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The Concepts of Adaptation and Viability in a Radical Constructivist Theory of Knowledge[1]

Theodore Mischel, to whose memory this chapter on constructivism is dedicated, was interested in epistemology as well as in psychology. In what he did and in what he wrote he never tired of reminding psychologists that their work, if it is to be of real consequence, must be rooted in philosophically firm ground. It is a measure of his success that a panel on "constructivism" can today draw a large and illustrious audience. To add a personal touch, I feel that it is to a large extent due to Mischel's work that someone like myself, whose qualifications as psychologist are rather unconventional, may venture to express ideas on the epistemology of cognition that are certainly alien to, and perhaps even incompatible with, some of the views that have for a long time dominated the branch of science that refers to itself as the study of behavior.

The ideas I shall be expounding owe a great deal to other people. First and foremost among them, Silvio Ceccato, who, 30 years ago, fathered the constructivist approach to cognition in Italy, and Warren McCulloch, the great poet of cybernetics. More recently I have drawn from the works of Humberto Maturana and Heinz von Foerster. Also, as I get into my subject, it will become clear, I am sure, that much of the conceptual basis on which I build was Piaget's long before.[2] However, the following ideas about adaptation and viability are my own concoction and cannot be blamed on anyone else.

The purpose of this chapter is to propose a radical reassessment of the meaning of the term "adaptation". I argue that it erroneously implies an adapting activity on the part of the organism and that the particular aspect of evolution to which we want to refer is better expressed by the term "viability". Having stripped away the misleading connotation, I shall try to show that the concept of viability can serve as the mainstay of a consistent constructivist theory of knowledge that eliminates some, if not all, of the age old problems of epistemology.

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[1] A short version of this paper was read in the Theodore Mischel Symposium on Constructivism at the 7th Annual Meeting of the Jean Piaget Society, Philadelphia, May 19-21, 1977.

[2] I shall not cease to thank Charles Smock, who, early on, detected that affinity and then patiently introduced me to Piaget's work.

Since the theory of knowledge I propose is not just constructivist, but *radically* constructivist (von Glasersfeld, 1975), a brief preliminary justification of constructivism will help to clear the ground for the further development. In discussing Piaget and particularly his ideas on the "construction of reality," the question is frequently raised why anyone should want to be a constructivist and hold that the knowing subject *constructs* his or her knowledge rather than obtains it simply by looking at the real world. The question, given our common sense traditions, sounds extremely sensible. Why, indeed, should anyone want to go to all that trouble? Reality appears so obvious, so close, so tangible and even inescapable, that it seems quite absurd to assume that the subject should have to construct it for himself or herself. I have no illusion that a common sense belief so general and so venerable as that one, could be dismantled by one simple argument; but that is all I shall offer here.[3]

Even the most naive of naive realists will at some point come to wonder *how* all the "information" one believes one is gleaning from the real world actually gets from that outside world into an individual's system so that the individual can have a cognitive representation of it. In other words, one begins to ask: How do I know? If the individual belongs to our culture and is of a scientific bent, he or she will not be satisfied with introspection but will begin to observe other organisms in order to find out how these organisms come to know *their* environment, which they tacitly but erroneously equate with the world (von Glasersfeld, 1976). Because one cannot really get inside the organism that is being observed, one eventually formulates or builds some kind of a model of this process of "knowing." That is what students of perception and the neurosciences in general have been doing and are doing. According to the more or less accepted contemporary models, there are "receptors," "firings," and "neural networks" or "fields" that compute a "representation" out of the firings. In the present context we can say that it is irrelevant whether or not the investigator then claims that the organism's representation is functionally equivalent to, isomorphic with, or, simply, a picture of "the real world" —whatever an observer says of it, there can be no doubt about the fact that the organism has to *construct* a representation out of such proximal data as it has. In the case of the neuronal model these proximal data are small elementary events referred to as "firings of neurons." As Hebb (1958) wrote: "At a certain level of physiological analysis there is no reality but the firing of single neurons [p. 461]."

It seems, then, that there is simply no way around the assumption that organisms construct their representations of their world, their environment, or whatever one chooses to call what is outside them. In other words, an activity of construction has to be assumed regardless of whether one wants to be a constructivist or not.

Scientific investigators can hardly stop at that point. No matter how diffident or suspicious they might be about questions that smack of philosophy, sooner or later they will be compelled to ask just how adequate, correct, or "true" a representation of an outside world the organisms can construct inside themselves. The moment they ask that question, they are at the very core of traditional epistemology. That is to say, they

[3] For a more complete exposition of the bases of constructivism see Ceccato, 1949 and 1964/66; Maturana, 1970, Piaget, 1937; von Foerster, 1972 and 1976; von Glasersfeld, 1975, 1976, 1977a, and 1977b; and Smock and von Glasersfeld, 1974.

face the scenario that was set up by the pre-Socratics and then formally and definitively presented by Plato. There is, on one side, an existing, fully structured world and, on the other, a Knower whose eternal task it is to get to *know* that world. This scenario has been welded so firmly to our concept of knowledge that there seems no way of separating the two. In our Western philosophical tradition, the "getting to know" has been viewed either as the activation of innate ideas which automatically match the structure of the real world (because God and, more recently, Evolution have predisposed that match) or it is viewed as the result of the action of our senses. The second, i.e., the empiricist, alternative has dominated science for quite some time now, and it has turned our senses into somewhat mysterious gadgets which, apart from their physiological functioning, have the ability of conveying *information* from outside the organism to its inside. Of course, there have been and still are many hybrid versions that attempt to combine the two alternatives, taking varying percentages of both. The one point in which they all are equivalent is that, owing to their common presupposition of preexisting "objective" structures, they are unable to resolve the question of how we could ever know that the representation inside the organism is really *like* that preexisting world which it is supposed to depict. The question was asked by Socrates and it has remained unanswered to this day.

In the 1930s, as a student of mathematics, like many of my generation, I thought I had found my bible in Wittgenstein's *Tractatus*. I read and reread that book until one fine day, coming to paragraph 2.223, I hesitated and the beautiful edifice of ideas collapsed. What I read and *understood* for the first time was: "In order to discover whether the picture is true or false we must compare it with reality" (Wittgenstein, 1933/1922, p. 43). How could one possible carry out that comparison? With that question, although I did not know it at the time, I found myself in the company of Sextus Empiricus, of Montaigne, Berkeley, and Vico – the company of all the courageous sceptics who throughout the history of this civilization have maintained that it is impossible to compare our image of reality with a reality outside. It is impossible, because in order to check whether our representation is a "true" picture of reality we should have to have access not only to our representation but also to that outside reality *before* we get to know it. And because the only way in which we are supposed to get at reality is precisely the way we would like to check and verify, there is no possible escape from the dilemma.

Today, 40 years later, the problems with the traditional scenario of epistemology are clearer to me. In order to make my ideas comprehensible, let me digress for a moment and talk about the concept of adaptation.

In the biological theory of evolution we speak of variability and selection, of environmental constraints and of survival. If an organism survives individually or as a species it means that, so far at least, it has been *viable* in the environment in which it happens to live. To survive, however, does *not* mean that the organism must in any sense reflect the character or the qualities of his environment. Gregory Bateson (1967) was the first who noticed that this theory of evolution, Darwin's theory, is really a cybernetic theory because it is based on the concept of constraint rather than on the concept of causation. Somehow we always tend to think that the character of surviving organisms is determined by its environment. We speak of "adaptation", and the idea of causation seems to become associated with that concept so that we end up believing

that environmental constraints can *cause* certain biological structures or certain behaviors in organisms. This is a serious conceptual error. In order to remain among the survivors, an organism has to "get by" the constraints which the environment poses. It has to squeeze between the bars of the constraints, to coin a metaphor. The environment does not determine how that might he achieved. It does not cause certain organisms to have certain characteristics or capabilities or to be a certain way. The environment merely eliminates those organisms that knock against its constraints. Anyone who *by any means* manages to get by the constraints, survives. We all should know that, from looking around us. If one looks around in Athens, Georgia, one can see cardinals and cockroaches, humming birds, bats, chipmunks, and snakes; daddy longlegs, opossums, frogs, and catfish; and a seemingly infinite variety of mushrooms, moulds, butterflies, and worms. All of them survive in that environment and they have found entirely different solutions for survival. For all we know, there is an infinite variety of solutions for survival, an infinite number of ways of being viable. Tomorrow, if the environment should change, some of today's organisms may no longer be viable, others may make it in spite of the change. In the ordinary way of speaking we would say that those organisms that survive the change have or are *adapted* to the new environment. This again invites the conceptual error mentioned before, since it suggests that the change in the environment has caused specific *corresponding* changes in the organisms. But that is not the case. Organisms may indeed change, but the changes they manifest are due to their inherent variability, their mutations, genetic drift, or what you will. All the environment contributes is constraints that knock out some of the changed organisms while others are left to survive. Thus we can say that the only indication we may get of the "real" structure of the environment is through the organisms and the species that have been extinguished; the viable ones that survive merely constitute a selection of solutions among an infinity of potential solutions that might be equally viable.

What I suggest now, is that the relationship between our knowledge and "reality" is similar to the relationship between organisms and their environment.[4] In other words, we construct ideas, hypotheses, theories, and models, and as long they survive, which is to say, as long as our experience can be successfully fitted into them, they are *viable*. (In Piagetian terms we might say that our constructs are viable as long as our experience can be assimilated to them.)

This, of course, immediately raises the question as to what "survival" and "viability" mean in the cognitive domain. Briefly stated, concepts, theories, and cognitive structures in general, are viable and survive as long hey serve the purposes to which they are put, as long as they more or less reliably get us what we want. "Getting us what we want," however, means different things in different realms of experience. In the realm of everyday experience, for instance, Newton's physics serves our purposes well and is perfectly viable. Most of us simply do not enter the realms of experience where the methods and predictions based on Newton's concepts break

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[4] The idea that science or the growth of knowledge resemble or are in some way subject to the "laws or evolution" is certainty not new; but whenever I have seen this idea, it was always contaminated by the conception of adaptation as a progressively *better* match with environment and reality.

down. This is not so for the ideal scientist (e.g., as portrayed by Popper, 1934/1965 and 1962/1968) who is perennially searching for concepts and theories that "get by" the constraints encountered in *all* realms of experience and who is, therefore, more concerned with the possible "falsification" of his concepts and hypotheses than with their practical success as means in the pursuit of certain limited ends. This leads to the somewhat peculiar situation that Newton's ideas are quite "true" for the man in the street, the mechanic, and the working engineer, whereas hey are "false" for a relatively small group of specialized scientists. What must be stressed, however, is that none of this can change the epistemological status of the ideas, concepts, theories, or models that we consider as constituting our "knowledge."

If we accept this concept of viability, it becomes clear that it would be absurd to maintain that our knowledge is in any sense a replica or picture of reality. It does not have to be, nor indeed could it ever be anything of the sort. On the pragmatic everyday level it has to be useful to us in that it reliably helps us to achieve our purposes. On the scientific level, however, usefulness does not seem particularly relevant. The scientist is looking for consistency, for mutually compatible theories and models, and, ultimately, for a unitary, homogeneous explanation of experience on all levels. Empiricists and statisticians have long been telling us that we can never "prove" a theory we can only disprove it. In my terms that means that while we can *know* when a theory or model knocks against the constraints of our experiential world, the fact that it does *not* knock against them but "gets by" and is still viable, does in no way justify the belief that the theory or model depicts a "real" world.

In this context it is important to realize that "constraints of our experience" do not necessarily refer to constraints that have to be thought of as inherent in an ontological reality. It was Piaget who has finally made clear that many, if not all, the constraints that govern our actual and potential experience stem from our own construction. Any construction, be it physical or mental, is subject to certain constraints that spring from the material that the constructor employs. It is easy to see that a bricklayer is to some extent constrained in his building by certain basic characteristics that are inherent in the bricks he uses. In much the same way, I believe, the representation we construct of our adult experiential world is constrained by certain basic characteristics of the building blocks we are using, which is to say, the building blocks which we created during the sensorimotor period. We call these building blocks "space," "time," "identity," and "change," and some of their early combinations give us, among others, "objects," "motion," and "causation". All of them are crucial elements in our later picture of the world and determine the kinds of world we can represent to ourselves. As Mischel (1971) formulated it, "What he (the subject) responds to is his construal of the external intrusion, and he is also the one who interprets the outcome of his compensatory activities [p. 324]."

Finally, there is yet another perhaps even more general way in which we can apply the concept of viability. A rather convincing case can be made for the notion that all practical learning may be considered the result of a process of induction. The simplest explication of inductive inference, I believe, is this: If an organism has an experience, and that experience is in some sense successful or satisfactory, the organism will be inclined to repeat it. If there is more experience, the organism will begin to extract or compute regularities from its corpus of experience. As David Hume

put it, we repeat what was successful in the past, on the assumption that there is some regularity and that the experience that we have not yet had will not be altogether different from the experience we *have* had. To use this principle in our models of living organisms, it is not at all necessary to presuppose "awareness" or "consciousness" on the part of the organism. Though some behaviorists may be shocked, I would suggest that this basic form of inductive inference is exactly equivalent to Thorndike's "Law of Effect." In any case, both Thorndike's principle and that of induction result in the setting up of more or less reliable regularities. These regularities, regardless of whether we consider them predictions, explanations, instruments for achieving goals, or merely learned patterns of behavior, are regularities that have been established in past experience, and as long as they are replicated in the organism's further experience, they "survive." Repetition thus creates and perpetuates the "viability" of posited regularities. We spread of "confirmation" or "corroboration" (Popper, 1962/l968), but again we must beware not to interpret perpetuated viability as correspondence to a "real" world or as "truth" in the traditional sense.

If we can accept this view of inductive inference as the establishing of regularities that survive and remain viable as long as our experience does not falsify them, and if we conclude that, by and large, we have no better way of explaining, predicting, and governing our experience, then we can take one further step that is relevant to the problem involved in what Piaget (1975) has called *equilibration majorante,* i.e., the incremental equilibration that proceeds in spirals, incorporating more and more items and events in the developing organism's experience. This constitutes a problem because of the tacit assumption that such an effort of incrementation could be explained only by some specific form of motivation. I would now suggest that one reason for this tendency to increment the range of experience within which equilibration is attempted by the organism, may be quite simply that the organism comes to make an inductive inference about the principle of induction itself. In other words, given that inferring regularities has been successful in the organism's past experience, to infer regularities will be likely to become a goal in its own right and the organism will begin to enlarge its range of experience, and will foster or create new experience simply for the sake of establishing regularities. Once such a tendency is established – and if living organisms can be described as "inductive systems" (Maturana, 1970), it could not help being established – it would lead the adult organism to engage in some of the activities that seem to defy utilitarian or other simple explanations. Activities such as solving puzzles for the sake of solving them, or, to use a more romantic traditional expression, to pursue truth for the sake of truth alone, fall under this rubric. This, clearly, is no more than a conjecture, and all that can be said to make it more plausible is that it would seem to be a logical consequence of the idea of viability presented here.

To sum up, then, according to the radical constructivist view, we must never say that our knowledge is "true" in the sense that it reflects an ontologically real world. Knowledge neither should nor could have such a function. The fact that some construct has for some time survived experience – or experiments, for that matter – means that up to that point it was viable in that it bypassed constraints that were inherent in the range of experience within which we were operating. But viability does

not imply uniqueness, because there may be innumerable other constructs that would have been as viable as the one we created.

This principle applies as much to the epistemological model suggested here as to any other model constructed. Thus, it should be emphasized that I am not claiming ontological status for the proposed model. The model being developed here is one that might allow us to think of knowledge and the activity of knowing *without* the basic contradiction that is inherent in traditional epistemology.

As a parting comment, let me borrow yet another idea from Piaget: the concept of decentration. Piaget has observed that not only the child in his or her ontogenetic development moves from egocentricity to states of increasing decentration, but so does our species. Looking at our intellectual history and the progression of cognitive constructs and explanatory models, Piaget singled out Copernicus who successfully abolished the egocentric notion that the little planet on which we live must be the center of the universe. We know that it was a difficult step to take and that resistance against it lasted longer than a century. It seems that now we shall have to make yet another, even more difficult step in that direction, namely, to give up the notion that the representations we construct from our experience should in any sense reflect a world as it might be without us.

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