

# An Introduction to Radical Constructivism

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The experiencing consciousness creates structure in the flow of its experience, and that structure is what conscious cognitive organisms experience as “reality.” Since that reality is created almost entirely without the experiencer’s awareness of his or her creative activity, it comes to appear as given by an independently “existing” world. Once knowing is no longer understood as the search for an iconic representation of ontological reality but, instead, as a search for fitting ways of behaving and thinking, the traditional problem of epistemology disappears. Knowledge can now be seen as something which the organism builds up in the attempt to order the as such amorphous flow of experience by establishing repeatable experiences and relatively reliable relations between them. The possibilities of constructing such an order are determined and perpetually constrained by the preceding steps in the construction. That means that the “real” world manifests itself exclusively where our constructions break down. Moreover, we can describe and explain these breakdowns only in the very concepts that we have used to build the failing structures.

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The gods have certainty, whereas to us as men conjecture [only is possible].  
— Alcmaeon [1]

## Preliminary Remarks

Within the limits of one chapter, an unconventional way of thinking can certainly not be thoroughly justified, but it can, perhaps, be presented in its most characteristic features anchored here and there in single points. There is, of course, the danger of being misunderstood. In the case of constructivism, there is the additional risk that it will be discarded at first sight because, like skepticism — with which it has a certain amount in common — it might seem too cool and critical, or simply incompatible with ordinary common sense. The proponents of an idea, as a rule, explain its non-acceptance differently than do the critics and opponents. Being myself much involved, it seems to me that the resistance met in the 18th century by Giambattista Vico, the first true constructivist, and by Silvio Ceccato and Jean Piaget in the more recent past, is not so much due to inconsistencies or gaps in their argumentation, as to the justifiable suspicion that constructivism intends to undermine too large a part of the traditional view of the world. Indeed, one need not enter very far into constructivist thought to realize that it inevitably leads to the contention that man — and man alone — is responsible

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for his thinking, his knowledge and, therefore, also for what he does. Today, when behaviorists are still intent on pushing all responsibility into the environment, and sociobiologists are trying to place much of it into genes, a doctrine may well seem uncomfortable if it suggests that we have no one but ourselves to thank for the world in which we appear to be living. That is precisely what constructivism intends to say — but it says a good deal more. We build that world for the most part unawares, simply because we do not know how we do it. That ignorance is quite unnecessary. Radical constructivism maintains — not unlike Kant in his *Critique* — that the operations by means of which we assemble our experiential world can be explored, and that an awareness of this operating (which Ceccato in Italian so nicely called *consapevolezza operativa*) [2] can help us do it differently and, perhaps, better.

This introduction, I repeat, will be limited to the exposition of a few aspects. The first section deals with the relation between knowledge and that “absolute” reality that is supposed to be independent of all experience, and I shall try to show that our knowledge can never be interpreted as a picture or representation of that real world, but only as a key that unlocks possible paths for us (see Alcmaeon’s fragment).

The second section outlines the beginnings of skepticism and Kant’s insight that, because our ways of experiencing are what they are, we cannot possibly conceive of an unexperienced world; it then presents some aspects of Vico’s constructivist thought.

The third section explicates some of the main traits of the constructivist analysis of concepts. Some of the many ideas I have taken over from Piaget as well as from Ceccato will be outlined and only sparsely supported by quotations. Piaget’s work has greatly influenced and encouraged me during the 1970s, and before that, the collaboration with Ceccato had provided direction and innumerable insights to my thinking. But for constructivists, all communication and all understanding are a matter of interpretive construction on the part of the experiencing subject and, therefore, in the last analysis, I alone can take the responsibility for what is being said on these pages.

## I.

The history of philosophy is a tangle of isms. Idealism, rationalism, nominalism, realism, skepticism, and dozens more have battled with one another more or less vigorously and continuously during the 25 centuries since the first written evidence of Western thought.

The many schools, directions, and movements are often difficult to distinguish. In one respect, however, any ism that wants to be taken seriously must set itself apart from all that are already established: it must come up with at least *one* new turn in the theory of knowledge. Often that is no more than a rearrangement of well-known building blocks, a slight shift in the starting-point, or the splitting of a traditional concept. The epistemological problem — how we acquire knowledge of reality, and how reliable and “true” that knowledge might be — occupies contemporary philosophy no less than it occupied Plato. The ways and means of the search for solutions have, of course, become more varied and complicated, but the basic question has, almost without exception, remained the same. The way that question was put at the very beginning made it impossible to answer, and the attempts that have since been made could not get anywhere

near a solution to the problem.

The philosopher of science, Hilary Putnam, has recently formulated it like this: “It is impossible to find a philosopher before Kant (and after the pre-Socratics) who was *not* a metaphysical realist, at least about what he took to be *basic* or unreducible assertions.” [3] Putnam explains that statement by saying that, during those 2,000 years, philosophers certainly disagreed in their views about what *really* exists, but their conception of truth was always the same, in that it was tied to the notion of objective validity. A metaphysical realist, thus, is one who insists that we may call something “true” only if it corresponds to an independent, “objective” reality. [4] On the whole, even after Kant, the situation did not change. There were some who tried to take his *Critique of Pure Reason* seriously, but the pressure of philosophical tradition was overwhelming. In spite of Kant’s thesis that our mind does not derive laws from nature, but imposes them on it, [5] most scientists today still consider themselves “discoverers” who unveil nature’s secrets and slowly but steadily expand the range of human knowledge; and countless philosophers have dedicated themselves to the task of ascribing to that laboriously acquired knowledge the unquestionable certainty which the rest of the world expects of genuine truth. Now as ever, there reigns the conviction that knowledge is knowledge only if it reflects the world as it is. [6]

The history of Western epistemology can, of course, not be described adequately and fairly in a few pages. Given the limits of this chapter, it will have to suffice if I pick out the main point in which the constructivism I am proposing differs *radically* from the traditional conceptualizations. That radical difference concerns the relation of knowledge and reality. Whereas in the traditional view of epistemology, as well as of cognitive psychology, that relation is always seen as a more or less picture-like (iconic) correspondence or match, radical constructivism sees it as an adaptation in the functional sense.

In everyday English, that conceptual opposition can be brought out quite clearly by pitting the words “match” and “fit” against one another in certain contexts. The metaphysical realist looks for knowledge that *matches* reality in the same sense as you might look for paint to match the color that is already on the wall that you have to repair. In the epistemologist’s case it is, of course, not color that concerns him, but he is, nevertheless, concerned with some kind of “homomorphism,” which is to say, an equivalence of relations, sequence, or characteristic structure — something, in other words, that he can consider *the same*, because only then could he say that his knowledge is of the world.

If, on the other hand, we say that something *fits*, we have in mind a different relation. A key fits if it opens the lock. The fit describes a capacity of the key, not of the lock. Thanks to professional burglars, we know only too well that there are many keys that are shaped quite differently from ours but nevertheless unlock our doors. The metaphor is crude, but it serves quite well to bring into relief the difference I want to explicate. From the radical constructivist point of view, all of us — scientists, philosophers, laymen, school children, animals, indeed any kind of living organism — face our environment as the burglar faces a lock that he has to unlock in order to get at the loot.

This is the sense in which the word “fit” applies to Darwin’s and neo-Darwinist theories

of evolution. Unfortunately, Darwin himself used the expression “survival of the fittest.” In doing that, he prepared the way or the misguided notion that, on the basis of his theory, one could consider certain things fitter than fit, and that among those there could even be a fittest. [7] But in a theory in which survival is the only criterion for the selection of species, there are only two possibilities: either a species fits its environment (including the other species), or it does not; i.e., it either survives, or it dies out. Only an external observer who introduces other criteria — e.g., economy, simplicity, or elegance of the method of surviving — only an observer who deliberately posits values beyond survival, could venture comparative judgments about those items that have already manifested their fitness by surviving.

In this one respect the basic principle of radical constructivist epistemology coincides with that of the theory of evolution: Just as the environment places constraints on the living organism (biological structures) and eliminates all variants that in some way transgress the limits within which they are possible or “viable,” so the experiential world, be it that of everyday life or of the laboratory, constitutes the testing ground for our ideas (cognitive structures). That applies to the very first regularities the infant establishes in its barely differentiated experience, it applies to the rules with whose help adults try to manage their common sense world, and it applies to the hypotheses, the theories, and the so-called “natural laws” that scientists formulate in their endeavor to glean lasting stability and order from the widest possible range of experiences. In the light of further experience, regularities, rules of thumb, and theories either prove themselves reliable or they do not (unless we introduce the concept of probability — in which case we are explicitly relinquishing the condition that knowledge must be *certain*).

In the history of knowledge, as in the theory of evolution, people have spoken of “adaptation” and, in doing so, a colossal misunderstanding was generated. If we take seriously the evolutionary way of thinking, it could never be organisms or ideas that adapt to reality, but it is always reality which, by *limiting what is possible*, inexorably annihilates what is not fit to live. In phylogenesis, as in the history of ideas, “natural selection” does not in any positive sense select the fittest, the sturdiest, the best, or the truest, but it functions negatively, in that it simply lets go under whatever does not pass the test.

The comparison is, of course, stretched a little too far. In nature, a lack of fitness is invariably fatal; philosophers, however, rarely die of their inadequate ideas. In the history of ideas it is not a question of survival, but of “Truth.” If we keep that in mind, the theory of evolution can serve as a powerful analogy: the relation between viable biological structures and their environment is, indeed, the same as the relation between viable cognitive structures and the experiential world of the thinking subject. Both *fit* — the first because natural accident has shaped them that way, the second because human intention has formed them to attain the ends they happen to attain; ends that are the explanation, prediction, or control of specific experiences.

More important still is the epistemological aspect of the analogy. In spite of the often misleading assertions of ethologists, the structure of behavior of living organisms can never serve as a basis for conclusions concerning an “objective” world, i.e., a world as it

might be prior to experience. [8] The reason for this, according to the theory of evolution, is that there is no causal link between that world and the survival capacity of biological structures or behaviors. As Gregory Bateson has stressed, Darwin's theory is based on the principle of constraints, not on the principle of cause and effect. [9] The organisms that we find alive at any particular moment of evolutionary history, and their ways of behaving, are the result of cumulative *accidental* variations, and the influence of the environment was and is, under all circumstances, limited to the elimination of non-viable variants. Hence, the environment can, at best, be held responsible for extinction, but never for survival. That is to say, an observer of evolutionary history may, indeed, establish that everything that has died out must in some way have transgressed the range of the viable and that everything he finds surviving is, at least for the time being, viable. To assert that, however, evidently constitutes a tautology (what survives, lives) and throws no light whatever on the objective properties of that world that manifests itself in negative effects alone.

These considerations fit the basic problem of the theory of knowledge equally well. Quite generally, our knowledge is useful, relevant, viable, or however we want to call the positive end of the scale of evaluation, if it stands up to experience and enables us to make predictions and to bring about or avoid, as the case may be, certain phenomena (i.e., appearances, events, experiences). If knowledge does not serve that purpose, it becomes questionable, unreliable, useless, and is eventually devaluated as superstition. That is to say, from the pragmatic point of view, we consider ideas, theories, and "laws of nature" as structures which are constantly exposed to our experiential world (from which we derived them), and they either hold up or they do not. Any cognitive structure that serves its purpose in our time, therefore, proves no more and no less than just that — namely, given the circumstances we have experienced (and determined by experiencing them), it has done what was expected of it. Logically, that gives us no clue as to how the "objective" world might be; it merely means that we know *one* viable way to a goal that we have chosen under specific circumstances in our experiential world. It tells us nothing — and cannot tell us anything — about how many other ways there might be, or how that experience which we consider the goal might be connected to a world *beyond* our experience. The only aspect of that "real" world that actually enters into the realm of experience, are its constraints; or, as Warren McCulloch, one of the first cyberneticists, so dramatically said: "To have proved a hypothesis false is, indeed, the peak of knowledge." [10]

Radical constructivism, thus, is *radical* because it breaks with convention and develops a theory of knowledge in which knowledge does not reflect an "objective" ontological reality, but exclusively an ordering and organization of a world constituted by our experience. The radical constructivist has relinquished "metaphysical realism" once and for all, and finds himself in full agreement with Piaget, who says: "Intelligence organizes the world by organizing itself." [11]

For Piaget, organization is always the result of a necessary interaction between conscious intelligence and environment, and because he considers himself primarily a philosopher of biology, he characterizes that interaction as "adaptation." With that, too, I agree - but after what was said in the preceding pages about the process of evolutionary selection, it should be clear that the adaptive fit must never be interpreted as a

correspondence or homomorphism. With regard to the basic question, how cognitive structures or knowledge might be related to an ontological world beyond our experience, Piaget's position is somewhat ambiguous. Frequently, one has the impression that, in spite of his massive contributions to constructivism, he still has a hankering for metaphysical realism. In that, of course, he is not alone. Donald Campbell, who has provided an excellent survey of proponents of "evolutionary epistemology" since Darwin, writes: "The controversial issue is the conceptual inclusion of the real world, defining the problem of knowledge as the fit of data and theory to that real world." [12] In his conclusion he then declares that the evolutionary epistemology, which he and Karl Popper represent, "is fully compatible with an advocacy of the goals of realism and objectivity in science." But the theory of which he provided an extremely lucid exposition, points in the opposite direction. [13]

In this first section, I have tried to show that the notion of correspondence or match between knowledge and reality, a notion that is indispensable for realism, cannot possibly be derived from, let alone substituted for, the evolutionary notion of "fit." In the second section, I shall provide at least an approximate account of the links between radical constructivism and the history of epistemology, from which it may be seen that it is not quite as radical as it appears at first sight.

## II.

Doubts concerning the correspondence between knowledge and reality arose the moment a thinking individual became aware of his own thinking. Already Xenophanes, one of the earliest of the pre-Socratics, said that no man has ever seen certain truth, nor will there ever be one who knows about the gods and the things of the world, "for if he succeeds to the full in saying what is completely true, he himself is, nevertheless, unaware of it; opinion (seeming) is fixed by fate upon all things." [14] Something that could be "seen" would have to *be there* before a glance can fall upon it — and knowledge, thus, becomes reflection or picture of a world that is there, i.e., exists, before any consciousness sees it or experiences it in any other way. The stage was set and with it the dilemma that has determined Western epistemology ever since the 6th century B.C. "Metaphysical realism" (Putnam), given that scenario, is not one philosophical stance among others, but it is inherently predetermined as the only possible one. As Maturana has made particularly clear; "The a priori assumption that objective knowledge constitutes a description of that which is known . . . begs the questions, '*What is to know?* and *How do we know?*'" [15] By taking for granted that knowledge must reflect reality traditional epistemology has created for itself a dilemma that was as inevitable as it was unsolvable.

If knowledge is to be a description or image of the world as such, we need a criterion that might enable us to judge when our descriptions or images are "right" or "true." Thus, with the scenario in which man is born into a ready-made independent world as a "discoverer" with the task of exploring and "knowing" that reality in the truest possible fashion, with this scenario the path of skepticism is there from the outset. The notion of "appearance" and "semblance" which, according to Xenophanes attaches to all human knowledge, was elaborated and applied above all to perception by Pyrrho's school and, later, by Sextus Empiricus; and the unanswerable question whether, or to

what extent, any picture our senses “convey” might correspond to the “objective” reality is still today the crux of all theory of knowledge. Sextus used, among other things, an apple as an example. To our senses it appears smooth, scented, sweet, and yellow — but it is far from self-evident that the real apple possesses these properties, just as it is not at all obvious that it does not possess other properties as well, properties that are simply not perceived by our senses. [16]

The question is unanswerable, because no matter what we do, we can check our perceptions only by means of other perceptions, but never with the apple as it might be *before* we perceive it. The skeptic’s argument made the philosopher’s life difficult for some 2,000 years. [17] Then Kant added a second, even more troublesome argument. By considering space and time aspects of our way of experiencing, he shifted them out of reality into the realm of the phenomenal, and in doing so, he made questionable not only the sensory properties but also the thinghood of the apple. Thus, not only the apple’s smoothness, scent, sweetness, and color are doubtful, but we can no longer be sure that there actually exists an object such as we experience it, separated from the rest of the world as a unitary whole or “thing.”

This second doubt is, indeed, more serious in its consequences than that concerning the reliability of our senses; it undermines any representation of objective structure in the real world and, thus, inevitably raises the question why and, above all, how it comes about that we search for and can also find a structure in our experiential world, when such a structure may not be given by reality. In other words, if Kant’s statement is correct and our experience can teach us nothing about the nature of things in themselves [18], how, then, can we explain that we nevertheless experience a world that is in many respects quite stable and reliable?

That is the main question which radical constructivism attempts to deal with, and the answer it suggests was prepared, at least in its main lines, by Giambattista Vico in 1710, more than half a century before Kant:

As God’s truth is what God comes to know as he creates and assembles it, so human truth is what man comes to know as he builds it shaping it by his actions. Therefore science (*scientia*) is the knowledge (*cognitio*) of origins, of the ways and the manner how things are made. [19]

Vico’s battle cry “*Verum ipsum factum*” — the truth is the same as the made (*factum* and “fact” both come from the Latin *facere*, to make!) — has been quoted quite frequently since Vico was rediscovered in our century as a cultural historian and a philosopher of history. His revolutionary epistemological ideas, however, are rarely mentioned, let alone explicated. According to him, the only way of “knowing” a thing is to have made it, for only then do we know what its components are and how they were put together. Thus God knows his creation, but we cannot; we can know only what we ourselves construct. Vico even uses the word “operation” and thus preempts the main term launched by constructivists such as Dewey, Bridgman, Ceccato, and Piaget, in our century.

Vico, of course, still tries to establish a connection between human cognitive constructions and God’s creation. Reading his treatise on metaphysics, one gets the impression that he occasionally frightened himself by his own ideas. Although the theory of know-

ledge he has developed is logically closed because man's knowledge is seen as man's construction and does not (and could not) pertain to God's ontological creation, Vico is reluctant to stress that independence. Because of that reluctance, his picture of the world could be seen as a counterpart to Berkeley's metaphysics. For Berkeley, the principle "*esse est percipi*" (to be is to be perceived) does the same trick as Vico's statement that God knows everything because he has made everything. For both, ontology is assured through God's activities. Vico, however, also opens another way towards ontology that I find much more acceptable, because it does not involve any form of rational realism. He suggests that mythology and art approach the real world by means of symbols. They, too, are *made*, but the interpretation of their meaning provides a kind of knowledge that is different from the rational knowledge of construction.

For us, the important difference between Vico and Berkeley, as well as later idealists, is that Vico considers man's rational knowledge and the world of rational experience simultaneous products of man's cognitive construction. [20] Thus Vico's "knowledge" is what, today, we might call an awareness of the operations that result in our experiential world. Though Berkeley says "that all the choir of heaven and furniture of earth, in a word all those bodies which compose the mighty frame of the world, have not any subsistence without a mind, their *being* is to be perceived or known," [21] and thus presupposes the activity of the intellect, his accent always lies on the *being*, whereas Vico invariably stresses human *knowledge* and its construction.

There can be no doubt that Vico's explicit use of *facere*, his constant reference to the composing, the putting together and, in short, the active construction of all knowledge and experience come very much closer to Piaget's genetic epistemology and to modern constructivism in general, than did Berkeley. Nowhere does that become clearer than in a statement with which Vico anticipated the epistemological attitude of some of today's philosophers of science: "Human knowledge is nothing else but the endeavor to make things correspond to one another in shapely proportion." [22]

Our main question was how it might come about that we experience a relatively stable and reliable world in spite of the fact that we are unable to ascribe stability, regularity, or any other perceived property to an objective reality. Vico does not answer that question; rather, he makes it superfluous and meaningless. If, as he says, the world that we experience and get to know is necessarily constructed by ourselves, it should not surprise us that it seems relatively stable. To appreciate this, it is necessary to keep in mind that the most fundamental trait of constructivist epistemology, i.e., that the world that is constructed is an experiential world that consists of experiences and makes no claim whatsoever about "truth" in the sense of correspondence with an ontological reality. Hence, Vico's position is in that respect similar to that of Kant, who says; "Nature, therefore . . . is the collective conception of all objects of experience." [23] For Kant, it is the "raw material of sensory impression" which "the mind's activity . . . processes so that it becomes knowledge of objects that we call experience." [24] In other words, experience as well as all objects of experience are under all circumstances the result of *our* ways and means of experiencing, and are necessarily structured and determined by space and time and the other categories derived from these. The processing of the raw material in Kant's system is governed *automatically* by space and time (without which *no* experience would be possible) and the other categories which,



for that very reason, are called a priori. The a priori, therefore, might be considered the technical description of the organism's experiential capability. The a priori describes the framework within which such an organism operates, but it does not tell us what the organism does, let alone why it does it. "A priori" is tantamount to "built-in" or "innate," and Kant's justification of it leads, albeit in a roundabout fashion, to God and to a Platonic mythology of ideas. In that respect, Vico is more modern and more prosaic. Of the category of causality, for instance, he says: "If true means to have been made, then to prove something by means of its cause is the same as causing it." [25] This notion (which has been rediscovered, no doubt without any knowledge of Vico, by the modern constructivist mathematicians) has, as Vico realized, a remarkably wide range of application.

Causes thus originate in the putting together of individual elements; that is, they originate from an experienter's active operating, such that, for instance, "the determinate (i.e., causally determined) form of the object springs from the order and the composition of elements." [26] Quite generally, that means that the world which we experience is, and must be as it is, because we have put it together that way. While the way in which that composition takes place is determined by the a priori for Kant, there are no immutably built-in principles in Vico's system that determine our ways of experiencing, thinking, and constructing. Instead, such constraints as we encounter spring from the history of our construction, because at any moment whatever has been done limits what can be done in the future. [27]

To sum up Vico's thought, the construction of knowledge, for him, is not constrained by the goal of (impossible) correspondence with an "objective" reality that can neither be experienced or known. It is, however, constrained by conditions that arise out of the material used, which, be it concrete or abstract, always consists of the results of prior construction. With this idea of consistency within certain constraints that replaces the iconic notion of "truth," Vico, without knowing it, anticipated the basic principle of *viability* in the constructivist theory of knowledge.

As elegant as his system is, it still leaves open two questions. First, what are the conditions under which a new construct will be considered compatible with what has already been constructed? Second, why should any organism undertake the task of cognitive construction? The third section will describe an attempt to answer these questions.

### III.

In traditional theories of knowledge, the activity of "knowing" is taken as a matter of course, an activity that requires no justification and functions as an initial constituent. The knowing subject is conceived of as a "pure" entity in the sense that it is essentially unimpeded by biological or psychological conditions. The radical constructivist epistemology quite deliberately breaks that conventional framework and commits what professional philosophers, more or less disparagingly, dismiss as "psychologism." The deliberations that have led me to this somewhat iconoclastic step derive from what was said in the first two sections as soon as one considers them jointly.

First, there is the realization that knowledge, i.e., what is "known," cannot be the result

of a passive receiving but originates as the product of an active subject's activity. This activity is, of course, not a manipulating of "things in themselves," i.e., of objects that could be thought to possess, prior to being experienced, the properties and the structure which the experiencer attributes to them. We therefore call the activity that builds up knowledge "operating," and it is the operating of that cognitive entity which, as Piaget has so succinctly formulated, organizes its experiential world by organizing itself. Epistemology thus becomes the study of *how* the mind operates, of the ways and means it employs to construct a relatively *regular* world out of the flow of its experience. The function of the mind, however, has always been a matter that interested psychology — and the more emphasis that is put on active operating the more psychological the investigation becomes. If, besides, a developmental view is taken and phylogenetic or ontogenetic concepts are applied, we are decidedly in the area of "genetic epistemology," an area which metaphysical realists take great pains to avoid, because in their view the theory of knowledge must on no account be adulterated by biological or psychological considerations. [28]

If, however, as Alcmaeon already suggested, the human activity of knowing cannot lead to a certain and true picture of the world but only to conjectural interpretation, then that activity can be viewed as the creating of keys with whose help man unlocks paths towards the goals he chooses. That means that the second question we asked at the end of the preceding section, namely, why a cognitive activity should take place, is inextricably connected with the first one: because the success of a key does not depend on finding a lock into which it might fit, but solely on whether or not it opens the way to the particular goal we want to reach.

Constructivism necessarily begins with the (intuitively confirmed) assumption that all cognitive activity takes place within the experiential world of a goal-directed consciousness. Goal-directedness, in this context has, of course, nothing to do with goals in an "external" reality. The goals that are involved here arise for no other reason than this: a cognitive organism evaluates its experiences, and because it evaluates them, it tends to repeat certain ones and to avoid others. The products of conscious cognitive activity, therefore, always have a purpose and are, at least originally, assessed according to how well they serve that purpose. The concept of purposiveness, however, presupposes the assumption that it is possible to establish regularities in the experiential world. Hume's argument describes the situation perfectly: "For all Inferences from Experience suppose, as their Foundation, that the future will resemble the past. . . . If there be any Suspicion, that the Course of Nature may change, and that the past may be no Rule for the future, all Experience becomes useless, and can give rise to no Inferences or Conclusions." [29] This belief is inherent in everything that we consider alive.

The concept of "nature," for Hume no less than for Kant, was the totality of objects of experience. [23] That is to say, whatever we infer from our experience — i.e., whatever we call *inductive* — necessarily concerns our experience and not that mythical experiencer-independent world of which metaphysical realists dream. The second insight the constructivist approach allows us to formulate concerns the nature of the regularities which a cognitive organism finds or, rather, produces in its experiential world. In order to claim of anything whatever that it is regular, constant, or in some sense *invariant*, a comparison has to be made. That is to say, something that has already been ex-

perienced is put in relation to a second experience which, in the experiential sequence, does not coincide with the first experience. This “putting-in-relation,” irrespective of whether the comparison yields similarity or difference, may give rise to two essentially different concepts: equivalence or individual identity. The confusion of these two mutually incompatible concepts is greatly enhanced by the fact that, in English, the word “same” is quite indiscriminately used for both. The confusion, however, is a conceptual one, because in other languages that originally provided two distinct expressions (e.g., German: *das gleiche* and *dasselbe*; Italian: *stesso* and *medesimo*) present-day usage is no less indiscriminate. Yet, if we want to understand one of the most elementary building blocks of cognitive construction, we must clearly distinguish the two concepts that are involved.

As Piaget has shown, the concepts of equivalence and individual identity are not given a priori (innate) but have to be built up; and every “normal” child does, in fact, build them up within the first two years of life. [30] The development of a representational capability is crucial in that achievement. On the one hand, it is the capability of representing to oneself a past perception or experience that makes possible the comparison between it and a present experience; and on the other hand, that same capability of representation makes it possible for us to consider repeated perceptions, and especially groups of repeated perceptions, as *objects* and to place them into a space that is independent of the subject’s own motion and into a time independent of the subject’s own stream of experience. Hand in hand with this development, there arise two possible ways of comparing. Two experiential items can be “externalized” as two mutually independent objects; but two experiential items can also be considered two experiences of one and the same individually “existing” object. This distinction does not depend on the result of a comparison between the two experiences but is determined by the conceptual character of the two items that are being compared. If that comparison leads to a verdict of “sameness,” we have either two objects that are equivalent with respect to the properties examined in the comparison, or we have *one* object that has remained unchanged during the interval between the two experiences. If, instead, the comparison leads to a verdict of “difference,” we have either two objects with different properties, or we have one object that has *changed* since our preceding experience of it.

In our everyday practice of experience, we do, of course, establish contexts which propel us towards the one or the other conceptualization respectively, without our consciously having to make the choice between equivalence and individual identity each time. I have shown elsewhere that there are cases of indecision and how we then try to determine individual identity by the more or less plausible demonstration of some continuity. [31] In the present context, I merely want to stress that any such continuity in the existence of an individual object is, under all circumstances, the result of operations carried out by the cognizing subject and can never be explained as a given fact of objective reality.

No one uses these conceptual possibilities more skillfully than the professional magician. During a performance he may, for instance, request a spectator’s ring, toss another ring across the room to his assistant, and then let the stunned spectator find his ring in his own coat pocket. The magic consists in directing the spectators’ perception in

such a way that they unwittingly construct an individual identity between the first experience of the ring and the experience of the thrown object. Once that has been done, it would, indeed, require magic to transfer the ring from the assistant to the spectator's pocket. Another case is that of the red ribbon which the magician cuts into little pieces and then — literally with a flick of his hand — produces once more as one whole piece.

A similar, often cited example, is the movie film which, depending on the conditions of perception, we see as a sequence of individually different images or as *one* continuously moving image. Irrespective of any “real” horse that may or may not have trotted somewhere at some time and been filmed while doing so, when the film is presented to us, we ourselves must construct the motion by constituting a *continuous* change of one horse from the succession of images. The fact that we do that unconsciously cannot alter the fact that we have to do it in order to perceive the motion.

No less constructed are the judgments of sameness and difference in the realm of perceptual objects. As I indicated above, “sameness” is always the result of an examination with regard to specific properties. Two eggs may be considered the same because of their shape, size, or color, or because they come from the same hen; but there will be a pungent difference between them if one was laid yesterday and the other six weeks ago. A field mouse and an elephant are different in many ways, but they will be considered the same whenever we want to distinguish mammals from other animals. Finally, all eggs, all animals, and indeed all objects that I have ever seen or imagined, are the same in that one respect that I have isolated them as bounded, unitary objects in the total field of my experience. In these cases, as in all conceivable ones, it should be clear that the criteria by means of which sameness or difference is established are criteria that are created and chosen by the judging, experiencing subject and cannot be ascribed to an experiencer-independent world.

For an understanding of radical constructivism it is even more important to appreciate the subject's active operating that gives rise to regularities and invariances in the experiential world. Both regularity and constancy presuppose repeated experience, and repetition can be established only on the basis of a comparison that yields a judgment of sameness. Sameness, however, as we have seen, is always relative: Objects, and experiences in general, are the “same” with respect to the properties or components that have been checked in a comparison. Hence, an experience that consists, for instance, of the elements a, b, and c, can be considered the same as an experience consisting of a, b, c, and x, as long as x is not taken into account. That, in fact, is the principle of *assimilation*. In a context in which only the components or properties of a, b, and c matter, every object that contains a, b, and c is acceptable. Indeed, no such object will be discriminable from other objects that also contain a, b, and c, as long as no other elements are included in the comparison. The situation, however, changes if an object, in spite of the fact that it manifests a, b, and c, turns out to behave in a way that is different from the behavior which, on the basis of prior experience, is expected of a-b-c-objects. If that happens, it causes a disturbance (perturbation) that can lead to the examination of other properties or components. That opens the way towards a discrimination of the disturbing object (i.e., the object that is no longer acceptable) on the basis of some hitherto disregarded element x. We then have an instance of the principle of *accommodation*, the mainstay of Piaget's theory within the framework of action schemes and of his

analysis of cognitive development. Here I merely want to emphasize that in that principle, too, the concept of “fit” is incorporated, because here, too, it does not matter what an object might be like in “reality” or from an “objective” point of view; what matters is exclusively whether or not it performs or behaves in the way that is expected of it, i.e., whether or not it fits.

If repetition can be constructed on the basis of such comparisons, it should be clear that the same holds for all kinds of regularities. All concepts that involve repetition are dependent on a particular point of view, namely *what* is being considered, and in respect of *what* sameness is demanded. Given that the raw material of the experiential world is sufficiently rich, an assimilating consciousness can construct regularities and order even in a chaotic world. The extent to which that will succeed depends far more on the goals and the already-constructed starting points than on what might be given in a so-called “reality.” But in our experience, which is always determined by the goals we have chosen, we always tend to ascribe the obstacles we meet to a mythical reality rather than to the way in which we operate.

A bricklayer who builds exclusively with bricks, must sooner or later come to the conclusion that wherever there is to be an opening for a door or window, he has to make an arch to support the wall above. If that bricklayer then believes he has discovered a law of an absolute world, he makes much the same mistake as Kant, when he came to believe that all geometry had to be Euclidean. Whatever we choose as building blocks, be it bricks or Euclid’s elements, determines limiting constraints. We experience these constraints from the “inside”; from the brick perspective or the Euclidean perspective, as it were. The constraints of the world, with which our enterprises collide, we never get to see. What we experience, cognize, and come to know, is necessarily built up of our own building blocks and can be explained in no other way than in terms of our ways and means of building.

## Summary

Language inexorably forces us to present everything as a sequence. The three sections of this paper, thus, will have to be read one after the other — but that inevitable succession should not be understood as a logically necessary order. What is contained in each of these sections could be outlined only very approximately as an independent theme because, in constructivist thought, it is so closely interwoven with the other principal themes that, presented separately, it would seem to be little more than a finger exercise. Singly, the arguments I have presented here certainly cannot create a new way of thinking about the world; if they can do that at all, it will be through the fabric of their interrelations.

The conceptual analysis shows, on the one hand, that a consciousness, no matter how it might be constituted, can “know” repetitions, invariances, and regularities only as the result of a comparison; on the other hand, it shows that there must always be a decision preceding the comparison proper, whether the two experiences that are to be compared should be considered as occurrences of one and the same or of two separate objects. These decisions determine what is to be categorized as “existing” unitary objects and what as relationships between them. Through these determinations, the ex-

perceiving consciousness creates *structure* in the flow of its experience. And that structure is what conscious cognitive organisms experience as “reality” — and since that reality is created almost entirely without the experiencer’s awareness of his or her creative activity, it comes to appear as given by an independently “existing” world.

This view is not particularly new. Skeptics have tended towards it ever since Pyrrho, and the theoretical physicists of our time come close to it in their own terms (they have to ask more and more often whether they are discovering laws of nature or whether it is not rather their sophisticated preparation of experimental observations that forces nature into the preconceived hypothesis). As long, however, as we remain, in our innermost belief, “metaphysical realists” and expect of knowledge (the scientific as well as the everyday) that it provide a “true” picture of a “real” world supposed to be independent of any knower, as long as we maintain that dogma, the skeptic cannot but seem a pessimist and spoil-sport because his arguments perpetually draw attention to the fact that no such “true” knowledge is possible. The realist may, of course, remain a realist in spite of that and say that the skeptic’s arguments can be disregarded simply because they contradict common sense. If, however, he takes those arguments seriously, the realist must retreat to some form of subjective idealism, and that retreat inevitably leads to solipsism, that is, to the belief that there exists no world at all apart from the conceiving mind of the subject.


On the one hand, that situation seems inevitable because of the unimpeachable logic of the skeptical arguments; on the other hand, we are intuitively convinced and find constant experiential confirmation that the world is full of obstacles which we do not ourselves deliberately place in our way. To resolve that situation, then, we must find our way back to the very first steps of our theories of knowledge. Among these early steps there is, of course, the definition of the relationship between knowledge and reality, and that is precisely the point where radical constructivism steps out of the traditional scenario of epistemology. Once knowing is no longer understood as the search for an iconic representation of ontological reality but, instead, as a search for *fitting* ways of behaving and thinking, the traditional problem disappears. Knowledge can now be seen as something which the organism builds up in the attempt to order the as such amorphous flow of experience by establishing repeatable experiences and relatively reliable relations between them. The possibilities of constructing such an order are determined and perpetually constrained by the preceding steps in the construction. That means that the “real” world manifests itself exclusively there where our constructions break down. But since we can describe and explain these breakdowns only in the very concepts that we have used to build the failing structures, this process can never yield a picture of a world that we could hold responsible for their failure.


Once this has been fully understood, it will be obvious that radical constructivism itself must not be interpreted as a picture or description of any absolute reality but as a possible model of knowing and the acquisition of knowledge in cognitive organisms that are capable of constructing for themselves, on the basis of their own experience, a more or less reliable world.

## Notes &amp; References

- [1] Kathleen Freeman (1948). *Ancilla to the Pre-Socratic Philosophers*. Cambridge, Mass.: Harvard University Press (p. 40). Diels, of whose work this is a translation, uses the German word *erschliessen* which, beyond “infer” and “conjecture,” also means “to unlock” — hence my use of the key metaphor.
- [2] Silvio Ceccato (1964/1966). *Un Tecnico fra i Filosofi*, Vol. 1 & 2. Mantua: Marsilio.
- [3] Hilary Putnam (1980). *Reason, Truth, and History*. Cambridge, MA: Harvard University Press. 1982.
- [4] Helmut F. Spinner (1977). Am Anfang, der Erkenntnis steht die Wahrheitsfrage. Ihre Einführung macht das menschliche Erkennen zu einem Wissensproblem. *Begründung, Kritik und Rationalität*, Vol. 1. Braunschweig: Vieweg (p. 61).
- [5] Immanuel Kant (1783). *Prolegomena zu jeder künftigen Metaphysik*. Kant's Werke, Vol. IV. Königliche Preussische Akademie der Wissenschaften, Berlin, 1911 (p. 294).
- [6] Spinner (1977) provides an excellent, comprehensive survey of the thinkers and their arguments that have attacked that still widespread notion and he documents the general bankruptcy of conventional epistemology.
- [7] C.F. von Weizsäcker, during a symposium in Bremen (1979), drew attention to the fact that in the German evolutionary literature “fit” is often translated as *tüchtig*, which has the flavor of “prowess” and therefore leads to talk of “the best” or “the toughest.”
- [8] Jacob von Uexküll, e.g. in his *Streifzüge durch die Umwelten von Tieren und Menschen* (with George Kriszat, 1933; reprinted in 1970, Frankfurt am Main: Fischer) shows very elegantly that each living organism, because of its own properties, determines an individual environment. Only an independent, wholly extraneous being that does not experience the world but knows it unconditionally and immediately, could speak of an “objective” world. For that reason, attempts, such as that by Lorenz, to explain the human concepts of space and time as an “adaptation,” but to consider them also as aspects of ontological reality, result in a logical contradiction (cf. Konrad Lorenz, 1941, Kants Lehre vom Apriorischen im Lichte gegenwärtiger Biologie, *Blätter für deutsche Philosophie*, 15, 94–125).
- [9] Gregory Bateson (1967). Cybernetic explanation. *American Behaviorist*. 10 (8), 29–32.
- [10] Warren S. McCulloch (1965). *Embodiments of Mind*. Cambridge, Mass.: M.I.T. Press (p. 154).
- [11] Jean Piaget (1937). *La construction du réel chez l'enfant*. Neuchâtel: Delachaux et Niestlé (p. 311).
- [12] Donald T. Campbell (1974). Evolutionary Epistemology. In P.A. Schilpp (Ed) *The Philosophy of Karl Popper*. La Salle, Ill.: Open Court (p. 449).
- [13] Cf. the critical review of Peter Skagestad (1978), Taking Evolution Seriously: Critical Comments on D.T. Campbell's Evolutionary Epistemology. *The Monist*, 61 (4), 611–621.
- [14] Freeman (note 1), (p.33).
- [15] Humberto Maturana (1970). *Biology of Cognition* (Report 9.0). Urbana, Ill.: Biological Computer Laboratory (p. 2).
- [16] Sextus Empiricus (ca. 200 A. D.) *Outlines of Pyrrhonism* (Translation, R.G. Bury) London: Heinemann, 1967 (p. 57, 94–95).
- [17] Cf. John Richards and Ernst von Glasersfeld (1979). The Control of Perception and the Construction of Reality. *Dialectica*, 33(1), 37–58.
- [18] Kant (1783), p. 295.
- [19] Giambattista Vico (1710). *De antiquissima Italorum sapientia*. Naples: Stamperia de' Classici Latini, 1858. (Chapter I, 1:5–6).
- [20] Ibidem, Chapter I, 3: 2.
- [21] George Berkeley (1710). *A Treatise Concerning the Principles of Human Knowledge*. La Salle, Illinois: Open Court, 1963, p. 32. Berkeley's *Treatise* and Vico's *De Antiquissima* were published at the same time and are in some ways remarkably parallel, yet the authors knew nothing

- of one another. They may have met a few years later in Naples but, to my knowledge, there is no record of the discussions which, it would seem inevitable, they must have had.
- [22] Vico (1710), Chapter VII, 3: 5.
- [23] Kant (1783), p. 295.
- [24] Immanuel Kant (1787). *Kritik der reinen Vernunft*, 2nd edition. Werke, Vol. III, p. 27.
- [25] Vico (1710), Chapter III, 1: 2.
- [26] Ibid. 1:3. George A. Kelly, the founder of the Psychology of Personal Constructs, independently came to the same conclusion: "To the living creature, then, the universe is real, but it is not inexorable unless he chooses to construe it that way." *A Theory of Personality* (1963). New York: Norton (p. 8).
- [27] Cf. Lionel Rubinoff (1976). Vico and the Verification of Historical Interpretation. In G. Tagliacozzo, M. Mooney, & D.P. Verene (Eds) *Vico and Contemporary Thought*. Atlantic Highlands: Humanities Press.
- [28] Cf. Wolfe Mays (1953). The Epistemology of Professor Piaget. *Minutes of the Aristotelian Society*, London (Dec. 7, 1953; p. 54–55).
- [29] David Hume (1750). *An Enquiry Concerning Human Understanding*. New York Washington Square Press (p. 47).
- [30] Piaget (1937).
- [31] Ernst von Glasersfeld (1979). Cybernetics, experience, and the concept of self, In M.N.Ozer (Ed.), *A cybernetic approach to the assessment of children: Toward a more humane use of human beings*. Boulder, CO: Westview Press, 67–113.

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