the person to utilize cues generated from technology interactions. By relying on the ontology of sociomateriality, the proposed view advances the notion of sensemaking as an embodied process, providing insights that can help in conceptualizing more integrated theories of sensemaking.

Acknowledgements

I would like to thank the anonymous review team for their suggestions.

References


