

Chapter 3. Biology_Part II: Towards the Where and the What? Biology & Epistemology

(Maturana and Varela and Kant)

"If in a new science which is wholly isolated and unique in its kind, we started with the prejudice that we can judge of things by means of alleged knowledge previously acquired - though this is precisely what has first to be called in question -we should only fancy we saw everywhere what we had already known, because the expressions have a similar sound. But everything would appear utterly metamorphosed, senseless, and unintelligible, because we should have as a foundation our own thoughts, made by long habit a second nature, instead of the author's." (Kant, Prolegomena, p.10)

From our ordinary way of looking at things, my third and final thesis, (which will be formally stated in Chapter 5), will appear convoluted, esoteric and disturbing. When the inverting glasses of habit are removed and a proper perspective is attained, however, it will become elegantly simple¹, plausible and profoundly more compatible with modern science than any proposed alternative. To reach that perspective and before I can even begin to properly state this thesis however, I must deal with several seemingly divergent, (but actually closely related), issues. This chapter will discuss the first of them. I must address the epistemological dilemma created by the conclusion of the first two theses.

Nobody writing meaningfully about the mind-body problem today appears to take Immanuel Kant as seriously and as literally as I do, and yet he seems to be the thinker most pertinent to it.² The problem of mind-body is, in one profound respect, the problem of knowing, (epistemology), itself. The questions of what we, as organisms, do know, or even *can* know -and how- reflect back on the very knowledge by which we judge the problem itself.

In an ancillary and important respect, moreover, the problem Kant faced in attempting to communicate his ideas is very similar to the one I face. (I referred to this in the introduction.) Both theses totally contravene the common wisdom, and (therefore) make sense only as a whole and not in their parts. Like his problem "of pure reason", (which is clearly a part of my own problem), my problem:

¹ in a mathematical sense of the term

² "This is an advantage no other science", [than epistemology/metaphysics], "has or can have, because there is none so fully isolated and independent of others *and so exclusively concerned with the faculty of cognition pure and simple*". Kant, "Prolegomena", Lewis Beck translation, Bobs-Merill, 1950, p.131, my emphasis

"is a sphere so separate and self-contained that we cannot touch a part without affecting all the rest. We can do nothing without first determining the position of each part and its relation to the rest; for, as our judgement within this sphere cannot be corrected by anything without, the validity and use of every part depends upon the relation in which it stands to all the rest within the domain [of reason]. As in the structure of an organized body, the end of each member can only be deduced from the full conception of the whole. It may, then, be said of such [a critique] that it is never trustworthy except it be perfectly complete, down to the minute elements [of pure reason]. In the sphere of this faculty you can determine and define either everything or nothing." ("Prolegomena", P. 11)

The combination of my first two theses provides radical and powerful simplifications to the mind-body problem. It raises a new and seemingly overwhelming difficulty however; if it is true, then what do we know, and what *can* we know of the reality in which we exist? Since my very arguments depend, moreover, on *accepted knowledge*¹ of that world, have I not reduced my own case to absurdity? The path to my third thesis will answer these questions and supply, (at its conclusion), the single remaining part of my promised *complete* solution to the mind-body problem. The latter is the answer to the problem of the "substance" of the mind. *What* is "mind" and *where* is it? How could it *be*?

Before I can formally state my third thesis which will answer these questions, (in Chapter 5), however, we must look at the problem of knowing, (epistemology), and at the broader problem of cognition generally, to include perception. It *demarcates* the problem of "substance". It sets the bounds and defines the very context within which we must consider it. The pivotal issue will be "closure!"²

Closure:

A mathematical domain D is called "closed" under operations "*" and "#", (let us say), if for every x and y in D, "x*y" and "x#y" are necessarily in D as well. The result of all such operations on the domain is, *no matter how far concatenated*, always again within the domain. It never "escapes" itself! I will argue that our

¹ e.g. Darwinian evolution

² This is, as an emotional issue, the most difficult of my theses and I must expect to lose my credibility with many of you here. It is a strange and esoteric idea, but, I believe, true. It must, on my part, be presented with the utmost delicacy. On your part, I must ask for a very careful reading as it may not be as it seems at first.

human cognitive domain is itself likewise closed, (though bounded),¹ under its operations. This was Kant's, (and Maturana's), conclusion as well. Surprisingly it will *simplify* the problem of "substance" and resolve the intolerable dilemma I (so innocently) raised as well. It is not that the problem of substance is itself so difficult; it is the demands that we make on the answer.

Kant was the most scientific, (I might equally say "mathematical"), thinker on this problem, and he is confirmed more recently, from the logical side by Quine,² and, from the side of biology, by Maturana and Varela. Though Kant's arguments belong to another era, his *overall* conclusions and his rigorous identification of the basic and necessary assumptions remains intact. Sanity and plausibility depend on just two, (*by definition* "metaphysical"), postulates of absolute existence: "externality" and "experience", ("intuition"). Without them, there is no reason for reason! But those postulates operate solely within the closed domain of reason: "our judgement within this sphere cannot be corrected by anything without."³

While fully affirming the *existence* of our external world as a necessary prerequisite to reason, Kant concluded that we are inherently incapable of knowing any of its independent properties, (to include time, space, extension, tactility - impenetrability), *independent of* their revelation in, and in combination with, human cognitive forms. Kant argued, (in quite a modern vein), that it is impossible to separate our "instrument", (the peculiarities of biological human cognition), from what it "measures", i.e. the world it cognates. His genuinely relativistic conclusion gains modern physical credence from the theories of relativity and quantum mechanics, and logical credence, (though it contravenes certain of his own, dated, arguments), from the axiomatic foundation of mathematics. He arrived at a position which I will call "ontic indeterminism"⁴, (i.e. an indeterminism as to properties, but

¹ A simple mathematical example of a closed and bounded domain would be the domain of the open interval $-1 < x,y < 1$ under the operation of multiplication. Another would be the open domain bounded by unit circle: for all $(x,y): -1 < x,y < 1$ with the operation #: $(x,y)\#(u,v) = (x*u,y*v)$. The integers are, of course, closed under addition and multiplication, the rationals under addition, multiplication, and division, ...

² cf Chapter 4

³ *ibid*

⁴ Kant himself was never satisfied with "critical idealism" but was forced to retain it for historical reasons. "This being the state of the case, I could wish, in order to avoid all misunderstanding, to have named this conception of mine otherwise, but to alter it altogether is probably impossible. It may be permitted me however, in future, as has been above intimated, to term it 'formal' or, better still, 'critical' idealism, to distinguish it from the dogmatic idealism of Berkeley and from the skeptical idealism of Descartes." -"Prolegomena", Pps.124-125

not as to the *existence* of external reality). More recently, Quine¹ has argued that our "system of knowledge and beliefs" is *logically* closed, and Maturana and Varela² have argued that biological organisms are *operationally and cognitively* closed -by definition!

I will argue that our knowledge and, even more broadly, *cognition generally*³, (to include perception!), is a closed, (i.e. self-referential), domain whose "boundary conditions"⁴ are:

- (1) the most general, (i.e. the weakest and most abstract), possible assumption of "externality" itself, and
- (2) "experience" as an *uninterpreted primitive*, i.e. not the interpretation or organization of that "experience" -not, for example, its interpretation as "sense impressions"⁵. The connection between these two assumptions is not necessarily simplistic. This chapter elaborates the first of them.

In this chapter, I will examine Maturana and Varela's arguments as set forth in "*The Tree of Knowledge*". (Maturana and Varela, 1987) They consummate the viewpoint of modern biology on the issue of closure. This penetrating work, very much the biological complement of Kant's "Prolegomena" I feel, defines the secure biological context in which they develop a single heuristic principle, ("structural coupling"), crucial to the mind-body problem. I will differ strongly with the conclusions they draw from it, however, as they were unwilling to accept the devastating consequences of their own arguments. I do.

Maturana and Varela characterize their book as an argument against a *representative model* of environment in the brain, against the existence of a current "map" which we use to compute behavior appropriate for survival in our contemporaneous world. Their argument propounds, instead, a closed, (and evolutionarily determined), reactive parallelism to environment -i.e. "congruent

¹ W.V.O. Quine, 1960. I will elaborate Quine's position in Chapter 4.

² Maturana and Varela, 1987

³ Cognition has two aspects. Repeating the definition cited earlier, (Websters. "cognition: the act or process of knowing, including both awareness and judgement". Also, "Perception: (4a) direct or intuitive cognition.")

⁴ See Chapter 4, re: Quine

⁵ But if our perceptual objects *are* cognitions, then how can they be a *boundary condition* of cognition as well? How can our perceptual objects and the things they do be "experience" themselves? I will argue that they are not! "Experience" is their invariant relationality across *all* orientations including even those which might distribute the "objects" themselves! Does *perceptual cognition* equate with "experience"? No, it is a particular (evolutionarily derived and "pictorial") *orientation* of that relationality! See Chap.4 and the "King of Petrolia".

structural coupling". They argue that organisms do not behave as they do *because* of the nature of their current surroundings; they behave *alongside of it!*¹ Organisms, as reactive physical systems, are "operationally closed". Their closed ontogenic state is only "triggered" by their environment. Environment is a "boundary condition" of survival, not a *motivation* for action. They conclude there is no *current model* because there is no flow of current "information".

They develop their fundamental thesis, "structural coupling", at the ground level of primitive evolution. It is a principle of purely mechanistic coexistence between "organism" and "environment" which preserves "autopoiesis", (reproduction). It is, I will argue however, weaker than the strict parallelism, ("congruence"), they demand of it. Their argument, examined more deeply, is against "information" between an organism and its environment *at any stage* -to include that of natural selection! "Congruence"², however, would clearly be *evolutionary* information!³ "Structural coupling" and the "conservation of autopoiesis", (and Darwin's "natural selection" itself), are quintessentially principles of raw *appropriateness* however.⁴ They are not informational. They say: "This works!"; they do not say: "This is what is!" (They do not exhaust or mirror the whole of possibility). Neither parallelism, ("congruence"), nor embodiment are legitimate consequences of these principles, I will argue, even at the evolutionary level. There are correlations between domains other than "isomorphism" or "congruence" which preserve pertinency. The mappings and transformations of abstract algebra are obvious counterexamples disproving the inference. It is only necessary that (some) feature(s) *compatible* with the milieu of the domain be preserved. I will argue that the presumed necessity of "evolutionary congruence" is a *human* precept and part of the closed and specifically human cognitive model.

I will now attempt to summarize Maturana and Varela's thesis. Please forgive the length of my citations, but I feel their arguments are profound, subtle, and more concise than any paraphrase. I believe they are, up to a certain point, conclusive.

¹ Their argument is considerably subtler than this as I will detail below.

² as in "*congruent* structural coupling"

³ cf Edelman, 1992. He argues that the human genome is simply too small for the purposes of information

⁴ i.e. they are boundary conditions, not limits!

Maturana and Varela:

Maturana and Varela,¹ make a profound and phenomenologically pure² argument proceeding from first principles. It leads to severe epistemological consequences. They begin by outlining *minimal and necessary* biological specifications for "living organisms". Those then become a *sufficient* rationale for the whole of metacellular organisms and their (nervous) behavior.³ The argument is wholly operational and constructive.⁴

"Our intention, therefore, is to proceed scientifically: if we cannot provide a list that characterizes a living being, why not propose a system that generates all the phenomena proper to a living being? The evidence that an *autopoietic unity* has exactly all these features becomes evident in the light of what we know about the interdependence between metabolism and cellular structure."⁵

Plausibly, they characterize a "living organism" as an "autopoietic unity", i.e. a replicating (cellular) physical entity. In so doing, they clarify the inherent nature of biological *phenomenology* itself, (i.e. its innate categories and operative principles).

"the potential diversification and plasticity in the family of organic molecules has made possible the formation of networks of molecular reactions that produce the same types of molecules that they embody, while at the same time they set the boundaries of the space in which they are formed.

¹ afterwards "Maturana"

² i.e. they do not mix their contexts or the origins of their presumptions

³ "And how can we tell when we have reached a satisfactory explanation of the phenomenon of knowing? ...when we have set forth a conceptual system that can *generate* the cognitive phenomenon as a result of the action of a living being, and when we have shown that this process can produce living beings like ourselves, able to generate descriptions and reflect on them as a result of their fulfillment as living beings operating effectively in their fields of existence." (op.cit P.30)

⁴ Please come back and review Maturana's preamble when you have gotten through Chapter 4, particularly [Hertz's reflections on the nature of science](#). I think the connection is important.

⁵ ibid P.48, my emphasis

These molecular networks and interactions that produce themselves and specify their own limits are ... living beings."¹

"Autopoietic unities specify biological phenomenology as the phenomenology proper of those unities", (my emphasis), "with features distinct from physical phenomenology... because the phenomena they generate in functioning as autopoietic unities depend on their organization and the way this organization comes about, and not on the physical nature of their components."²

The legitimate and minimal principles appropriate to biological process are operational closure and independence.

"Ontogeny is the history of structural changes in a particular living being. In this history *each living being begins with an initial structure. This structure conditions the course of its interactions and restricts the structural changes that the interactions may trigger in it*", (my emphasis). "At the same time, it is born in a particular place, in a medium that constitutes the ambience in which it emerges and in which it interacts. This ambience appears to have a structural dynamics of its own, *operationally distinct* from the living being. This is a crucial point. As observers, we have distinguished the living system as a unity from its background and have characterized it as a definite organization. *We have thus distinguished two structures that are going to be considered operationally independent of each other*, (my emphasis), "living being and environment."³

Physical science's primal principle of "mechanism", however, leads to a distinct point of view on the interactions of the "autopoietic unity" with its environment: "triggering", "perturbation", and "structural coupling". Organism and environment are *coincident*, not operationally dependent!

"Every ontogeny occurs within an environment; we, as observers, can describe both as having a particular structure such as diffusion, secretion,

¹ ibid Pps. 39-40

² ibid P.51

³ ibid P.63

temperature. In describing autopoietic unity as having a particular structure, it will become clear to us that the interactions (as long as they are recurrent) between unity and environment will consist of reciprocal perturbations. In these interactions, the structure of the environment only *triggers* structural changes in the autopoietic unities (*it does not specify or direct them*), (my emphasis), "and vice versa for the environment. The result will be a history of mutual congruent structural changes as long as the autopoietic unity and its containing environment do not disintegrate: there will be a *structural coupling*."¹

(I argue that their phenomenology applies to genetic modification as well as ontogenic modification. A genetic change -randomly and not causally obtained- is retained simply if it is a benefit to the functioning of the organism -i.e. solely on the basis of *appropriateness*. It, and the summation of such genetic changes, therefore, do not actually imply "congruence", but *some* pertinent, (beneficial or at least non-destructive), correlation between domains. "Structural coupling" and "conservation of autopoiesis" are not determinate. They are not "specified or directed" by the environment either; they are *bounded* by it. Structural coupling is therefore a weaker and more abstract condition than they presume.)²

Between the living being and the environment there is a "necessary structural congruence", [but see my comment above], "(or the unity disappears)." But organisms *must*, (in the innate phenomenology of biology), be considered as *independently reactive to*, rather than determinately, (i.e. informationally), *guided by* their environment. The conclusion is grounded in the structure of science itself:

"In the interactions between the living being and the environment within this structural congruence, the perturbations of the environment do not determine what happens to the living being; *rather, it is the structure of the living being that determines what change occurs in it*. This interaction is not *instructive*",³ (my emphasis), "for it does not determine what its effects are going to be. Therefore, we have used the expression 'to trigger' an effect. In this way we refer to the fact that the changes that result from the environment

¹ *ibid* Pps. 74-75

² Cognition as a coordination of atomic *primitives*, (as argued in chapter 1), makes a great deal of sense in this context. The organization is not itself correlative to externality, but is an operative device working on ultimately indeterminate primitives.

³ i.e. informational

are brought about by the disturbing agent but *determined by the structure of the disturbed system*. The same holds true for the environment: the living being is a source of perturbations and not of instructions."¹

"The key to understanding all this is indeed simple: as scientists, *we can deal only with unities that are structurally determined*. That is, we can deal only with systems in which all their changes are determined by their structure, whatever it may be, and in which those structural changes are a result of their own dynamics or triggered by their interactions."²

Organisms *react!* They react, moreover, in the operational closure of their *current* (physical) *structure*. The latter is determined by their "ontogeny", (i.e. on their summed history of structural change as individuals), which has modified the original phenotypic structure:

"This ongoing structural change occurs in the unity from moment to moment, either as a change triggered by interactions coming from the environment in which it exists or as a result of its internal dynamics. As regards its continuous interactions with the environment, the cell unity classifies them and sees them in accordance with its structure at every instant. That structure, in turn continuously changes because of its internal dynamics. The overall result is that the ontogenic transformation of a unity ceases only with its disintegration."³

Maturana goes on to define "second order" and "third order structural coupling" as the structural coupling of the multicellular organism with its environment, and the coupling of intraspecies' behavioral interaction, (e.g. linguistic behavior), with environment respectively. But these are always dependent upon the necessary conservation of the autopoiesis of the *germ cell*. The scope of the subsequent development, (the operational range), of the *metacellular* organism⁴ is determinate from its unicellular stage, and subject to its phenomenology. "The life of a multicellular individual as a unity goes on through the operation of its components, *but it is not determined by their properties*. Each one of these

¹ ibid Pps. 63-64

² ibid P.96

³ ibid P.74

⁴ i.e. the phenotype

pluricellular individuals...results from the division and segregation of a lineage of cells that originate ... (from) a single cell or zygote. ...It is as simple as this: the logic of the constitution of each metacellular organism demands that it be part of a cycle in which there is a necessary unicellular stage"¹. The conservation of the autopoiesis of that unicellular stage is the necessary boundary condition of the (independent and coincident) function of any organism, unicellular or multicellular.

"Living beings are not unique in their determination nor in their structural coupling. What is proper to them, however, is that structural determination and coupling in them take place within the framework of ongoing conservation of the autopoiesis that defines them, whether of the first or second order, *and that everything in them is subordinate to that conservation*. Thus, even the autopoiesis of the cells that make up a metacellular system is subordinate to its autopoiesis as a second-order autopoietic system. *Therefore, every structural change occurs in a living being necessarily limited by the conservation of its autopoiesis; and those interactions that trigger in it structural changes compatible with that conservation are perturbations, whereas those that do not are destructive interactions*. Ongoing structural change of living beings with conservation of their autopoiesis is occurring at every moment, continuously, in many ways at the same time. It is the throbbing of all life."²

Behavior, from the biochemical behavior of the amoeba to the nervous behavior of man, is simply an aspect of primary structural coupling. It is the correlation of sensory surfaces with motor surfaces: "...the sequence of movements of the amoeba is therefore produced through the maintenance of an *internal correlation* between the degree of change of its membrane and those protoplasmic changes we see as pseudopods. That is, a recurrent or invariable correlation is established between a perturbed or sensory surface of the organism and an area capable of producing movement (motor surface), which maintains unchanged a set of internal relations in the amoeba."³

"This basic architecture of the nervous system is universal and valid not only for the hydra, but also for higher vertebrates, including human beings. ...

¹ ibid Pps. 80-81

² ibid Pps. 95-102, (my emphasis)

³ ibid Pps.147-148

the basic organization of this immensely complicated human nervous system follows essentially the same logic as in the humble hydra ...the nervous tissue understood as a network of neurons has been separated like a compartment inside the animal, with nerves along which pass connections that come and go from the sensory surfaces and motor surfaces. The sole difference lies not in the fundamental organization of the network that generates sensorimotor correlations, but in the form in which this network is embodied through neurons and connections that vary from one animal species to the other. ... But we emphasize: ... this is the key mechanism whereby the nervous system expands the realm of interactions of an organism: *it couples the sensory and motor surfaces through a network of neurons whose pattern can be quite varied*. Once established, however, it permits many different realms of behavior in the phylogeny of metazoa. In fact, the nervous systems of varied species essentially differ only in the specific patterns of their interneuronal networks."¹

Brain cells do not connect only to motor and receptor cells, however, most of them connect to *other brain cells*: "in humans, some 10^{11} (one hundred billion) interneurons interconnect some 10^6 (one million) motoneurons that activate a few thousand muscles, with some 10^7 (ten million) sensory cells² distributed as receptor surfaces throughout the body. Between motor and sensory neurons lies the brain, like a gigantic mass of interneurons that interconnects them (at a ratio 10:100,000:1) in an everchanging dynamic."³

The sensory surface includes, however, not only those cells that we see externally as receptors capable of being perturbed by the environment, "but also those cells capable of being perturbed by the organism itself, including the neuronal network."

"Thus the nervous system participates in the operation of a metacellular as a mechanism that maintains within certain limits the structural changes of the organism. This occurs through multiple circuits of neuronal activity structurally coupled to the medium. In this sense, the nervous system can be characterized as having *operational closure*", (my emphasis). "In other words, the nervous system's organization is a network of active components

¹ ibid Pps.157-159

² cf Appendix A

³ ibid p.159

in which every change of relations of activity leads to further changes of relations of activity. Some of these relationships remain invariant through continuous perturbation both due to the nervous system's own dynamics and due to the interactions of the organism it integrates. In other words, the nervous system functions as a closed network of changes in relations of activity between its components."¹

External perturbations only *modulate* the constant interplay of internal balances of sensorimotor correlations. "It is enough to contemplate this structure of the nervous system... to be convinced that the effect of projecting an image on the retina is not like an incoming telephone line. Rather, it is like a voice (perturbation) added to many voices during a hectic family discussion (relations of activity among all incoming convergent connections) in which the consensus of actions reached will not depend on what any particular member of the family says."²

"a nervous system...as part of an organism, will have to function in it by contributing to its structural determination from moment to moment. This contribution will be due both to its very structure and to the fact that the result of its operation (e.g., language) forms part of the environment which, from instant to instant, will operate as a selector in the structural drift of the organism with conservation of adaptation. Living beings (with or without a nervous system), therefore, function always in their structural present. The past as a reference to interactions gone by and the future as a reference to interactions yet to come are valuable dimensions for us to communicate...however, they do not operate in the structural determinism of the organism at every moment. *With or without a nervous system, all organisms (ourselves included) function as they function and are where they are at each instant, because of their structural coupling.*"³

¹ *ibid* Pps.163,164

² *ibid* Pps. 161-163. Also consider Edelman's comment on this same issue: "... To make matters even more complicated, neurons generally send branches of their axons out in diverging arbors that *overlap* with those of other neurons, and the same is true of processes called dendrites on recipient neurons To put it figuratively, if we 'asked' a neuron which input came from which other neuron contributing to the overlapping set of its dendritic connections, it could not 'know'." Edelman, 1992, p.27

³ *ibid* P.124, my emphasis

Maturana presents a sufficient and scientifically necessary rationale for the whole of "living organisms" -to include their "behavior". It is convincing because of the *purity* and the *correctness* of his phenomenology *as biology*. At each step of evolution, on each fundamental aspect of the functioning of an "organism", on the reconciliation of the metacellular, (in all its functions), with the germ cell, these are the *biologically definitive* categories and principles proper to a "living being". Its "purity" lies in the fact that he never, (and never *has to*), step outside this phenomenology -this context- to complete his thesis. It is necessary and sufficient, - and *legitimate*, (in the legal sense),- to the whole of "living beings". It is, therefore, completely plausible.

Nowhere does his mechanics involve "representation", however! Indeed, "representation" is inconsistent with the mechanics itself. He concludes as a necessary consequence of scientific principle that neither organisms, nor their brains, operate with *representations* of their surroundings. "Representation" is inconsistent with the necessary phenomenology of organisms -and extrinsic, (and inessential), to the "mechanism" of science. The principle of parsimony, (i.e. least cause), dictates his conclusion. *Organisms are structurally closed systems*, only "perturbed" by their environment, *never* "in knowledge" of it.

"The most popular and current view of the nervous system considers it an instrument whereby the organism gets information from the environment which it then uses to build a *representation* of the world that it uses to compute behavior adequate for its survival in the world. This view requires that the environment imprint in the nervous system the characteristics proper to it and that the nervous system use them to generate behavior, much the same as we use a map to plot a route. We know, however, that the nervous system as part of an organism operates with structural determination. Therefore, the structure of the environment cannot specify its changes, but can only trigger them. ...Our first tendency to describe what happens .." (is in) "... some form of the metaphor of 'getting information' from the environment represented 'within'. *Our course of reasoning, however, has made it clear that to use this type of metaphor contradicts everything we know about living beings.*"¹

¹ *ibid* Pps.129-133, my emphasis

His argument is not specifically against models in general, however, but, rather, against *representative* models, and in this I think it is conclusive.¹ It leaves very little room for objection. It is consistent, convincing and in the mainstream of science. It leads, perplexingly, to a disastrous paradox: "We are faced with a formidable snag because it seems that *the only alternative to a view of the nervous system as operating with representations is to deny the surrounding reality*"!

"Indeed, if the nervous system does not operate -and cannot operate -with a representation of the surrounding world, what brings about the extraordinary functional effectiveness of man and animal and their enormous capacity to learn and manipulate the world? If we deny the objectivity of a knowable world, are we not in the chaos of total arbitrariness because everything is possible? This is like walking on the razor's edge. On one side there is a trap: the impossibility of understanding cognitive phenomena if we assume a world of objects that informs us *because there is no mechanism that makes that 'information' possible*", (my emphasis). On the other side, there is another trap: the chaos and arbitrariness of nonobjectivity, where everything seems possible."²

"In fact, on the one hand there is the trap of assuming that the nervous system operates with representations of the world. And it *is* a trap, because it blinds us to the possibility of realizing how the nervous system functions from moment to moment as a definite system with operational closure. ... On the other hand, there is the other trap: denying the surrounding environment on the assumption that the nervous system functions completely in a vacuum, where everything is valid and everything is possible. This is the other extreme: absolute cognitive solitude or solipsism. ... And it is a trap because

¹ I have proposed a very different, and plausible, alternative model in chapter 1. I proposed that organisms *do* use models, but that those models are schematic; their "objects" schematic objects only, aspects of operationally closed process. The "objects" of that model are not "entities" in reality; they are optimizing loci of process itself.

I propose that models do, in fact, exist in the human brain, but they are *schematic* models. Their *virtual* "objects", (in no necessarily simple correlation with externality), are evolutionarily derived *schematic artifacts* of process like the "objects" of the training seminar of chapter 1. They effectively coordinate the sensory and motor faculties of the brain!

² op.cit p.133

it does not allow us to explain how there is a due proportion or commensurability between the operation of the organism and its world."¹

Maturana and Varela have honed their "razor's edge" with the same care and meticulous skill with which, as biologists, they would undoubtedly hone a microtome. I suggest they are proposing that we stand, therefore, not on a razor's edge, but on a *microtome's*! That, as any biologist should surely know, is an invitation to suicide.² They have created a full-blown antinomy. The usual method of dealing with antinomies is to examine the presuppositions.

Wait though, you must surely be thinking! Couldn't we just *deny* "mind" in its ordinary sense, then? Isn't this the simplest solution to the difficulty? Why not just abandon (organic) "cognition" entirely, and "experience" and "externality", (in our normal meanings of them), right along with it- and go back solely to parallel and congruent *behavior* itself -i.e. to parallel *reactivity*, predetermined by evolution? Why not just deal with the reactivity and the (reductionist) process of the brain *as part of the world*,³ accepting the arguments for the inadequacy and the inconsistency of organic cognition as a final reductio ad absurdum of "mental states" and deal only with organisms' (behavioral) function?

Maturana and Varela have, you might correctly continue, specified a phenomenology specific to organisms, but they have specified it *within* the context of an actual physical world. Couldn't we, therefore, just deny the "figment"⁴ of the mind, (the "consciousness", the "awareness" of the brain -or organism), as "folk psychology" and myth?⁵ Couldn't we consider "mind" as just a linguistic and behavioral phenomenon? Sure we could, and it is a necessary consequence of ordinary Naturalism. But then we are right back, (necessarily), in Maturana's⁶ dilemma, but invoked at a deeper level! For how then does even the behavioral, and especially the linguistic⁷ function, (our descriptive language), of (human) organisms, *as behavior*, come to be *specifically*, (i.e. informationally), relevant to the world? Is

¹ ibid Pps. 133-134

² It is likely to result, depending on the angle of fall, in decapitation or, as seems to have happened here, in a severing of the corpus callosum. :-)

³ as most current Naturalists, in fact, actually do

⁴ cf Dennett, 1991

⁵ cf P.S. Churchland, 1986, Dennett, 1991

⁶ and Quine's and Kant's which are themselves the children of an ancient line of legitimate skepticism.

⁷ for behavioral "knowledge"

this not *linguistic idealism*?¹ Maturana's whole argument -and Darwin's as well - is one of simple appropriateness. It is "survival" and "structural coupling", not "information". This Naturalist argument presumes that organisms' reactivity -third order coupling, (language), and behavior- determined from the beginning by evolution *for the phenotype* and operationally closed thereafter, *is categorical*!^{2 3}

This, however, is the *only* plausible course left to ordinary⁴ Naturalism after Maturana, but it is a difficult one. It assumes that *whatever* evolution determines, (whatever "parallelism" or "congruency" or "adaptability" that evolution gets for an organism), is embodied in the genotype and subsequently in the phenotype. From that point on, the argument is necessarily entrapped in the operational closure of the organism. That closed system must determine its reactivity, (its supposed "parallel reactivity"), *forever after* throughout its subsequent ontogenic history.

But if even the weather is not determinate from a fixed set of principles and starting point, then how are we to believe that evolution has embodied the complexity of day to day, week to week, or year to year physical reality in such a fixed beginning? What model does evolution, (as embodied in the genotype), *itself* have that it is trying to parallel? If a butterfly in Australia can cause a hurricane in Florida then how are we to believe that evolution has a model *at all*, much less that it can embody such in closed (behavioral or linguistic) principles and laws of reactivity *for the phenotype*.

¹ As I suggested earlier was also the case with Dennett's thesis

² any two models are isomorphic

³ This is an astounding conclusion and more than the principles, (and Occam's razor), will bear! At best it is *petitio principii*, (assuming what you have to prove), at worst it is magic!

⁴ cf Chapter 4 for my distinction of "ordinary Naturalism" from "relativized Naturalism".

The argument assumes that evolution launched a closed operational system, (the phenotype), out into the world. But evolution could not know what that phenotype must be functional *with* -i.e. evolution has no model *itself!* Evolution cannot predict the world -especially in its human-scale features. It cannot predict the weather, the pattern of rocks, foliage, water and heat -i.e. "*the facts*"- in an ecosystem, and, if not them, then it surely cannot predict the more complex reactivity of the organism's fellow biological creatures -pinching claws, a stalking tiger, or an infection by vibrio comma, (cholera). "Chaos theory", (for instance), argues that while cyclical processes, (e.g. the large-scale motions of the planets and stars), produce regular and predictable results, non-linear processes do not.

But physical process, (the ongoing world), *especially at the human scale*, is dynamic and non-linear. Moreover it is, by and large, *not* cyclical. It is, therefore, not predictable in a determinate model. To assume that such a correspondence to the physical world can be implemented throughout the lifespan of an organism in a fixed and determinate, and specifically *a parallel* operative model, (an informational model), is a difficult premise. (See specifically the arguments of Appendix A or Lakoff's arguments in the Lakoff/Edelman appendix). For the specifically biological world, the biological ecosystem, it is *more* than difficult. More plausible is that evolution works by the creation of dynamic and operative local -and not *informational* -functions, that are intimately and locally connected to changing process.

The creation of a multitude of these atomic functions that track, (i.e. trigger from), incremental change in the physical world is a more plausible evolutionary scenario than the representationist one. But this is exactly my first hypothesis: that evolution created local functions like this at the cellular level. The *organization* of these atomic processes then becomes the real problem for the "evolutionary engineer", and it is this organization which, I propose, was accomplished incrementally by the schematic model. Our (biological) "objects" are organizers, I argue, *organizing loci* of these atomic processes and not informational representations. The schematic object is an organization of atomic processes, which latter track we-know-not-what.

For how could even evolution know what that "what" might be? Evolution produces the operationally closed structural coupling of the phenotype, but that structural coupling must be specifically dynamic rather than informational. What evolution *can* deal with are such processes, not information. It can deal with processes that *work* on the local, tactical level.

The representationalist schema, (of ordinary Naturalism), is not plausible. No, that is not quite true, it is plausible *inside* of our own human cognitive model. It is plausible *because it happens that way!* My argument is that it happens *that way* because it *is* inside of our model!

To quote Dennett, (a surprising passage for me):

"it is not the point of our sensory systems that they should detect 'basic' or 'natural' properties of the environment, but just that they should serve our 'narcissistic' purposes in staying alive; *nature doesn't build epistemic engines.*" Dennett, 1991, P.382, my emphasis.¹

This is an antinomy. No, more accurately, it is a specific and pointed reductio ad absurdum of the (ordinary) Naturalist premise!² What Bertrand Russel says of naive realism applies to ordinary Naturalism, its (natural) child:

"We all start from 'naive realism'. We think that grass is green, that stones are hard, and that snow is cold. But physics assures us that the greenness of grass, the hardness of stones, and the coldness of snow are not the greenness, hardness, and coldness that we know in our own experience, but something very different. The observer, when he seems to himself to be observing a stone, is really, if physics is to be believed, observing the effects of the stone upon himself. Thus science seems to be at war with itself: when it most means to be objective, it finds itself plunged into subjectivity against its will. Naive realism leads to physics, and physics, if true, shows that naive realism is false. Therefore naive realism, if true, is false; therefore it is false." "An Inquiry into Meaning and Truth", Bertrand Russell, Pp. 14-15

To paraphrase Russell, if we *know*, then we *can't* know. Therefore we *do not* know.

Maturana and Varela characterized the dilemma incorrectly, however. They specified a necessary choice between solipsism on the one hand, and representationalism/realism on the other, and this is not the case.

We needn't deny *reality* based on their arguments, just our specific *knowledge* of it! Nor need we deny "mind". It is the acceptance of an "Axiom of Externality", in its *most abstract* form, *taken axiomatically*, that is demanded here,³ and *that* is not denied by their arguments. It is the improper extension of that demand, and its confusion with the particulars of our specifically human organic process, (to include cognition), that generates the difficulty.

¹ I find this a very curious statement –coming from Dennett.

² but not of relativized Naturalism! cf Chapter 4

³ both here and in the foundations of physics

As realists we *must* grant the presumption of "externality" -the simple *posit* of an ontic existence. It is fundamental to sanity and to plausibility. The posit of *our world*, men and baseballs and trees and planets as *necessary ontic entities*, however, is *not*! Even our perceptual world is a part of our closed cognitive process. I have argued, (in chapter 1), that it is an operative, (and dynamic), artifact.

But, you surely object once again, we *cannot* deny the "objects of our experience" and their apparent relationality! I agree, it is these objects which provide the stability of our life experience and ground the very essence of sanity, (my thesis is *not* solipsism). In the next chapter, I will show why we need not.

We all want our naive world to be real: trucks, men, planets and baseballs, and all our normal relations between them -i.e. all the things they do. It is a necessary component of "sanity", and distinguishes it from dreams, fantasies, and, baldly, insanity. If a rock hits me on the head, it *will* hurt!

But, contrarily, our *best science* says that our naive world is *not* real! What is real for science are atoms, forces, photons, quarks,... all embedded in some mathematically esoteric spatial context. For it, myself and the man in front of me are, in fact, biological pluralities, or, deeper still, atomic amalgams... down to the deepest levels of physical conception. Naturalism, (the scientifically extended¹ form of our naive conception and the verity Maturana is loathe to lose), allows this heresy only because it says that our natural world is hierarchically,² (and isomorphically), *embedded* in that primitive existence which science posits, and that those hierarchical entities, (our normal "objects"), act *as units*. It maintains that this reduction is specifically a *hierarchical*³ one which maintains

¹ to *whatever* level of sophistication!

² See Afterword: Lakoff and Edelman for a detailed discussion of hierarchy

³ The reduction of scientific theories, (and theoretic reduction in general), is subject to a fundamental logical limitation under the classical, (pre-Cassirerian), concept. In the last chapter, (chapter 2), I exhibited Cassirer's arguments that the whole root of the classical formal concept is set-theoretical. Concepts, or concepts of "things", (to include, for instance, our ordinary objects), were reducible only in a set-theoretic sense, i.e. by abstraction, (intersection), of common properties. They are, therefore, subject to Russell's "theory of types". At the bottom level, and there *must* be a bottom level according to the theory of types, there are atomic primitives. Each of the levels above that must be hierarchically oriented, each containing the one above it, (i.e. the "things" of the next higher level are abstractions - intersections- of the ones below). This theory of types was the logically necessary result of the antinomies discovered in the roots of set theory. The most famous is, of course, Russell's paradox.

Cassirer's fundamental advance on the classical formal concept, "the mathematical concept of function" however, provides an escape. There is no "Cassirer's paradox" in the universal formation of concepts. There is no "concept of all concepts", because concepts are now constituted as an assemblage of (consistent) generative rules, not as a (set-theoretic)

all the spatial and material relationships down through each and all of the depths of scale -*hence their reality!* Modern science has not confirmed, but rather has seriously questioned, that assertion. What are we to embed them *in*? At the bottom level of physics, "matter", "space", even "existence", in the sense in which naive realism uses them, are anomalous terms. Even "cardinality" *as such* -the "how many of it"- is dubious!¹

Even *ordinary* Naturalism² does not, therefore, maintain the integrity of our naive objects! But is its insistence on the maintenance of the *hierarchical* integrity of those objects a necessary, or even a plausible presupposition at this juncture in our intellectual history?

My hypothesis of the schematic object, contrarily, says that our naive world -to include its relationality, (its laws and happenings),-is more probably *unhierarchically*, (but rather transformationally), correspondent with absolute externality, *whatever* and *however* the latter may be. Ultimately it says that our naive world is in correspondence to "points" of *atomic biological process*,³ and not to "points" of ontology. It is a *metaphor of response*. It says that the further correspondence between those atomic processes themselves and ontology is *completely indeterminate* to us as biological and cognitive entities!

abstraction (intersection) of properties -which currently stands for the process of scientific reduction. There is clearly no "rule of all rules" as some rules obviously contravene others. At the level of my "concept of implicit definition", concepts are assemblages of "axioms", (i.e. fundamental and consistent generative rules), and the same situation obtains. But, just as is the well demonstrated case for mathematical axiom systems, it is possible to exchange an appropriate subset of theorems for the pre-existing axioms, (while still absolutely preserving the integrity -the interior relationality- of the mathematical subject), so is it possible to "cross-reduce" theories. We do not have one single preferred perspective.

This is the relativism of Cassirer's "symbolic forms". What remains is the "web" of relationality, the "invariants" of experience that must be preserved under *all* comprehensive perspectives. But that web, those invariants must be viewed, in Van Fraassen's term, in a "coordinate-free" sense, i.e. they must be viewed in their abstract relationality, not from any *particular* orientation. cf. Chapter 4 and Afterword: Lakoff / Edelman.

¹ Cf Penrose on the twin-slit experiment, for instance

² i.e. scientific naturalism = "scientific realism"

³ It is an optimizing organization of primitive, organic *process* -i.e. of primitive *operational* process.

The Axiom of Externality

The acceptance of the raw *existence*¹ of such a correlation, however, constitutes a necessary requirement for any sane or plausible argument -to include my own.² This is the assertion, the "Axiom of Externality" in its most abstract form, and constitutes the first of the two necessary, (apodictic), premises for realist reason.³ (The other is the "Axiom of Experience" which I will treat in the following chapter.)

The "realism" Maturana impeaches is, in fact, (ordinary) "Naturalism". Nor has he really made a case that solipsism is the only other alternative.⁴ While his case against representationalism *does* destroy the claims of ordinary Naturalism,⁵ a *realistic* case is still possible -but it must be a theoretically mature one. Einstein's realism⁶ is more plausible. That brand of realism involves simply that "theory be organized around a [some] conceptual model of an observer-independent realm".⁷ My thesis takes this "some" in its most abstract form, as the (pure) limit of reason. *This* "realism" is certainly more credible in light of today's physics. Realism is more robust than Maturana assumes, and is capable of greater sophistication than a mere linear extension of the naive world-view. In Fine's words, it is an "attitude". In disagreement with Fine however, I believe it is a *robust* attitude.

Maturana came very close to the answer I propose. His "object" of cognition⁸ is an object of *process*: "cognition does not concern" [external] "objects, for cognition is effective action." He relapses, however, into the "objects" of the Naturalistic context in which he framed the problem:

¹ which assumes, therefore, both the axiom of existence and the reality of experience

² See Appendix B

³ Is the "axiom of externality" the same as the "realistic imperative" of Hume? Is it an *emotional* imperative? It *orients* world-views.

⁴ There is a *structured* isolation. It does not support the implication that "everything is valid and everything is possible"!

⁵ Since it assumes the premise of naturalism and ends in a contradiction, it is, in fact, a *reductio ad absurdum*.

⁶ "It is existence and reality that one wishes to comprehend. ... When we strip the (this) statement of its mystical elements we mean that we are seeking for the simplest possible system of thought which will bind together the observed facts." (Einstein 1934, Pps. 112-113)

⁷ cf Fine, 1986. p.97

⁸ In fact, they do not actually allow an "object" of cognition, as the following citation shows. I am referring here to that aspect of brain process -the effective action- which corresponds to their object of linguistic coupling -which latter is the only "object" they will explicitly allow.

"Thus, *human cognition as effective action* pertains to the biological domain, but it is always lived in a cultural tradition. The explanation of cognitive phenomena that we have presented in this book is based on the tradition of science and is valid insofar as it satisfies scientific criteria. It is singular within that tradition, however, in that it brings forth a basic conceptual change: *cognition does not concern objects, for cognition is effective action...*"

"At the same time, as a phenomenon of languaging in the network of social and linguistic coupling, *the mind is not something that is within my brain. Consciousness and mind belong to the realm of social coupling.* That is the locus of their dynamics....Language was never invented by anyone only to take in an outside world. *Therefore, it cannot be used as a tool to reveal that world.* Rather, it is by languaging that the act of knowing, in the behavioral coordination which is *language, brings forth a world.* ...We find ourselves in this co-ontogenic coupling, not as a preexisting reference nor in reference to an origin, but as an ongoing transformation in the becoming of the linguistic world that we build with other human beings", (metacellular organisms).¹

But "*language ... cannot be used as a tool to reveal [the] world.*" Hence, (accepting his own conclusion), *all* his primitives at the final telling are "entities" *solely* of linguistic (and ontogenic) coupling, and, *as such*, have no absolute referent! He maintains that we are *wrong* in characterizing the actual world "in reference to an origin". Yet he does exactly that himself. He frames his primitives: structural coupling, metacellular coupling, intraspecies' coupling, ("third order coupling"), and linguistic coupling as interactions of "autopoietic [biological] unities"!

What "autopoietic unities"? And where? Where do these linguistic domains exist -and between what and whom? Where does *his book* exist? *Does* it, and, if so, how is it relevant to anything at all? *What "history of evolution"?* These linguistic terms supposedly do not "reveal the world"!

He *is*, in fact, committed to a Naturalist ground, and it contains real organisms, i.e. "objects". His "object" is ambiguous however. On the one hand it is solely a product of linguistic coupling, (the object of language), but, on the other hand, (in his presupposition of objects/biological unities which are coupled), it is also the basis of his ontology. This is an explicit and fatal self-

¹ op.cit Pps.234-244, my emphasis

contradiction. Either the object, i.e. the organism, *exists* -providing the *ground* of this linguistic coupling, -or does not -in which case "linguistic coupling" is vacuous!

Does *my* thesis make our objects *not real*, then?¹ Does it mean that there is no connection between them and the "externality" we must assume? The answer is an emphatic "No!" The connection is in *the interface itself*, ("structural coupling") and "experience". But the latter must be understood in terms of the former. We are not justified in assigning a *particular* ontic interpretation to "experience".²

In my next chapter I will "slice" this problem from another side, (citing Quine and Cassirer), and argue that "experience", as an ontic posit -and a cognitive primitive -while absolutely justified as such, can be legitimately described only as that which *remains invariant* under all possible (viable) interpretations, (and I will argue there is always more than one interpretation). But "invariants" are in themselves a very concrete form: they stand, for instance, as the foundation of the Theory of Relativity. Our human cognitive world, and specifically our perceptual world: people and baseballs and the things they do, *are real*, but they are real in the most general interpretation of their relationality, (them and the things they do). This is not so strange a conception -it is implicit in the reductions of science already. But the latter's requirements of hierarchy and isomorphism are *not* inherent; they constitute the *crux* of the problem. It is those requirements which lead to the disastrous end of Maturana's noble and profound enterprise. Beneficial connection, *pertinent* connection between domains, (i.e. "structural coupling"), does *not* require "parallelism", it does not imply "congruence", it does not require "hierarchy".³ Virtual embodiment demonstrates another, non-hierarchical yet exhaustive possibility of compatibility, and it is this that I have argued in my first thesis.

Maturana's thesis of "structural coupling" is of profound importance. It is an epistemological principle of the highest significance.⁴ It is a necessary

¹ I will make this case in greater detail in the next chapter.

² Naturalism's mistake is in trying to assign an ontic reference to our *whole* cognitive domain. As I have argued, we are justified in making only two primitive ontic, (metaphysical), assertions: "externality" and "experience". These are the minimal and the maximal legitimate ontic posits. See Chapter 4.

³ *Could* there be a congruent correspondence, (though admittedly not apodictic), however? Sure, but would be "magic" of a high order- "and then a miracle occurs"! Dennett, 1991

⁴ It is, in fact, a biological and epistemological principle of relativity. This does not imply that it is a *frivolous* relativity, (i.e. solipsism), however, no more than did Einstein's Relativity imply a lawlessness in physics!

consequence of his Naturalist beginnings -and impeaches them! It precedes and supercedes even its biological origin in its relation to the fundamental problem of knowledge. Biology, therefore, must integrate into a new and *larger* frame, a new orientation of the whole context of our world and our reality. But the Copernican center of that frame must be structural coupling *itself*. It is "structural coupling" which must ground biology; not biology which must ground "structural coupling"!¹

I propose to accept *absolutely* the consequences of "structural coupling": that the "object" of biological cognition is a function of brain process itself, and not an embodiment of its environment.² But this must *necessarily* translate into a Copernican revolution in our very *world-view*: if *we* are biological organisms, then the objects of *our* human world-view are objects of process, of response as well. They are "objects" of "effective action"!

Maturana and Varela's profound heuristic principle reduces their premise to absurdity -i.e. the metaphysical certitude of the ordinary Naturalist world-view from which they started. The naive-realistic world, (the represented "naturalist" world), can have no internal relevance to the organism, *as* organism. But this does *not* impeach the science, (evolution and biology), which is their ground -no more than did Einstein's Relativity impeach the physics which was *his* ground! The *viable relationality*, (the viable system of predictivity), of biology and evolution, (and of science generally), can be, (*must be!*), preserved, (as was the observed relationality of Ptolemean astronomy -times and angles and relative positions- in the Copernican system which replaced it), but it must be "*reduced*"!³

Are we to throw away the whole of our human enterprise then -to include its science? Of course not -that would be preposterous! But the most profound and most radical advances in human thought, its "Copernican revolutions" and "SUPERB⁴ theories", have always, (by necessity), subsumed the viable parts of pre-existing knowledge. In the present case, the subsumption of the *preponderance* of naive realism and the *preponderance* of naturalist science stand as necessities. They *work*, after all, with a power and effectiveness which

¹ It is not an unusual, (nor inconsistent), practice in mathematics to begin by constructing a new mathematical discipline from one set of premises, and then to start all over with what were originally derivative consequences as the new, (and more appropriate), primitives.

² Though this might still seem self-contradictory, please bear with me for a few more paragraphs. I will explain myself fully in the next chapter.

³ Though my reasons for using this word are obvious, it is clearly inappropriate to my conception. "Property-preserving or distributive re-interpretation with conservation of relationality" would be more appropriate.

⁴ cf Penrose

is awesome. My proposal does not suggest or imply that they be considered any less important. It subsumes the whole of those vistas, but it subsumes them in their viable *relationality*,¹ and not in their specific ontic (*metaphysical*) reference! Their connection to externality is operational, and not referential. In their whole, they constitute a profoundly effective and complex *algorithm* of unparalleled significance whose link to externality is "structural coupling". The latter, however, is *referentially* indeterminate, (i.e. metaphysically so).

Science turns recursively back on itself in biology and finds that there is a limitation to knowledge itself. Structural coupling is the antinomy which forces the absolute relativization of all knowing -to include "biology" and "evolution" - and even "perception" - themselves. These are "creatures" of *human* knowledge, of cognition. They are *organizers*, not primitives.² Our true primitive is "*experience*", (under the necessary premise of "externality"), not any particular interpretation -or organization- of it. My hypothesis implies, then, a relativization of epistemology precisely equivalent to Einstein's relativization of physics. This is what Cassirer concluded as well.³

An Answer to the New Dilemma:

At last I can give a preliminary answer, (which I will complete in the next chapter), to the disturbing question raised at the beginning of the chapter. How can I presume the naturalistic world -with its "evolution"- to prove a hypothesis which severely questions them?⁴ How can I use a (Darwinian) biological argument, (which *presumes* a simple correspondence between our cognitions and the real physical world), *against* that very simplicity -and embodiment- itself? If my thesis is true, then our ultimate external reality, (ontology), is *not* necessarily, (nor even probably), like the reality of our cognitive model!

The answer is that "evolution" is as much an organizing principle as is "causation". It, (and the objects it treats), is part of the (closed) model itself. It is not a necessary, (or proper!), *metaphysical* presumption, but is, in Kant's words, a "synthetic a priori" proposition. It is not a necessary part of reality; it is a necessary (plausible), part of our *cognition* of reality. As such, I can use it with perfect legitimacy within that closed domain. But I use it, (modifying but keeping

¹ i.e. their *predictivity*! I will clarify this point in my next chapter.

² It is explicit in Maturana's argument, (as we have seen), that "structural coupling" and "the conservation of autopoiesis", (and "congruence" itself), are specifically part of the closed, human (biological) cognitive process.

³ cf chapter 4

⁴ This is also, obviously, a reiteration of Maturana's "razor's edge".

the sense of Dennett's word), "*heterophenomenologically*", i.e. with a neutral ontic reference!

My epistemological and metaphysical position, therefore, corresponds very much to Kant's, and ultimately, to Cassirer's. It is neither idealism nor solipsism, but a genuine, (*and realistic*), ontic indeterminism.¹ The term "indeterminism" refers to the impossibility of knowing the nature of that ontic reality *independent of our cognition*. It does not, however, assert a doubt as to, but rather affirms, its *existence*.

"Matter is *substantia phaenomenon*. Whatever is intrinsic to it I seek in all parts of the space that it occupies and in all effects that it exerts, which, after all, can never be anything but phenomena of the outer sense. Thus I have nothing absolute but merely something comparatively internal which, in its turn consists only of external relationships. But what appears to the mere understanding as the absolute essence of matter is again simply a fancy, for matter is never an object of pure understanding; but the transcendental object that may be the ground of this appearance called

¹ "Idealism consists in the assertion that there are none but thinking beings, all other things which we think are perceived in intuition, being nothing but representations in the thinking beings, to which no object external to them in fact corresponds. I, on the contrary, say that things as objects of our senses existing outside us *are*", (my emphasis), "given, but we know nothing of what they may be in themselves, knowing only their appearances, that is, the representations which they cause in us by affecting our senses. Consequently I grant by all means that there are bodies without us, that is, things which, though quite unknown to us as to what they are in themselves, we yet know by the representations which their influence on our sensibility procures us. These representations we call 'bodies', a term signifying merely the appearance of the thing which is unknown to us, but not therefore less actual. Can this be termed idealism?"

Long before Locke's time, but assuredly since him, it has generally assumed and granted without detriment to the actual existence of external things that many of their predicates may be said to belong, not to the things in themselves, but to their appearances, and to have no proper existence outside of our representation. Heat, color and taste, for instance, are of this kind. *Now, if I go farther and, for weighty reasons, rank as mere appearances the remaining qualities of bodies also, which are called primary -such as extension, place, and, in general, space... with all that which belongs to it (impenetrability or materiality, shape, etc.)*", (my emphasis), "-no one in the least can adduce the reason of its being inadmissible. As little as the man who admits colors not to be properties of the object in itself, but only as modifications of the sense of sight, should on that account be called an idealist, so little can my thesis be named idealistic merely because I find that more, nay, *all the properties which constitute the intuition of a body belong merely to its appearance* [his emphasis]."

The existence of the thing that appears is thereby not destroyed as in genuine idealism, but it is only shown that we cannot possibly know it by the senses as it is in itself." Kant, "Prolegomena" pps. 36-37

matter is a bare Something, whose nature we should never be able to understand even though someone could tell us about it. ... The observation and analysis of phenomena press toward a knowledge of the secrets of nature and there is no knowing how far they may penetrate in time. But for all that we shall never succeed in answering those transcendental questions that reach out beyond nature, though all nature were to be revealed to our gaze."¹

I will, (in chapter 5), however, make the limiting step that Kant did not. I will posit our cognitive interface, (whatever that may ontically be!), as *itself* a metaphysical entity. It is a part of the minimal (realistic) ontic posit. It is the synthesis of "externality" and "experience".²

Knowledge is cognitively closed. It is an organizational system that *works*. It is Quine's "body of statements and beliefs", (see Chapter 4), constrained only by its "boundary conditions", ("experience"). But it exists always within the human (biological) cognitive frame. It can never achieve a "God's eye view"!

"It is by languaging that the act of knowing, in the behavioral coordination which is language, brings forth a world. ...We find ourselves in this co-ontogenic coupling, not as a preexisting reference nor in reference to an origin, but as an ongoing transformation in the becoming of the linguistic world that we build with other human beings."³

In the next chapter I will explore the other axiom of reason, the Axiom of Experience, and conclude my answer to the epistemological problem I have raised. Quine and Cassirer show the way. This will then allow a brief and succinct statement of my third and final thesis in Chapter 5.

¹ Kant, "Critique of Pure Reason", 2nd edition, 333, translated by Woglom and Hendel, and cited in Cassirer: "The Problem of Knowledge", 1950, Pps. 101-102 I prefer this to Smith's rendering.

² cf Chapter 5

³ op*.cit Pps.234-244, my emphasis