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COGNITIVISM, SITUATED COGNITION, AND DEWEYIAN PRAGMATISM

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> One of the weightiest problems with which the philosophy of education has to cope is the method of keeping a proper balance between the informal and the formal, the incidental and the intentional, modes of education. When the acquiring of information and of a technical intellectual skill do not influence the formation of a social disposition, ordinary vital experience fails to gain in meaning, while schooling, in so far, creates only "sharps" in learning — that is, egoistic specialists.
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> John Dewey, *Democracy and Education* (1916, p. 9)

The "symbol-processing" view of cognition, in which human thinking is seen as akin to a computer performing formal operations on symbols, has been the uncontested leader among approaches to understanding human thinking, learning and development since some time in the 1960s. This dominant position has recently been challenged, however, by proponents of "situated cognition," who suggest that we would do better to conceive of cognition as it is involved in the practical doings of "just plain folks" (Lave, 1988) than in the formal operations of computers.

An informal sense of the difference between these approaches can be gained by considering the research that has been paradigmatic for each. Research in the symbol-processing tradition has generally focused on the kinds of tasks familiar to academics or other professionals. Logical deduction, cryptarithmetic, chess-playing, disease diagnosis, mechanical fault-finding, and scientific discovery are examples. Work on situated cognition, on the other hand, has focused on methods of price-comparison used by grocery shoppers, the ways in which dieters calculate their portions by physical manipulation, how milkmen figure out their deliveries using the constraints of the delivery boxes, the way Liberian tailors learn to sew through apprenticeship, and so on. The difference is not just a matter of professional versus lay expertise, however, but of priority given to theory versus practice. The symbol-processing approach begins with theory and works towards practice, while the situated approach begins with practice and works towards theory.

In what follows I will consider the debate between these two approaches. I begin by discussing the symbol-processing model, following out its assumptions with respect to the relations between language and reality, mind and body, and individual and society. In each case I characterize the approach as a form of dualism. I then discuss a situated approach, relating it to Dewey's transactionalism (Dewey and Bentley, 1949). The way in which a situated approach tackles each of these relations is characterized as a form of pluralism. In the conclusions I suggest a desirable relation between these two strategies, one of which puts theory before practice and the other practice before theory.

COGNITION AS SYMBOL-PROCESSING

One assumption common to many members of the family of symbol-processing approaches is the belief that individual and environment are separately described and in need of being related. In Newell and Simon's (1972) influential model, for example, problem-solving consists of formal operations on symbols "in the head" which represent objects, properties, and relationships in the external world. Problem-solving consists of the process of transforming these symbolic structures,

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using a set of rules or operators, until an initial state is changed into the goal state. The sequence of operations which accomplishes this transformation is a plan representing the sequence of actions solving the problem in the "real world." This same model is used in explaining human learning, development, and other processes, and is used in many artificial systems, such as expert systems, intelligent tutoring systems, and robot planners.

The subject/object dualism on which this approach is often based can be related to a number of more specific splits.

Language and Reality

In a symbol-processing approach describing the world correctly is a matter of having the properties and relationships specified in a set of sentences or other symbolic structures match the properties and relationships in the external world. This approach thus involves tacit belief in "representationalism," the belief that symbols mirror reality.

> At its simplest, the rationalistic [that is, symbol-processing] view accepts the existence of an objective reality, made up of things bearing properties and entering into relations. A cognitive being "gathers information" about those things and builds up a "mental model" which will be in some respects correct (a faithful representation of reality) and in other respects incorrect. Knowledge is a storehouse of representations, which can be called upon for use in reasoning and which can be translated into language. Thinking is a process of manipulating representations (Winograd and Flores, 1986, p. 73).

The educational equivalent of this belief is the view that knowledge representing how the world "really" is must be transmitted to students. When they have the same statements in their heads as the teacher, it is presumed that they "know" something.

Beliefs about sentences mirroring reality have been thoroughly questioned in contemporary philosophy, which finds this position not so much false as incoherent (Rorty, 1979). The difficulty is that it is hard to understand what it would mean for there to be a language-independent reality against which a description could be compared, for any such reality must be something about which nothing can be said or expressed (Goodman, 1978).

> How can we possibly know that our representations of the world are correct? The only answer seems to involve checking those representations against the world to see if they in fact match, but, by assumption, the only epistemic contact we have with the world is via those representations themselves — any such check, therefore, is circular (Bickhard, 1992, p. 63).

Or, as Rorty (1991a, p. 7) suggests, "questions which we should have to climb out of our own minds to answer should not be asked."

Mind and Body

A second dualism involves the tacit separation of mind from body. Thinking is often conceived as something that goes on in the head without intimate physical interaction with the surroundings. Such physical contact and the mechanisms by which it comes about are implicitly viewed as parts of body rather than mind. The educational analog is the view that students learn by passively sitting still and absorbing knowledge rather than by actively manipulating things and testing the results of their inquiries (Dewey, 1916).

Roboticist Rodney Brooks points out that such assumptions arose in work in artificial intelligence and robotics, in part, because these fields developed in a fragmented way (Brooks, 1991). Perception systems, planning systems, and motor systems were all developed more or less separately. When these separately developed components were stuck together to build a whole system (what Brooks calls a "traditional academic robot") the tendency was to construct it in serial fashion, with the outputs of the perception system feeding into the planning and representing system, which then fed into the motor system. Such a system first sees, *then* thinks, *then* acts. Its perception is passive and

not tightly related to its activity, giving it no direct *feel* for the situation, only cognitive descriptions of it.

The principal difficulty with such systems arises from the fact that they use a given vocabulary or set of primitives to describe "the world." The primitives of such a language define the space of possible discriminations available to the system; their use amounts to adoption of a certain theory about the world. The problem is that any such theory will be blind to the side-effects of adopting that theory in the first place.

> Whenever we treat a situation as present-at-hand, analyzing it in terms of objects and their properties, we thereby create a blindness. Our view is limited to what can be expressed in the terms we have adopted….In writing a computer program, the programmer is responsible for characterizing the task domain as a collection of objects, properties, and operations, and for formulating the goals in terms of these….The program is forelimited to working within the world determined by the programmer's explicit articulation….It therefore embodies the blindness that goes with this articulation (Winograd and Flores, 1986).

The practical consequence is that most current systems are limited to carefully-engineered environments for which they have been preprogrammed with the appropriate descriptors.

Individual and Society

A third subject/object split involves the tacit separation of individual and group in symbol-processing research. Thinking, learning, and development are often thought of as processes taking place inside the individual with social influences coming from the outside (Newman, Griffin, and Cole, 1989). The educational analog is the belief that students should work alone, learning being a basically private matter.

One of the principal methods for separating individual and social influences is through the adoption of a standardized task. If researchers or teachers think they know what *the* task is, then they can compare the performance of different individuals on the task, or compare changes in the performance of the same individual over repeated trials. Common views of intelligence, problem-solving, learning, and development presuppose such stable and known tasks. In fact, without this assumption it is not clear what we would mean by "learning" (Bateson, 1972). However, knowing *the* task assumes that there is one correct interpretation of what is going on. If a subject has a different interpretation then judgments based on performance on the researcher's version will be misleading. This is of great practical importance because laboratory subjects and school pupils are often judged to be stupid or not to have learned anything when they might equally well be seen as having been doing something different than what was understood by the teacher or researcher (Newman, et al., 1989).

Summary

Each of these dualisms is the product of a privileged description. In each case it is assumed that the proper space in which things are to be described is known. The difficulty with this approach is that presupposing a particular vocabulary amounts to adopting a fixed and unquestioning orientation before inquiry begins. Such an orientation will have blindnesses and rigidity built in from the start because its own usefulness cannot be questioned. This may well be why the symbol-processing model has little to say about psychopathology. If the proper vocabulary can emerge from *within* the process of acting and inquiring, however, then it may be changed and adapted as needed. Such considerations bring us to a situated view of cognition.

COGNITION AS SITUATED

A common theme uniting many situated approaches to cognition is a shift in the way the person/environment relationship is conceived. Rather than a person being "in" an environment ("like

a cherry in a bowl," as Dewey once put it), the activities of person and environment are viewed as parts of a mutually-constructed whole. Put simply, the inside/outside relationship between person and environment is replaced by a part/whole relationship.

This shift in view is made more plausible by viewing person and environment in terms of their contributions to an activity rather than as separately described *things*. Viewed actively, the adaptation of person and environment involves dynamic mutual modification rather than static matching. Such an "interactivist" (Bickhard, 1992) "relational" (Lave and Wenger, 1991) or "dialectical"(Clancey, 1991) view has been as central to work on situated cognition as a "transactional" view was to pragmatism (Dewey and Bentley, 1949). Work relating to this view includes that inspired by Vygotsky's socio-historical approach (Newman, et al., 1989; Rogoff and Lave, 1984; Wertsch, 1985; Wertsch, 1991), Garfinkel's ethnomethodology (Suchman, 1987), evolutionary epistemology and cybernetics (Bateson, 1972; Bickhard, 1992; Varela, et al., 1991), neo-Marxist theories of practice (Lave, 1988; Lave and Wenger, 1991), philosophical situation theory (Barwise and Perry, 1983), and Deweyian pragmatism (Schön, 1983).

In fleshing out this view one may find it helpful to think about a performance as the product of a history of relating in which both person and environment change over the course of the transaction (Dewey, 1958; Varela, et al., 1991). Drawing, for example, is a drawn out affair when viewed in this way: one draws, responds to what one has drawn, draws more, and so on. The goals for, and interpretation of, the drawing change as it evolves and different effects become possible. Acting *with* the environment in this way contrasts with acting *on* it, because it presupposes that it will turn around and alter oneself in return. The production of a well-coordinated performance then involves a kind of dance *between* person and environment rather than the one-way action of one on the other. Such performances are often described in artistic terms acknowledging interplay, such as "concerted," "orchestrated," or "composed" (for example, Erickson and Schultz, 1982).

Language and Reality

Rather than viewing language as mirroring a separately given reality, a situated view tends to see it as a means for social coordination and adaptation (Mead, 1934; Winograd and Flores, 1986). As Rorty (1991b, p. 4), puts it, language can be seen as "strings of marks and noises which organisms use as tools for getting what they want." Viewed in this way, it makes no sense to think of linguistic utterances as truths or falsehoods depending on whether they mirror separately described objects, for knowledge is not a matter of mirroring. It is the product of a particular process of inquiry arising within a situation which allows action to carry on (Dewey and Bentley, 1949). Thus, in this interpretation, knowledge is inseparable from the occasions and activities of which it is the product (Brown, Collins, and Duguid, 1989, p. 32).

Dewey argued that linguistic expressions must function in a joint activity if they are to have any determinate meaning. In fact, such functioning is what gives them meaning in the first place.

> The sound h-a-t would remain as meaningless as a sound in Choctaw…if it were not uttered in connection with an action which is participated in by a number of people….the sound h-a-t gains meaning in precisely the same way that the thing "hat" gains it, by being used in a given way. And they acquire the same meaning with the child which they have with the adult because they are used in a common experience by both….Understanding one another means that objects, including sounds, have the same value for both with respect to carrying on a common pursuit….We conclude…that the use of language to convey and acquire ideas is an extension and refinement of the principle that things gain meaning by being used in a shared experience or joint action (Dewey, 1916, p. 15-16).

Viewed in this way, language is no longer a mirror of nature but part of a natural process involving evolutionarily successful habits and capabilities. As Dewey, again, put it:

> If…language…is recognized as the instrument of social cooperation and mutual participation, continuity is established between natural events (animal sound, cries, etc.) and the origin and development of meanings.

> Mind is seen to be a function of social interactions, and to be a genuine character of natural events when these attain the stage of widest and most complex interaction with one another (Dewey, 1958, p. xii-xiii).

The practical implication is that education is a matter of learning to participate in a jointly constructed social activity rather than transmission from one head to another.

Mind and Body

If one thinks of mind not as a thing, but as a verb or adverb, such as "minding" or acting "mindfully," then mind is more likely to be seen as a functional property of the interaction between individual and environment than as something tucked away in the cranium.

> Psychological does not mean psychic, or refer to events going on exclusively within the head or "subcutaneously." To become aware of an object cognitively…involves external physical movements and external physical appliances physically manipulated (Dewey, 1958, p. 379-380).

Dewey (1896) explicitly argued against the view, discussed earlier, that perception, thinking and action are three separate faculties. Unlike "academic robots" which have to first see, then think, then act, he argued that perception and action are mutually shaping. Perception is altered by actively moving and manipulating things, just as action is controlled by properly coordinated perception. Perception is part of an active sensori-motor "coordination" rather than a mirror of given objects. In much the same way, Brooks (1991, p. 1227) suggests that robot intelligence should be "embodied" so that "actions are part of a dynamic with the world, and the actions have immediate feedback on the robot's own sensations." Clancey makes much the same point.

> The claim of situated cognition (in my formulation) is that perception and action arise together, dialectically forming each other. Perceiving landmarks is not retrieving descriptions and matching against current categorizations…Simply put, the claim is that people navigate through familiar space without referring to representations; sensations are directly coupled to actions without intermediate *acts* of description….we can walk through a room *without referring to an internal map of where things are located*, by directly coordinating our behaviors through space and time in ways we have composed and sequenced them before (Clancey, 1992, p. 5-7).

Clancey summarizes the point in suggesting that "'situated' means coordination without deliberation."

Sensori-motor coordinations, such as are involved in habitual action, come first in this view, with conscious thought occurring only when action is brought to a halt by unexpected events. Current thinking (Winograd and Flores, 1986) concurs with this classical work of Dewey and Mead (1934) that when conscious problem-solving arises, it does so within a blocked or puzzling cycle of activity. The situation in which the blockage occurs then forms the practical context for thinking, as opposed to a static set of relevancies. Different ways in which the situation may be represented and different hypothetical solutions help select one another. Testing the proposed solution then involves practical action to see if anticipated consequences result rather than mere passive contemplation. Viewed in this way, there is no dualistic separation of mind and body because the physical interaction involved in inquiry is a part of the process of acting mindfully.

One of the implications of this embodied view of mind is that a difficulty is had and felt. The difficulty is tangible and *precognitive*. It is a tangle of interrupted actions and not something "in the head." Active problem-solving begins with immediately present conditions — which may be interpreted in any number of ways — rather than with a predefined problem-space. Considered in this way, minding is a tangibly physical matter.

Individual and Society

From a situated perspective, any sequence of interaction can have multiple interpretations and be aligned to different goals. Different interpretations can be disambiguated by further moves, forming

a new sequence for which further interpretations are possible. Such diversity of interpretation is not only possible, it is a necessary source of novelty needed for learning.

> An object, such as a poem, a chart or a spoken concept may be understood very differently by the child and the teacher…But these differences need not cause "trouble" for the teacher or the child or the social interaction; the participants can act *as if* their understandings are the same. At first, this systematic vagueness…may appear to make cognitive analysis impossible. However, it now appears that this looseness is just what is needed to allow change to happen (Newman, et al., 1989, p. 62).

The assumption that "we are making some kind of sense together, even though I do not yet know which kind" is clearly different from assuming that the proper description is already given. Of course, one can behave as though only one description is possible, but such behavior is likely to lock interaction into rigid positions, thereby freezing growth and conceptual change.

If "individual" and "society" are not separately described things, insofar as social activity is concerned, then individual change will not be fully separable from social change. Hanks summarizes Lave and Wegner's position in this regard:

> Learning is a process that takes place in a participation framework, not in an individual mind. This means, among other things, that it is mediated by the differences in perspective among the coparticipants. It is the community, or at least those participating in the learning context, who "learn" under this definition. Learning is, as it were, distributed among coparticipants, not a one-person act (Lave and Wenger, 1991, p. 15-16).

On this conception one cannot describe individual "learning" separately from changes in a social role or identity. Bateson (1976, p. 54) makes much the same point when he notes that

> "socialization" (by definition) requires *interaction*, usually of two or more organisms. From this it follows that, whatever goes on below the surface, inside the organisms where we cannot see it, there must be a large part of that "iceberg" showing above the surface. We, biologists, are lucky in that evolution is always a co-evolution and learning is always a co-learning. Moreover, this visible part of the process is no mere by-product. It is precisely that production, that set of appearances, to produce which is supposedly the "goal" of all learning which we call "socialization."

This practical inseparability of individual and social change has led some to suggest that the term "learning" be jettisoned as being inappropriately individualistic (Suchman, 1992) while others suggest it be replaced by a more neutral term, such as "cognitive change" (Newman, et al., 1989). For Dewey such socially-informed and meaningful change would simply be termed "education."

Summary

Work on situated cognition depicts language as emerging from physical and social transactions rather than as a mirror of a previously described reality. Similarly, physically active agents are viewed as thinking in the context of a practical breakdown in action, for which a useful conceptualization must be found, rather than starting with given descriptive language. In social interaction the definition of the task similarly evolves out of the interaction, rather than being given from outside. In each case, practice comes first, with theory evolving within it. Thus conceived, a situated approach can be seen as a species of pluralism (Dewey, 1958) rather than a monism (like behaviorism) or a dualism (like cognitivism) because there are many emergent ways in which things are defined or constituted as useful in different situations. Taking this suggestion to mean that there "really" are multiple realities would be inconsistent, however, for that would be just another paradoxical attempt to climb out of our minds.

BALANCING THE FORMAL AND INFORMAL

So far it seems as though a situated approach is clearly the better of the two I have been comparing. While I believe it represents a very fruitful direction for inquiry, I would now like to suggest that a symbol-processing approach is not always as bad as I have suggested and a situated approach can be considerably worse.

The symbol-processing view began as an attempt to use computers to simulate human intelligence. It ended, all too often, by *defining* human cognition as computation. In effect, useful means for understanding human thinking became ends. The theory shifted from a hypothesis to a foregone conclusion, thereby becoming "cognitivism." Reducing practice to theory in this way devalued everyday experience, losing the common touch for psychology.

Yet difficulties with the approach would vanish if it were seen as simply an attempt to model human capabilities on the computer so as to better understand them. If the model were a tool, useful for solving certain problems, rather than "the way the world is" (Goodman, 1972), then it would be unobjectionable. All of the dualisms I outlined would then disappear along with the attempt to force human cognition into a given descriptive language. Computational models would simply be tools for working out the implications of certain formal theories.

Situated cognition arose to counter the misuse of symbol-processing theory, yet its polemical assertion has sometimes lead its proponents to a position similar to cognitivism. At times they too are reductionist, although they tend to reduce theory to practice rather than the reverse. For instance, Winograd and Flores (1986) adopt Maturana's view in which co-evolving or co-developing biological entities are said to share a "language," reducing language to biological interaction. Brooks's attempts to build machines that behave "intelligently" through direct lower-level interactions, without central processing, can also be seen as reductionist. Clancey's motto, "situated means coordination without deliberation" could be seen as reducing intelligence to unreflective practice, although he denies this. And Lave and Wegner's (1991) view, which sees learning as distributed across persons and things, could be seen as denying internalization. Finally, Lave's (1988) and Becker's (1986) appeals to apprenticeship rather than teaching could be seen as a bias against formal schooling, and perhaps against normalization in general.

Not only does work in situated cognition — at times — attempt to reduce theory and cognition to practice, it also sometimes implies that this is the way things "really" are. Suchman (1987, p. x) seems to suggest that her situated view of planning describes the way things are "beyond the cognitive scientist's models." But this stance is self-contradictory. It is another attempt to climb outside of our minds. To be consistent, situated cognition must itself be understood as a possibly helpful response to a particular social and intellectual situation, rather than the way the world "really" is.

What seems to be needed is mostly greater humility on both sides. If we do not claim to have reduced practice to theory or theory to practice, then it may be possible to develop a more cooperative relationship between systematizers and contextualizers. This would reflect Dewey's efforts at the turn of the century to define the part/whole relationship between cognition and context or science and everyday life. Or, it might reflect Rorty's more skeptical contemporary description of the relationship between systematizers (Kantians) and contextualizers (non-Kantians).

> These traditions live each other's death, die each other's life….The dialectician will always win if he waits long enough, for the Kantian norm will in time become tedious, full of anomie and anomaly. The Kantian, on the other hand, escapes triviality, and achieves self-identity and self-conscious pride, only by the contrast between his mighty deeds and the mere words of the dialectician. *He* is no effete parasite, but one who does his share in the mighty time-binding work of building the edifice of human knowledge, human society, the City of Real Men. The non-Kantian knows that the edifice will one day be deconstructed, and the great deeds reinterpreted, and reinterpreted again, and again. But of course the non-Kantian *is* a parasite — flowers could not sprout from the dialectical vine unless there were an edifice into whose chinks it could insert its tendrils. No constructors, no deconstructors.…Everybody needs everybody else (Rorty, 1982, p. 107-108.)

Whichever way one has it, it seems clear that our theorizing about human cognition should seek to represent and express such an open and evolving quality of mind.

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