

THE SIMPLICITY COMPLEX  
Ernst von Glasersfeld

Ich habe mir erst später klargemacht,  
dass das Prinzip der Kausalität in der  
Tat nichts anderes ist als die  
Voraussetzung der Gesetzmäßigkeit aller  
Naturerscheinungen.

H. von Helmholtz <sup>1</sup>

We have an indomitable urge to simplify experience in order to predict and control it. I shall argue that it is this compulsion that leads us to believe that the real world must be a world of formidable complexity. Whenever we succeed in managing experience, we tend to think we are managing reality; when our management fails, we conclude that we have not yet found the rules that govern and, therefore, simplify what we take to be the baffling complexity of the universe. We forget that the complexity we believe to be facing springs from one source alone: the fact that whatever regularities, rules, or laws we construct are derived from and apply to our experience -- and our experience is a world which we ourselves engender, define, and delimit by our own activity of segmenting and conceptualizing. The history of science shows, perhaps better than anything else, how mutable and relative the way of segmenting and conceptualizing has been; and I would suggest that it could not be otherwise.

I have elsewhere proposed an epistemological model that is radically different from the traditional one. Instead of the usual requirement that knowledge should match an independent, absolute reality to which we have no access, the model substitutes the relation of "fit" in the evolutionary sense that our cognitive structures are required to survive in such space as they find between experiential constraints. In this shifted perspective, the traditional notion of "truth" as corresponding to an ontological state of affairs is replaced by the concept of viability.<sup>2</sup> Here I shall be concerned not with the problems of "knowing" as such but quite specifically with ways and means the human knower might be using in the organization of experience.

To some readers it will soon become clear that I am propagating what professional philosophers condemn as "genetic fallacy". I do this quite deliberately because I hold that knowledge consists of conceptual structures and, with Piaget, to whom I owe a great many of my ideas, I believe that "there is no structure without construction".<sup>3</sup> I emphasize that I am engaged in exploration and that what follows should not be mistaken for the description of something that "really" goes on; it is intended simply as a tentative, hypothetical model. The model itself is, of course, a manifestation of the "simplicity complex" – it does not even begin to deal with the more complicated aspects of cognitive construction; but the principles it embodies could, I maintain, cover a large part, if not all, of what we call "knowledge" of the experiential world.

## I

We can think of the unborn child in the womb as a potential organizer of experience with very little opportunity to begin the cognitive career. Yet, in the maturing nervous system there may already be some perturbations of the kind the adult observer would later call "sensory". (Since I, as an adult, am considering the unborn child's initiation into cognitive activities, I cannot help thinking about it in the way I have grown to think; it is a case of cognition modeling cognition and, therefore, an enterprise that is quite deliberately circular. In that respect, however, it is no more reprehensible than any attempt to know about knowing.)

The prenatal sensory world is no doubt sparse and monotonous compared to mine. As yet, there are no perturbations of the kind which, later, would be categorized as vision, taste, or smell; but those that I would call touch, and perhaps hearing, are beginning to occur. From my adult perspective, I must further assume that in some primitive way a segmentation of the amorphous flow is setting in, and that at some point the prenatal organism is beginning to experience one fuzzy sensation after another. If that is granted, there is the possibility of coordinating segments of experience. There maybe "noises" that are often followed by some particular "pressure" and there may be particular "pressures" that are often followed by a "noise". I place these sensations between quotation marks, because it is only very much later in the organism's development that they will be categorized as such. I accept Heinz von FOERSTER's notion that neural signals from "different sensory modalities" are indistinguishable qua signals and could be differentiated only on the basis of an internal topography of correlations.<sup>4</sup>

Published in Italian in *La Sfida della Complessità* (The Challenge of Complexity) edited by Gianluca Bocchi

& Mauro Ceruti. Milan: Feltrinelli, 1985. Original title: *Il complesso di semplicità*.

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Nevertheless, I want to suggest that such correlations can begin to be formed at that early stage. Mummy, after all, walks about, the walking involves her abdominal muscles, and the joints which she moves in walking are not totally noiseless. Thus there is the possibility of establishing regular sequences of sensations.

This hypothesis is not as far-fetched as it might seem. Studies with infants have shown that, even a few hours after their birth, they can be "conditioned" to move their head one way to switch on a light, and the other to sound a buzzer.<sup>5</sup> Whatever else this may be taken to indicate, it does show that the new-born organism's nervous system is capable of establishing relatively stable sequential links. We do not know precisely what this "establishing of regular sequences" means or what mechanisms are involved in achieving it; but we do know that even as unsophisticated a creature as the common earth worm can do it.<sup>6</sup> Psychologists who, like many other scientists, are bent on reducing as many phenomena as possible to one and the same principle, invoke Thorndike's "Law of Effect", which simply states that a living organism tends to repeat any activity that has led to a satisfying result.

The Law of Effect is eminently plausible for at least two reasons. On the one hand, it allows us to make fairly reliable predictions about the behavior of living organisms. (It is unlikely that one will act, i.e., work, in order to obtain some unsatisfactory result. Even the earth worm will "learn", albeit slowly, that it must turn elsewhere if the soil at the end of the accustomed pathway has dried up). On the other hand, the Law of Effect is plausible because it says no more and only a little less than the principle of induction: Whatever works will be repeated.<sup>7</sup>

## II

The interesting thing about the "inductive" principle is that it functions, as it were, in two directions. We go in the one and infer that something is going to "work" (in the sense that we are ready to try it again), if we have seen it work on a number of occasions. We go in the other direction whenever we establish anything as an "it", i.e., an item of which we believe that it has recurred or will recur; and it seems clear that only items that are supposed to recur could be used as components in one of those sequences or patterns of which we then say that they do or do not "work". In both cases there is the implicit assumption that our experience reflects an independent world that is predictable because it has a basically stable structure. David HUME saw this with admirable clarity:

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For all Inferences from Experience suppose, as their Foundation, that the future will resemble the past, and that similar Powers will be conjoin'd with similar sensible Qualities. 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.<sup>8</sup>

The inductive prediction that something will recur infuture experience, thus, seems to be based on having experienced it recurrently in the past. To establish the recurrence of an item, however, requires that one be able to recognize it – and the moment we use that term, we introduce a problem and an ambiguity. The problem is that recognition seems to entail what we usually call "memory" and, at present, we have no satisfactory conception of how that might function. It cannot be any kind of storage or file but must be dynamic, i.e., some type of re-enactment and I shall leave it at that.<sup>9</sup>

The ambiguity, on the other hand, is this: to recognize an item can mean one of two things, and both involve repetition and "sameness". Either we intend that we are experiencing something that we consider equivalent to an item we have experienced before, or we intend that we are experiencing an item that we consider to be the self-same individual that we experienced at some other occasion. In the first case we are "classifying", in the second "identifying". The differences that arise from these two ways of proceeding, though often confused, are epistemologically profound and I have tried to deal with them elsewhere.<sup>10</sup>

What I am concerned with here is the way in which we establish sameness in the equivalence sense. Obviously such a notion can arise only in a flow of experience that has been segmented and registered in chunks. Only if one cuts a piece of experience out of the ongoing flow can one compare that piece to some other piece and come up with the conclusion that the two are, or are not, "the same". Similarly it is clear that a conclusion of "sameness" will always be limited to the particular aspects or properties one has happened to take into account. (There are, after all, no two things in our experience, that could not be considered the same in some sense – just as there are no two things that could not be considered different) In any such comparison that is made in order to simplify experience by lumping individual items into a category, the aspects or properties that are taken into account depend on what one intends to do with the items. The "doing" may refer to a particular

context of action, of description, or of categorization that has become an end in itself. Under all circumstances, therefore, it will be our context of action that determines how simple or how complex the particular area of experience must be made so that our actions might have an acceptable chance of success.

### III

The notion of assimilation, as Piaget elaborated it, is of the utmost importance in this regard. The way the human experimenter comes to organize chunks of experience into categories is a good example. Take a two-year-old who, for the first time, encounters the word "pear". She already knew the word "apple", but when she now used it to request an item out of her reach on the table, she is told: "That's not an apple - it's a pear." As Daddy passes it to her, he repeats that it is a pear. The two-year-old's categorization of certain experiential items has again failed. She had been simplistic, and once more the world in which she might satisfy her desires turned out to be more complex than her organization allowed. To adapt that organization, more segmentation and differentiation are needed. The slight perturbation caused by the failure of her categorization may now lead her to look at the unruly item and focus attention on some sensory element that could be considered a difference relative to the experiential items for which the word "apple" has worked satisfactorily in the past.

In practice such an accommodation may of course take many more instances of failure than just one; but if the child is ever to discriminate apples and pears, it must isolate differences between them. These differences may be in seeing, eating, or acting upon the items in some other way. The differences are differences in the way of experiencing, and once they have been made and registered, both kinds of item will be perceived in a new way.

Let me take this childish example one step further. It will not be long before the two-year-old uses appropriately not only the word "pear" but also its plural, when three or four are lying on the table. This is a momentous step in the child's construction of reality, a step that is quite different from the preceding ones and which, though seemingly complicated at first, will eventually afford the kind of spectacular simplification that we may call "conceptual economy".

To my knowledge, neither developmental psychologists nor linguists or philosophers have paid much attention to the conceptual construction of pluralities. Yet, without it, we could

never come to have the kind of Weltbild our societies require. William JAMES put his finger on it:

Kinds, and sameness of kind – what colossally useful Denkmittel for finding our way among the many! The manyness might conceivably have been absolute. Experiences might have all been singulars, no one of them occurring twice. In such a world logic would have had no application; for kind and sameness are logic's only instruments. Once we know that whatever is of a kind is also of that kind's kind, we can travel through the universe as if with seven-league boots.<sup>11</sup>

In order to isolate pear-experiences in one's experiential field, one must have established a reliable difference that allows one to recognize them. To "recognize" an experiential item as equivalent to an item one has experienced before, requires a comparison of some sort. In order appropriately to use the plural "pears", however, one must attend to something that is of a kind altogether other than sensations and differences between sensations. To "recognize" a plurality of pears requires taking into account that, in a given context, one is carrying out the same comparison repeatedly and that it yields equivalence more than once. That is to say, attention must be focused not only on sensations or groupings of sensations but on what one is doing, on one's own operating. In fact, instead of creating a category that could be defined as a specific sequence of sensations, one creates a category that can be defined only as a specific sequence of operations.

Clearly, "doing" or "operating", in this context, does not refer to movement of hands and feet, or physical activity of any kind, but to activities that are carried out by an agent which, for the lack of a better word, we may call mind. We are concerned with mental operations. I want to stress that, in saying this, one does not preclude that some physical machinery might be functioning as well. The important point, however, is that it is not the machinery that matters but the way in which its function and, above all, its results are interpreted.

Many years ago, in the 1950s and 60s, Silvio CECCATO, who one day will be recognized as the pioneer of conceptual analysis, spoke of lavoro apportativo.<sup>12</sup> I like that formulation because it makes explicit the active role of the experiencer. John LOCKE, an early proponent of mental operations, subsumed them under the term "reflection" and said: "In time the mind comes to reflect on its own operations",<sup>13</sup> and he explained that, in reflection, complex ideas are formed by compounding simple ones. Yet, in the framework of Locke's general philosophy, the mind had little if

any autonomy with regard to its operating. His notion of reflection was somewhat like his notion of perception – a process of passive receiving that enables the cognizing agent to understand what is already there. More recent schools of Empiricism, though they claim Locke as a founding father, have tried to eliminate the mind and its operations altogether.

In contrast, PIAGET, in whose genetic epistemology the concept of "reflective abstraction" plays an important part, has throughout his work stressed the active role of the cognizing organism. Even so, it requires a considerable effort to appreciate the full extent of the generative power assigned to the knower in Piaget's theory. One reason for this is that active construction takes place on more than one level.

There is the level of segmentation that creates chunks of experience, where we construct recurrent "things" by focusing on similarities and disregarding differences. There is the level of relating that creates sequences and links that enable the experiencing subject to think in terms of more or less reliable "schemes". And there is the level of reflection, where abstraction, not from things but from the subject's own operating, creates complex conceptual structures which, then, are called theories, systems, and knowledge of the world.

#### IV

From the constructivist perspective, the segmenting, the relating, and the abstracting are done by us, for our purposes and with our means. We evaluate them first and foremost according to whether or not they do what we expect them to do. Only if they work, if they achieve what we expect, are we inclined to apply other considerations, such as economy, speed, or, indeed, simplicity. In other words, the constructivist theory of knowledge is unashamedly instrumentalist. That is one reason why philosophers who still cling to the established dogma, cannot accept it. In spite of the fact that logic tells us that we cannot, they will not relinquish the precept that we must strive to attain knowledge that might be ontologically "true".

The bulk of the resistance that the constructivist epistemology is meeting, however, springs from the fact that it proposes a radical change in the conception of knowledge itself. As I said initially, constructivism suggests that the way in which the cognitive structures that we call "knowledge" relate to "real world" should be considered as fitting, and not as matching. That means that the relation must not be conceived in analogy to the way a picture may relate to what it is supposed to depict, but rather in analogy to the way a river relates to the

landscape through which it has found its course. The river forms itself wherever the landscape allows water to flow. There is a continuous, subtle interplay between the "logic" inherent in the water (e.g., that it must form a horizontal surface and cannot flow uphill) and the topology of the land. Both constrain the course of the river, and they do so inseparably. At no point could you say, for instance, that the river turns right "because" there is a hill, without implicitly presuming the logic of the water that prevents the river from flowing uphill. Thus, the river does not "match" the landscape but "fits" into it, in the sense that it finds its course between constraints that arise, not from the landscape or the logic of the water but always and necessarily from the interaction of both.

An analogous, irreducible interaction takes place between the "landscape" of ontological reality and the "course" of our cognitive constructing that generates what we call "know-ledge". At no point could we say that a particular conceptual structure must reflect "reality" because it helps us to circumvent some experiential constraint. It would, indeed, be a strangely ingenuous conceit to believe that, having found one path, it must be the only one possible and therefore "real". No less ingenuous would it be to forget that the goals we try to attain, the ideas and theories we construe in order to attain them, and the constraints and obstacles we meet in our endeavor, are all and sundry products of our own way of conceptualizing experience.

From that point of view, then, whatever complexity we are facing is of our own making, for it can arise only from the relation between the goals we have chosen and the ways and means we construct for getting there. Attributing it to an ontological world as a property it might have in itself and apart from our conceptual activity seems as unwarranted as the pious hope that the "real" universe might be ruled by comprehensible and therefore "simple" laws because God would not have played with dice.

Franz EXNER, the Austrian physicist to whom Schrödinger said he owed part of his own orientation, said it very well in one of his last lectures:

Nature does not ask whether man understands it or not, nor do we have to construct a nature that might be adequate to our understanding, we merely have to manage with what is given us as best we can.<sup>14</sup>

## Footnotes

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1. H. von Helmholtz, 1881, Addendum zu seiner Abhandlung über die 'Erhaltung der Kraft', 1847. Quoted by Franz EXNER in his *Vorlesungen über die physikalischen Grundlagen der Naturwissenschaften*. Vienna: Deuticke, 1911; p.663.
2. E. von GLASERSFELD, Einführung in den Radikalen Konstruktivismus. In P.Watzlawick (Ed.), *Die erfundene Wirklichkeit* (p.16-38), Munich: Piper, 1981; and Reconstructing the concept of knowledge, *Archives de Psychologie*, 1985, 53, 91-101.
3. J. PIAGET, *Le Structuralisme*. Paris: Presses Universitaires deFrance, 1970; p.120.
4. H. von FOERSTER, Thoughts and notes on cognition. In P.Garvin (Ed.), *Cognition: A multiple view* (25-48). New York:Spartan Books, 1970.
5. L.R.LIPSITT, The study of sensory and learning processes inthe newborn. *Symposium on Neonate Neurology*, 1977, 4, 163-186.
6. R.M.YERKES, The intelligence of earthworms. *Journal of Animal Behavior*, 1912, 2, 332-352.
7. H.MATURANA formulated this in his *Biology of cognition* (Report 9.0). Urbana, Illinois: B.C.L., 1970:  
  
A living system, due to its circular organization, is an inductive system and functions always in a predictive manner: what happened once will occur again. Its organization (genetic and otherwise) is conservative and repeats only what works. (p.39)
8. D. HUME, *An enquiry concerning human understanding* (1750).New York: Washington Square Press, 1963; p.47.
9. For an inspired approach to this problem see: H.von FOERSTER, Memory without record, in D.P.Kimble (Ed.), *Learning, remembering, and forgetting, Vol.I: The anatomy of memory* (388-433). Palo Alto, California: Science and Behavior Books, 1965.
- 10) E. von GLASERSFELD, Cybernetics, experience, and the conceptof self. In M.N.Ozer (Ed.), *A cybernetic approach to the assessment of children: Toward a more humane use of human beings* (67-113). Boulder, Colorado: Westview Press, 1979;and

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11. W. JAMES, *Pragmatism* (1907). New York: Meridian Books, 1955; p.119.
12. S. CECCATO, *Un tecnico fra i filosofi, Vol.2*. Padova: Marsilio, 1966.
13. J. LOCKE, *An essay concerning human understanding* (1690). Garden City, N.Y.: Dolphin Books, no date.
14. F. EXNER, 1919 (Footnote 1), p. 697.

### **Acknowledgement**

I am indebted to Siegfried Schmidt for helpful comments on a draft of this paper.

