

Chapter 2

Mediated Cognition

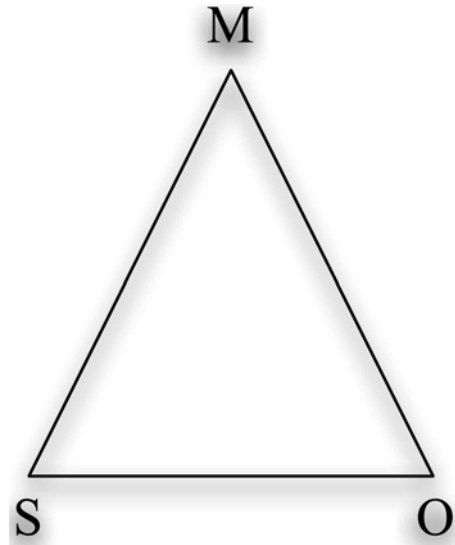
To be able to analyse such complex interactions and relationships, a theoretical account of the constituent elements of the system under investigation is needed ... Activity Theory a strong candidate for such a unit of analysis in the concept of object-oriented, collective and culturally mediated human activity. (Engeström and Miettinen 1999, p. 9)

2.1 Introduction

In this chapter we will consider Activity Theory and we will do so from the perspective of *tool mediation*. Although ostensibly Activity Theory addresses the same issues as classical cognition, it really is quite different and this is largely attributable to its complex origins. Engeström (1999) has observed that its aetiology is three-fold. Firstly, he identifies the contribution of classical German philosophy ranging from Kant to Hegel; secondly, the political writings of Marx and Engels and finally, the cultural-historical psychology of Vygotski, Leont'ev and Luria (the so called “Vygotskian” school). This is a heady mix of Continental thought which stands in sharp contrast to the Anglo-Saxon tradition of classical cognition. Engeström laments, parenthetically, that the contribution from Marxist thought is often lost in modern treatments and we should also remember that Stalin suppressed the publication of Vygostki's work for the two decade after his premature death. Indeed, Activity Theory was not well known in the West before the 1980s so it was aptly described by Engeström and Miettinen (1999) as “a well kept secret”. Just to add to this complexity, the name Activity Theory itself is something of a misnomer as it is not a theory, in the sense that it is not falsifiable or predictive in character, instead it is a conceptual framework and vocabulary for describing human purposive behaviour – or activity.

The work of Vygotski and his colleagues still lie at the heart of Activity Theory, and their contribution is the observation that human behaviour is a matter of historical development and not a product of evolution or biology. These historical

Fig. 2.1 The basic mediation triangle



developments, in turn, rely on tools. Luria (1928), in what has been described as the first English language publications of the Vygotskian school, writes, “Man differs from animals in that he can make and use tools” and he continues, “... the tools used by man not only radically change his condition of existence, they even react on him in that they effect a change in him and his psychic condition”. This places tool mediation at the heart of our actions, behaviour, and cognition.

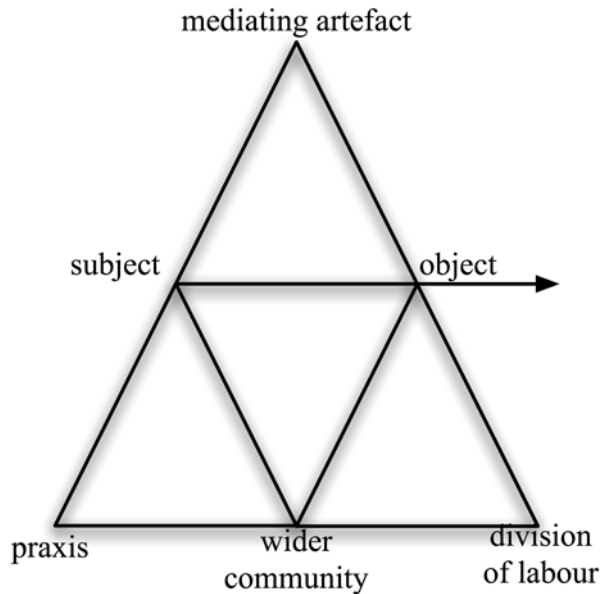
Luria (1928, p. 495) places the first appearance of tools in the hands of children when he writes, “instead of applying directly its natural function to the solution to a particular task, the child puts between that function and that task a certain auxiliary means ... by the medium of which the child manages to perform the task”.

The importance of tool mediation in Activity Theory is thus revealed – it is species wide, it is central to just about everything we do, we begin to use tools in childhood and this use is not simply a matter of achieving our ends but we should recognise the ability of tools to “change our minds” – quite literally. And all of this is usually and remarkably represented as a simple triangle, thus (Fig. 2.1).

The triangle comprises a subject or subjects (s), an object (o) and a mediating tool (m). Unmediated functions (s-o) are represented along the base of the triangle, and examples of these tend to be very simple and often biological – digesting food comes to mind. Just about everything else, the arguments goes, is mediated and this is easy to recognise when we appreciate that tools are not limited to physical artefacts like hammers but include “psychological” tools such as language which Clark has described as “the ultimate artefact” (Clark 1997a, b) – please see Chap. 6.

Despite the remarkable power of this simple triad, Leont’ev (1981) was to extend this, as it failed to account for the social (collective) nature of most of our endeavours. This was to be further elaborated by Engeström (1987). The extended triangle, which is by no means a universally popular form of representation for an activity, adds community, division of labour and praxis to the original formulation.

Fig. 2.2 An (extended) activity triangle



Community should be understood as standing for all other groups with a stake in the activity which, of course, can be potentially very large. The division of labour is the recognition of “horizontal” and “vertical” lines of division of responsibilities and power within any activity. Finally, there is praxis which is a neat way of representing the great array of formal and informal rules and social and cultural norms which govern the relationships between the subjects and the wider community for a given activity. As we can see this is a very “broad-brush” approach. These relationships are illustrated here (Fig. 2.2).

Since the 1980s Activity Theory has moved beyond the specialist scholar to be embraced by researchers in disciplines as diverse as human computer interaction, cultural psychology, computer supported cooperative working, information systems and, of course, pedagogy. As a consequence of this dissemination, Activity Theory was quite readily identified as a potential theoretical framework for HCI (e.g. Bødker and Bannon 1991; Kuutti 1996) and within this community a number of key players have been responsible for both developing and promoting it. Bødker (1991) and Kuutti (1991) have broadly, but not exclusively, established a Scandinavian perspective with a focus on user-centred and participative design, while Bannon (1991), Grudin (1990), Kaptelinin (1996), Nardi (1996b), Engeström (1999) and others have made significant contributions to Activity Theory’s acceptance and uptake within HCI. The appearance of Nardi’s *Context and Consciousness* (1996a, b) brought Activity Theory to the attention of many within HCI and it remains a particularly important collection. Finally, Activity Theory should very much be seen as a continuing project as, for example, Bødker’s recent work on artefact ecologies demonstrates its continued relevance to new and emerging fields within HCI. We now examine the anatomy of an activity.

2.2 Object-Orientedness

The principle of object-orientedness is one of the most important in Activity Theory; it is also said to be the most difficult to articulate. Leont'ev (1978, p. 4) tells us that “The basic, constituent feature of activity is that it has an object. In fact, the very concept of activity (doing, Tätigkeit) implies the concept of the object of activity. The expression “objectless activity” has no meaning at all”. Kozulin (1986) underlines this by telling us that, “the main thing which distinguishes one activity from another [...] is the difference of their objects”.

Object as Objective

The simplest understanding of the object of an activity is that it is held by the subject, motivates and gives it direction (Leont'ev 1974). The object is the need or desire to which the activity is directed. Christiansen (1996) uses the term “objectified motive” and Nardi (1996a) writes of it as the *object* of the “object lesson” or the “object of the game”. However, objects are not fixed but can be transformed in the course of the execution of an activity.

Object as Intentionality

Perhaps a more sophisticated understanding of an activity's object is it that refers to an activity's intentionality. Intentionality refers to the about-ness or directed-ness of many of our mental and bodily states. An activity is intentional in that it is about something. This may seem an entirely obvious observation but it is conspicuously absent in, say, the description of a task. The concept of intentionality can be traced back to the philosophical writings of St. Thomas Aquinas, who introduced the concept in the thirteenth century, by recognising that most of our mental states (including attitudes, beliefs and emotions) are directed towards things and events in the world. Brentano (1874) revived the idea when he defined intentionality as the main characteristic of mental phenomena (i.e. as a “mark of the mental”) and the means by which they could be distinguished from physical phenomena. In much the same vein but more recently Searle has written, “Intentionality is that property of many mental states and events by which they are directed at or about or of objects and states of affairs in the world” (1983, p. 1).

Leont'ev writes of this in the following (fairly obscure) way when he tells us that the object appears in two forms: first, in its independent existence, commanding the activity of the subject, and second, as the mental image of the object, as the product of the subject's “detection” of its properties, which is effected by the activity of the subject and cannot be effected otherwise”. To understand this we must recognise

that Activity Theory is a materialist account which recognises that human beings live in an objective reality which gives rise to subjective phenomena, a consequence of which is that an activity's intentionality is necessarily bi-directional. While every activity is oriented towards something in the real world it must also be pointing back to the person or persons who gave rise to it. As Kaptelinin (2005, p. 5) puts it, "The object of activity has a dual status; it is both a projection of human mind onto the objective world and a projection of the world onto human mind". Kaptelinin continues that this bi-directionality anchors and contextualises subjective phenomena in the objective world. So, "Instead of being a collection of 'mental processes' the human mind emerges as biased, striving for meaning and value, suffering and rejoicing, failing and hoping, alive, real. On the other hand, the world is no longer just a collection of physical bodies, organizational structures, and so forth, but a place full of meaning and value, a place that can be comfortable or dangerous, restricting or supporting, beautiful or ugly, or (as it is often the case) all of these at the same time" (*ibid*).

From Kaptelinin's description we can see that there are very clear similarities between the definition of an Activity's object and what Merleau-Ponty calls the "intentional arc" which he describes as the means by which we are bound to the world. Dreyfus (2002) offers a clearer definition of this when he describes the intentional arc as the tight connection between the agent and the world. He writes that, for example, as the agent acquires skills, these are not held as mental representations but as "dispositions to respond to the solicitations of situations in the world". This again emphasizes the bi-directional quality of an activity's object.

2.3 The Structure and Dynamics of an Activity

The extended triangle representation we considered above is only a partial representation of an activity, indeed, it might be better thought of as a nexus, existing as it does in a continuum of development and learning while at the same time masking its internal structure.

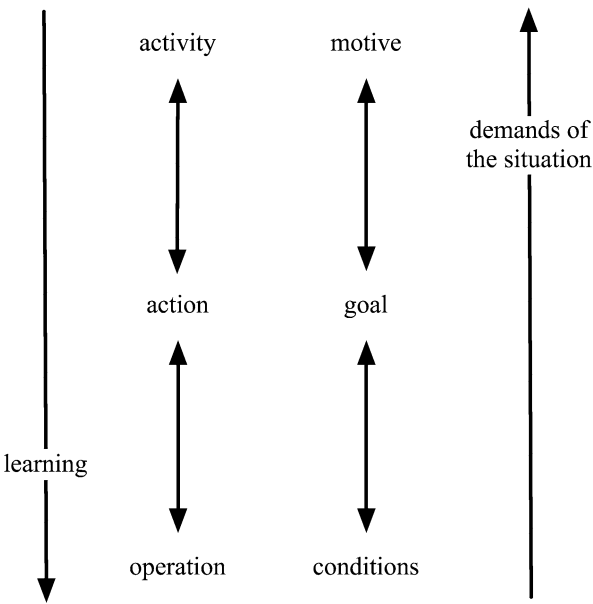
An activity is realised by a collection or aggregation of behaviours called *actions*. An action is similar to a task in that it is directed at achieving a particular goal, except that it is always mediated by an artefact or tool. Actions, in turn, have their own fine grain internal structure as they are executed by means of unconscious *operations*. Although this is quite hierarchical in structure, an activity is not fixed as it may be flexibly reconfigured as a consequence of learning, context or both. Table 2.1 is reproduced from Bødker and Klokmoose 2012, p. 202, illustrates these relationships.

By way of example, it is something of a convention to consider how people learn to drive a motorcar at this point in the discussion. The object of the activity is likely to be quite complex and might include the need to be able to drive to work; to take the family on holiday or to participate in an armed robbery. The activity is realised by means of an aggregation of actions (i.e. taking driving lessons; obtaining a car;

Table 2.1 The structure of an activity

Levels of activity	Mental representation	Realises	Level of description	Analytical question
Activity	Motive – not necessarily conscious	Personality	The social and personal meaning of activity ...	Why?
Action	Goal – under conscious control	Activities (systems of actions organised to achieve goals)	Possible goals, critical goals, particularly relevant sub-goals	What?
Operation	Conditions of actions – normally not under conscious control	Actions (chains of operations organised by goals and concrete conditions)	The concrete way of executing an action in accordance with the specific conditions surrounding the goal	How?

Fig. 2.3 The activity hierarchy



buying petrol and so on). These individual actions in their turn are realised by a set of operations – (i.e. steering, indicating at junctions, changing gear and so forth). This, of course, is very much a static account of the activity whereas humans are constantly learning with practice, so when first presented with the intricacies of the gear-stick (manual gear shift) it is likely that the process of disengaging the engine, shifting gear and re-engaging the engine are under conscious control. With practice this becomes automatic and unconscious. Unless, of course, circumstances demand otherwise. If the driver were to find themselves driving in icy conditions, gear changing and braking may become more consciously controlled and with it a shift in our attention depending upon the competence of the driver. In such circumstances our attention becomes focused at the level demanded by that context (Fig. 2.3).

The Dynamics of an Activity

While Activity Theory differentiates between internal and external activities it also emphasizes their inter-relatedness, so internal activities cannot be understood independently of external activities (and vice versa). Further, Bertelsen and Bødker (2003) tell us not to assume a fixed separation between these representations as they are prone to mutual transformation (and swap places) with each other.

Internalisation is the transformation of external activities into internal ones and in doing so it provides a means for people to practice, rehearse, simulate and generally try out potential interactions with the real world without committing to them. These internal states might include make-believe and various forms of “what-if” thinking. In turn, externalisation is the process by which internal activities become externalised which is often necessary when an internalized action needs to be coordinated between people. For Vygotski, internalisation-externalisation is a key mechanism in a child’s cultural development, writing “Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (inter-psychological) and then inside the child (intra-psychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals”.

For such an important mechanism, Activity Theory offers only relatively few examples of internalisation-externalisation. We are invited to consider, for example, mental arithmetic which can be thought of as internalised “counting on our fingers”. The external counting on our fingers, which a child learns, is internalised with practice but if this becomes too demanding, it may be externalised by prompting the child to use pencil and paper or, more likely, resort to the calculator on her mobile phone.

Development

Activity Theory is perhaps unique among accounts of how we use technology in placing such a strong emphasis on the role of learning. The most famous aspect of this is Vygotski’s “zone of proximal development” (ZPD). He defines this as, “The distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (1978, p. 88). Consider a child trying to tie her shoe laces (I suppose I should update this to “downloading an app”). We can imagine the struggle she might have if this challenge were a little beyond her abilities. Naturally she turns to a parent or teacher to help. We might expect the adult to demonstrate the process, or guide the child through the process with a running dialogue (“left over right”). Later when the child needs to retie a loose lace she can repeat what she was instructed but this time to herself. The public language of the adult, having

been successfully internalised, now functions to guide behaviour. Vygotski has argued, using examples such as this, that the use of public language has profound effects on cognitive development.

The ZPD is not merely a product of child-adult relationships as it is always with us. Every time we ask for help from a more skilled, knowledgeable, or for that matter, the nearest available person, we can see this mechanism at work. Indeed when we fail to cope with a situation or technology, we do not simply experience an all or nothing breakdown, instead we rely on epistemic¹ nudges to allow us to continue to engage with the technology.

This can be seen in the following example (a form of which I have quoted elsewhere – Turner 2013). I witnessed a pair of young backpackers at the Centraal railway station in Amsterdam trying to use a left luggage locker. They selected the picture of the British flag on the system’s user interface and the display was promptly rendered into English. The instructions told them to choose a locker of the appropriate size, put the luggage inside, close the door, insert money (or credit card) and then wait for a receipt. The receipt providing the number they would need to unlock the locker and retrieve their luggage. This sequence is a familiar one and from a usability perspective the sequence was clearly logical. However for these backpackers, the situation appeared to be fraught and uncertain. However within a few seconds the situation was resolved by the pair asking a nearby user of the system whether it was “ok”. He replied, “*Yeah, it’s ok*”.

The concept of the ZPD has been widely accepted by educationalists but has also been adopted by those who see this as the basis of scaffolding – please see Chap. 5. More recently, Engeström (1987) has proposed expansive learning, which for some, marks the appearance of the third “generation” of Activity Theory. Engeström has demonstrated the applicability of expansive learning with its cycles of internalisation, questioning, reflection and externalisation in the development of activities in a variety of domains (Engeström 1990, 1999; Engeström et al. 1997). The drivers for these expansive cycles of learning and development he calls contradictions – an explicitly Marxist concept – which arise within and between activities. While this is something of a departure from Vygotski, it has proved of interest to information scientists and CSCW researchers.

2.4 Mediation

The artefactual world into which children are born contains the accumulated knowledge of our species. Harari (2014, p. 48) writes “Over the course of his or her life, a typical member of a modern affluent society will own several million artefacts – from cars and houses to disposable nappies and milk cartons. There’s hardly an activity, a belief or even an emotion that is not mediated by objects of our

¹In this instance, the contribution of a little “know that” to our “know how”. We pick up on the epistemic in more detail in Chap. 7.

own devising.” He goes on to suggest that our eating habits, play, romantic and sexual relations and religions are all comfortably defined as examples of mediated behaviour.

Artefacts are created by people to mediate and, to an extent, control their own behaviour. These have been developed over time and are local to the community which created them, so that they have an historical and cultural lineage. Modes of acting within an activity system may be realised or crystallized into artefacts – “Artifacts can be characterized as “crystallised” knowledge, which means that operations that are developed in the use of one generation of technology are later incorporated into the artefact in the next” (Bannon and Bødker 1991, p. 342). Wartofsky (1979, p. 205) has also observed that, “the artefact is to cultural evolution what a *gene* is to biological evolution.” Cole (1996) adds that artefacts embody their own “developmental histories” which is a reflection of their use, i.e. these artefacts have been manufactured or produced and continue to be used as part of, and in relation to, intentional human actions. Cole stresses another aspect of tool mediation and this is with respect to the affordances they offer. He identifies, for example, the affordance offered by a variety of mediating artefacts including the personal histories of recovering alcoholics in AA meeting (affording rehabilitation), patients’ medical charts in a hospital setting (afford access to a patient’s medical history), and poker chips (inviting gambling). Sellen and Harper (2002) have written in detail of the affordances of paper in an office setting which include reading, offering easy navigation through a [paper] document; one being able to read more than one document at once; and writing notes upon/annotating; ease of filing; portability; joint viewing and so forth. (Please see Sect. 2.5 for a different view of “affordances”).

Vygotski (1930) recognised the importance of tool mediation and was the first to offer an extended definition of tools to include language, algebraic symbolism, works of art and writing. He distinguished between what he calls “psychological tools” from the “means-to-an-end” variety of tools such as hammers and garden furniture. He writes that psychological tools are artificial, social “formations”, not individual devices and tells us that they are directed toward the mastery of [mental] processes – one’s own or someone else’s. Of these tools, language is the most important and as they are intrinsic to our behaviour, their use modifies our cognition.

As we have seen, one of the great insights offered by Activity Theory is that most of what we do is mediated and the substance of this mediation is artefactual – the product of human, purposive endeavour which has, and which continues to develop over time. So cognition, for example, can only be understood with respect to this cultural – historical mediation. Cole and Engeström (1993, p. 9) have very conveniently created a list of the key issues with respect to this mediation. We offer an edited summary of their work (we preserve their numbering):

1. The naturally occurring psychological functions we share with the great apes are different in kind to those which are the product of “tools and rules”;
2. Tool mediation has created a structure for the human mind. It has also shaped the ways in which we use the tools themselves;
3. Tool mediation is bi-directional and modifies both mind and environment;

4. Tools are both material and “symbolic”. The master tool is language.
5. The benefits of tool mediation are transmitted culturally from one generation to another.
6. The historical effects of tool mediation are with us in the present and are a species-specific mode of development.
7. Tool mediation highlights the importance of the social, again because this is the medium of transmission for these developments.

As we can see, Activity Theorists are at pains to underline our intimacy with tools.

Functional Organs

Finally, Kaptelinin (1996) writes of the *two interface boundary problem* which arises with the use of tools. He points out that there is a boundary/interface between (i) the user *and* her computer and (ii) the user and her computer *and* the world. He tells us that Activity Theory has provided a means to reason about this in the concept of the “functional organ”. Leont’ev coined this term to describe, “functionally integrated, goal-oriented, configurations of internal and external resources”. External tools function to support and complement human abilities which, when working in concert, are more effective. He gives examples of notebooks enhancing memory and eyeglasses enhancing sight (*ibid*, p50). When the use of these external tools is well integrated they are experienced as a property of that person, though they are experienced as separate while we are learning to use them.

Kaptelinin tells us that these original observations about tools also apply to digital technology and writes that a problem within HCI lies with integrating these technologies into functional organs. He suggests that an integrated technology has the potential to be a *transparent technology*. He also notes that computers are a special form of tool which are not limited to a single, fixed function and because of this they can give rise to a special kind of functional organ. In this instances, he is writing of the IPA – the inner plane of action. The IPA is said to arise during child development and provides for a new form of interaction between internal and external activities. Initially, a child only has control over things in the external world as a consequence of an action and feedback loop. Through the processes of internalisation-externalisation which transform external activities into internal ones, the child acquires the ability to perform or rehearse some of these activities in their “mind’s eye” – or IPA. This, of course, has significant advantages in rehearsing or considering a plan of action in the real world without committing to it with all of the unfortunate consequences that might attract. Finally, we note that technology often supports the IPA in exploring the what-if (*cf.* the what-if analysis functions in spreadsheets or the print preview facilities in word processors).

We conclude this brief introduction to Activity Theory with an illustration of its power to provide the necessary concepts to explain intriguing and problematic issues in HCI. We offer an alternative treatment of affordance.

2.5 Affordance – Soviet Style

It should be noted that the author published “Affordance as Context” which appeared in the journal Interacting with Computers, in 2005. This chapter, like the paper before it, draws heavily on Bakhurst’s excellent commentary on the work of Ilyenkov where he makes a difficult topic, lucid (1991).

Ilyenkov has offered a materialist account of an interesting non-material phenomena, namely, significances. Significances closely resemble affordances but are collective rather than individual. Ilyenkov begins by identifying two classes of non-material phenomena namely: mental phenomena such as thoughts, beliefs and feelings and phenomena that are neither material nor mental such as meaning and values, an example of which might be goodness. It is this second class which are of interest which he calls ideal. Ilyenkov then considers how we might account for them. One account might argue that such ideal phenomena are external to us individually, for examples, religions often present their teachings such as the importance of charity as ‘God-given’. Alternatively, we could argue that these phenomena are product of human nature and have no independent existence. But there is a third possibility, as Ilyenkov proposes a dialectic position arguing that a thing can be *objective* without being *independent* of us. He reasons that we have idealised the world, that is, endowed it with meaning and in so doing we also endow it with properties that come to exist completely independently of us. These properties are the product of our labour and are not defined by nature. (Ilyenkov, 1977). Indeed we have seen reference to this already when we recognised that artefacts are “crystalised actions”. These established ideal phenomena are objective but as to the independence from an individual mind, the key is the word “individual” rather than “mind”. The ideal exists in the collective not the individual mind – a concept reminiscent of distributed cognition (Chap. 5) and it is also quite *meme*-like (Dawkins, 1976). So our social lives are a product of the dealings with others, experienced individually as a formal – informal set of rules, practices, tools and artefacts. We, individually, grow up among pre-existing and apparently objective phenomena. From this perspective human development can be seen as the process of becoming enculturated into this objectified, historically developed world. Ilyenkov offers a specific example of this: ancient mariners saw the stars as a pre-existing navigational aid, while priests regarded them as pre-existing guides to future events (astrology). These interpretations, that is, the need to find one’s way at sea or the need to predict future events, were subsequently attached to the stars as the result of their incorporation into human activity.

Ilyenkov (1977) describes the creation of artefacts as a further illustration of how ideal properties could be held to exist objectively in the world. He uses the example of a table. A table is part of objective reality and yet can be distinguished from a block of wood because it has been objectified by the human activity responsible for shaping it. Indeed, this is how we distinguish wood from tables. Wood itself affords a variety of uses, for example, burning, throwing, shaping, trading and so forth, but through purposive use it acquires significance. So, for example, shaping a block of wood into a pair of clogs, endows the clogs with the significances of working

footwear, or as a souvenir, or as a means of looking ridiculous when worn with socks. In a sense, these significances make a thing knowable. For Ilyenkov, nothing about the physical nature of a thing in itself explains how it is possible that it can be knowable and it is perhaps this point which allows us to distinguish between significance and affordance. In order to be knowable some significance has to be attached to the thing through the process of the object's incorporation into the sphere of human activity. This is not necessarily true of an affordance – particularly simple affordances. The ideal properties of an artefact represent to the individual a reification or embodiment of the practices of the human community that has historically developed the thing. In other words, objects acquire this ideal content not as the result of being accessed by an individual mind, but by the historically developing activities of communities of practice.

Activity Theory as a Theory of HCI

Activity Theory is complex, demanding and occasionally obscure, but it is remarkably comprehensive and coherent. As we noted earlier, Activity Theory has been proposed by a number of people as a platform or theory for HCI and we can but agree. It not only offers its own version of task analysis and cognitive modelling which parallel that of classical cognition but it does so while recognising that cognition is tool mediated. Further, its treatment of mediation is not confined to physical artefacts such as hammers or keyboards or Photoshop® but also includes psychological tools too. Activities are not just recognised to be situated but (a) they are made meaningful by recognising that they are the expression of peoples' motivation or purpose; and (b) an activity explicitly includes the other people with whom we work and play; and (c) activities does not just appear, they have a history – they have come from somewhere and are likely to change and develop in the course of their execution. Activities are also distributed across other people, across time, and across a range of tools and artefacts. This social distribution has an immediate face validity. We do not work alone, we rely on others, nor are we confined to the bounds of our individual cognition.

Activity Theory has all the qualities to provide a solid, extensible and theoretically rich platform for human-computer interaction but yet it is not. Why not? Two possible answers present themselves. The first answer is very simple, it is not because it is at odds with the Western, Anglo-Saxon tradition. The Western cognitive psychology tradition which is embedded in HCI is predicated on single users. In contrast, Activity Theory is based on the collective (or the group or the soviet) rather than the individual and favours Kant, Hegel and Marx to Descartes, Hume and Locke. These difference are rarely addressed. Secondly, we can draw a parallel with what Dreyfus has to say about the “facts and rules” approach to creating artificially intelligence systems (as discussed at the end of the last chapter). He notes that if this hasn't worked after all of this effort, it probably never will – perhaps the same is true for Activity Theory. Thirty years ago, it was not well known and had only a small number of advocates. This is not true now. Activity Theory has become well

known and is well respected but it is still not widely used. It is not that it is too complex or obscure because its supporters have done an excellent job in promoting and demystifying it but because (I suspect) HCI is much more concerned with *designing* interactive systems than it is understanding how they are used. Activity Theory focussed publications in HCI are not primarily about how to design a system which embodies its principles but are more concerned with using it to describe how the technology was used. Learning, breakdowns (as contradictions), mediation, internalisation, the role of the zone of proximity will all be regularly, and completely properly, invoked to *explain* technology use but are rarely used prospectively to contribute to its design. The psychological aspects of Activity Theory are still largely confined (mistakenly) to education or perhaps organisational learning. It may be that HCI is pretty much *atheoretic* at heart and a design discipline in practice to find a place for Activity Theory.

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