

# **Epistemology and conceptual resources for the development of learning technologies**

## **Abstract**

The issues raised by the design and development of technologies to enhance learning has led to a demand for an appropriate language and form of conceptualisation. However we are insufficiently familiar with the way in which different types of mediated tool use occur, to develop the theoretical models needed for the development of this language and form of conceptualisation. In its absence a somewhat eclectic variety of concepts and research, such as the concept of affordance, are recruited in accounts of learning with new technologies. In looking briefly at the relevant area in philosophy this paper will consider whether or not the use of concepts such as affordance give adequate weight to social practice, meaning and knowledge in the design of educational technology. A fruitful source for work in this field which has not been sufficiently exploited is philosophy, particularly recent work in epistemology.

Key words: affordance, epistemology, meaning, perception, knowledge.

## **Introduction**

The use of new technologies in education would appear to offer a powerful alternative to traditional formal learning and what is normally characterized as the transmission mode of teaching. There are the possibilities that technologies open up for the presentation of materials in a variety of forms and the opportunities for working on materials rather than passively consuming them. However, the potential of technology to enhance learning can only be realised if it is based on a secure foundation of a robust understanding of learning, teaching and knowledge.

It is important to stress that education, as it is understood in this paper, goes beyond the simple acquisition of information and certain capacities to follow rules or procedures, and involves the development of the capacity of judgment; the capacity not merely to respond passively to events but the ability to actively make decisions appropriate to a variety of contexts.

Spelling out what a robust understanding of learning and knowledge entails is far from straightforward. Here just one difficulty can be noted, namely that the study of learning is not an established discipline as is the case for physics or chemistry. There is not an established paradigm of learning in Kuhn's sense of the term, that is to say there is no agreed framework of thought in which ideas are communicated and research is developed. The emergence of the 'learning sciences' in recent years is a significant attempt to draw together a disparate research field (Sawyer 2006). In many

ways this development has arisen as a result of the intensive introduction of new technologies into education. With the attempt to enhance learning via the use of technologies, the design of learning has become paramount, in turn demanding detailed attention to claims made and their presuppositions as well as to the possibility of generalising results.

The lack of an established paradigm currently has the consequence that one term may have a variety of different meanings or an idea may be advanced in one area whilst having been rejected in another. The aim of this paper is to draw attention to this insufficiency; the way in which concepts common in the literature on learning-technologies are inadequate for their intended purposes and are based on epistemological assumptions that are disputed. This paper will aim to indicate how the study of some of the classical questions of philosophy make some contribution to overcoming these difficulties.

As a way of accessing these questions, attention here is centred on the concept of affordance, in particular the function that it is called upon to perform in the theorisation and investigation of learning with technologies. It is argued that the concept gives insufficient weight to both knowledge and social practice (Alrechtsen, Andersen Bodker and Pejtersen 2001) and is regularly used in a form that fails to recognise what is distinctive about human learning. Here, it is not affordances as such that is of concern but as a concept that provides ready access to the issue of representation and meaning and therefore a way of raising broader questions concerning the nature of human learning. In turn this introduces issues which illustrate the importance of epistemology.

The concept of affordance itself has a technical meaning within ecological psychology but even within this well-defined area it is still the subject of debate and disagreement - what it involves is still being worked out (Stroffregen 2000). Nevertheless, the term has slipped into the vernacular of work dealing with what technologies can offer learners. At this point, questions arise illustrating just how much remains to be done to make our understanding of the nature of learning explicit. In philosophical terms making explicit means bringing into the open exactly what meaning is being carried by a term and what is being taken as given when claims and judgments are made.

The term affordance is frequently used without any careful specification as to what it means (Boyle & Cook 2004; McGenere & Ho 2000). Although authors rely on the original usage of the concept in the psychology of perception, the meaning is broadened when applied to education. For example in Conole and Dyke's discussion of the affordances of information and communications technologies in relation to education the following claims are made: "Exposure to the experience of others is a key ingredient to effective learning and a potential affordance of ICT" and "[a]nother affordance of ICT is the potential for multi-modal and multi-linear approaches to learning" (Conole & Dyke, 2004, p.119). Both of these claims carry far more than their authors might have intended. Rather than speaking in general terms of how ICT may offer or *afford* opportunities when used within carefully designed educational contexts, the authors prefer the use of the technical noun 'affordance', a word made up by Gibson to communicate the possibility of direct perception of meaning. This alters the focus of attention and contributes to the view that technologies can offer educational advantages independently of the individuals engaging with them for

specific purposes. In a recent article on ICT and Science Education, Webb refers to the origin of the term affordances in Gibson's theory of the ecology of perception saying:

Just as in an ecological system in which affordances for a particular organism depend upon the potential interaction between organisms and the environment and interactions with other organisms, so in an ICT-supported learning environment affordances are provided by interactions between hardware, software, other resources, teachers and other students.

(Webb, 2005, p. 707)

Again slippage in the use of the term while making use of Gibson's concept to refer to the whole learning environment, detracts from crucial educational issues. For example, to what extent is it possible to speak of "direct perception" when *learning* is the issue under consideration? The leap from ideas originating in perceptual psychology linking perception and action in a non-cognitive relation of organism and environment to an educational context dependent on interactions between humans, is at the very least questionable. Moreover, the idea of direct perception is controversial within psychology. Gregory has long argued, in contrast to Gibson, that perception involves predicative hypotheses, that knowledge is a prerequisite for perception and that experience is only indirectly related to external reality (Gregory 1997, 1998). Laurillard, Stratfold, Luckin, Plowman & Taylor (2000) note that the term affordance has common currency for 'describing characteristics of the learning process'. They comment approvingly that although the word is borrowed from the psychology of perception: 'it expresses very well the fact that there is an internal relation between

the perceiver and the perceived'. However, they do attempt to delimit how the term might be applied: 'We may like to think that a lecture affords learning, but the only affordances we can be sure of are those constituting its definition - it is a vocal presentation, and thereby at least affords listening' (Laurillard et al 2000, p. 3).

Following Gibson, it might be more accurate to say that all that the lecture involves (by way of affordance) is a cacophony of sound albeit expressive sound. Listening involves an *intelligent* engagement on the part of the audience.

Had the term affordance been made explicit (i.e. its connection to other concepts been made clear), as for example the idea of a particle has been made explicit, this type of inconsistency would not arise. Whether it matters that the term is not made explicit depends upon what weight of argument is being carried by the term or, more importantly, whether the use of the term forecloses areas requiring further investigation. The noun "affordance" carries a greater weight of meaning, when incorporated into accounts of technology-enhanced learning, than the verb "afford". Where it is argued that the *affordances* of educational technologies have educational benefits, the concept of affordance really needs to be spelled out in some detail. In the complex case of education, the derivation of the noun affordance, where it is taken to mean that an object or technical situation can be immediately grasped, is quite misleading. Webb (2005) includes the disposition of the student as a factor relevant to the effect of an affordance but it is precisely the disposition of the student that the whole concept of affordance is avoiding when it is transferred from the realm of animals and environment to human learning.

A particular epistemology, that is a particular set of ideas about what it is to know,

how knowing occurs and how knowledge is possible, underpins the approach to learning enhanced by new technologies here. An aspect of this epistemology which has particular importance concerns both representation and meaning. In this paper I take up some of the questions concerning meaning by looking at those streams of contemporary philosophy which have instigated a radical reopening of the question of *Mind and World*. It turns out that this reconsideration parallels the work of Vygotsky (Bakhurst 1997) and through Vygotsky a connection to education is forged.

### **Affordance and Meaning**

The term affordance was coined by James Gibson who developed the concept as a core element of his theory of the ecology of perception. He distinguishes the noun affordance from the verb to afford saying “I mean by it something that refers to both the environment and animal in a way that no existing term does. It implies the complementarity of the animal and environment” (Gibson, 1986, p. 127). His theory of ecological psychology addressed what he saw as the inadequacy of accounts both in mentalist terms, emphasising the subjective constitution of concepts, and in behaviourist terms emphasising habits. He was concerned to provide a naturalistic account of animal-environment reciprocity drawing particular attention to the way in which our bodily activity is constrained by ecological position. As an example of what he meant by affordance he wrote of:

an elongated object, especially if weighted at one end and graspable at the other affords hitting or hammering (a club). A pointed object affords piercing (a spear, and arrow, and awl, or

a needle)...users of such tools must keep within certain limits of manipulation, since they themselves may be cut or pierced.

(Gibson, 1986, pp.40-41)

The idea that an organism's responses to an environment could operate without requiring a higher level of cognitive awareness, is central to the idea that meaning is contained within the environment itself or by virtue of the relation existing between the organism to its environment (direct perception). The complexity of what is involved here, for the application of the concept in education, pivots on how we understand the process of human perception and its relation to meaning. Although 'meaning', if we can speak about the term in this physical sense, would arise directly due to the organism/environment relation, Jones argues that Gibson struggles with the issue of meaningful perceptions, arguing that at points in his work Gibson was in fact arguing that meaning could be inherent in an object (Jones 2003). Distinguishing his own view from that of Koffka's, Gibson argues that whereas in Koffka's view the 'value of something was assumed to change as the need of the observer changed' his own concept affordance had a crucial difference:

The affordance of something does *not change* as the need of the observer changes. The observer may or may not perceive or attend to the affordance, according to his needs but the affordance, being invariant is always there to be perceived.

(Gibson, 1986, p.139)

The issue of value and hence meaning is the crux of the matter; what meaning is and how it may be understood in relation to thought, learning and knowledge. This cannot



but involve a consideration of the distinctive relation of humans to the world that they inhabit and the extent to which that relation is one characteristic of an animal or a *human* nature. If it is the case that *meaning* can be conveyed directly to our senses by virtue of a co-evolved relation with an environment then the design and development of technology-enhanced learning is quite a different matter than if it is the case that humans develop intellect, not through a cumulative build up of sense data but instead, as Vygotsky proposed, by enculturation into a humanized environment. Education, a peculiarly higher form of behaviour, cannot be adequately understood by starting from the standpoint of an empiricist epistemology. Unlike animals which evolve human beings also develop. And in this process of development, through which whole new needs and capacities are created including new ways of thinking about the world, acting in it and on it, education plays a crucial role. It is only when it is conceived in the most wide of contexts that its importance can be fully appreciated. The issues involved in articulating the distinctive character of human knowing and of knowledge go beyond the reach of this article. However, in so far as philosophical work raises questions concerning the use of the concept of affordance within social practices, just one small aspect will be considered below; the difference between mechanical and human responsiveness to the world.

The concept of affordance, in the sense of conveying meaning directly, was taken up and developed further by Donald Norman (1988) in his book *The Psychology of Everyday Things*. A major theme of his book 'was the attempt to understand how we manage in a world of tens of thousands of objects, many of which we would encounter only once' and Norman's response to the question was 'that the required information was in the world: *the appearance of the device* [my emphasis] could

provide the critical clues for its operation' (Norman, D.1999, p. 38). Norman's work played an important role in the uptake of the concept of affordance although the concept was used in a way that Norman had not originally intended. The benefits of a further means for defining design criteria detracted from a better appreciation of what was really involved in the concept. The concept has currency in work concerned with the interaction between humans and technologies and, as such, figures in consideration of how new technologies can be used to enhance learning.

In Gibson's view objects disclose themselves directly to the perceiving subject since he conceives information as a direct relation between an organism and its environment. Potentially this is a very powerful argument, as it cuts through problems concerning representation and the like and makes perception the remit of a direct and straightforward relation. However, it is open to the criticism that its directness closes off the space for meaning and effectually rejects the whole issue of interpretation. Gibson's argument has obvious strengths. It is widely used by designers (e.g. in calculating the optimum tread of a step required for a particular mode of climbing) however, it is not clear that these strengths qualify it to be applied to education. The reason for this is it leaves no space for a full conception of meaning. As an exponent of Gibson's ideas, Jones makes meaning follow from direct experience; 'objects and events have inherent meaning which is detected and exploited by the animal without mental calculation' (Jones 2003, p.107) but this derivation of meaning directly from the sensual perception of objects is highly questionable. At least when used in relation to higher order processes such as education it requires the most careful application. For example in an earlier passage we saw that Laurillard et al said that lectures afford listening – exactly the same issue arises here. What lectures afford in the technical

sense is the hearing of sound, listening involves the translation of sound into meaningful statements and this relies not only on the sound and the organisms response but a receiver which is capable of making this construction. Such a capability requires the induction into culture and into the use of language i.e. it depends upon the social development of mind.

The key question that arises in this context is whether or not meaning is specifically a human characteristic. A human's relation to its environment involves concept use, i.e. it is mediated. That is not to say that any one individual is necessarily aware of concepts in play as background to their responsiveness. However, it does mean that our contact with the world as humans rather than animals involves a different relation, one mediated by meaning (i.e. reasons). The philosopher Robert Brandom provides a helpful way of thinking about the issue of our distinctive relation to the world. He raises the question of how it would be possible to distinguish between a human and machine response if both could be conceived in terms of 'differential responses' to an environment. For the purposes of the argument being developed here I will take the phrase 'differential response' to be implicit in the idea of direct perception contained in the concept of affordance.

It is Gibson's claims that 'the basic affordances of the environment are usually perceivable directly, without an excessive amount of learning' (Gibson, 1986, p. 143) that has proved highly influential. To the extent that technologies are self-revealing the concept of affordance has clearly got a crucial part to play in their design. However, questions remain of just how self-revealing technologies are in the context of their use in enhancing learning and of whether the concept of affordance is helpful

when it detracts from more fundamental issues as to what is involved in learning. It is generally appreciated that technology by itself is insufficient and that human intervention in the process of learning is essential. But this general recognition does not by itself resolve the problem of how the human and the technological should be combined. In the case of Gibson's original conception of affordance this problem is dealt with by the addition of motives and needs:

affordances are properties taken with reference to the observer. They are neither physical or phenomenal. The notion of invariants that are related at one extreme to the motives and needs of an observer and at the other extreme to the substances and surfaces of the world provides a new approach to psychology.

(Gibson, 1986, p.143)

But as far as learning was concerned, he recognised that problems arose:

If the affordances of a thing are perceived correctly, we say that it looks like what it is. But we must of course learn what things really are for example, that the innocent looking leaf is really a nettle or that the helpful sounding politician is really a demagogue. And this can be very difficult.

(Gibson, 1986, p. 142)

To repeat, the main point of the argument here is not the strengths and weaknesses of the concept of affordance as Gibson originally applied it to the matter of perception, but the problems that occur when it is used in a more reductive way as a component in accounts of learning. In this connection what is especially important is the issue of epistemology, of the carrying over from what for the sake of argument may be considered by some a relatively straightforward question of perception to the far more complex issue of learning. For example it is one thing to perceive that this object is for hammering. It is quite another to determine that this event is historical (E.H.Carr's *What is History*) or, to choose another example, where to decide the part played by judgment is in the practice of medicine. Although he may not have spelled it out in this way, Gibson's notion of affordances would seem to imply the idea that perception occurs through 'mechanical' causation whereby the actual relation of the object to the senses of the subject determines information. For example, seeing and feeling an object that is heavy at one end communicates that what is felt and seen affords hammering, according to the position of the actor. Although at odds with Gibson's own claim for the epistemological basis of his work, the line of thinking originates in a categorical separation of mind and world. This separation, from the time of its formulation by Descartes in the seventeenth century, has defined the problem of knowledge - how can a mind totally apart from the world ever gain knowledge of it? A considerable amount of philosophic work since that time has been dedicated to resolving this problem. Outside philosophy and in the applied social sciences and psychology the difficulties posed by dualism have been less acute with the question of the validity of knowledge taking precedence over how it is constituted

in the first place and Cartesian dualism has been tacitly accepted in these fields of study. The proximity of learning to knowledge, that is the proximity of acquiring knowledge to what counts as knowledge in the first place, throws this acceptance into question and opens the way for the criticism of it within philosophy.

### **Mind and World**

As a preface to considering philosophy that is pertinent to the question of what sort of conceptual resources we need for thinking about technologies and the enhancement of learning, it is helpful first to note some of what Vygotsky said about the development of mind. Vygotsky dealt with the question of how a child learns language by introducing a social aspect to the development of mind. The problem of how it is possible to learn meaning without a cumulative building up of more and more complex words, is dealt with by understanding meaning to be located in social practices which a child inhabits by default. The actions and utterances of a newborn are made meaningful, not by an original intention of the child, but by the meaning given to the utterances by other human beings. In this sense a newborn becomes human by his/her induction into the meanings and practices of the social group. The distinctive character of human beings is that contact with the world is not a matter of responsiveness to causes but to reasons. Meaning cannot be understood apart from the social practices that govern our responses to our environment. The human environment is not one of 'first nature' but of 'second nature' i.e. it is an environment made meaningful through the significance given to it by human activities. A child

inhabiting such a humanized environment ipso facto learns (everyday) meaning as an aspect of the activities of living with other human beings.

Formal education plays a further and distinctive role, according to Vygotsky, by inducting learners into domains of meaning not part of everyday practices. Social practices are not restricted to everyday experience but many of the characteristics of the knowledge domains (and the social practices underpinning them) that constitute formal education take a very different form. Vygotsky characterised this difference by distinguishing between scientific (abstract) and everyday concepts. The relevant point here is that the relation between experience and the world is not direct and in the case of domains of formal knowledge the relation may well be counterintuitive. The philosophical issues involved are not straightforward but what is of interest here is the extent to which epistemological presuppositions inform conceptions of how we come to know. In very general terms one such presupposition is that of dualism.

Turning now to the criticism of dualism: the first point to note is that this criticism has a long history. For example both Kant and Hegel devoted considerable attention to this issue. Here however attention is drawn to the work of contemporary philosophers who, working from within the analytic tradition, have called the categorical separation of Mind and World into question. The starting point here is Sellars' attack on what he termed 'the myth of the given', that is the idea that we have direct contact with the world. For Sellars the concept of knowledge belongs in a normative context: that is to say it cannot be separated from making judgments and giving reasons as Sellars puts it;

In characterising an episode or a state as that of knowing, we are not giving a ... description of that episode or state; we are placing it in the ...space of reasons, of justifying and being able to justify what one says.

(Sellars cited in McDowell 1996, p.5)

The philosophy involved here is not easily accessible but this does not mean that it is not important. Our common sense understanding of saying that we know something is that we give a description of an event as the event impinges on our senses. However taking a step back from this apparently self-evident proposition it can be seen that the organization of words contained in our description relies upon a whole set of reasons informing each term in the description (i.e. each concept depends upon many other concepts for its meaning). This is counterintuitive, as we believe an utterance - particularly one as simple as the exclamation 'Fire!' - to be nothing more than a straightforward response to a stimulus. However, when we look at the issue from the standpoint of Vygotsky or Brandom, this is not the case. If it were indeed the case, then the 'description' we would give could be given by a parrot or a machine: i.e. it would not be a case of knowing but merely that of a response to a stimulus. The distinctive feature of human contact with the world is that perception has a conceptual dimension. Without this, we could understand our responsiveness to an environment as indistinguishable from a fire alarm or parrot which responds differentially to environmental forces (Brandom 2000).



To take further Brandom's illustration of differential responses to a fire: the distinctive feature of a thinking being is its responsiveness to reasons rather than to causes. For example, when human beings shout 'Fire!' they understand something of what follows from the event of a fire (their response involves reasons as well as causes). They are aware of the dangers and of the actions that need to be taken, unlike a fire alarm which is merely responding differentially to smoke and heat. In other words, the human action consists not merely of registering alarm. If we were to apply Gibson's concept of affordances to such an event, the human cry, being a response to a fire, would be more or less identical to that of a fire alarm. Brandom's point is that what distinguishes the human form of knowing from the type of 'knowing' we might ascribe to a machine is the same as Sellars' position that knowing for a human being, consists not merely in expressing a response but in knowing what follows from it, knowing the implications, or what Brandom calls the 'giving and asking of reasons' (Brandom 2000). As Brandom puts it 'even non-inferential reports must be inferentially articulated'. To put this point in another form, the child using words having not yet acquired their precise meaning, may not know all of the reasons which support the application of a particular word. Yet their use of the word is dependent upon those reasons, even if the child is not in a position yet to operate with the word in its full sense. Concept development continues throughout formal education. To learn something is to be inducted into the space of reasons in which the concepts constituting what is learnt function.

To the extent that this proposition is crucial to the understanding of human intellect, so it must be equally vital for the understanding of learning:

One of the most important lessons we learn from Sellars's masterwork, *Empiricism and Philosophy of Mind* (as from the section on 'Sense Certainty' in Hegel's *Phenomenology*), is the inferentialist one that even noninferential reports must be inferentially articulated. Without that requirement we cannot tell the difference between noninferential reporters and automatic machinery such as thermostats and photocells, which also have reliable dispositions to respond differentially to stimuli.

(Brandom 2000, p.48)

For Brandom the fact that the response is made by a human, that is to say by creatures who inhabit a world in which reasons are asked and given, the shout 'Fire!' is always more than the blast of an alarm or the squawk of the parrot even when the person shouting is responding to the urgency and does not have in mind all the reasons for the exclamation. Reasons are always present for the response to have meaning in the first place. This point needs to be stressed, that living in the space of reasons, as the philosophers McDowell and Brandom have developed the idea, does not entail full consciousness of reasons all of the time. The space of reasons is the environment in which human beings live; it is the equivalent of Gibson's ecology.

The difference between the understanding of knowledge from philosophers discussed here and Gibson's concept of affordance (as information) is apparent at once. To determine that this is a hammer, we not only have to sense it in use but also in what

McDowell, following Sellars, calls ‘the space of reasons’ (McDowell, 1996). Animals can use stones as hammers but what they cannot do is make hammers specifically designed for the task. This requires holding a concept of hammer - putting hammering into the space of reasons, i.e. understanding it in all its aspects. McDowell’s stresses the distinctive character of human contact with the world when he notes that receptivity (our basic intake) already involves the conceptual:

though Sellars here speaks of knowledge in particular, that is just to stress one application of thought that a normative context is necessary for being in touch with the world at all, whether knowledgeably or not.

(McDowell, 1996, p. xiv)

Combined with a Vygotskian account of learning these ideas of Sellars, McDowell and Brandom provide powerful resources for thinking about knowing as well as thinking about knowledge itself. The contrast with Gibson’s ecology of perception is particularly sharp, since instead of suggesting a child enters the world experiencing an ecology of perception, rather, it is inducted into an already constituted space of reasons. The environment that humans inhabit is not the immediate sensual environment that Gibson claims but a mediated one, i.e. a world of second nature in the sense characterized above.

According to this approach, our actions in the world are intrinsically normative; i.e. when we attend to something it has significance for us and that significance is part of

our involvement with it in the context of social practice of which other humans are party.

Every theory of education necessarily has epistemological foundations but, as these are rarely spelt out, exploring their significance is far from a straightforward exercise. But if anything, developing a theory of education on the basis of an epistemology which was developed without education in mind is an ever difficult task. However, simply to insist that such a theory can be developed is another matter and this is as far as the claims made here go, that as the work of philosophers like Sellars, McDowell and Brandom have compelling implications for understanding the nature of knowledge so they offer grounds for conceptualising innovative ways of communicating it. As this is occurring at exactly the same time as the practice of communicating technology is undergoing radical transformation, an unexpected but interesting possibility of convergence arises between the practical concerns of those who design the technology which is to bring about this transformation and the most abstract of all philosophic enquiries – what is knowledge and how do we know it?

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