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Studying Context: A Comparison of Activity Theory, Situated Action Models, and Distributed Cognition

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It has been recognized that system design will benefit from explicit study of the context in which users work. The unaided individual divorced from a social group and from supporting artifacts is no longer the model user. But with this realization about the importance of context come many difficult questions. What exactly is context? If the individual is no longer central, what is the correct unit of analysis? What are the relations between artifacts, individuals, and the social groups to which they belong? This chapter compares three approaches to the study of context: activity theory, situated action models, and distributed cognition. I consider the basic concepts each approach promulgates and evaluate the usefulness of each for the design of technology.[1]

A broad range of work in psychology (Leont'ev 1978; Vygotsky 1978; Luria 1979; Scribner 1984; Newman, Griffin, and Cole 1989; Norman 1991; Salomon 1993), anthropology (Lave 1988; Suchman 1987; Flor and Hutchins 1991; Hutchins 1991a; Nardi and Miller 1990, 1991; Gantt and Nardi 1992; Chaiklin and Lave 1993), and computer science (Clement 1990; Mackay 1990; MacLean et al. 1990) has shown that it is not possible to fully understand how people learn or work if the unit of study is the unaided individual with no access to other people or to artifacts for accomplishing the task at hand. Thus we are motivated to study context to understand relations among individuals, artifacts, and social groups. But as human-computer interaction researchers, how can we conduct studies of context that will have value to designers who seek our expertise?

Brooks (1991) argues that HCI specialists will be most valuable to designers when we can provide (1) a broad background of comparative understanding over many domains, (2) high-level analyses useful for evaluating the impact of major design decisions, and (3) information that suggests actual designs rather than simply general design guidelines or metrics for evaluation. To be able to provide such expertise, we must develop an appropriate analytical abstraction that ``discards irrelevant details while *isolating and emphasizing those properties of artifacts and situations that are most significant for design*'' (Brooks, 1991, emphasis added). It is especially difficult to isolate and emphasize critical properties of artifacts and situations in studies that consider a full context because the scope of analysis has been widened to accommodate such holistic breadth. Taking context seriously means finding oneself in the thick of the complexities of particular situations at particular times with particular individuals. Finding commonalities across situations is difficult because studies may go off in so many different directions, making it problematic to provide the comparative understanding across domains that Brooks (1991) advocates. How can we confront the blooming, buzzing confusion that is ``context'' and still produce generalizable research results?

This chapter looks at three approaches to the study of context—activity theory, situated action models, and the distributed cognition approach—to see what tools each offers to help manage the study of context. In particular we look at the unit of analysis proposed by each approach, the categories offered to support a description of context, the extent to which each treats action as structured prior to or during activity, and the stance toward the conceptual equivalence of people and things.

Activity theory, situated action models, and distributed cognition are evolving frameworks and will change and grow as each is exercised with empirical study. In this chapter I ask where each approach seems to be headed and what its emphases and perspectives are. A brief overview of each approach to studying context will be given, followed by a discussion of some critical differences among the approaches. An argument is made for the advantages of activity theory as an overall framework while at the same time recognizing the value of situated action models and distributed cognition analyses.

SITUATED ACTION MODELS

Situated action models emphasize the emergent, contingent nature of human activity, the way activity grows directly out of the particularities of a given situation.[2] The focus of study is situated activity or practice, as opposed to the study of the formal or cognitive properties of artifacts, or structured social relations, or enduring cultural knowledge and values. Situated action analysts do not deny that artifacts or social relations or knowledge or values are important, but they argue that the true locus of inquiry should be the ``everyday activity of persons acting in [a] setting'' (Lave 1988).[3] That this inquiry is meant to take place at a very fine-grained level of minutely observed activities, inextricably embedded in a particular situation, is reflected in Suchman's (1987) statement that ``the organization of situated action is an emergent property of moment-by-moment interactions between actors, and between actors and the environments of their action.''

Lave (1988) identifies the basic unit of analysis for situated action as ``the activity of persons-acting in setting.'' The unit of analysis is thus not the individual, not the environment, but a relation between the two. A *setting* is defined as ``a relation between acting persons and the arenas in relation with which they act.'' An *arena* is a stable institutional framework. For example, a supermarket is an arena within which activity takes place. For the individual who shops in the supermarket, the supermarket is experienced as a setting because it is a ``personally ordered, edited version'' of the institution of the supermarket. In other words, each shopper shops only for certain items in certain aisles, depending on her needs and habits. She has thus ``edited'' the institution to match her personal preferences (Lave 1988).

An important aspect of the ``activity of persons-acting in setting'' as a unit of analysis is that it forces the analyst to pay attention to the flux of ongoing activity, to focus on the unfolding of real activity in a real setting. Situated action emphasizes responsiveness to the environment and the improvisatory nature of human activity (Lave 1988). By way of illustrating such improvisation, Lave's (1988) ``cottage cheese'' story has become something of a classic. A participant in the Weight Watchers program had the task of fixing a serving of cottage cheese that was to be three-quarters of the two-thirds cup of cottage cheese the program normally allotted.[4] To find the correct amount of cottage cheese, the dieter, after puzzling over the problem a bit, ``filled a measuring cup two-thirds full of cheese, dumped it out on a cutting board, patted it into a circle, marked a cross on it, scooped away one quadrant, and served the rest'' (Lave 1988).

In emphasizing improvisation and response to contingency, situated action deemphasizes study of more durable, stable phenomena that persist across situations. The cottage cheese story is telling: it is a one-time solution to a one-time problem, involving a personal improvisation that starts and stops with the dieter himself. It does not in any serious way involve the enduring social organization of Weight Watchers or an analysis of the design of an artifact such as the measuring cup. It is a highly particularistic accounting of a single episode that highlights an individual's creative response to a unique situation.

Empirical accounts in studies of situated action tend to have this flavor. Lave (1988) provides detailed descriptions of grocery store activity such as putting apples into bags, finding enchiladas in the frozen food section, and ascertaining whether packages of cheese are mispriced. Suchman (1987) gives a detailed description of experiments in which novices tried to figure out how to use the double-sided copy function of a copier. Suchman and Trigg (1991) describe the particulars of an incident of the use of a baggage- and passenger-handling form by airport personnel. These analyses offer intricately detailed observations of the temporal sequencing of a particular train of events rather than being descriptive of enduring patterns of behavior across situations.

A central tenet of the situated action approach is that the structuring of activity is not something that precedes it but can only grow directly out of the immediacy of the situation (Suchman 1987; Lave 1988). The insistence on the exigencies of particular situations and the emergent, contingent character of action is a reaction to years of influential work in artificial intelligence and cognitive science in which ``problem solving'' was seen as a ``series of objective, rational pre-specified means to ends'' (Lave 1988) and work that overemphasized the importance of plans in shaping behavior (Suchman 1987). Such work failed to recognize the opportunistic, flexible way that people engage in real activity. It failed to treat the environment as an important shaper of activity, concentrating almost exclusively on representations in the head—usually rigid, planful ones—as the object of study.

Situated action models provide a useful corrective to these restrictive notions that put research into something of a cognitive straitjacket. Once one looks at real behavior in real situations, it becomes clear that rigid mental representations such as formulaic plans or simplistically conceived ``rational problem solving" cannot account for real human activity. Both Suchman (1987) and Lave (1988) provide excellent critiques of the shortcomings of the traditional cognitive science approach.

ACTIVITY THEORY

Of the approaches examined in this chapter, activity theory is the oldest and most developed, stretching back to work begun in the former Soviet Union in the 1920s. Activity theory is complex and I will highlight only certain aspects here. (For summaries see Leont'ev 1974; Bødker 1989; and Kuutti 1991; for more extensive treatment see Leont'ev 1978; Wertsch 1981; Davydov, Zinchenko, and Talyzina 1982; and Raeithel 1991.) This discussion will focus on a core set of concepts from activity theory that are fundamental for studies of technology.

In activity theory the unit of analysis is an activity. Leont'ev, one of the chief architects of activity theory, describes an activity as being composed of subject, object, actions, and operations (1974). A *subject* is a person or a group engaged in an activity. An *object* (in the sense of ``objective") is held by the subject and motivates activity, giving it a specific direction. ``Behind the object," he writes, ``there always stands a need or a desire, to which [the activity] always answers." Christiansen (this volume) uses the term ``objectified motive," which I find a congenial mnemonic for a word with as many meanings in English as ``object." One might also think of the ``object of the game" or an ``object lesson."

Actions are goal-directed processes that must be undertaken to fulfill the object. They are conscious (because one holds a goal in mind), and different actions may be undertaken to meet the same goal. For example,

> a person may have the object of obtaining food, but to do so he must carry out actions not immediately directed at obtaining food.... His goal may be to make a hunting weapon. Does he subsequently use the weapon he made, or does he pass it on to someone else and receive a portion of the total catch? In both cases, that which energizes his activity and that to which his action is directed do not coincide (Leont'ev 1974).

Christiansen (this volume) provides a nice example of an object from her research on the design of the information systems used by Danish police: ``[The detective] expressed as a vision for [the] design [of his software system] that it should be strong enough to handle a `Palme case,' referring to the largest homicide investigation known in Scandinavia, when the Swedish prime minister Oluf Palme was shot down on a street in Stockholm in 1986!" This example illustrates Raeithel and Velichkovsky's depiction of objects as

> actively ``held in the line of sight." ... the bull's eye of the archer's target, which is the original meaning of the German word *Zweck* (``purpose"), for example, is a symbol of any future state where a real arrow hits near it. Taking it into sight, as the desired ``end" of the whole enterprise, literally causes this result by way of the archer's action-coupling to the physical processes that let the arrow fly and make it stop again (Raeithel and Velichkovsky, this volume).

Thus, a system that can handle a ``Palme case" is a kind of bull's eye that channels and directs the detective's actions as he designs the sofware system that he envisions.

Objects can be transformed in the course of an activity; they are not immutable structures. As Kuutti (this volume) notes, ``It is possible that an object itself will undergo changes during the process of an activity." Christiansen (this volume) and Engeström and Escalante (this volume) provide case studies of this process. Objects do not, however, change on a moment-by-moment basis. There is some stability over time, and changes in objects are not trivial; they can change the nature of an activity fundamentally (see, for example, Holland and Reeves, this volume).

Actions are similar to what are often referred to in the HCI literature as tasks (e.g., Norman 1991). Activities may overlap in that different subjects engaged together in a set of coordinated actions may have multiple or conflicting objects (Kuutti 1991).

Actions also have operational aspects, that is, the way the action is actually carried out. Operations become routinized and unconscious with practice. When learning to drive a car, the shifting of the gears is an action with an explicit goal that must be consciously attended to. Later, shifting gears becomes operational and ``can no longer be picked out as a special goal-directed process: its goal is not picked out and discerned by the driver; and for the driver, gear shifting psychologically ceases to exist'' (Leont'ev 1974). Operations depend on the conditions under which the action is being carried out. If a goal remains the same while the conditions under which it is to be carried out change, then ``only the operational structure of the action will be changed'' (Leont'ev 1974).

Activity theory holds that the constituents of activity are not fixed but can dynamically change as conditions change. All levels can move both up and down (Leont'ev 1974). As we saw with gear shifting, actions become operations as the driver habituates to them. An operation can become an action when ``conditions impede an action's execution through previously formed operations'' (Leont'ev 1974). For example, if one's mail program ceases to work, one continues to send mail by substituting another mailer, but it is now necessary to pay conscious attention to using an unfamiliar set of commands. Notice that here the object remains fixed, but goals, actions, and operations change as conditions change. As Bødker (1989) points out, the flexibility recognized by activity theory is an important distinction between activity theory and other frameworks such as GOMS. Activity theory ``does not predict or describe each step in the activity of the user (as opposed to the approach of Card, Moran and Newell, 1983)'' as Bødker (1989) says, because activity theory recognizes that changing conditions can realign the constituents of an activity.

A key idea in activity theory is the notion of *mediation* by artifacts (Kuutti 1991). Artifacts, broadly defined to include instruments, signs, language, and machines, mediate activity and are created by people to control their own behavior. Artifacts carry with them a particular culture and history (Kuutti 1991) and are persistent structures that stretch across activities through time and space. As Kaptelinin (chapter 3, this volume) points out, recognizing the central role of mediation in human thought and behavior may lead us to reframe the object of our work as ``computer-mediated activity,'' in which the starring role goes to the activity itself rather than as ``human-computer interaction'' in which the relationship between the user and a machine is the focal point of interest.

Activity theory, then, proposes a very specific notion of context: the activity itself is the context. What takes place in an activity system composed of object, actions, and operation, *is* the context. Context is constituted through the enactment of an activity involving people and artifacts. Context is not an outer container or shell inside of which people behave in certain ways. People consciously and deliberately generate contexts (activities) in part through their own objects; hence context is not just ``out there.''

Context is both internal to people—involving specific objects and goals—and, at the same time, external to people, involving artifacts, other people, specific settings. The crucial point is that in activity theory, external and internal are fused, unified. In Zinchenko's discussion of functional organs (this volume) the unity of external and internal is explored (see also Kaptelinin, this volume, chapters 3 and 5). Zinchenko's example of the relationship between Rostropovich and his cello (they are inextricably implicated in one another) invalidates simplistic explanations that divide internal and external and schemes that see context as external to people. People transform themselves profoundly through the acquisition of functional organs; context cannot be conceived as simply a set of external ``resources'' lying about. One's ability—and choice—to marshall and use resources is, rather, the result of specific historical and developmental processes in which a person is changed. A context cannot be reduced to an enumeration of people and artifacts; rather the specific transformative relationship between people and artifacts, embodied in the activity theory notion of functional organ, is at the heart of any definition of context, or activity.

DISTRIBUTED COGNITION

The distributed cognition approach (which its practitioners refer to simply as distributed cognition, a convention I shall adopt here)

> is a new branch of cognitive science devoted to the study of: the representation of knowledge both inside the heads of individuals and in the world ...; the propagation of knowledge between different individuals and artifacts ...; and the transformations which external structures undergo when operated on by individuals and artifacts.... By studying cognitive phenomena in this fashion it is hoped that an understanding of how intelligence is manifested at the systems level, as opposed to the individual cognitive level, will be obtained. (Flor and Hutchins 1991)

Distributed cognition asserts as a unit of analysis a cognitive system composed of individuals and the artifacts they use (Flor and Hutchins 1991; Hutchins 1991a). The cognitive system is something like what activity theorists would call an activity; for example, Hutchins (1991a) describes the activity of flying a plane, focusing on ``the cockpit system." Systems have goals; in the cockpit, for example, the goal is the ``successful completion of a flight."[5] Because the system is not relative to an individual but to a distributed collection of interacting people and artifacts, we cannot understand how a system achieves its goal by understanding ``the properties of individual agents alone, no matter how detailed the knowledge of the properties of those individuals might be" (Hutchins 1991a). The cockpit, with its pilots and instruments forming a single cognitive system, can be understood only when we understand, as a unity, the contributions of the individual agents in the system and the coordination necessary among the agents to enact the goal, that is, to achieve ``the successful completion of a flight." (Hutchins 1994 studies shipboard navigation and makes similar points.)

Thus distributed cognition moves the unit of analysis to the system and finds its center of gravity in the functioning of the system, much as classic systems theory did (Weiner 1948; Ashby 1956; Bertalanffy 1968). While a distributed cognition analyst would probably, if pushed, locate system goals in the minds of the people who are part of the system, the intent is to redirect analysis to the systems level to reveal the functioning of the system itself rather than the individuals who are part of the system. Practitioners of distributed cognition sometimes refer to the ``functional system" (instead of the ``cognitive system") as their central unit of analysis (Hutchins 1994; Rogers and Ellis 1994), hinting at an even further distance from the notion of the individual that the term *cognitive* cannot help but suggest.

Distributed cognition is concerned with structure—representations inside and outside the head—and the transformations these structures undergo. This is very much in line with traditional cognitive science (Newell and Simon 1972) but with the difference that cooperating people and artifacts are the focus of interest, not just individual cognition ``in the head." Because of the focus on representations—both internal to an individual and those created and displayed in artifacts—an important emphasis is on the study of such representations. Distributed cognition tends to provide finely detailed analyses of particular artifacts (Norman 1988; Norman and Hutchins 1988; Nardi and Miller 1990; Zhang 1990; Hutchins 1991a, Nardi et al. 1993) and to be concerned with finding stable design principles that are widely applicable across design problems (Norman 1988, 1991; Nardi and Zarmer 1993).

The other major emphasis of distributed cognition is on understanding the coordination among individuals and artifacts, that is, to understand how individual agents align and share within a distributed process (Flor and Hutchins 1991; Hutchins 1991a, 1991b; Nardi and Miller 1991). For example, Flor and Hutchins (1991) studied how two programmers performing a software maintenance task coordinated the task among themselves. Nardi and Miller (1991) studied the spreadsheet as a coordinating device facilitating the distribution and exchange of domain knowledge within an organization. In these analyses, shared goals and plans, and the particular characteristics of the artifacts in the system, are important determinants of the interactions and the quality of collaboration.

DIFFERENCES BETWEEN ACTIVITY THEORY, SITUATED ACTION MODELS, AND DISTRIBUTED COGNITION

All three frameworks for analyzing context that we have considered are valuable in underscoring the need to look at real activity in real situations and in squarely facing the conflux of multifaceted, shifting, intertwining processes that comprise human thought and behavior. The differences in the frameworks should also be considered as we try to find a set of concepts with which to confront the problem of context in HCI studies.

The Structuring of Activity

An important difference between activity theory and distributed cognition, on the one hand, and situated action, on the other hand, is the treatment of motive and goals. In activity theory, activity is shaped first and foremost by an object held by the subject; in fact, we are able to distinguish one activity from another only by virtue of their differing objects (Leont'ev 1974; Kozulin 1986; Kuutti 1991, this volume). Activity theory emphasizes motivation and purposefulness and is ``optimistic concerning human self-determination" (Engeström 1990). A distributed cognition analysis begins with the positing of a *system goal*, which is similar to the activity theory notion of object, except that a system goal is an abstract systemic concept that does not involve individual consciousness.

Attention to the shaping force of goals in activity theory and distributed cogntion, be they conscious human motives or systemic goals, contrasts with the contingent, responsive, improvisatory emphasis of situated action. In situated action, one activity cannot be distinguished from another by reference to an object (motive); in fact Lave (1988) argues that ``goals [are not] a condition for action.... An analytic focus on direct experience in the lived-in world leads to ... the proposition that goals are *constructed*, often in verbal interpretation'' (emphasis in original). In other words, goals are our musings out loud about why we did something *after* we have done it; goals are ``retrospective and reflexive'' (Lave 1988).

In a similar vein, Suchman (1987), following Garfinkel (1967), asserts that ``a statement of intent generally says very little about the action that follows.'' If we appear to have plans to carry out our intent, it is because plans are ``an artifact of our *reasoning about* action, not ... the generative *mechanism* of action.'' (emphasis in original). Suchman (1987) says that plans are ``retrospective reconstructions.''[6] The position adopted by Lave (1988) and Suchman (1987) concerning goals and plans is that they are post hoc rationalizations for actions whose meaning can arise only within the immediacy of a given situation.

Lave (1988) asks the obvious question about this problematic view of intentionality: ``If the meaning of activity is constructed in action ... from whence comes its intentional character, and indeed its meaningful basis?'' Her answer, that ``activity and its values are generated simultaneously,'' restates her position but does not explicate it. Winograd and Flores (1986) also subscribe to this radically situated view, using the colorful term ``throwness'' (after Heidegger) to argue that we are actively embedded, or ``thrown into,'' in an ongoing situation that directs the flow of our actions much more than reflection or the use of durable mental representations.

In activity theory and distributed cognition, by contract, an object-goal is the beginning point of analysis. An object precedes and motivates activity. As Leont'ev (1974) states, ``Performing operations that do not realize any kind of goal-directed action [and recursively, a motive] on the subject's part is like the operation of a machine that has escaped human control.''

In activity theory and distributed cognition, an object is (partially) determinative of activity; in situated action, every activity is by definition uniquely constituted by the confluence of the particular factors that come together to form one ``situation.'' In a sense, situated action models are confined to what activity theorists would call the action and operation levels (though lacking a notion of goal at the action level in the activity theory sense). Situated action concentrates, at these levels, on the way people orient to changing conditions. Suchman's (1987) notion of ``embodied skills'' is similar to the notion of operations, though less rich than the activity theory construct which grounds operations in consciousness and specifies that operations are dependent on certain conditions obtaining and that they may dynamically transform into actions when conditions change.

While in principle one could reasonably focus one's efforts on understanding the action and operation levels while acknowledging the importance of the object level, neither Lave (1988) nor Suchman (1987), as we have seen, does this. On the contrary, the very idea of an object's generating activity is rejected; objects (goals) and plans are ``retrospective reconstructions,'' post hoc ``artifacts of reasoning about action,'' after action has taken place. Why people would construct such explanations is an interesting question not addressed in these accounts. And why other people would demand or believe such retrospective reconstructions is another question to be addressed by this line of reasoning.

Situated action models have a slightly behavioristic undercurrent in that it is the subject's reaction to the environment (the ``situation'') that finally determines action. What the analyst observes is cast as a response (the subject's actions/operations) to a stimulus (the ``situation''). The mediating influences of goals, plans, objects, and mental representations that would order the perception of a situation are absent in the situated view. There is no attempt to catalog and predict invariant reactions (as in classical behaviorism) as situations are said to vary unpredictably, but the relation between actor and environment is one of reaction in this logic.[7] People ``orient to a situation'' rather than proactively generating activity rich with meaning reflective of their interests, intentions, and prior knowledge.

Suchman and Trigg (1991) cataloged their research methods in describing how they conduct empirical studies. What is left out is as interesting as what is included. The authors report that they use (1) a stationary video camera to record behavior and conversation; (2) ``shadowing'' or following around an individual to study his or her movements; (3) tracing of artifacts and instrumenting of computers to audit usage, and (4) event-based analysis tracking individual tasks at different locations in a given setting. Absent from this catalog is the use of interviewing; interviews are treated as more or less unreliable accounts of idealized or rationalized behavior, such as subjectively reported goals as ``verbal interpretation'' (Lave

1988) and plans as ``retrospective reconstructions'' (Suchman 1987). Situated action analyses rely on recordable, observable behavior that is ``logged'' through analysis of a videotape or other record (Suchman and Trigg 1993; Jordan and Henderson 1994).[8] Accounts from study participants describing in their own words what they think are doing, and why, such as those in this book by Bellamy, Bødker, Christiansen, Engeström and Escalante, Holland and Reeves, and Nardi, are not a focal point of situated action analyses.

Activity theory has something interesting to tell us about the value of interview data. It has become a kind of received wisdom in the HCI community that people cannot articulate what they are doing (a notion sometimes used as a justification for observational studies and sometimes used to avoid talking to users at all). This generalization is true, however, primarily at the level of operations; it is certainly very difficult to say how you type, or how you see the winning pattern on the chessboard, or how you know when you have written a sentence that communicates well. But this generalization does not apply to the higher conscious levels of actions and objects; ask a secretary what the current problems are with the boss, or an effective executive what his goals are for the next quarter, and you will get an earful!

Skillful interviewing or the need to teach someone how to do something often bring operations to the subject's conscious awareness so that even operations can be talked about, at least to some degree. Dancers, for example, use imagery and other verbal techniques to teach dance skills that are extremely difficult to verbalize. The ability to bring operations to a conscious level, even if only partially, is an aspect of the dynamism of the levels of activity as posited by activity theory. When the subject is motivated (e.g., by wishing to cooperate with a researcher or by the desire to teach), at least some operational material can be retrieved (see Bødker, this volume). The conditions fostering such a dynamic move to the action level of awareness may include skillful probing by an interviewer.

In situated action, what constitutes a situation is defined by the researcher; there is no definitive concept such as object that marks a situation. The Leont'evian notion of object and goals remaining constant while actions and operations change because of changing conditions is not possible in the situated action framework that identifies the genesis of action as an indivisible conjunction of particularities giving rise to a unique situation. Thus we find a major difference between activity theory and situated action; in the former, the structuring of activity is determined in part, and in important ways, by human intentionality before the unfolding in a particular situation; in situated action, activity can be known only as it plays out in situ. In situated action, goals and plans cannot even be realized until after the activity has taken place, at which time they become constructed rationalizations for activity that is wholly created in the crucible of a particular situation. In terms of identifying activity, activity theory provides the more satisfying option of taking a definition of an activity directly from a subjectively defined object rather than imposing a definition from the researcher's view.

These divergent notions of the structuring of activity, and the conceptual tools that identify one activity distinctly from another, are important for comparative work in studies of human-computer interaction. A framework that provides a clear way to demarcate one activity from another provides more comparative power than one that does not. Analyses that are entirely self-contained, in the way that a truly situated description of activity is, provide little scope for comparison. The level of analysis of situated action models—at the moment-by-moment level—would seem to be too low for comparative work. Brooks (1991) criticizes human-factors task analysis as being too low level in that all components in an analysis must ``be specified as at atomic a level as possible.'' This leads to an ad hoc set of tasks relevant only to a particular domain and makes cross-task comparison difficult (Brooks 1991). A similar criticism applies to situated action models in which a focus on moment-by-moment actions leads to detailed descriptions of highly particularistic activities (such as pricing cheeses in a bin or measuring out cottage cheese) that are not likely to be replicated across contexts. Most crucially, no tools for pulling out a higher-level description from a set of observations are offered, as they are in activity theory.

Persistent Structures

An important question for the study of context is the role that persistent structures such as artifacts, institutions, and cultural values play in shaping activity. To what extent should we expend effort analyzing the durable structures that stretch across situations and activities that cannot be properly described as simply an aspect of a particular situation?

For both activity theory and distributed cognition, persistent structures are a central focus. Activity theory is concerned with the historical development of activity and the mediating role of artifacts. Leont'ev

(1974) (following work by Vygotsky) considered the use of tools to be crucial: ``A tool mediates activity that connects a person not only with the world of objects, but also with other people. This means that a person's activity assimilates the experience of humanity.'' Distributed cognition offers a similar notion; for example, Hutchins (1987) discusses ``collaborative manipulation,'' the process by which we take advantage of artifacts designed by others, sharing good ideas across time and space. Hutchins's example is a navigator using a map: the cartographer who created the map contributes, every time the navigator uses the map, to a remote collaboration in the navigator's task.

Situated action models less readily accommodate durable structures that persist over time and across different activities. To the extent that activity is truly seen as ``situated,'' persistent, durable structures that span situations, and can thus be described and analyzed *independent of a particular situation*, will not be central. It is likely, however, that situated action models, especially those concerned with the design of technology, will allow some latitude in the degree of adherence to a purist view of situatedness, to allow for the study of cognitive and structural properties of artifacts and practices as they span situations. Indeed, in recent articles we find discussion of ``routine practices'' (Suchman and Trigg 1991) and ``routine competencies'' (Suchman 1993) to account for the observed regularities in the work settings studied. The studies continue to report detailed episodic events rich in minute particulars, but weave in descriptions of routine behavior as well.

Situated action accounts may then exhibit a tension between an emphasis on that which is *emergent*, *contingent*, *improvisatory* and that which is *routine* and *predictable*. It remains to be seen just how this tension resolves—whether an actual synthesis emerges (more than simple acknowledgment that both improvisations and routines can be found in human behavior) or whether the claims to true situatedness that form the basis of the critique of cognitive science cede some importance to representations ``in the head.'' The appearance of routines in situated action models opens a chink in the situated armor with respect to mental representations; routines must be known and represented somehow. Routines still circumambulate notions of planful, intentional behavior; being canned bits of behavior, they obviate the need for active, conscious planning or the formulation of deliberate intentions or choices. Thus the positing of routines in situated action models departs from notions of emergent, contingent behavior but is consistent in staying clear of plans and motives.

Of the three frameworks, distributed cognition has taken most seriously the study of persistent structures, especially artifacts. The emphasis on representations and the transformations they undergo brings persistent structures to center stage. Distributed cognition studies provide in-depth analyses of artifacts such as nomograms (Norman and Hutchins 1988), navigational tools (Hutchins 1990), airplane cockpits (Hutchins 1991a), spreadsheets (Nardi and Miller 1990, 1991), computer-aided design (CAD) systems (Petre and Green 1992), and even everyday artifacts such as door handles (Norman 1988). In these analyses, the artifacts are studied as they are actually used in real situations, but the properties of the artifacts are seen as persisting across situations of use, and it is believed that artifacts can be designed or redesigned with respect to their intrinsic structure as well as with respect to specific situations of use. For example, a spreadsheet table is an intrinsically good design (from a perceptual standpoint) for a system in which a great deal of dense information must be displayed and manipulated in a small space (Nardi and Miller 1990). Hutchins's (1991a) analysis of cockpit devices considers the memory requirements they impose. Norman (1988) analyzes whether artifacts are designed to prevent users from doing unintended (and unwanted) things with them. Petre and Green (1992) establish requirements for graphical notations for computer-aided design (CAD) users based on users' cognitive capabilities. In these studies, an understanding of artifacts is animated by observations made in real situations of their use, but there is also important consideration given to the relatively stable cognitive and structural properties of the artifacts that are not bound to a particular situation of use.

Distributed cognition has also been productive of analyses of work practices that span specific situational contexts. For example, Seifert and Hutchins (1988) studied cooperative error correction on board large ships, finding that virtually all navigational errors were collaboratively ``detected and corrected within the navigation team.'' Gantt and Nardi (1992) found that organizations that make intensive use of CAD software may create formal in-house support systems for CAD users composed of domain experts (such as drafters) who also enjoy working with computers. Rogers and Ellis (1994) studied computer-mediated work in engineering practice. Symon et al. (1993) analyzed the coordination of work in a radiology department in a large hospital. Nardi et al. (1993) studied the coordination of work during neurosurgery afforded by video located within the operating room and at remote locations in the hospital. A series of studies on end user computing have found a strong pattern of cooperative work among users of a variety of software systems in very different arenas, including users of word processing programs (Clement 1990), spreadsheets (Nardi and Miller 1990, 1991), UNIX (Mackay 1990), a scripting language (MacLean et al. 1990), and CAD systems (Gantt and Nardi 1992).

In these studies the work practices described are not best analyzed as a product of a specific situation but are important precisely because they span particular situations. These studies develop points at a high level of analysis; for example, simply discovering that application development is a collaborative process has profound implications for the design of computer systems (Mackay 1990; Nardi 1993). Moment-by-moment actions, which would make generalization across contexts difficult, are not the key focus of these studies, which look for broader patterns spanning individual situations.

People and Things: Symmetrical or Asymmetrical?

Kaptelinin (chapter 5, this volume) points out that activity theory differs fundamentally from cognitive science in rejecting the idea that computers and people are equivalent. In cognitive science, a tight information processing loop with inputs and outputs on both sides models cognition. It is not important whether the agents in the model are humans or things produced by humans (such as computers). (See also Bødker, this volume, on the tool perspective.)

Activity theory, with its emphasis on the importance of motive and consciousness—which belong only to humans—sees artifacts and people as different. Artifacts are mediators of human thought and behavior; people and things are not equivalent. Bødker (this volume) defines artifacts as instruments in the service of activities. In activity theory, people and things are unambiguously asymmetrical.

Distributed cognition, by contrast, views people and things as conceptually equivalent; people and artifacts are ``agents" in a system. This is similar to traditional cognitive science, except that the scope of the system has been widened to include a collaborating set of artifacts and people rather than the narrow ``man-machine" dyad of cognitive science.

While treating each node in a system as an ``agent" has a certain elegance, it leads to a problematic view of cognition. We find in distributed cognition the somewhat illogical notion that artifacts are cognizing entities. Flor and Hutchins (1991) speak of ``the propagation of knowledge between different individuals and artifacts." But an artifact cannot know anything; it serves as a medium of knowledge for a human. A human may act on a piece of knowledge in unpredictable, self-initiated ways, according to socially or personally defined motives. A machine's use of information is always programmatic. Thus a theory that posits equivalence between human and machine damps out sources of systemic variation and contradiction (in the activity theory sense; see Kuutti, this volume) that may have important ramifications for a system. The activity theory notion of artifacts as mediators of cognition seems a more reasoned way to discuss relations between artifacts and people.

Activity theory instructs us to treat people as sentient, moral beings (Tikhomirov 1972), a stance not required in relation to a machine and often treated as optional with respect to people when they are viewed simply as nodes in a system. The activity theory position would seem to hold greater potential for leading to a more responsible technology design in which people are viewed as active beings in control of their tools for creative purposes rather than as automatons whose operations are to be automated away, or nodes whose rights to privacy and dignity are not guaranteed. Engeström and Escalante (this volume) apply the activity theory approach of asymmetrical human-thing relations to their critique of actor-network theory.

In an analysis of the role of Fitts's law in HCI studies undertaken from an activity theory perspective, Bertelsen (1994) argues that Fitts's ``law" is actually an effect, subject to contextual variations, and throws into question the whole notion of the person as merely a predictable mechanical ``channel." Bertelsen notes that ``no matter how much it is claimed that Fitts' Law is merely a useful metaphor, it will make us perceive the human being as a channel. The danger is that viewing the human being as a channel will make us treat her as a mechanical device.... Our implicit or explicit choice of world view is also a choice of the world we want to live in; disinterested sciences do not exist" (Bertelsen 1994). Seeing Fitts's findings as an effect, subject to contextual influence, helps us to avoid the depiction of the user as a mechanical part.

Activity theory says, in essence, that we are what we do. Bertelsen sees Fitts's law as a tool of a particular kind of science that ``reduces the design of work environments, e.g., computer artifacts, to a matter of economical optimization." If we wish to design in such a manner, we will create a world of ruthless optimization and little else, but it is certainly not inevitable that we do so. However, no amount of evidence that people are capable of behaving opportunistically, contingently, and flexibly will inhibit the development and dispersal of oppressive technologies; Taylorization has made that clear. If we wish a different world, it is necessary to design humane and liberating technologies that create the world as we wish it to be.

There are never cut-and-dried answers, of course, when dealing with broad philosophical problems such as the definition of people and things, but activity theory at least engages the issue by maintaining that there is a difference and asking us to study its implications. Many years ago, Tikhomirov (1972) wrote, ``How society formulates the problem of advancing the creative content of its citizens' labor is a necessary condition for the full use of the computer's possibilities."

Situated action models portray humans and things as qualitatively different. Suchman (1987) has been particularly eloquent on this point. But as I have noted, situated action models, perhaps inadvertently, may present people as reactive ciphers rather than fully cognizant human actors with self-generated agendas.

DECIDING AMONG THE THREE APPROACHES

All three approaches to the study of context have merit. The situated action perspective has provided a much-needed corrective to the rationalistic accounts of human behavior from traditional cognitive science. It exhorts us not to depend on rigidly conceived notions of inflexible plans and goals and invites us to take careful notice of what people are actually doing in the flux of real activity. Distributed cognition has shown how detailed analyses that combine the formal and cognitive properties of artifacts with observations on how artifacts are used can lead to understandings useful for design. Distributed cognition studies have also begun to generate a body of comparative data on patterns of work practices in varying arenas.

Activity theory and distributed cognition are very close in spirit, as we have seen, and it is my belief that the two approaches will mutually inform, and even merge, over time, though activity theory will continue to probe questions of consciousness outside the purview of distributed cognition as it is presently formulated. The main differences with which we should be concerned here are between activity theory and situated action. Activity theory seems to me to be considerably richer and deeper than the situated action perspective.[9] Although the critique of cognitive science offered by situated action analysts is cogent and has been extremely beneficial, the insistence on the ``situation" as the primary determinant of activity is, in the long run, unsatisfying. What is a ``situation"? How do we account for variable responses to the same environment or ``situation" without recourse to notions of object and consciousness?

To take a very simple example, let us consider three individuals, each going on a nature walk. The first walker, a bird watcher, looks for birds. The second, an entomologist, studies insects as he walks, and the third, a meteorologist, gazes at clouds. The walker will carry out specific actions, such as using binoculars, or turning over leaves, or looking skyward, depending on his or her interest. The ``situation" is the same in each case; what differs is the subject's object. While we might define a situation to include some notion of the subject's intentions, as we have seen, this approach is explicitly rejected by situated action analysts. (See also Lave 1993.)

To take the example a step further, we observe that the bird watcher and the meteorologist might in some cases take exactly the same action from a behavioral point of view, such as looking skyward. But the observable action actually involves two very different activities for the subjects themselves. One is studying cloud formations, the other watching migrating ducks. The action of each, as seen on a videotape, for example, would appear identical; what differs is the subject's intent, interest, and knowledge of what is being looked at.

If we do not consider the subject's object, we cannot account for simple things such as, in the case of the bird watcher, the presence of a field guide to birds and perhaps a ``life list" that she marks up as she walks along.[10] A bird watcher may go to great lengths to spot a tiny flycatcher high in the top of a tree; another walker will be totally unaware of the presence of the bird. The conscious actions and attention of the walker thus derive from her object. The bird watcher may also have an even longer-term object in mind as she goes along: adding all the North American birds to her life list. This object, very important to her, is in no way knowable from ``the situation" (and not observable from a videotape). Activity theory gives us a vocabulary for talking about the walker's activity in meaningful subjective terms and gives the necessary attention to what the subject brings to a situation.[11] In significant measure, the walker construes and creates the situation by virtue of prior interest and knowledge. She is constrained by the environment in important ways, but her actions are not determined by it. As Davydov, Zinchenko, and Talyzina (1982) put it, the subject actively ```meets' the object with partiality and selectivity," rather than being ``totally subordinate to the effects of environmental factors ... the principle of reactivity is counterposed to the principle of the subject's activeness."

It is also important to remember that the walker has consciously chosen an object and taken the necessary actions for carrying it out; she did not just suddenly and unexpectedly end up in the woods. Can we really say, as Suchman (1987) does, that her actions are ``ad hoc''? Situated action analyses often assume a ``situation" that one somehow finds oneself in, without consideration of the fact that the very ``situation" has already been created in part by the subject's desire to carry out some activity. For example, Suchman's famous canoeing example, intended to show that in the thick of things one abandons plans, is set up so that the ``situation" is implicitly designated as ``getting your canoe through the falls" (Suchman 1987). Surely the deck is stacked here. What about all the plotting and planning necessary to get away for the weekend, transport the canoe to the river, carry enough food, and so forth that must also be seen as definitive of the situation? It is only with the most mundane, plodding, and planful effort that one arrives ``at the falls." To circumscribe the ``situation" as the glamorous, unpredictable moment of running the rapids is to miss the proverbial boat, as it were. An activity theory analysis instructs us to begin with the subjectively defined object as the point of analytical departure and thus will lead not simply to crystalline moments of improvisatory drama (whether measuring cottage cheese or running rapids) but to a more global view that encompasses the totality of an activity construed and constructed, in part, prior to its undertaking, with conscious, planful intent.

Holland and Reeves (this volume) studied the differing paths taken by three groups of student programmers all enrolled in the same class and all beginning in the same ``situation." The professor gave each group the same specific task to accomplish during the semester and the students' ``performances were even monitored externally from an explicit and continually articulated position." The students were all supposed to be doing the same assignment; they heard the same lectures and had the same readings and resources. But as Holland and Reeves document, the projects took radically different courses and had extremely variable outcomes *because the students themselves redefined the object of the class*. Our understanding of what happened here must flow from an understanding of how each group of students construed, and reconstrued, the class situation. The ``situation" by itself cannot account for the fact that one group of students produced a tool that was chosen for demonstration at a professional conference later in the year; one group produced a program with only twelve lines of code (and still got an A!); and the third group ``became so enmeshed in [interpersonal struggles] that the relationships among its members frequently became the object of its work."

Bellamy (this volume) observes that to achieve practical results such as successfully introducing technology into the classroom, it is necessary to understand and affect the objects of educators: ``to change the underlying educational philosophy of schools, designers must design technologies that support students' learning activities and design technologies that support the activities of educators and educational administrators. Only by understanding and designing for the complete situation of education ... will it be possible for technology to bring about pervasive educational reform."

Situated action models make it difficult to go beyond the particularities of the immediate situation for purposes of generalization and comparison. One immerses in the minutiae of a particular situation, and while the description may feel fresh, vivid, and ``on-the-ground" as one reads it, when a larger task such as comparison is attempted, it is difficult to carry the material over. One finds oneself in a claustrophobic thicket of descriptive detail, lacking concepts with which to compare and generalize. The lack of conceptual vocabulary, the appeal to the ``situation" itself in its moment-by-moment details, do not lend themselves to higher-order scientific tasks where some abstraction is necessary.

It is appropriate to problematize notions of comparison and generalization in order to sharpen comparisons and generalizations, but it is fruitless to dispense with these foundations of scientific thought. A pure and radically situated view would by definition render comparison and generalization as logically at odds with notions of emergence, contingency, improvisation, description based on in situ detail and point of view. (I am not saying any of the situated theorists cited here are this radical; I am playing out the logical conclusion of the ideas.) Difficult though it may be to compare and generalize when the subject matter is people, it is nonetheless important if we are to do more than simply write one self-contained descriptive account after another. The more precise, careful, and sensitive comparisons and generalizations are, the better. This is true not only from the point of view of science but also of technology design. Design, a practical activity, is going to proceed apace, and it is in our best interests to provide comparisons and generalizations based on nuanced and closely observed data, rather than rejecting the project of comparison and generalization altogether.

Holland and Reeves compare their study to Suchman's (1994) study, which centers on a detailed description of how operations room personnel at an airport coordinated action to solve the problems of a dysfunctional ramp. Holland and Reeves point out that they themselves might have focused on a similar minutely observed episode such as studying how the student programmers produced time logs. However, they argue that they would then have missed the bigger picture of what the students were up to if they had, for example, concentrated on ``videotapes and transcriptions ... show[ing], the programmers' use of linguistic markers in concert with such items as physical copies of the time-log chart and the whiteboard xeroxes in order to orient joint attention, for example."

Holland and Reeves's analysis argues for a basic theoretical orientation that accommodates a longer time horizon than is typical of a ``situation." They considered the entire three-month semester as the interesting frame of reference for their analysis, while Suchman looked at a much shorter episode, more easily describable as a ``situation." (See also Suchman and Trigg 1993, where the analysis centers on an hour and a half of videotape.) Holland and Reeves's analysis relies heavily on long-term participant-observation and verbal transcription; Suchman focuses on the videotape of a particular episode of the operations room in crisis. In comparing these two studies, we see how analytical perspective leads to a sense of what is interesting and determines where research effort is expended. Situated action models assume the primacy of a situation in which moment-by-moment interactions and events are critical, which leads away from a longer time frame of analysis. Videotape is a natural medium for this kind of analysis, and the tapes are looked at with an eye to the details of a particular interaction sequence (Jordan and Henderson 1994). By contrast, an activity theory analysis has larger scope for the kind of longer-term analysis provided by Holland and Reeves (though videotapes may certainly provide material of great interest to a particular activity theory analysis as in Bødker, this volume, and Engeström and Escalante, this volume).

Of course the observation that theory and method are always entangled is not new; Hegel (1966) discussed this problem. Engeström (1993) summarized Hegel's key point: ``Methods should be developed or `derived' from the substance, as one enters and penetrates deeper into the object of study." And Vygotsky (1978) wrote, ``The search for method becomes one of the most important problems of the entire enterprise of understanding the uniquely human forms of psychological activity. In this case, the method is simultaneously prerequisite and product, the tool and the result of the study."

Situated action models, then, have two key problems: (1) they do not account very well for observed regularities and durable, stable phenomena that span individual situations, and (2) they ignore the subjective. The first problem is partially addressed by situated action accounts that posit routines of one type or another (as discussed earlier). This brings situated action closer to activity theory in suggesting the importance of the historical continuity of artifacts and practice. It weakens true claims of ``situatedness" which highlight the emergent, contingent aspects of action.

There has been a continuing aversion to incorporating the subjective in situated action models, which have held fast in downplaying consciousness, intentionality, plans, motives, and prior knowledge as critical components of human thought and behavior (Suchman 1983, 1987; Lave 1988, 1993; Suchman and Trigg 1991; Lave and Wenger 1991; Jordan and Henderson 1994). This aversion appears to spring from the felt need to continue to defend against the overly rationalistic models of traditional cognitive science (see *Cognitive Science* 17, 1993 for the continuing debate) and the desire to encourage people to look at action in situ. While these are laudable motivations, it is possible to take them too far. It is severely limiting to ignore motive and consciousness in human activity and constricting to confine analyses to observable moment-by-moment interactions. Aiming for a broader, deeper account of what people are up to as activity unfolds over time and reaching for a way to incorporate subjective accounts of why people do what they and how prior knowledge shapes the experience of a given situation is the more satisfying path in the long run. Kaptelinin (chapter 5, this volume) notes that a fundamental question dictated by an activity theory analysis of human-computer interaction is: ``What are the objectives of computer use by the user and how are they related to the objectives of other people and the group/organization as a whole?" This simple question leads to a different method of study and a different kind of result from a focus on a situation defined in its moment-by-moment particulars.

METHODOLOGICAL IMPLICATIONS OF ACTIVITY THEORY

To summarize the practical methodological implications for HCI studies of what we have been discussing in this section, we see that activity theory implies:

1. *A research time frame long enough to understand users' objects*, including, where appropriate, changes in objects over time and their relation to the objects of others in the setting studied. Kuutti (this volume) observes that ``activities are longer-term formations and their objects cannot be transformed into outcomes at once, but through a process consisting often of several steps or phases." Holland and Reeves (this volume) document changing objects in their study of student programmers. Engeström and Escalante (this volume) trace changes in the objects of the designers of the Postal Buddy. Christiansen (this volume) shows how actions can become objectified, again a process of change over time.

2. *Attention to broad patterns of activity* rather than narrow episodic fragments that fail to reveal the overall direction and import of an activity. The empirical studies in this book demonstrate the methods and tools useful for analyzing broad patterns of activity. Looking at smaller episodes can be useful, but not in isolation. Bødker (this volume) describes her video analysis of episodes of use of a computer artifact: ``Our ethnographic fieldwork was crucial to understanding the sessions in particular with respect to contextualization."[12] Engeström and Escalante apply the same approach.

3. *The use of a varied set of data collection techniques* including interviews, observations, video, and historical materials, without undue reliance on any one method (such as video). Bødker, Christiansen, Engeström and Escalante, and Holland and Reeves (this volume) show the utility of historical data (see also McGrath 1990; Engeström 1993).

4. *A commitment to understanding things from users' points of view*, as in, for example, Holland and Reeves (this volume). Bellamy (this volume) underscores the practical need for getting the ``natives'" point of view in her study of technology in the classroom.

For purposes of technology design, then, these four methodological considerations suggest a phased approach to design and evaluation. Laboratory-based experiments evaluating usability, the most commonly deployed HCI research technique at present, are a second phase in a longer process initiated by discovering the potential usefulness of technology through field research. Raeithel and Velichkovsky (this volume) describe an innovative technique of monitored communication for facilitating collaboration between designers and users. This technique sits somewhere between experimental and field methods and shows promise of providing a good way to encourage participatory design in a laboratory setting.

CONCLUSION

Activity theory seems the richest framework for studies of context in its comprehensiveness and engagement with difficult issues of consciousness, intentionality, and history. The empirical studies from all three frameworks are valuable and will undoubtedly mutually inform future work in the three areas.

Human-computer interaction studies are a long way from the ideal set out by Brooks (1991): a corpus of knowledge that identifies the properties of artifacts and situations that are most significant for design and which permits comparison over domains, generates high-level analyses, and suggests actual designs. However, with a concerted effort by researchers to apply a systematic conceptual framework encompassing the full context in which people and technology come together, much progress can be made. A creative synthesis of activity theory as a backbone for analysis, leavened by the focus on representations of distributed cognition, and the commitment to grappling with the perplexing flux of everyday activity of the situated action perspective, would seem a likely path to success.

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NOTES

1. This chapter is an expanded version of the paper that appeared in *Proceedings East-West HCI Conference* (pp. 352–359), St. Petersburg, Russia. August 4–8, 1992, used with permission of the publisher.

2. I concentrate here on what Salomon (1993) calls the ``radical'' view of situatedness, to explore the most fundamental differences among the three perspectives.

3. Lave (1988) actually argues for the importance of institutions, but her analysis does not pay much attention to them, focusing instead on fine-grained descriptions of the particular activities of particular individuals in particular settings.

4. Weight Watchers is an organization that helps people lose weight. Dieters must weigh and measure their food to ensure that they will lose weight by carefully controlling their intake.

5. The word *goal* in everyday English usage is generally something like what activity theorists call an object in that it connotes a higher-level motive.

6. Suchman (1987) also says that plans may be ``projective accounts'' of action (as well as retrospective reconstructions), but it is not clear what the difference is between a conventional notion of plan and a ``projective account.''

7. Rhetorically, the behavioristic cast of situated action descriptions is reflected in the use of impersonal referents to name study participants when reporting discourse. For example, study participants are referred to as ``Shopper'' in conversational exchanges with the anthropologist in Lave (1988), or become ciphers, e.g., A, B (Suchman 1987), or initials denoting the work role of interest, such as ``BP'' for baggage planner (Suchman and Trigg 1991). The use of pseudonyms to suggest actual people would be more common in a typical ethnography.

8. A good overview of the use of video for ``interaction analysis'' in which moment-by-moment interactions are the focus of study is provided by Jordan and Henderson (1994). They posit that understanding what someone ``might be thinking or intending'' must rely on ``*evidence* ... such as errors in verbal production or certain gestures and movements'' (emphasis in original). The ``evidence'' is not a verbal report by the study participant; it must be something visible on the tape—an observable behavior such as a verbal mistake. Jordan and Henderson observe that intentions, motivations and so forth ``can be talked about *only by reference to evidence on the tape*'' (emphasis in original). The evidence, judging by all their examples, does not include the content of what someone might say on the tape but only ``reactions,'' to use their word, actually seen on the tape.

This is indeed a radical view of research. Does it mean that all experimental and naturalistic study in which someone is said to think or intend that has heretofore been undertaken and for which there are no video records does not have any ``evidence''? Does it mean that a researcher who has access only to the tapes has as good an idea of what study participants are up to as someone who has done lengthy participant-observation? The answers would appear to be yes since the ``evidence'' is, supposedly, encased in the tapes. In the laboratory where Jordan and Henderson work, the tapes are indeed analyzed by researchers who have not interacted personally with the study participants (Jordan and Henderson 1994). While certainly a great deal can be learned this way, it would also seem to limit the scope and richness of analysis. Much of interest happens outside the range of a video camera. The highly interpretive nature of video analysis has not been acknowledged by its supporters. The method is relatively new and in the first flush of enthusiastic embrace. Critiques will follow; they are being developed by various researchers taking a hard look at video.

Jordan and Henderson do invite study participants into the lab to view the tapes and comment on them. This seems like a very interesting and fruitful idea. However, their philosophy is to try to steer informats toward their own epistemology—that is, that what is on the video is reality—not some other subjective reality the study participants might live with. As Jordan and Henderson (1994) say, ``elicitation'' based on viewing tapes ``has the advantage of staying much closer to the *actual events* [than conventional interviews]'' (emphasis added).

9. Rogers and Ellis (1994) make this same argument but for distributed cognition. However they do not consider activity theory.

10. Many bird watchers keep ``life lists'' in which they write down every individual bird species they have ever seen. They may want to see all the North American birds, or all the birds of Europe, or some other group of interest to them.

11. I use the term *subjective* to mean ``emanating from a subject'' (in activity theory terms), not ``lacking in objectivity'' in the sense of detachment, especially scientific detachment (a common meaning in English).

12. While Jordan and Henderson state that participant-observation is part of their method in interaction analysis, they use participant-observation to ``identify interactional `hot spots'—sites of activity for which videotaping promises to be productive'' (Jordan and Henderson 1994). Participant observation is used as a heuristic for getting at something very specific—interactions—and further, those particular interactions that will presumably be interesting on tape. In a sense, interaction analysis turns participant-observation on its head by selectively seeking events that will lend themselves to the use of a particular technology— video—rather than using video if and when a deeper understanding of some aspect of a culture is revealed in the process of getting to know the natives in their own terms, as in classic participant-observation. Note that Bødker (this volume) pairs ethnographic fieldwork with video to provide for contextualization; she thus uses ethnography to *add to* what can be seen on the tape, while Jordan and Henderson use it to *pare down* what will appear on the tape and thus what will be analyzed as ``evidence.''

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