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The Construction of Knowledge

When I am asked to talk about Constructivism, I usually start by explaining the four sources from which I proceeded to develop this way of thinking, They are both historical and biographical sources and can be summarily described by the headings: (1) Language, (2) the work of the skeptics from the beginnings of Western History, (3) a key concept of Darwin's theory of evolution and, (4) Cybernetics.

About thirty years ago, Heinz von Foerster noticed an inherent quality of the nervous system (and almost everybody believes that human beings must be viewed as nervous systems when one focuses on cognition): The signals that are sent from sensory elements to the cortex are all the same. This had been discovered by Johannes Müller around the middle of the last century, but von Foerster was, as far as I know, the first to emphasize its epistemological implications.

He called this "undifferentiated coding".¹ What this means is that if a neuron in the retina sends a "visual" signal to the cortex, this signal has exactly the same form as the signals that come from the ears, from the nose, from fingers or toes, or any other signal-generating part of the organism. There is no qualitative distinction between any of these signals. They all vary in frequency and amplitude, but there is no qualitative indication of what they are supposed to mean.

It was a very baffling observation. It has since been confirmed by Humberto Maturana in the field of color vision, where he has shown that the receptors which are supposed to sense red – or what physicists think of as the kind of light waves we call red – send signals that are in no way different from the ones that sense green. If we are able to distinguish them, the distinctions must be made in the cortex. Yet, they cannot be made on the basis of simple qualitative differences, because there are no such differences.² It is therefore unwarranted to maintain that we distinguish things because we receive "information" from what we usually call the outside world.

From the epistemological point of view, this is earth-shaking. Yet if you look through the contemporary literature of psychology and especially the psychology of perception, one finds practically no reference to it.

Language

When I explain that, for me, language was a source of constructivism, I cannot help but speak in a biographical vein. I was in what I consider the fortunate position of growing up without a particular native language. I grew up with two, and very soon it was three. So I grew up *between* languages.

For a child, learning two or three languages is no problem whatsoever if the languages are spoken in the everyday environment. Indeed, the child for the most part is unaware of speaking different languages to different people. But then, in the course of growing up, the child reaches the stage when the first philosophical questions begin to bubble up. It happens around the time of puberty. You stand in front of a mirror and for the first time ask yourself: Who am I? Why am I here? What is all this about? – And philosophy begins.

Having grown up the way I did, you sooner or later also come to ask another question. You realize that the differences between the languages are not merely a matter of vocabulary or grammar, but a matter of looking at the world. This inevitably raises the question, which of these ways of looking might be the right one. But then, because you have been living quite happily among people who look at the world differently, you realize that this is a silly question, because all the speakers of one language obviously think that theirs is the “right” way of looking at the world. After a while you conclude that each group may be right for itself and that there is no rightness outside the groups.

In retrospect, I believe it was this circumstance that drove me into philosophy and was the primary source of my interest in theories of knowledge. I read philosophy eclectically and without supervision. This has a disadvantage. Having no professional guidance, it may take you many years to solve a problem, and then you discover that you could have found the solution in a book, if only someone had told you where to look. On the other hand, eclectic reading has the advantage that you read some authors that are never mentioned in standard philosophy courses. And in my case some of these authors happened to be particularly important for constructing a constructivist theory of knowing.

The Skeptics

My thinking took a serious turn when I happened upon the skeptics. What they have been saying has remained essentially the same for two thousand five hundred years. It did not change, because the argument that was well formulated already by the Pre-Socratics in the 6th century B.C. is a logically incontrovertible argument.

The way I see it is very simple. The skeptics argue that what we come to know has gone through our sensory system and through our conceptual system and it gives us a picture. But when we would like to know whether this is a correct picture, a *true* picture of an outside world, we are completely stuck, because every time we look at the outside world, what we see is again seen through *our* sensory system and through *our* conceptual system.

So we are trapped in a paradox. We want to believe that we can know something of the outside world, but we can never tell whether this knowledge is true. Because to establish such truth would require a comparison which we simply cannot make. We

have no way of getting at the outside world, except by experiencing it. And in experiencing it, we may be making the same mistakes; even if we saw it all correctly, we would have no way of knowing that it is correct.³

This leaves epistemology in a rather dismal position. If you look at the Western History of Philosophy, you find some beautiful dreams, some beautiful stories about how it could be. But none of them is able to answer that primary problem of how our knowledge could be considered true, if by true we intend a true representation of an ontological world, a world before we have come to know it.

If this is the situation, it seems to me one has to try to see whether there is another way. And that other way, I think, was first thought of in the Renaissance. It surfaced with the trial of Galileo. As you know, Galileo was accused of heresy by the Vatican because his model of the planetary system was not the same as the one the Vatican wanted to have true.

At that time, Cardinal Bellarmino tried to warn Galileo. Bellarmino, who had been the prosecutor in the case against Giordano Bruno, was a civilized man and, although he was a believing Catholic, he felt it was a pity that some of the most intelligent men should have to be burned. He wrote a letter to a friend of Galileo's saying that Galileo would be prudent if he always spoke in the hypothetical mode and presented his theories as theories for making calculations and predictions, but he must not present them as descriptions of God's world.

This was the beginning of a split between what I would call rational knowledge and mystical knowledge. The separation of these two kinds of knowledge can be found in much of the skeptical thinking of the 16th, 17th, and 18th Centuries. Among others there were thinkers like Gassendi and Mersenne in France, who argued that it was perfectly all right for science to make rational models, but they were always models of our experiential world and not models of a real world.

This separation of two kinds of knowledge – the rational and the non-rational – was a novel idea in skepticism. If I have called the second “mystical”, some people may think that I intend an evaluation, that I value the mystical less than the rational. This is not so. In that regard I follow the first real constructivist, the Italian philosopher *Giambattista Vico*, who contrasted the knowledge of reason and the knowledge of “poetic imagination” but did not question the value of both. He wrote a Latin thesis at the very beginning of the 18th century and called it “*De Antiquissima Italorum Sapientia*”. It is the first constructivist manifesto. Speaking about the real world, Vico said very clearly that humans can only know what humans themselves have made. He crystallized this in the rather beautiful statement that God is the artificer of the world, man the god of artifacts.⁴ (When Vico said “man”, he included women, which at that time was always taken for granted.)

An Evolutionary Concept

So much for the history of philosophy. Epistemology was left in a precarious situation. There were two kinds of knowledge in need of justification. The mystical could be justified only by the dogma of sacred books or a metaphysical myth. The rational seemed to have lost its justification if one could no longer say that scientific knowledge was true in the sense that it provided a true representation of an outside

world. This made rational knowledge seem rather weak in the eyes of most philosophers. What was needed was a justification that did not involve representation.

A way to build such a justification was first supplied by a concept that is inherent in Darwin's Theory of Evolution. The moment I say this, I realize that it will be misinterpreted. I do not mean that scientific knowledge could evolve in the same manner that species evolve in an environment. It is important to make this clear because there is much talk today about "evolutionary epistemology" and I consider this misleading. For me, as for a number of thinkers at the turn of the century, the important idea was the notion of "fit" rather than "match".

In Darwin's Theory an organism's physical form and its way of behaving must fit into the environment in which it has to live. You all know that adaptation in this Darwinian sense is not something that the organism itself can do. It is something accidental. Biological adaptation is not an activity of either organisms or species but a state of affairs. Anything that has the possibility to survive in the given environment is "fit". As the biologist *Colin Pittendrigh* said, it is a pity that Darwin himself occasionally slipped and talked of "the survival of the fittest", which is misleading. In principle, to be "fit" means to be able to survive.⁵ For the organism it is an either/or matter, not a matter of degree.

That relationship of fitting into a set of constraints is what we call the relationship of "viability". Organisms are viable if they manage to survive in spite of the constraints their environment places on their living and reproducing. This relationship, therefore, is not one of representation but one of fitting into given circumstances.

Where knowledge is concerned, the circumstances are often purely logical ones. They do not constitute a physical environment but a conceptual one. To be viable, a new thought should fit into the existing scheme of conceptual structures in a way that does not cause contradictions. If there are contradictions, either the new thought or the old structures are deemed to require changing.

The first person to take this idea and bring it into cognition was Mark Baldwin, who was one of Jean Piaget's teachers in Paris. Piaget then developed it into a full-fledged theory of cognition and cognitive development.⁶ Throughout his works he repeated that cognition was an adaptive activity.

In my opinion, however, a great many readers of Piaget never took this seriously. And still today, most read Piaget as though he talked about knowledge of the old kind, knowledge that is representational.

If one tries to make a coherent interpretation of Piaget, one comes to the conclusion that this can be done only through a change of the concept of knowing and the concept of knowledge, a change from the representational to the adaptive.

In this changed perspective, then, knowledge does not provide a representation of an independent world but rather a map of what can be done in the experienced environment.

Cybernetics

The last root of Constructivism is Cybernetics. This relatively new branch of studies focused much interest on self-regulation and self-organizing organisms.

It seems to me that a serious study of Self-Regulation must come to the point where it asks also about the activity of knowing, and whether knowing is not also a result of self-regulation. Once again, a very simple statement. It means that whatever you call knowledge must be made-up or constructed out of material that is accessible to the knower. In fact, it is the cybernetician's way of formulating what Vico said; namely, that you can only know what you yourself have made. And to make it yourself, you must have access to the building blocks, to the raw material. Cybernetics then helps to unravel the question of what is accessible and what not.

From the Cybernetic point of view, self-regulating systems are informationally closed. To explain this, we must remember what Claude Shannon, in his famous paper on the *Theory of Communication*,⁷ showed about signals and their meaning. Two of his points are sufficient to clear up the wide-spread misconception of the term "information":

(1) meaning does not travel from the sender to the receiver – the only thing that travels are signals;

(2) signals are signals only insofar as someone can decode them, and in order to decode them you have to know their meaning.

Communication, therefore, works when two people send each other a telegram and they have previously established a code outside that communication system. They can decode the message because they already know the code. But how should we decode the signals that we get from our sensors, the signals that, according to the traditional view, are coming from the outside world? We do not know who or what encoded them in that hypothetical outside world, nor do we know the code. We can only look at the signals from the inside, namely from the receiver's side. Hence the use of the term information makes no sense in this context. We can speak of "information" relative to our own experiences, but never with regard to anything that is supposed to lie beyond our experiential interface.

Professor Prigogine said, if I understood him rightly, "Knowledge is participation".⁸ As you can tell from what I have said, I go further and say: "Knowledge is construction."

Differences and Samenesses

In order to show you how Constructivism imagines this construction, I would like to describe one example. It is a construction which, I believe, most of us have accomplished within the first two years of our lives. What I am going to say is to a large extent based on Piaget's *La construction du réel chez l'enfant*.⁶

There is no constructing unless you have some form of reflection. What I mean by reflection is much the same that Piaget and, long before him, the British empiricist Philosopher John Locke meant. Locke said early on in his treatise that there are two sources of knowledge. One is the senses, and the other is the mind's reflection upon its own operations.⁹

The child's reflection upon its own mental operations is for Piaget the basis of "reflective abstraction" which yields all the important concepts that cannot be derived directly from sensory or motor experience. These abstract or "operative" concepts form a level above the "figurative" ones that can be abstracted from sensory material.

But, how would reflection start to build up anything? I would suggest (as did William James a long time ago) that the notions of differences and sameness are among the first indispensable tools. George Spencer Brown, in his treatise "Laws of Form",¹⁰ begins with an injunction that says simply: "Make a distinction." I think this is a good beginning for any mental activity. The distinction inevitably comes out of a comparison, and the comparison could just as well end in sameness. I want to talk about the kind of comparison that does not show a difference and you conclude that two things are the same.

In some languages you have two words for this sameness. I do not know about Spanish, but in Italian you have "*lo stesso*" and "*il medesimo*." Unfortunately they are both interchanged in common Italian today, but originally they probably had two different meanings. One for things considered the same with respect to all the characteristics that are examined, in the sense that members of a class are all the same. I call this kind of sameness "equivalence". It is a very important conceptual building block, because without it one could never classify, and classification is responsible for a large part of our intellectual picture of the world.

The other meaning of sameness is different. You use it when you intend that a given thing being considered now is not only like a thing seen yesterday, but is the *same* individual. I will call this sameness "individual identity." It is clear that this too is very important in the construction of our conceptual world because it generates permanence.

However, the attribution of individual identity is not free of problems. Let us assume that I was here yesterday and, just as now, had a glass of water in front of me. I come in today and say: "Oh, this is the same glass, the identical glass that stood here yesterday." If someone asked me, how I can tell that it is the identical glass, I should have to look for a particular that distinguishes this glass from all others. This may turn out to be impossible. But this is not the problem I want to focus on.

Time and Space

There is another conceptual problem that is difficult for adults to see, because it was solved in an ingenious way at a very early age. I am claiming that the glass I see now is the self-same individual that I saw yesterday, but I did not see it during the entire interval of 24 hours. During that interval this glass was not part of my experiential world and my attention was on other things, and for a third of the interval I was asleep. Yet, I want to say this is the self-same, identical glass. This would require that the glass had some form of continuity *outside my experiential world*. Therefore there must be some place beyond my field of experience where the glass could *be* while I was busy experiencing other things or asleep.

Piaget has called this "externalisation", and according to him, children form this conception at an age between 18 months and 2 years. I have called it the construction of Proto-Space. It is not yet a metric space, and does not yet comprise any spatial relations. It is merely a kind of repository where things can be put to keep their

individual identity while they are not being experienced. Their relations to one another can of course be added later as they are needed.

This construction of proto-space immediately raises a second question: What are the items in it *doing* while one is experiencing other things? After all, a lot was going on in one's experiential world during the interval the abandoned items spent in their repository. The language in which I am describing this, the words "while" and "during", already give away the trick. The "being" of the things in the repository gets extended so that they can keep up with the flow of my experience and be available when my attention turns to them again. This parallelism of two extensions – the flow of a subject's experience and the individual identities stretched over intervals in their repository is what I call "proto-time". It is the beginning of the concept of time. It is different from the notion of proto-space because in it there are already the notions of "before" and "after". But this "before" and "after" is constructed by the projection of the subject's experiences on things in the repository that are not in the field of experience. It is, indeed, this parallelism that makes it possible to choose a standard experience, for instance the movement of a clock's hand, and to project it on some other experiential sequence as a measure of time.

To me, therefore, time is not, as Prigogine said, an illusion. If I called the construct of time an illusion, the entire world that I know, the world that I live in, would also have to be called an illusion. And that is not the way I would characterize it. Although my entire world is a construction, I can still make a useful distinction in it between illusion and reality. But remember that for me "reality" always refers to *experiential* reality, not to the ontological reality of traditional philosophy. If we want to construct a rational reality for ourselves, time and space are indispensable building blocks, and I would rather call "illusion" any claim to knowledge beyond the field of our experience.

Conclusion

Let me summarize some salient aspects of the constructivist way of thinking. First of all, it is a way of thinking and it is not a description of any world. It is a model, a hypothetical model. It makes no ontological claims. It does not purport to describe any absolute reality, but only phenomena of our own experience.

If constructivists could have their way, they would never use the word "to be" in any form. Unfortunately our languages are made in such a way that we cannot do without that verb. The ambiguity of "to be" inevitably generates misconceptions. On the one hand it designates merely a copula that connects words, but on the other, since the beginning of our time, it has been tied to ontological existence.

If I say "this glass is small", it is relatively easy to understand that I am speaking from my point of view, given my experience. But if I say "this glass *is*", I seem to be claiming that the glass "exists" as an entity independently of anyone's experience. In this case, it is far more difficult to understand that I am speaking from my point of view, and that I consider it convenient to attribute a lasting individual identity to the glass I am perceiving. Like the philosopher *George Berkeley*, I do not know what "to exist" could mean, unless it simply refers to the things one perceives.¹¹

This is important to remember when critics say that constructivism denies reality. It does not – it merely says that one cannot know an independent reality.

Constructivism does not make ontological statements. It does not tell you how the world is. It merely suggest a way of thinking about it, and provides an analysis of the operations that generate a reality from experience.

Constructivism is probably best characterized by saying that it is the first serious attempt to separate epistemology from ontology. In our history of ideas, epistemology – the study of what we know and how we come to know it – has always been tied to the notion that knowledge has to be a representation of an ontological world outside. Constructivism tries to do without that. It tries to do away with that condition and says, instead, that knowledge only has to be viable, to suit our purposes. It has to function, i.e., it has to fit into the world as we see it, not into the world as it might *be*.

Because I was talking of time, let me end with a quotation from Shakespeare, who seems to have known all this perfectly well. Using the word “thought” instead of “knowledge”, he said: “But thought’s the slave of life, and life time’s fool; and time, that takes survey of all the world, must have a stop.”¹²

Notes

1. Heinz von Foerster, “On constructing a reality”. In F.E.Preiser (Ed.), *Environmental design research, Vol.2*. Stroudsburg: Dowden, Hutchinson, & Ross, 1973; p.38.
2. Humberto Maturana, G.Uribe, & S.G.Frenk, “A biological theory of relativistic colour coding in the primate retina”, *Archivos de Biología y Medicina Experimentales*, Suplemento no.1, 1968, 1–30.
3. Xenophanes saw this, as early as the 6th century B.C. (See Hermann Diels, *The Fragments of the Pre-Socratics*).
4. Giambattista Vico, *De antiquissima Italorum sapientia* (1710). Naples: Stamperia de’Classici Latini, 1858, p.123.
5. Colin Pittendrigh, “Adaptation, natural selection, and behavior”. In A.Roe & G.G.Simpson (Eds.), *Behavior and evolution*. New Haven: Yale University, 1958.
6. Jean Piaget, *La construction du réel chez l’enfant*. Neuchâtel: Delachaux et Niestlé, 1937.
7. Claude Shannon, “The mathematical theory of communication”, *Bell System Technical Journal*, 1948, 27, 379–423 & 623–656.
8. Prigogine’s contribution to this meeting.
9. John Locke, *An essay concerning human understanding*. 1690. Book II, §4.
10. George Spencer Brown, *Laws of form*. London: George Allen & Unwin, 1969.
11. George Berkeley, *A treatise concerning the principles of human knowledge*. 1710. Part I, §3.
12. Shakespeare, William. *King Henry IV, Part 1*, Act V, Scene IV.

Dialogue after the Plenary Presentation “The Construction of Knowledge”

A dialogue will now take place with the participation of Dr. Evelyn Fox Keller, Professor of the Department of Rhetoric in Studies on Women, University of California in Berkley and Co-director of the Berkley Project concerning Bio-science and Society. And Dr. W. Barnett Pearce, Director of the Communications Department, Loyola University, Chicago, Illinois.

Evelyn Fox Keller: I think I would like to start simply by raising some questions.

Darwin had a very particular notion of the meaning of adaptation as the meaning of fit – in fact, the meanings were non-separable. What was fit survived, what survived was fit by definition. Asdrees [?], in attempting to generalize Darwin’s notion of adaptation to cognition – a move I welcome whole heartedly – raises some larger questions about what cognition is adapted to. He repeatedly emphasizes the idea that knowledge must suit our purposes, and began his talk with recollections of his youth growing up in different languages and the early precocious appreciation of the difference in world views as contained in different languages.

The question then becomes, if one talks about epistemology, if one talks about the construction of Proto-space, Proto-time, Proto-particle, Proto-whatever – that the knowledges that one constructs are always knowledges relative to the purposes of a world view. The purposes that are embedded. Going back to his own example of his childhood, it becomes immediately evident that not all cultures, not all languages have the same notion, convey the same notion of purpose or the same notion of adaptation. And in this sense, Darwin had it much, much easier because his *cut out* was simply survival.

So the question is opened up, and I would like to invite Ernst to explore in that direction: What are the purposes of cognition, of knowledges. In particular, he might want to reflect back on Professor Prigogine’s remarks, to think a little bit about the purposes that different epistemic constructions – as in physics, for example, the long-range mechanism or different knowledge systems: What are the purposes, whose purposes, how do these purposes become adaptations and for whom are they adapted?

Ernst von Glasersfeld: That is a very big question.

The purposiveness of knowledge is at least on two quite different levels – two levels that are somewhat connected with one another but are essentially different because the criteria are different on each of them.

The first is of the physical world – survival in the physical world, which is survival more or less, I imagine, the way Darwin meant it. But the second is on a purely conceptual level.

I tried to suggest this when I said that the new pieces of knowledge we construct not only have to satisfy the particular problem for which they were constructed at the moment, but ideally they should also fit into the other structures that we already have. In a philosopher’s terms, that would be a coherence theory of truth – except that I try to avoid the word “truth”. It is a coherence theory, period. We feel much more comfortable when the conceptual models we have constructed for one situation are

such that they are at least compatible with the models we have constructed for other situations. We are uncomfortable when we use one particular way of thinking for this problem here and another way of thinking for that problem there.

I am not a physicist myself, but I worked with physicists for the last ten years and they – some of them at least – lose a good deal of sleep because they have to work with two quite different models of matter and two quite different models of light. It is supposed to be particles on the one hand, and waves on the other. There is a certain amount of incompatibility between those models. And trying to get around that by saying that they are complementary is a trick that not all physicists feel quite happy with. So the purposiveness is at least twofold. One is survival and the other is conceptual coherence or non-contradictoriness.

They both amount to what Piaget called equilibration. Now, Piaget also has two quite different levels of equilibration. Equilibration, to me, means that there are no disturbances, no contradictions, that everything goes relatively smoothly. On the conceptual level of course, that is never the case. We make things coherent up to a point and the moment we have a new experience and try to fit it in, things are likely to become less coherent. But that is half the fun of remaining alive.

What was the other thing that you wanted me to address?

Evelyn Fox Keller: Since we want to repudiate representation as a basis for knowledge – and I think everyone here would agree – and shift our conception of knowledge to one that is interactive and participatory, the two definitions or criteria for adaptation that you gave me, I think are too short a list. I think that the second – the question that it must fit with established systems of knowledge, with what we have already taken to be true – is essentially what I would call part of the first. It is called intellectual survival or academic survival.

Ernst von Glasersfeld: We usually do not die when we have wrong ideas and you may regret that, but...

Evelyn Fox Keller: No. Well, no. I say the second part – the conservative part. The first part is our survival. That raises a question. We are talking even though we are ostensibly repudiating the picture of knowledge as representation. It seems to me that we are leaving out what is beginning to be a quite conspicuous entire dimension of scientific knowledge as intervention in the world. And that the aims, the purposes of modern science have in fact never been purely representational, but have always been an articulated set of interventional aims. That is to say, we may die if our knowledge is not right, the world may die if it is! That we develop techniques of analysis that have consequences not simply for our own survival, but consequences because the world is only one. We develop knowledge systems, we construct forms of knowledge that are tested by their effects in the world and selected according to the extent to that those are effects which we as a culture want to embrace.

I have often just in thinking about this – in thinking about the absolute necessity for including the consequences of science and technology in our thinking about the epistemological questions – posed the question for myself in the extreme form: Suppose (I am not trying to be an alarmist here, I don't actually believe this is going to happen) as physicists, we developed a system of knowledge and technology that was sufficiently powerful that it succeeded in annihilating human life.

Let us suppose that. Would that have been true knowledge? By Darwinian measure, obviously no. This is just to challenge you to enlarge your sense of purposes.

Ernst von Glasersfeld: Well, you are certainly challenging me – as I am often pressured to say something about ethics, because the choice of the purposes for which we operate is ultimately an ethical question.

All I can say is that if you look at the history of rational philosophical theories, to my mind, none of them – ever since the Pre-Socratics – none of them has ever been able to formulate a basis for ethics. They tried very hard, but ultimately they failed because they are wonderful theories if you already agree about the basic values which they propagate. There is no way of justifying these values rationally. That belongs, I think, to what I call the mystical world which in the long run – and there I think I agree with Evelyn – is much more important than the rational. But I believe that most people brought up in the Western World have to get through reason. They have to exhaust reason from the inside before they are actually able to try something else.

I have not reached that point yet. So there is nothing I can say about purposes.

For the benefit of constructivism, I would like to say that I have tried to develop the concept of viability so that it does reach a second level – which I call a second-level or higher-level viability – it includes the construction of others and what they construct. So there is a social element in it. And it does show that, if you adopt that way of thinking about knowledge, others become important. You need others in order to confirm some of the things that you construct yourself. In doing that, constructivism provides at least a basis, which, I think, is more than other rational theories of knowledge and of ethics have done. Because they have the greatest difficulty in telling you at the outset why you should ever be interested in other people. That is the one thing that they take for granted.

So there is a little bit of something, but certainly I have no hopes whatsoever that constructivism could ever formulate particular precepts, particular ethical rules or anything like that. I do not think it can.

W. Barnett Pearce: Please I would like to comment there. I would like to begin by just giving you a couple of reactions that I had to your presentation and things that I really wish to commend you for.

I was struck by the fact that you began with a biographical description. That is always a risky thing to do in a congress like this. But I think that it was absolutely appropriate for those of us in the new paradigm who think that knowledge is humanly crafted, not sentences suitable for inscription in God's own blackboard in the sky, but incarnate in the practices and beliefs and volitions of human beings. I think that you set a good model for us in that.

The second is that I want to commend you again on the clarification and the clarity with which you present the constructivist viewpoint. I have talked with many people who have read your writings, who are not nearly as clear...of course. And one of the things I have always found when I talk with you is your clarifying the very careful limits you place on the context of the domains that you are prepared to talk about – for example the discussion of ethics just now.

I would just like to tell you how I am hearing you portray constructivism – and then you can tell me if I have got it wrong. If I have it at least partially right, I would like to go back to the discovery of others and the social context.

I am hearing you describing the primary problem that is confronted: How can I construct the world? The perspective that I hear is very heavily characterized in these two ways: First, it is an individual's perspective. The individual standing in front of his or her mirror asking who am I. Secondly, it is a cognitive perspective. The question is how can I understand. How can I know. In fact, I found your statement just a moment ago very useful. That you need other people to confirm what you have constructed for yourself. I am going to argue in a moment that we need others for far more than that, but is that a fair characterization of the cognitive interest and the individualistic perspective?

Ernst von Glasersfeld: Yes, it wants to talk about knowing and nothing else – in so far as that is possible.

W. Barnett Pearce: Then that helps me set up the point where I want to follow your quotation of G. Spencer Brown's injunction to make a distinction. And I wish to make a distinction between constructivism and social constructivism. What I would like to do is to set up a couple of paradigm tracks and then see if we can talk about what might be gained and what might be lost if we were to take them. When you were talking about Piaget, you were talking about cognitionists and adaptive functions and Evelyn asked an adaptive function to what. The discussion took the form of purposes.

I would like to shift that from purposes to contexts – adaptive to what context. Then ask the question, where do these contexts come from? It seems to me that even Piaget, when he is looking at the behavior of infants, is looking at infants who are not just playing with physical entities but are doing so in a larger social context of caring adults, perhaps experimenting scientists, other infants that might be around and so on – all of which create a kind of context.

What I would like to then do is to suggest that the use of cybernetics might be extended one step further. At least it seems to me it could, and I would like to ask your reaction to it.

In addition to knowledge as just looking at the self-regulation of observing one's own cognitive functions, the operatives, what if it were the case or what if we were to view the case this way – that social settings preexist and prefigure the kinds of operations that can go and the kinds of purposes that would be met within them? That our actions themselves help to recreate those contexts not always in the same way that they were before, setting forth a new set of pre-figurations?

Is not this a way of taking the ideas you have and putting them into motion in terms of a social dynamic? Or am I missing something here?

Ernst von Glasersfeld: You are perfectly free to do that. Because ideas are not any particular person's ideas. Once they are written, anyone can use them any way they like.

Let me put it this way, from my point of view it is not part of my specific task to say anything about a world that pre-exists. I cannot do that. If I want to speak of knowledge and the cognitive function alone, I have to start from inside the cognitive organism. Because only an observer – an outside observer – could say that this organism lives in such and such an environment. The organism itself cannot say that.

That is my basic difference between social constructionism and social constructivism. They make an assumption which from the radical constructivist's

point of view is just not allowable. You may be perfectly right, but if you want to keep your model clean, you cannot make that assumption. You have to ask yourself how does a child, a sort of developing cognitive organism, ever come to have others in its world.

You see, in what you said – I don't know if you actually mean it like that – the child's environment is divided into the physical environment and people. Other social constructionists do that. They say on the one hand is the physical environment, and then we have people and language. Language exists out there so it has an influence on the child.

As a constructivist of my kind, you cannot make those assumptions. You have to ask yourself: How does the child ever come to have a notion that outside itself exist other people, that are different from the table and cot and all that. And you can. You can make a kind of fairy tale of how it happens – with the pet cat in the house that is distinguished from the teddy bear because it moves by itself. It is a long story.

But eventually, the child comes to attribute its own capabilities, the capabilities that it finds in itself, to others. I was delighted to find that Kant, in the first edition of the Critique of Pure Reason, has a wonderful paragraph which describes precisely this. There he says you can only think of another subject – by subject he means a cognitive subject – if you attribute to that other entity your own subjectness, which means all the capabilities on the basis of which you call yourself a subject.

That is exactly how a constructivist would have to proceed. Now let me immediately say I am quite ready to believe that babies when they are born have a special relationship with their mothers. But it is not a rational relationship. It is not a relationship that I can in any way capture rationally. To me, that is part of the enormous mystical surrounding in which we live. The environment is basically mystical to me. I do not know what this world is like. It has all sorts of ways and means that I cannot capture rationally.

I do not know if that answers your question.

Evelyn Fox Keller: Well, it does not answer my question and I do not know whether our questions are similar or not. But your answer has just reaffirmed, re-drawn a distinction that is part of the very tradition that I thought you were undertaking to critique. In particular, the very sharp line you draw around the cognitive subject, or the distinction you make between rational and irrational – rational and mystical.

I take your own story about your development, your own biographical recollection, as counter to that distinction. I take it – in fact, I have tried to ask: Where does that distinction come from? – that that, too, is a developmental, historical/cultural linguistic distinction. I would like to start an account of cognition, if you like, also with a young child. But I would not separate or isolate the child from the social linguistic setting. Nor would I draw a distinction between the cognitive and the affective development, since I think that developmentally, those distinctions are not backed meaningfully historically.

So the question becomes – I would argue, that the distinction itself between reason and feeling is a consequence of a particular historical, cultural, even perhaps psychological condition or set of developments.

So can you imagine going back and re-drawing those boundaries – perhaps we can only speak from the inside but re-describing the contents of that inside.

Ernst von Glasersfeld: I can re-describe it, but I do not think you will be happier with it.

I think that whatever I say about my growing up is obviously *my* interpretation of *my own* experiences. The fact is that at the age of – whenever – at the age of two or three, I was in a position to isolate other human beings in my experiential world, and at the age of six or seven I was able to tell myself that there are differences between these human beings whether they speak Italian or speak German or speak English.

That was my experiential world. That does not describe an ontological reality. I try to be as consistent in that as I can.

Now with regard to your question, I have no doubt that the emotional – if for the moment we call it emotional or put it on the mystical side – has enormous influences all along. But they are not influences that I can capture in rational terms. Which does not say that they do not exist, because I do not talk about what exists. I am merely trying to make a model of the rational part of the mind.

W. Barnett Pearce: I would like to spring right off that. Let us assume that we have dispensed with the ontological myth, that there is a world out there that we can describe in any sort of way as it existed before we perceived it.

I am interested in the rigor of your limitation – self-imposed limitation – to rationality. I would like to bracket that term for analysis and ask: Whence comes rationality? By what processes are its affordances and limitations determined? If I can use the title of the recent book by Alister MacIntyre, “*Who’s Rationality, Which Justice*” – I think I have said them backward. I think it is “*Which Rationality, Who’s Justice*.”

Is rationality something that exists in an ontological sense? Is rationality only Ernst von Glasersfeld’s rationality? Is it a social rationality? Where does it come from?

Ernst von Glasersfeld: There is no question in my mind that what I call rationality is my rationality. It is one that I have constructed. It is rather a nebulous construct. I do not mind admitting that.

W. Barnett Pearce: Is it mystical? Is it part of this mystical world?

Ernst von Glasersfeld: I hope not.

W. Barnett Pearce: Because then you could not speak of it rationally.

Ernst von Glasersfeld: If it is, then the whole thing crumbles immediately. So I hope it is a fairly clean rational construct. Clean, not in a value sense but in the sense that there are no assumptions that ask for something structured outside.

W. Barnett Pearce: But consistent with your own methodology we could not know that to be sure.

Ernst von Glasersfeld: Of course you cannot, because you only hear the words I say and you interpret them in your way. That is the wonderful and terrible thing about language. We always talk of shared meanings. But to speak of “shared meanings” is pure nonsense. We have learnt to make our meanings in such a way that they are compatible in most situations. No matter how old we get, and I know this very well, we discover that there are words that we have been using with meanings that are not compatible with other person’s meanings.

W. Barnett Pearce: May I be playful with you for a moment and ask you, do I understand you? (laughter)

Ernst von Glasersfeld: You have to decide that.

W. Barnett Pearce: I am hesitant to speak now because I am afraid that I am going to fall into one of the traps that have been set for us.

Ernst von Glasersfeld: I do not set traps.

W. Barnett Pearce: But you frequently find yourself in the situation that you are in now, that Evelyn Fox Keller and I are pushing you to. What is the question people ask you in situations like this that gives you the most trouble in coming up with an answer? (laughter)

Ernst von Glasersfeld: What gives me trouble, but not that I can do anything about, is the notion of ethics. Because I would love to be in the position to say to you: “This is good and this is bad”.

Yet I realize that I cannot do that. With this goes my assumption that no one else can either. But I may be wrong there. So, yes that troubles me.

What troubles me in a very different way – and that is excluding the present – is that a lot of people try to turn what I am saying into ontological statements. So I find I have to repeat and try to change them around from that. But the troubling thing is that no one asks the question that would really put me into difficulties.

That is: You are building a model, a kind of theory, what are your presuppositions? I think the reason why that kind of question is not being asked is because sometime in the 1920s it became fashionable for some philosophers to change the meaning of the word “ontology.” Rather than treat the word in the manner that it had traditionally been treated, as the study of “being” and the “world of being,” they began to call ontological, the presuppositions of a theory. A theory has an ontology.

On a linguistic basis I disapprove of the use of that word, because it confounds several issues. If Humberto Maturana were here I would say it to him. He should never use the word “ontology” because he gives the wrong impression. He does not talk about an ontological reality. He uses the word for presuppositional assumptions, and that is a misuse.

However, I would like to be forced to work out what are the presuppositions I make when I am building this model. I have worked very hard to make a consistent interpretation of Piaget. I have worked very hard to find out what his suppositions are, because he never states them either.

I have come to the conclusion that there are at least three. You have to have an organism that has memory. You have to have an organism that has some values – they may be as primitive as like-dislike, or pain-no pain, etc., otherwise it does not work. And you have to have that mysterious thing I call Consciousness ,i.e., what allows reflection. Without those three things you cannot start any construction. This is already quite a lot – you can use it against me any way you like.

W. Barnett Pearce: No, I hear you sharing Piaget’s presuppositions and then I hear you making two more. Therefore, I am going to ask you the question you invited, the additional presuppositions say something about rationality which is to be explained. Rationality, at least for you, exists, has certain limits and affordances. Another is that

the appropriate unit of analysis is knowledge, from an individual perspective. So let me ask you, are there any other presuppositions that you make?

Evelyn Fox Keller: I would like to add one to identify – in addition to your definition of rationality, which is a presupposition – your definition of ethics and your separate distinction between ethics and rationality, which I would also challenge.

Ernst von Glasersfeld: You mean the presupposition is that I separate rationality from ethics. I do not want to seem stubborn but that does not fall under presupposition for me. It falls under the operational procedures. I think you can show that, within the system, you cannot work up justifications you could call ethical. Yet you can work up justifications you could call non-contradiction. But to get from there to ethics, I do not see that.

Evelyn Fox Keller: It is invited from your description of cognition as an adaptive function. And from that point of view you bracketed into the realm of ethics. But what it has to do with, it returns to the question: What is it adaptive to? And since we do, we are, we may not start out as social beings. We can argue about that, but we certainly live in a world which is social. So the aims to which cognition is adaptive include social, conventional, ethical aims. But precisely because cognition is an adaptive function that does not make it separable.

Ernst von Glasersfeld: Thank you, because this allows me now to make something clear which I meant to do before. You are using adaptive and adaptation as a relation between the organism and the environment. You say: “We live in a social world and we adapt to it,” whereas I try to use the adaptive function only relative to the experiential world of the organism.

Evelyn Fox Keller: Which is also a social world.

Ernst von Glasersfeld: After a while, it becomes a social world. But it is the social world, the society that I have constructed. It is not the society as it exists for anyone else outside me.

Evelyn Fox Keller: It is the social world that you have internalized, just as with language. You have not constructed the language.

Ernst von Glasersfeld: Well now, I have not constructed the language just as I have not constructed this table, but I have adapted to the table by not walking through it. I have adapted to the language that exists by making my meanings so that they more or less fit the meanings of others. But “fit” is not an equivalence. The “fit” gives me no knowledge of what the others have. I can only say, it has not caused a perturbation.

Let me quickly say something: there is a catch in the word “fit” in English. If you go to buy yourself a pair of shoes, you are looking for a pair that fits you. By that you mean that your foot goes into the shoe, but you also mean that the shoe is not so big that it gives you blisters when you walk.

So there are two dimensions to fit. The fit I use in the cognitive model is only one-dimensional. It is only the getting into of the foot. In this bottle a certain amount of water would fit, a fly would fit, a molecule, a photon would fit. Anything that is small enough fits. It does not say that it has to have any relation to the contour of the bottle or to the limitation from the outside. And that is very important when we talk

about meanings. As children we learn the meanings of words by trying them out. We are not given dictionaries, we are rarely given any verbal explanations of words. We learn them in situations and that means we associate parts of our experiential world with a particular word, but it remains part of our experiential world.

If you follow the language acquisition of a child, which we have done at the University of Georgia very seriously, you discover that the meaning of a child's word, between years one and three, sometimes expands and sometimes contracts, and it takes a long time for the meaning of any particular word to be more or less compatible with the meanings of the adults. "Compatible" does not mean "like." Compatible merely means that it does not cause disturbances: It functions for whatever the child wants to do.

W. Baronet Perch: I would like to state a response that I am having as a way of clarifying and of thanking you for the clarification. The response I am having is that I would personally be very uncomfortable living within the very sharp limits you have set for your world. And I think it is very useful and helpful for you to be able to articulate those limits so carefully and to legitimate their application beyond that.

I am also very uncomfortable with the idea of using that notion of "fit" as a model, because it seems to me that it pre-supposes that the goal state of the cognitive development is the lack of any perturbation, the lack of any sort of energy or provocations, an ability to come to an equilibrium state which I would not like to work with in my own theory.

Having said that, I would like to lengthen the table a little and invite two people to join us and ask you to explain things about two other folks, one is Humberto Maturana, the other is Ilya Prigogine. You said that Maturana should not say or use the word "ontological" in his work. I want to underscore the word "should" in your statement, and ask what kind of statement is that? Is it an ethical judgement and if so, is it in the area of mysticism?

Ernst von Glasersfeld: This statement is probably advice because since Maturana's theory is somewhat parallel to mine – although his is a biological theory, mine is not, and his is a much more encompassing theory than mine. But we are often thrown together. And I frequently have to answer questions that I think spring from the fact that Maturana uses the word "ontological." I think it makes it difficult for people to arrive at a compatible understanding of his theory. Ontology has a 2,500 year tradition, but many people – especially those who are little versed in philosophy – just tend to misunderstand that term.

W. Barnett Pearce: Good, this is consistent with your theory that he should not do that because it causes problems for your rational explanation of things.

Ernst von Glasersfeld: Yes, and in my view, it also causes problems for him – the way I have constructed him for myself.

W. Barnett Pearce: Good, right. (laughter) Prigogine talked about irreversible time, non-integrative systems, a world that is very fluid, in fact chaotic, catastrophic and so on. I am wondering if you can tell us how the image of that world fits or does not fit with your system of cognitive development as a function of fitting the environment.

Ernst von Glasersfeld: This is a lovely question because it gives me the opportunity to cite Piaget, who made a wonderful statement that I think has been overlooked by many Piaget readers in the US. He says the cognitive organism would be able to generate for himself or herself a relatively stable world even if reality were in constant flux, which I take to be a chaotic Brownian motion of everything. All it has to be is rich enough for the cognitive organism to pick out things, and the cognitive organism can always pick out things that seem regular, that seem the same. It can construct individual identities and all the rest and build a stable world out of that.

W. Barnett Pearce: Should Prigogine talk about all of these clumsy, chaotic and dynamic systems? Does it cause problems for your rational reconstruction of the process?

Ernst von Glasersfeld: I did not get that impression. I am not a physicist, and certainly of not that caliber. But I listened to Professor Prigogine and found most of what he said quite understandable from my point of view. One difference is the word illusion. I would not call time an illusion. It is no more and no less a construct than anything else in my world. It is just that it is a very basic construct. Without it I could not do much else. I have no difficulty.

Evelyn Fox Keller: Let me try to create a difficulty. (laughter) Your only fixed point seems to me at the cognitive subject. Now part of what I think Prigogine is concerned with and is working against is the construction of a world of static, mechanist, determinist structures that are products of certain kinds of cognitive subjects. He wants to advocate and facilitate the development of different kinds of cognitive endeavors that will aim at the identification of constructions not as static mechanist systems but as dynamic systems which have in themselves a time and age, a sense of becoming. That transforms the cognitive subject or presupposes a different cognitive subject.

I would suggest that the world which subject's construct in some sense match the subject's sense of him/herself, that part of that adaptive function is to fit with – and I think I use the word in a more Darwinian sense – one's own sense of self. Therefore, when I hear Professor Prigogine calling for a different kind of cognitive object, I presuppose that also calls for a different kind of cognitive subject, a more dynamic cognitive or subject to match the more dynamic object.

Ernst von Glasersfeld: I do not think I can agree with your division of static and dynamic. Professor Prigogine said that time was a relation. I cannot quote him word for word, but he said it was not a question of the individual particles but relations between these particles. So we would have something that is relational.

I do not know whether you call relations per se static or dynamic, but I feel the difference lies in that. I have no difficulty in expressing some model of a chaotic world in terms of relations which I believe to hold, which means that they stay the same, that in some ways I can experience them again in the relationship.

I do not think that is incompatible with my notion of the cognitive organism at all. Because for Piaget the operative (Operatoire) – which is in fact the reflective part that thinks in terms of one's own operations and what can be abstracted from those operations – is all dynamic. Perception is all dynamic because of that. And that shocks a lot of people who think we see the world in the form of picture postcards. It is all

movement, all dynamics. So I am not quite sure what you are trying to imply by saying it is not dynamic...

Evelyn Fox Keller: It nevertheless presupposes a different subjectivity. I think a subjectivity that searches for static or determinist objects in the world is a different subjectivity from that which seeks to construct a world of becoming.

Ernst von Glasersfeld: You may be right there. I am not sure how I can answer that question because I am not certain how you really mean that. Again, I think determinism has nothing to do with it. We try to make models of things that are deterministic but only in the sense that they function for us. We like them to function rather well.

Evelyn Fox Keller: But the different models of the world will function differently for different *us's*, for different kinds of subjects.

Ernst von Glasersfeld: Of course, no doubt, but I can only talk about *this* subject. It would be an impertinence if I tried to say what is working for you.

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