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Affordances of online technologies: More than the properties of the technology

David Day
Hawker College, ACT

Margaret Lloyd
Queensland University of Technology

Abstract

This paper argues that concepts derived from affordance theories are highly useful in understanding the role of online technologies in learning. However, it is suggested that the value of this approach is maximised when the focus is moved away from the inherent properties of the technologies to the opportunities for learning provided by the total context in which the technologies are embedded. Recent examples from educational literature are used to illustrate this approach to the interpretation and application of affordance theories.

Introduction

Online technologies have unique properties (Garrison & Anderson, 2003) raising the question of how these properties might be described in terms of their possible role in supporting learning (Smith & Dillon, 1999). In recent years, the term “affordance” has increasingly appeared in educational literature, especially that related to the use of online technologies in education. The term has been used particularly in the context of attempting to relate the attributes of various technologies to their potential value in the learning process. According to Anderson (2004), “the greatest affordance of the web for educational use is the profound and multifaceted increase in communication and interaction capability” (p. 42). This affordance is evidenced in the contemporary descriptions of Web 2.0, or the read/write web (Price, 2006), a concept that has been increasingly adopted to describe a perceived second-generation of the web that “is about the architecture of participation” (Barsky & Purdon, 2006, p. 65), rather than the set of linked information sources that characterised Web 1.0. Examples of Web 2.0 services are wikis, blogs, folksonomies, social networking sites, podcasts, and syndicated content.

The position argued in this paper, and illustrated through the scenarios, is that it is too simplistic to view learning outcomes as depending solely on the properties of the technologies. Rather, they result from a complex interaction of factors that contribute to a learning context. Affordance theories are able to accommodate this view of the relationship between online technologies and learning outcomes.

Scenario 1

Twenty-five secondary school students sit one to a computer in one of the school’s computer laboratories. The students are in a Science class that is currently studying famous scientists. Their task, as set by their teacher, is to use a wiki to collaboratively develop a set of notes about Louis Pasteur. The teacher has recently attended a professional development presentation about Web 2.0 technologies where she learned that a key affordance of wikis is the collaborative construction of knowledge. This

immediately attracted her interest because of her constructivist pedagogical beliefs. Close observation of the class shows that some students are engrossed in the task, others are trying but having difficulties with the software or with finding any information to add to the wiki, one student is writing notes on a piece of paper rather than contributing to the wiki, while other students are not engaged in the task at all, preferring to talk amongst themselves about unrelated topics or surf irrelevant sites on the Internet. One boy is engrossed in a quiz game about famous scientists he discovered while searching in Google. Another student has discovered how to create a new wiki site on which he is creating his own presentation about Louis Pasteur without any collaboration with other students. Two students start to discuss the topic aloud but are quickly told by the teacher that they should only collaborate using the wiki. Three students who are in the Advanced Computer studies class on another line have declared loudly on at least twenty occasions that they are utterly bored because they have done this activity many times before. At the end of the lesson the teacher is disappointed because only a few of the students appear to have achieved the learning outcomes linked to the affordance she had identified as being offered by the wiki technology.

Careful analysis of Scenario 1 leads to at least two important conclusions. First, the identified affordance is clearly present in the technology because some students are successfully utilising it to create a genuinely collaborative text. Second, there must be other factors present in the learning context that are interfering with the actualisation of the affordance by the other students. Some of these factors would appear to relate to different student characteristics, including prior knowledge and skills, learning styles and motivation, while others might result from the physical environment, including the available access to information resources, the attitudes of the teacher, and the degree and nature of structuring of the learning context.

It can be argued that, in technological terms, Web 2.0 does not provide any new possibilities for use that were not already inherent in online technologies. While Web 2.0 does not involve any update of web technical specifications, most proponents of the concept describe Web 2.0 in terms of new ways that the inherent possibilities of the technologies have been used. O'Reilly (2005) believed that these new uses emerged within the context arising from the bursting of the dot-com bubble in 2001. In other words, a changing sociocultural context gave rise to the perception and development of new uses for the same technologies. Similarly, a changing learning context can affect the way that the inherent properties of a technology will be realised in learning outcomes.

Development of affordance theories

Affordance theories are a rich source of useful concepts for describing how attributes of online technologies interact with the other elements of a learning context, including learners, teachers and the physical environment. Before using the concept of affordance to theorise the role of online technologies in learning, care must be taken to define exactly what is meant by “affordance” because the concept is “not well understood” (McGrenere & Ho, 2000, p. 179). The origin of the term “affordances” is generally attributed to the perceptual psychologist, J.J. Gibson, who used it as a core component of his ecological theory of human perception (Gibson, 1979). Affordances are what the environment offers an organism referring “to both the environment and

the animal in a way that no existing term does” (Gibson, 1979, p. 127) and were thus seen as properties of the environment relative to a specific organism or group of organisms. The organism’s capabilities for action were referred to as “effectivities” with action being a product of the interaction between properties of the environment and characteristics of the perceiver. In more general terms, perception was seen as emerging from the mutual constraints on action determined by characteristics of both the perceiver and the environment. A more recent definition similarly offered that affordances were “the attributes that provide potential for action” while constraints were “the conditions and relationships between attributes that provide structure and guidance for the course of actions” (Kennewell, 2001, p. 106). In this view, constraints are not seen as the opposite of affordances but rather as “complementary and equally necessary for activity to take place” (Kennewell, 2001, p. 106).

Gibson’s (1979) theory of affordances was adapted to the design of everyday objects by Norman (1988) whose initial work confused the concept of affordances inherent in an object with the idea of perceived affordances. In later work, Norman (1998) clarified the distinction between “real” and “perceived” affordances. While not making a separate category for affordances that could actually be used, Norman (1998) did note that “the perceived affordances are what determine usability” (p. 123). In contrast to Gibson (1979), Norman (1998) linked affordances closely with the mental and perceptual capabilities of the observer.

Other theorists have developed different categorisations of affordances based on Gibson’s original concepts (Gibson, 1979). For example, Gaver (1991), working in the field of human-computer interfaces (HCI), extended the original definition to include the idea of complex affordances, namely nested, grouped in space, and sequential affordances where “acting on a perceptible affordance leads to information indicating new affordances” (Gaver, 1991, p. 82). Warren (1995) developed the idea of degrees of affordance, in response to a belief that Gibson’s (1979) binary view of affordances, as existing or not existing, was too simplistic. Further to this, Turner (2005) argued that affordances should be classified into “simple” and complex affordances that embody such things as history and practice.

Affordances in educational contexts

If these ideas about affordances are to be helpful in understanding the use of online technologies in education, then it is important to be able to describe the affordances made available through this medium. Conole and Dyke (2004) attempted such a description by constructing an initial taxonomy of information and communication technologies (ICT) affordances based on identified features of the late modern age such as uncertainty, speed of change, non-linearity and multimodality. Apart from questioning whether these categories would suit the needs of a classroom practitioner, it is suggested that this taxonomic approach goes part of the way towards describing affordances. This is because, while it considers the potential affordances of a technology, it excludes the myriad of other contextual factors that determine the degree to which these affordances are able to be perceived and used by learners.

It may be that the term “affordances” is simply a new term for a concept that had previously been explained in different ways. For example, Ally (2004) described the idea of different technologies having particular attributes providing specific opportunities but did not use the term “affordances.” However, it can also be argued

that the term might also usefully provide a new perspective for conceptualising the role of online technologies in education. This acknowledges how technologies are intricately related to the many other elements of the learning context that can shape the possibilities they offer to learners, the way learners perceive those possibilities, and the extent to which the possibilities can be realised.

According to Gunawardena and McIsaac (2004), the question that should be evaluated is “not which medium works best but rather how best to incorporate media attributes into the design of effective instruction for learning” (p. 378). Each medium consists of many attributes that could affect that medium’s instructional value and it is more relevant to examine each attribute for its pedagogical possibilities relative to the needs of learners than to generalise the impact of the medium as a whole (Lockee, Moore, & Burton, 2001). Smith and Dillon (1999) suggested a framework based on identifying categories of attributes embedded in each delivery system that can be used to support learning in different ways. Many studies have tried to control for this by delivering the same strategy by the different media being compared. By so doing, they removed the very differences that make one medium a better choice than another in a given learning context. It is possible that new types of learning, such as those based on constructivist principles, are not being captured in research because there is a failure to adequately account for the context variables that impinge on the learning (Underwood & Dillon, 2004).

There is an alternate view that emphasises the impact of technological affordances within a context rather than as discrete from it. Context is here seen from a constructivist viewpoint as being something that is “woven together with the act of learning, rather than around it, as conveyed by the word ‘environment’” (de Figueiredo & Afonso, 2006, p. 12). The concept of context also refers to “the relationship between a setting and how participants interpret the setting, including the meaning of practices” (Moschkovich & Brenner, 2000, p. 463). For example, Kennewell (2001) saw affordances as referring to a much larger part of the learning environment than just the tool. In describing a framework for analysing the effects of ICT in the classroom that recognised the large number of contextual variables at work, it was concluded that any use of ICT does not act independently of these factors. Therefore, it becomes impossible to identify the most suitable ICT to meet particular learning objectives without detailed reference to the context. Although all the variables cannot be controlled, they can be analysed systematically in each setting. This analysis needs to go beyond simply looking at the way learning is mediated by ICT. It needs to consider the ways in which both ICT and other factors contribute to learners’ capabilities for bridging the gap between potential and actual activity in a learning setting.

Particularly in constructivist learning approaches, the role of the teacher is to orchestrate the supporting features, including the technology, of a learning context so that learners can use these features together with their existing abilities to achieve learning task outcomes (Kennewell, 2001). Kennewell supported a total context view of affordances by recognising that the properties of a technology, the characteristics of a learner, and many other factors in the learning context interact in a complex manner to generate the actual affordances for learning. Scenario 2 will illustrate how the management of these factors supports the affordances inherent in the technology.

As part of a major literature review of pedagogy related to ICT in primary and secondary schools, Webb and Cox (2004) employed the concept of affordances extensively when identifying trends in the ways in which ICT is understood and used in the school curriculum. Like Kennewell (2001), they stressed the need to consider the possibilities provided by the whole learning context when examining the use of ICT in education. However, they particularly emphasised the importance of the values and beliefs of the teacher with respect to the importance of ICT for learning, the teacher's understanding of the affordances of a range of ICT resources, and how they might best support students in making use of those affordances in learning interactions. They believed that the need to incorporate knowledge of new affordances provided by the use of ICT in learning environments has increased the complexity of pedagogical reasoning that teachers need to carry out in their planning and teaching. They suggested that, once teachers have decided what affordances are likely to benefit their students, they can facilitate their students' learning in three ways:

- by providing them with the affordance;
- by increasing the degree of an affordance provided by ICT, for example by prompting students to predict the results of a simulation;
- by giving students additional information about an affordance, for example by explaining and demonstrating a feature of software.

(Webb & Cox, 2004, p. 239)

From an extensive examination of literature describing the use of ICT in different subject areas, Webb and Cox (2004) concluded that some types of ICT provide affordances across a range of subjects while others facilitate much more specific affordances to particular subjects. In a similar vein, John and Baggott La Velle (2004) used a case-survey methodology and sociocultural theory to examine whether teachers from various subject areas differ in the way they perceive the role of ICT in their teaching as a result of their subject identities, personal theories and pedagogical styles. The study found that the use of ICT is affected by the ideologies of different subject areas and that many teachers transfer their own private affordances to their classroom setting.

Webb (2005) analysed how affordances of ICT-rich environments might be used to support the learning of science in schools and emphasised a number of features of context-oriented affordance theories. These included the ideas that the same environment can enable different affordances for different learners, that features of a range of different aspects of the environment may compound together to provide an affordance, and that whether or not a person perceives an affordance depends on the information available as well as the person's disposition. These principles were transferred to educational contexts to argue that many components of such settings can interact to provide affordances for learning. ICT is but one of these components.

Furthermore, Webb (2005) argued that the affordances provided by ICT can interact with other elements of contexts to enhance and support a wide range of pedagogical innovations. Particular support was given to constructivist learning theories and conceptual change, emphasising that teachers need to be able to use their knowledge of learners and their understanding of their subject, together with a recognition of the

affordances of various ICT resources, in order to most effectively enable their students to meet learning objectives (cf: Kennewell, 2001).

Wijekamar, Meyer, Wagoner and Ferguson (2006) examined the influence of prior experience on learners' perceived affordances for computers. They recognised the importance of both the individual learner and the tool in the affordance relationship and acknowledged that the same tool might have different affordances for different individuals. However, they also recognised the role of other contextual factors in shaping learners' experiences and ultimately the actual affordances provided by a contextualised tool to a learner. They suggested that the current generation of students has spent the majority of their time with computers in playing games and communicating with peers. Based on the results of studies in K-12 and undergraduate settings, they argued that the students' affordances for computers relate strongly to entertainment and communication rather than to learning. This raises important questions about whether educators should attempt to employ these affordances to promote learning or whether they should try to change the affordances and to what extent can entertainment and communication affordances overlap with learning affordances. They contended that there is a fine line between affordances that motivate and engage learners and those which distract them from worthwhile learning.

Scenario 2 builds upon Scenario 1 by altering several variables. The changes made reflect the theory presented in this paper particularly relating to the recognition of learner and tool in the affordance relationship. It also offers a pragmatic management model for making the most of the ICT employed.

Scenario 2

The same group of students that we observed in Scenario 1 is engaged in a similar task with the same teacher. They are required to use a wiki to collaboratively produce a document about famous scientists. However, this time there are some significant differences in the learning context. The students are working in a classroom where the desks are arranged in pods with a networked computer to each pod. Students have been allowed to negotiate about which scientists they would like to study and have been organised into different groups based on their choices. Within each group, students are actively encouraged to discuss their ideas or to map them out on paper before entering them into the wiki. There is a collection of books about famous scientists and some students are using these, rather than, or in addition to, the Internet to find information. The teacher started the lesson by displaying some existing wikis to the class as well as presenting a demonstration of the online software that was used to produce them. She also provided a list of useful websites with relevant information. The three students from the Advanced Computer Studies class who have had prior experience with wikis have been nominated as "help desk personnel" and are busily answering queries from the different groups. When not required to provide help, they have been challenged by the teacher to collaborate on using a wiki to create an online quiz about scientists. One boy, who has adamantly insisted that he would prefer to work alone, has been allowed to do so but after a while has been observed wandering across to one of the groups to see what they are doing. At the end of this lesson the teacher considers that most students have made some progress in achieving the identified learning outcome.

Conclusion

Affordance theories provide useful concepts for understanding the place of online technologies in learning. However, the usefulness of these concepts is improved when affordances are seen as being products of a whole learning context, of which online technologies are an integral part, rather than being inherent properties of the technologies in isolation from the context in which they are used. Another way of explaining this context-based concept of affordances is to view technologies as having potential affordances. However, the actualisation of these potential affordances can be understood only with reference to all the contextual factors that act to promote or constrain them.

In the second scenario the teacher has moved beyond the idea that simply providing an online technology with an identified affordance to match her desired learning outcomes is a sufficient condition for success. In addition to the properties of the technologies, she has considered the characteristics of the learners and a host of other factors that can act to enhance or constrain the impact of the technologies on affordances for learning.

For a start, learners need to be able to perceive the potential affordances of the technologies and then the learning context conditions need to support the use of the perceived affordances. The teacher has manipulated where possible the conditions of the learning context to help the students see the affordances and to support the potential affordances of the technology. She has provided structure by demonstrating models of the required product, building in technical assistance and collecting a range of different resources.

In practice, even with suitable structure, it cannot be assumed that the affordances for learning that might appear to be provided by properties of online technologies will be realised in any given context. Learning contexts are sufficiently complex that there is always a degree of uncertainty in planning for the use of online technologies. In the second scenario the teacher has modified her attitude in recognising and addressing this uncertainty by allowing for a higher degree of flexibility in the use of the online technology by her students. She has allowed for individual differences in the way the way different students prefer to go about the task, without altering her pedagogical objectives. She has also provided a more flexible physical environment and a wider range of information resources. Although she has insisted on the use of one particular online technology in this class, it is anticipated that she would be able to facilitate greater flexibility in choice in the future, after having introduced a range of technologies to her students.

A challenge for research into the use of online technologies in learning is to provide guidance to teachers when they are attempting to design their learning contexts with an appropriate mixture of structure and flexibility. Affordance theories suggest that both conditions are required if the combined effects of all elements of a learning context on the use of the inherent properties of a technology are to be accommodated.

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