

# Broadening Affordances

**Dhaval Vyas**

Department of Computer Science  
Vrije Universiteit Amsterdam  
The Netherlands  
dvyas@few.vu.nl

**Cristina M. Chisalita**

Faculty of Behavioral Science  
Twente Universiteit  
The Netherlands  
c.m.chisalita@gw.utwente.nl

**Gerrit C. van der Veer**

School of Computer Science  
Open Universiteit Nederland  
The Netherlands  
gerrit@acm.org

## ABSTRACT

Affordance is an important concept in HCI. There are various interpretations of affordances but it has been difficult to design them. Often the treatment of affordances has been as a one-to-one relationship between a user and an artifact. We believe that affordances should be taken into account to support the overall ‘experience of use’ and not just the artifact level considerations. Using a Structuration Theory approach, we argue that affordances need also be treated at practice level – encompassing broader social and cultural aspects. Focusing on the practice level affordance, we provide details of several important factors that affect the use of technology in big organizations.

## Author Keywords

Affordance, Structuration Theory, HCI, Design, Meanings & Interpretations

## ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

This paper explores a broader scope and treatment of affordances in order to develop better understanding of designed artifacts and technologies. In the field of HCI, Gibson’s [6] notion of affordance has been used to understand usability problems, but engineering affordances has shown to be rather difficult. In several approaches to conceptualize affordance, its treatment has been merely as a one-to-one relationship between a user and a technology [5, 8]. However, when a technology is situated in a large organization, where it is used and is affected by more than one users, it is important that a broader view of affordance is considered that encompasses social and cultural aspects of work organizations.

Gibson defines affordance as, “*the affordances of the environment are what it offers the animal, what it provides and furnishes, either for good or for ill*” [6, p.127]. Having its origin in perceptual psychology, affordances are described as a shared relationship between humans and the world. Some cognitivist accounts on affordances limit them to “*properties of the world that are compatible with and relevant for people’s interactions*” [5, p.79]. Recently, however, attempts have been made to broaden the notion of affordances. For instance, taking a phenomenological account, Turner [12] suggests that in addition to the ‘simple’ affordances (as Gibson’s original version of affordance), designers should also take into account the ‘complex’ affordances that include issues such as history and practice. Bærentsen and Trettvik [1] argue that the phenomenon of affordance only exists when a user is actively involved in interaction with a system. To them, user’s active participation with the system is an important determinant of its affordances. Hence, affordance is an emergent property of the material world.

Based on Chisalita’s [2] work on understanding contextual issues in technology use, we focus on the factors that need to be considered for developing better understanding of affordances. These factors go beyond the basic functionality, dialogue and representations of a technology and encompass organization culture, changes in organizations, users’ identity and power differences, their emotional, symbolic and functional values related to the technology, etc. In the rest of the paper we will first provide reasons for developing a broader view on affordances, followed by showing how affordances emerge in practice and what factors contribute to this emergence. Finally, we briefly provide details of two cases where these factors are used to understand the technology use. We show that contextual aspects, within which the technology is being used, affect the emergence of technology affordances and conclude that affordance should be treated as a *product* as well as a *mediator* of human actions.

## A BROADER VIEW OF AFFORDANCES

Recently, several attempts [1, 12, 13] have been made to re-clarify and expand Gibson’s original notion of affordance. The focus these attempts provide can be labeled: interaction-centered, as they emphasize the fact that affordances of a system emerge during users’ actual

interaction with it. Unlike the cognitivist views [5, 8], from the interaction-centered view affordances of an artifact are the possibilities for, both, thinking and doing, that are *signified* by its users during their actual interaction with the artifact. Users actively participate in the interaction with the artifact, continuously interpret the situation, and construct or re-build meanings about the artifact. From the interaction-centered view, affordances are not the pre-determined properties of a technology but a relationship that is socially and culturally *constructed* between the users and the artifact in the lived world. This view also suggests that affordance is an interpretive (in addition to the behavioral) relationship between users and the technology that emerges during users' interaction with the technology in the lived environment. We believe that there are historical and socio-cultural reasons for developing a broader view of affordances in HCI.

*Historically*, in HCI, systems are built to convey designers' meanings and interpretations to the users [10]. The designers determine what possibilities or opportunities should be offered to the users. From a design perspective, this suggests that designers can premeditatedly decide what affordances (possibilities for different activities) of a system should be offered to users [5, 8]. During the technology use, however, users do not just passively receive information. They actively participate in the interaction and also add to this interaction, sometimes beyond what is offered by the designers.

From a *socio-cultural* point of view a broader view of affordance is necessary too, especially in big organizations where more than one actors play a collective role to define meanings of a technology. Additionally, technologies are becoming more complex in terms of functionality and interaction, hence ways to use these are also changing. It is important for the designers to know what impact their technology has on users and vice versa. The current notions on affordances do not adequately reason about the emergent nature of affordances.

#### **AFFORDANCE AT PRACTICE LEVEL**

According to Gibson's view, ways of using a complex technology, for example, is directly perceivable from the technology itself [6]. His original notion of affordance was criticized for supporting only the artifact level considerations (e.g. representations, dialogue, functionality, etc.), leaving aside the actual use of the technology. Additionally, there was a minimal relevance to users' social contexts. In order to understand technology use and to improve design practices, we believe that a holistic view of affordance is required.

Take the Fax machines for example. When the first Fax machine was invented, its main functionality was to allow its users to send and receive Faxes. Overtime, however, users' understandings of the Fax machine evolved as they

learnt to use it for photocopying. Photocopying can be considered as a side effect, rather than a major functionality but through users' involvement and long-term acquaintance, the Fax machine '*afforded*' photocopying. As a result we now see a machine comprising of fax, photocopying and scanning facilities.

During the technology use, users adapt and re-structure their (shared) working practices, hence users' understandings, of what the technology does and symbolizes for, may also emerge over time. We believe that affordances should not be seen as static entities of a technology. In this section we will discuss the practice level affordances that focus on the emergent nature of affordances. We will especially focus on the technologies that are used in big organizations, where more than one actors affect the use of the technology and vice versa. We will draw on Giddens' [7] Structuration Theory to develop our understanding of affordances.

Structuration Theory focuses on human-human interactions and shows that through communications, using power and giving sanctions, we apply social structures in practice. It is one of the most employed frameworks for investigating the use of technology by groups or organizations. There are two views in which Structuration Theory can be applied to understand the use of technology in practice: 'appropriation' and 'enactment'.

The *appropriation* view is used by approaches that focus on structural properties of a technology [e.g. 3]. They observe how users, during their interaction with the technology, adapt their social structures to the technology. Orlikowski [9] proposes the *enactment* view and states that social structures are instantiated only through actions and practice. And they cannot be seen embedded into the technology. So, properties of a technology may not be useful to determine social structures, as they are external to the human actions. Orlikowski suggests that users do not just use the technology as it is given. Users may ignore certain properties of the technology while they interact with it, or invent new properties beyond designers' expectations (e.g. the Fax machine example). During their use, users modify the technology and their understandings of the technology, after it is designed. The repeated and on-going interaction of users with a technology determines the production of structures of technology use, so-called "*technology-in-practice*".

From the enactment view of the Structuration Theory, we can say that a specific format of technology use (technology-in-practice) determines what the technology affords. Affordances of a technology emerge through this continuous process of technology affecting human actions and actions affecting the technology use. In this way affordances refer to the *behavioral* and *interpretive* forms of people's situated use of the technology. This means that affordances do not just have behavioral forms, e.g. "how to physically grab something" but also interpretive forms as to

"what this technology is about". In the following we show several factors that contribute to the emergence of affordances.

## **FACTORS AFFECTING THE EMERGENCE OF AFFORDANCES**

Using a Structuration Theory approach, Chisalita [2] explores the use of technologies in two different settings: 1) in a large governmental organization (a system that supports budgetary processes); and 2) in an international bank (bank's Intranet system). In this paper, we propose four conditions as the main factors based on which affordances of a technology may emerge: technological, cultural, power and interpretive conditions.

- *Technological conditions:* These refer to the functionality, design features and infrastructure of a technology. In a dynamic technology (such as an Intranet) the technological conditions may also include changes in the technology and the frequency of those changes. Technological conditions influence the emergence of affordances, by providing the technical facilities of work and social interaction.
- *Cultural conditions:* These refer to beliefs and values held by a group of people concerned with a technology. In a big organization different subcultures may appear (e.g. team/departmental/professional) [11]. Depending on the values and beliefs of people, technology may be perceived affording different possibilities.
- *Power conditions:* Usually the concept of power is used to refer to formal power – the relation of dominance among different classes of actors based on their hierarchical positions. It is important to note here that power does not have to be just top-down. We consider that power can also be constructed in a bottom-up way [4]. This means that even a group with no formal power can exercise power by bringing changes in the organizations. With regards to the use of technology, power can exercise different social influences on the emergence of affordances like: changing access to applications of technology as regulated by laws; changing the way technology has to be used; changing the way technology use is controlled; etc.
- *Interpretive conditions:* The interpretive conditions refer to members' knowledge of, and attitude towards, the technology.

In fact, these conditions represent the 'context' in which a technology is used. The conditions are reinforced or sometimes changed (even the technological ones) by the very use of technology in a particular way. Due to the fact that these conditions influence the emergence of ways in which technology is used in a particular setting, they can also be interpreted as factors that influence the emergence of affordances of a certain technology.

It is important to understand that all the conditions mentioned above have a combined influence on the emergence of affordances. There is no situation in which one condition influences the emergence of affordances in an independent way. These conditions constitute the context; and the emergence of a certain affordance can reinforce the conditions or, in some cases, change them. The two cases, described below, will provide a deeper understanding and refinement of these conditions.

### **Case 1: The Budgetary System**

Chisalita [2] investigates the use of a technology that supports budgetary processes within a large governmental organization. The system is used with a specific purpose of controlling the budget of other governmental organizations. The culture of the organization can be described as an elite culture (pride, status, power, 'no-mistakes', etc.). Within the organization there are people who work with the system as part of their daily activities, which are evaluated by their managers. In this situation, it is shown how the convergence of cultural, power and technological conditions can lead to the emergence of an unwanted affordance. A certain design characteristic (the system is designed in such a way that any mistake in the budget cannot be undone unless an equivalent amount is detracted from the whole; in this way any mistake is documented and can be controlled – technological condition) combined with an elite culture where there is no room for mistakes (culture condition) and with a situation in which managers are interested in controlling all mistakes made with the system (power conditions) leads to the emergence of an interpretation of the system by the people working with it as a "history pool for employees' mistakes". From that moment on, this interpretation is also part of the interpretive conditions of the people working with the system. The perception of people working with the system is that the system becomes a transparent window affording exposure of their vulnerability in front of power structures (the managers). This in turn leads to feeling of stress when using the system [13] and a tendency of avoiding working with it.

### **Case 2: The Bank Intranet**

The second example comes from an international bank study [2], in which the use of Intranet within different branches of an international bank is observed. At the time of the study there was a transition from a DOS-based system (the "old system") to a Windows based system (the "new system"). This transition required a process in which applications were gradually transferred from one platform to another. As the rules and procedures of the bank changed, new applications were developed (and implemented only on the new Windows-based medium) and the old applications that did not correspond anymore with the new regulations were no longer allowed to be used. Over time, these applications were iteratively blocked in the old system. However, at a certain time certain applications were still

available in the old system. The managers of the bank branches had a mediating role to decide whether to allow (or not) the old applications to run on the system. However, some of the employees used them anyway. For example, one subculture found within bank branches was “service oriented” (cultural condition) with a strong belief that clients should be served as good as possible, opposed to the new management philosophy that required to sell as much as possible to clients. In certain technological conditions (some applications are still available in the old system), power conditions (managers allowing the old application to be kept into the system) and interpretive conditions (employees had the knowledge and skills to operate the older applications), employees used the technology to provide services that were no longer allowed by the management. For the “service oriented” subculture the old system afforded the possibility of fulfilling their values, even if these contradicted management regulations. In this particular case, the kind of historical analysis that is supported by the four factors helped us develop better understandings of the technology use.

#### DISCUSSION & CONCLUSION

In this paper we show that the notion of affordance needs to be treated at practice level, in addition to the artefact level. When it comes to design, the artefact level affordances of a technology refer to the functionality, dialogue and representation of the technology. This requires understanding of the one-to-one relationship between a user and a system. However, dealing with the practice level affordances requires going beyond this one-to-one relationship and understanding the cultural and social effects on the human-technology interaction.

The two cases suggest that even when a system is technologically functional, usable and efficient, there are contextual aspects that may affect the use of the system. Our notion of affordances allows designers to consider the broader impact their designed products could have in a socio-cultural context. This supports the HCI design processes in two ways: 1) it views users as active creators, and 2) it allows designers to focus beyond the one-to-one relationship between users and artefacts or technologies.

#### Affordance as a ‘mediator’ and a ‘product’ of human actions

Our notion of affordance, influenced by the Structuration Theory, suggests that affordances are the *mediator* as well as the *product* of human actions. Affordance is a mediator in the sense that it offers, and at the same time constrains, action possibilities and opportunities to use the properties of a technology that are inscribed by designers. On the other hand, it is a *social* product of human actions, as through practices users develop new understanding of what the

technology is and how to use it. The four conditions (technological, cultural, power, and interpretive), in combination, affect the emergence of affordances. We suggest HCI practitioners to take into account these conditions while designing systems for large organizations.

#### ACKNOWLEDGMENTS

This work is partially funded by a generous grant from Microsoft Netherlands.

#### REFERENCE

1. Bærentsen, K. B., and Trettvik, J. An activity theory approach to affordance. *Proc. of NordiCHI'02*, ACM Press: NY, (2002), 51-60.
2. Chisalita, C., M. *Contextual issues in the design and use of technology in organizations*. Ph.D. Thesis. Vrije Universiteit Amsterdam, the Netherlands, 2006.
3. DeSanctis, G. and Poole, M. S. Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science*, vol. 5, 1994, 121-147.
4. Fox, S. Communities of practice, Foucault and actor-network theory, *Journal of Management Studies*, vol. 37, 2000, 853-867.
5. Gaver, W. Technology affordances. *Proc. of CHI'91*, ACM Press: NY, (1991), 79 – 84.
6. Gibson, J.J. *The Ecological Approach to Visual Perception*. Houghton Mifflin Company, USA, 1986.
7. Giddens, A. *The constitution of society: outline of the theory of structuration*. Cambridge: Polity Press, 1984.
8. Norman, D. A. *The Psychology of Everyday Things*. Basic Books, New York, 1988.
9. Orlikowski, W., J. Using technology and constituting structures: a practice lens for studying technology in organizations. *Organization Science*, vol. 11, 2000, 404-428.
10. Sengers, P., and Gaver, W. Staying open to interpretation: engaging multiple meanings in design and evaluation. *Proc. of DIS'06*. ACM Press: NY, (2006), 99-108.
11. Trice, H., M. and Beyers, J., M. *The cultures of work organizations*. Prentice-Hall, 1993.
12. Turner, P. Affordance as Context. *Interacting with Computers*. Vol 17, 2005, 787-800.
13. Vyas, D., Chisalita, C.M., and van der Veer, G.C. Affordance in Interaction. *Proceedings of 13<sup>th</sup> European Conference on Cognitive Ergonomics (ECCE-13)*. ACM Press: NY, (2006), 92-99.