Chapter 1. Why? The Biological Problem: Part One

(Representative Models and the Mind)

> "The plastic splendor of the nervous system does not lie in its production of 'engrams' or representation of things in the world; rather, it lies in its continuous transformation in line with transformations of the environment as a result of how each interaction affects it. From the observer's standpoint this is seen as proportionate learning. What is occurring, however, is that the neurons, the organism they integrate, and the environment in which they interact operate reciprocally as selectors of their corresponding structural changes and are coupled with each other structurally: the functioning organism, including its nervous system, selects the structural changes that permit it to continue operating, or it disintegrates." [1] [2]
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> "… the nervous system ...is not solipsistic, because as part of [its] organism, it participates in the interactions [with] its environment. ... Nor is it representational ... [it] does not 'pick up information' from the environment, as we often hear... *The popular metaphor of calling the brain an 'information-processing device' is not only ambiguous but patently wrong.*" (Maturana and Varela, 1987, pp.170-171, my emphasis)

Humberto Maturana and Francisco Varela's "The Tree of Knowledge"[3] is a detailed and compelling argument, based in the very structure of physical explanations, against even the *possibility* of a biological organism's possession of a representative model of its environment. They and other eminent modern biologists, (Walter Freeman and Gerald Edelman for instance), argue even against "information" itself moreover! They maintain that information *never passes* between the environment and organisms; there is only the "triggering" of

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[1] Consider also Edelman: "…recognition is not an instructive process. No direct information transfer occurs… Instead, recognition is selective." (Edelman, 1992, p.81)

[2] See also Edelman, 1992, pps. 190-191, for a conception comparable to Maturana's "structural coupling"

[3] Maturana and Varela, 1987.

structurally determinate organic forms.[1] I believe that theirs is the inescapable conclusion of current science and I will argue that case as the subject of Chapter 3.

It is not my intention to present that argument in *this* chapter however. Here, instead, I will present an explicit and constructive *counterproposal* for the existence of a different *kind* of model in the brain, "the schematic operative model". This model, I believe, (and contrary to the case of the representative model), *does* remain viable within the critical context of modern science. I believe that we, as human organisms, do in fact embody a model. I believe it is the stuff of mind! Let me now present an inductive argument –and a concrete counterproposal- that the brain embodies a scientifically viable, (and biologically efficacious), *model of internal process* rather than a representational model of its surroundings. Representative models are *not* the only possible kinds of models. Nor is representation a model's only conceivable or best use.

The First Hypothesis: A Non-Representational Model in the Brain

A. *The Schematic Model: a New Paradigm for Models*[2]

A.1. *The Simplest and Most General Case of the New Paradigm*:

Our most *simplistic* models, the models of even our mundane training seminars for instance, suggest the possibility of a usage very different than as representative schemas. They demonstrate the possibility of a wholly different paradigm whose primary function is *organization* instead.

Consider: " 'Motivation' plus 'technique' yields 'sales'.", we might hear at a sales meeting. Or, " 'Self-awareness of the masses' informed by 'Marxist-dialectic' produces 'revolution'! ", we might hear from our local revolutionary.[3] Visual aids, (models), are ubiquitous. The lecturer stands at his chalkboard and asks us to accept drawings of a sundry set of shapes: triangles,

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[1] Edelman makes an argument to the same conclusion based in embryology and the actual size of the human genome for his theory of "Neural Darwinism" . He concludes that the brain is an "ex post facto" *adaptive* rather than an "informational" system. Freeman argues similarly "that perception does not consist of information reception, processing, storage, and recall.." -that the brain is not representational.

[2] A series of examples and the question: What *is* "an object"? I mean to question our most fundamental conception of “object” itself.

[3] The single quotes are meant to parse the "objects" as will become clear shortly.

squares, … even cookies, horseshoes[1]... *as objects* -with a "calculus"[2] of relations between them. These shapes are stand-ins for concepts or processes like "motivation", "the nuclear threat", "sexuality", "productivity", "evolution", ... in the diagrams on his board. In these presentations, the "objects" often do *not* stand in place of *entities* in objective reality, however. What *is* "a productivity" or "a sexuality", after all? What *entities* are these?

Another lecturer might invoke *different* symbols however, and a *different* "calculus" to explicate the *same* topic. In analyzing the French Revolution in a history classroom, let us say, (a classroom is a *kind* of training seminar after all!), a fascist, a royalist, a democrat might alternatively invoke "the Nietzschean superman", "the divine right of kings", "freedom", ... *as "objects*" on his board, (with appropriate symbols), *redistributing* certain of the explanatory aspects, (and properties), of the Marxist's entities, (figures) -or rejecting them as entities altogether.[3] That which is unmistakably explanatory, ("wealth", let us say), in the Marxist's entities, (and so which must be accounted for by *all* of them), might be embodied, instead, solely within the fascist's "calculus" or in an interaction *between* his "objects" and his "calculus". Thus and conversely the Marxist would, (and does), reinterpret the royalist's "God"-figure, (and his –the Marxist's- admitted function of that "God" in social interaction), as "an invention of the ruling class" -i.e. as an expression solely of his "calculus" and not as a distinct symbol, (i.e. object). Their objects -as objects- *need not be compatible*.[4] Usually they *are not*! What is important is that a viable "calculus"-plus-"objects", (a given model), *explain or predict "history"*[5] -i.e. that it be *compatible with the phenomena*, (in this particular example the historical phenomena). In Chapter 4, I will argue, (with Hertz and Cassirer), that the same accounting may be given of competing scientific theories, philosophies, and, indeed, of *any* mutually viable explanations.[6]

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[1] Mathematicians love to be cute like this!

[2] Webster's defines "calculus", (math): "a method of calculation, any process of reasoning by use of symbols". I am using it here in contradistinction to "*the* calculus", i.e. differential and integral calculus.

[3] Is this not the *usual* case between conflicting theories and perspectives?

[4] Consider Edelman: "...*certain symbols do not match categories in the world*. ... Individuals understand events and categories in more than one way and sometimes the ways are inconsistent." Edelman, 1992, pps. 236-237, his emphasis.

[5] more generally: the phenomena

[6] Hertz, for instance, argues that science makes symbols whose one essential quality lies in the generation of a parallelism with experiential consequence but that "*we do not know and have no means of finding out whether our ideas of things accord with them in any other*

The very *multiplicity* of alternately viable calculuses, (sic), and the *allowable incommensurability* of the "objects"[1] of their models, however, suggests an interpretation of those "objects" contrary to representation or denotation. It suggests the converse possibility that the function and the motivation of those objects, *specifically as entities/objects* in what I will call these "schematic models", is instead to illustrate, to enable, *-to crystallize and simplify the very calculus of relation proposed between them*![2]

I propose that their boundaries -the demarcations and definitions of these "objects", (their "contiguity" if you will)- are formed to meet the needs of the operations, -to serve structure- not the converse.[3] I suggest that the objects of these "schematic models" –specifically *as objects*- serve *to organize process*, (i.e. analysis or response). They are *not* representations of actual objects or actual entities *in reality*.[4] This, I propose, *is why they are "things"*! *These* objects functionally bridge reality in a way that physical objects do not. I propose that they are, in fact, metaphors of analysis or response. The rationale for using them, (as any good "seminarian" would tell you), is clarity, organization and efficiency.

(But how is this even conceivable?[5] How are "objects" even *possible* independent of some ultimate "reference"? I will argue shortly that a "calculus"-plus-"objects"[6] can be *freely formed*, (ad hoc rather than contingently, referentially formed), as an interface –a "front end"- to efficiently organize[7] a domain of correlation, (experience for instance, or a mathematical domain).[8] This conclusion will impose consequential and severe constraints on the *nature* of the

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respect than in this one fundamental relation." (my emphasis) cf Chapter 4: Hertz, Cassirer, Quine

[1] together: the possible conceptual contexts

[2] cf the arguments of Chapters Two and Four for a detailed rationale

[3] cf Afterword: Lakoff/Edelman for a discussion of mathematical "ideals" which bears on this discussion.

[4] this directly relates to the issues of "hierarchy" which I will discuss shortly, and at greater length later

[5] This is specifically a *logical* question –i.e. it is a question of logical possibility, and my detailed answer is the subject of Chapter 2.

[6] a model

[7] i.e. predict, analyze or control

[8] rather than being constrained by the contiguous, (object-contained), properties of real, (or possible), metaphysical objects

correspondence however. I will propose that it is redressed in the constitution, (correspondence), of the "objects" themselves![1])

Though framed in plebian terms, the "training seminar", (taken in its most abstract sense), defines the most general and abstract case of schematic non-representative models in that it presumes, (as presented), no *particular* agenda. It might as well be a classroom in nuclear physics or mathematics, the boardroom of a multinational corporation, -or a student organizing his leisure time on a scratchpad.

A.2. *A Deeper Example: Instrumentation,* (A Schematic Usage More Closely Related to the Problem of the Brain)

Instrumentation and control systems provide another, somewhat more respectable example of the possibilities of schematic, non-representational models and "entities". Consider the *most general* case of instrumentation for instance. Here "objects" need not mirror objective reality either. A gauge, a readout display, a control device, (*the "objects*" of such systems), need not mimic a single parameter -or an actual physical entity. Indeed, in the monitoring of an *especially complex or critical* process, it *should not*! Rather, "an object", (a readout device for instance), should represent an efficacious synthesis of *just those aspects* of the process which are relevant to response, and be crystallized *around* those relevant responses![2] A warning light or a status indicator, for instance, need not refer to just one parameter. It may refer to the composite of electrical overload and/or excessive pressure and/or... Or it may refer to an optimal relationship, (perhaps a *complexly functional* relationship!), between *many* parameters! It may refer to a relationship between temperature, volume, mass, etc. in a chemical process, for instance.

The exactly parallel case holds for its *control devices*. A single control "object" may orchestrate a multiplicity of (possibly disjoint) objective responses.

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[1] That the combined model *must* so correlate, (to have any value), is, of course, a given. But must it correlate in its parts? Must the "objects" of the model correlate *as objects* to *objective* objects? Must the *operations* of the model, ("the calculus"), correlate to *objective* relations between them? Can we not conceive of a more abstract situation, suggested by higher mathematics, wherein the whole of the model correlates to its domain in a distributed sense? Transformations, after all, are not defined on the domain of "spaces", but of *abstract sets* -i.e. without an *a priori* presumption of order.

[2] Precisely *because* it is complex and critical, (or dangerous) –e.g. it may explode with very little warning!

The accelerator pedal in a modern automobile, as a simplistic example, may integrate fuel injection volumes, spark timing, transmission gearing...

"The calculus" of this joint system of readout and control is the relationship between the objects of the readout and the necessary actions upon the objects of control. It is the calculus of response and, for especially complex and critical, (or dangerous), processes, *coherence* and *simplicity* of that calculus is absolutely crucial.

Ideally -for maximal simplicity and speed- instrumentation and control might unify in the *same* "objects" in a *single* contextual frame. We would then manipulate "the objects" of the display, which would *themselves* be the control devices as well. (We might, in a simplest example for instance, grasp an errant pointer on a gauge –on a speedometer, let us say- and force it back into the "safe" range to effect a necessary correction. The pointer would be both the speedometer *and* the accelerator/brake in one.) Think about this possibility as applied to our ordinary "objects of perception" -in relation to the sensory-motor coordination of the brain and the problem of naive realism! Consider the fecund and profoundly simplifying possibility[1] that our "naive objects", (our sensory objects), could be the *unified* "objects", (for readout-*plus*-response), of "the calculus" of biological instrumentation. The brain *is* a control system, after all. It is an *organ* of control! The process it controls is both *profoundly* complex and *dangerously* urgent, the extreme and biologically appropriate criteria specified above.

A.3. *The Richest Example: The "GUI"*

.....(the most sophisticated example of a schematic model and the most pe

Consider finally the graphic user interface, (the "GUI"), of a computer. The use of "objects", (icons), in GUI's is perhaps the best example of a "schematic" usage presently available, and suggests its deepest potential. It is also the most pertinent to the problem of cognition.

In my simplistic manipulation of the virtual objects of my computer's GUI, I am, in fact, effecting and coordinating quite diverse and eclectic -and unbelievably complex- operations at the physical level of the computer, operations impossible, (in a practical sense), to accomplish directly. What those virtual objects represent and what my virtual and naive manipulation of them actually does, (at the physical level of the computer), need not even be known to

[1] which I will argue in Chapter 2

me. The disparate voltages and physical locations, (or operations!),[1] represented by a single "object", (icon), and the (possibly different) ones effected by manipulating it, correlate to "an object" only in this "schematic" sense. *Its efficacy lies in the simplicity of the "calculus" it enables*!

The pragmatic criterion for a GUI is that *the rules* be simple or intuitive,[2] consistent with proper function. Its value, (its goodness as an interface), is measured by the *simplicity* of the calculus it embodies.

Current usage is primitive, admittedly. Contemporary software designers have a limiting preconception of the "entities" to be manipulated and of the operations to be accomplished in the physical computer by their icons and interface. But GUI's and their "objects", (icons), have a *deeper* potentiality of "free formation" -they have the potential to link to *any* selection across a substrate, i.e. *they could "cross party lines*". They can cross categories of "things in the world", ("objectivist categories" in Lakoff's term[3]), as I will argue shortly.[4]

How does one *make* a "GUI", after all? One constructs a system of objects, (icons), plus rules in such a way that the application of those rules on the objects will allow the accomplishment of some desired goal. It allows the operation of my computer, for instance, or the control of a machine, or the control of a process.

Ultimately, of course, the combination of "objects" and "calculus" *must* accomplish the purpose desired. Since it is the *primary* intent of a GUI that the "calculus" be simple however, then the "objects" must then be defined *dependently* in terms of it. It is the distribution of function in the objects, I argue, which allows the simplicity of the calculus.

B. *Schematism: The Formal and Abstract Problem and The Argument*:

B.1. *The Problem*: Consider, finally, the formal and abstract problem. Consider the problem of designing instrumentation for the efficient

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[1] In my computer, I have icons for "things", (text files or databases, for instance), processes, (print the screen or run a program), script files, (which may execute *any combination* of things I choose: e.g.: wait 30 secs; run wordprocessor; calculate spreadsheet; search a database for someone who owes me money, search my wordprocessor documents for a misspelling of the word "thought", wait till 6:00 am; get email, turn on the coffee pot, ...), etc.

[2] The name of the user interface on my old Amiga is actually called "intuition".

[3] Cf Lakoff, 1987. Also see my "Afterword: Lakoff, Edelman…"

[4] See Appendix J for an elaboration.

control of *both* especially complex *and* especially dangerous processes. In the general case, what kind of information would you want to pass along and how would you best represent it? How would you control it? How would you design your *display and control* system?[1]

B.2. *The Argument for Schematism*:

It would be impossible, obviously, to represent *all* information about the objective physical reality of a, (any), process or its physical components, (objects). Where would you stop? Is the color of the building in which it is housed, the specific materials of which it is fabricated, that it is effected with gears rather than levers, -or its location in the galaxy- necessarily relevant information? (Contrarily, even its designer's middle name might be relevant if it involved a computer program and you were considering the possibility of a hacker's "back door"!)[2] It would be counterproductive *even if you could* as relevant data would be obscured and the consequent "calculus", (*having to deliberate all that intricacy*!), would become too complex and inefficient thereby for rapid and effective response.[3] Even the use of realistic *abstractions* could produce enormous difficulties in that you might be interested in many differing, (and, typically, conflicting), significant abstractions and/or their interrelations.[4] This would produce severe difficulties in generating an intuitive and efficient "calculus" geared towards maximal response.

For such a complex and dangerous process, the "entities", (instrumentation), you create must, (1) necessarily, of course, be viable in relation to both data and control -i.e. they must be comprehensive in their necessary function. But they would also, (2) need to be constructed with a primary intent towards *efficiency of response*, -towards a simplistic "calculus", (rather than

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[1] Alternatively, how would you *organize* control?

[2] cf Dennett on the "frame problem"

[3] This is precisely Dreyfus' "large database" problem: “a problem on which no significant progress has been made”. Dreyfus 1992 Also see footnote to Appendix A.

[4] This is *typically* the case! A working project manager, for instance, must deal with all, (and often conflicting), aspects of his task -from actual operation to materials acquisition, to personell problems to assuring that there are meals and functional bathrooms! Any one of these factors, (or some combination of them), -even the most trivial- could cause failure of his project. A more poignant example might involve a U.N. military commander in Bosnia. He would necessarily need to correlate many conflicting imperatives -from the geopolitical to the humanitarian to the military to the purely mundane! See also Lakoff on conflicting frames, (ICM’s).

realism), as well -the process *is*, by stipulation, dangerous! They would need to be fashioned *to optimize the "calculus"*, (pattern of required response), while *still fulfilling* their (perhaps consequently distributed!) operative role.

Your "entities", (instrumentation), would need to be primarily fabricated in such a way as to intrinsically define a *simple* operative calculus of relationality between them -analogous to the situation in our training seminar or a computer's GUI. Maximal efficiency, (and safety), I argue therefore, would demand crystallization into schematic *virtual* "entities" -a "GUI"[1]- which would resolve both demands at a single stroke. Your "objects" could then distribute function so as to concentrate and simplify control, (operation)! These virtual entities would be in no necessarily simple (or hierarchical -i.e. via abstraction) correlation with the objects of physical reality.[2] But they *would* allow rapid and effective control of a process which, considered objectively, might not be simple at all. It is clearly the optimization of the process of response that is crucial here, not literal representation. We do not *care* that the operator knows what function(s) he is actually fulfilling, *only that he does it (them) well*!

B.3. *An Immediate Corollary: The Specific Case of Biology*

Biological survival is exactly such a problem -it is both (a) especially complex, (indeed biology is the *paradigm case* of complexity), *and* (b) especially dangerous. For the metacellular colossus, life is a *moment by moment* confrontation with disaster! The problem for the "evolutionary engineer" therefore was *exactly that* detailed in the formal and abstract problem of B.1! It is a schematic model in just the sense of B.2 that I conclude evolution constructed

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[1] the objects of which must be logically, but not necessarily visually resolved

[2] But *how* does the schematic model present a better solution to the problem of conflicting abstractions? The answer is that it does not improve the conflicts *per se*, but it does better deal with the *practical* problem as it does not lose "data", (i.e. *detail*), as does a model built on abstraction. Think about an example based on a military chain of command. A general makes decisions based on many levels of abstraction presented progressively from sergeants, to lieutenants, captains, majors, colonels, etc. At each level detail is lost in abstractions, (in a hierarchical model). But those details, (or a combination of them), -or conflicting abstractions- may decide the course of a battle. This is *typically* the complaint of lower-level managers, (from sergeants to shop foremen) -that upper management does not live in the "real world".

The schematic model is theoretically capable of preserving all this complexity so that a best *overall* solution, (towards some goal), based on the *actual* situation may be reached on the highest level. Cassirer's functional concept shows that we need not lose detail in abstraction, (for synthesis), but may preserve it in a functional synthesis.

therefore,[1] and I propose that it is the basis for both the "percept" and the "mind". I conclude that our "natural world", our naive world, is a "GUI" evolutionarily constituted for maximal operational efficiency.

But it is just the *converse* of the argument made above that I assert for evolution. It is not the *distribution* of function, but rather the *centralization* of disparate atomic biological function into efficacious schematic -and virtual- objects that I urge that evolution effected while compositing the complex metacellular organism.[2]

But let's talk about the "atomic" in the "atomic biological function" of the last paragraph. There is another step in the argument to be taken at the level of biology. The "engineering" argument, as made above, deals specifically with the schematic manipulation of "data". At the level of primitive evolution, however, it is *modular (reactive) process* that is significant to an organism, not data functions.[3] A given genetic accident corresponds to the addition or modification of a given (behavioral/reactive) process which, for a primitive organism, is clearly and simply merely beneficial or not. But that process is itself informationally indeterminate to the organism -i.e. it is a modular whole.[4]

No one can presume that a particular, genetically determined response is informationally, (rather than reactively), significant to a Paramecium or an Escherichia coli, for example, (though *we* may consider it so). It is significant, rather, solely as a *modular unit* which either increases survivability or not. Let me therefore extend the prior argument to deal with the schematic organization of atomic, (modular), *process*, rather than of primitive, (i.e. absolute), data.[5] It is my

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[1] To prove a corollary, it is necessary only to demonstrate that the conditions of the theorem- in this case profound complexity and profound risk- are met which I have.

[2] See third following footnote re: complementary perspectives

[3] cf Maturana or Edelman, for instance

[4] Compare this argument with Edelman's on immunology or his own theory of TNGS.

[5] These are clearly just the complementary perspectives on the same issue. My thesis is one of *organization* after all and the argument above was made on those specific grounds. The identical argument can be made step by step for an organization of primitive process as was made for an organization of data, based alike in efficacy. The conditions are the same: (1) profound complexity and (2) extreme and immediate risk. In the earlier case, we sought to consolidate enormous and conflicting data to maximize response. In this case, we seek to integrate multitudinous and conflicting "atomic processes" to the same end. The arguments and the conclusion are the same: a non-topological schematism. It is an issue of perspective and these are complementary perspectives on the same issue of organizational efficiency. In the context of the a priori human (organism's) cognitive perspective, for instance), it can be considered as distribution of topobiological "objects". From a more abstract, less preconceived perspective, however -from the mathematical standpoint of multivariate statistical analysis, for instance, (cf Lara, 1994), it can be considered centralization. Crudely put, it depends on which

contention that the cognitive model, and cognition itself, is solely constituted as an organization of that atomic modular process, designed for computational and operational efficiency. The atomic processes themselves remain, *and will forever remain*, informationally indeterminate to the organism.

The purpose of the model was *computational* efficiency! The calculational simplicity[1] potentiated by a *schematic* and virtual object for dealing with a multifarious environment constitutes a clear and powerful evolutionary rationale. Such a model, (the "objects" and their "calculus"), allows rapid and efficient response to what *cannot* be assumed, a priori, to be a simplistic environment. From the viewpoint of the sixty trillion or so individual cells that constitute the human cooperative enterprise, *that* assumption, (environmental simplicity), is implausible in the extreme!

But theirs, (i.e. *that* perspective), is the most natural perspective from which to consider the problem. For five-sixths of evolutionary history, (three billion years), it was the one-celled organism which ruled alone. As Stephen Gould puts it, metacellular organisms represent only occasional and unstable spikes from the stable "left wall", (the unicellulars), of evolutionary history.

> "Progress does not rule, (and is not even a primary thrust of) the evolutionary process. For reasons of chemistry and physics, life arises next to the 'left wall' of its simplest conceivable and preservable complexity. This style of life (bacterial) has remained most common and most successful. A few creatures occasionally move to the right... "

> "Therefore, to understand the events and generalities of life's pathway, we must go beyond principles of evolutionary theory to a paleontological examination of the contingent pattern of life's history on our planet. ...Such a view of life's history is highly contrary both to conventional deterministic models of Western science and to the deepest social traditions and psychological hopes of Western culture for a history culminating in humans as life's highest expression and intended planetary steward."(Gould, 1994)

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end of the "telescope" you are looking through. From the perspective of "the operator", (function), the system is distributive, whereas from the standpoint of "the engineer", (design), it is concentrative.

[1] alternatively, the operational organization

B.4. *An Immediate Retrodictive Confirmation*:

Do you not find it strange that the fundamental laws of the sciences, (or of logic), are *so few*? Or that our (purportedly) accidentally and evolutionarily acquired logic works *so well* to manipulate the objects of our environment? From the standpoint of contemporary science, this is a subject of wonder -or at least it *should* be. (c.f. contra: Minsky, 1985) It is, in fact, *a miracle*![1] From the standpoint of the "schematic model", however, it is a trivial, (obvious), and necessary consequence. *It is precisely the purpose of the model itself!* This is a *radical* teleological simplification![2]

C. *Conclusion*, (section):

Evolution, in constructing a profoundly complex metacellular organism such as ours, was confronted with the problem of coordinating the physical structure of its thousands of billions of individual cells. It also faced the problem of coordinating the response of this differentiated colossus, this "Aunt Hillary", (Hofstadter's "sentient" ant colony.[3]) It had to coordinate their functional interaction with their environment, raising an organizational problem of profound proportions.

Evolution was *forced* to deal with exactly the problem outlined above. The brain, moreover, is universally accepted as an evolutionary organ of response. I argue that a schematic entity, (and its corresponding schematic model), is by far the most credible here -to efficiently orchestrate the coordination of the ten million sensory neurons with the one million motor neurons,[4] and with the profound milieu beneath. A realistic, (i.e. representational / informational), "entity" would demand a concomitant "calculus" *itself necessarily embodying*[5] the very complexity of the objective reality in which the organism exists, and this,

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[1] The "anthropic principle", sometimes cited, is clearly self-serving and tautological: "if it were not so, it would not be so"! My thesis supplies a specific counterproposal.

[2] Just one of many effected by my thesis.

[3] cf Hofstadter, 1979

[4] Maturana and Varela, 1987

[5] which again raises Dreyfus' "large database problem" -i.e. how could [a brain/computer] deal with huge amounts of information in a reasonable amount of time? ..."a problem on which no significant progress has been made" (paraphrase, Dreyfus, 1992)

I argue, is overwhelmingly implausible.[1] [See Appendix A: An elaboration of the argument]

Aside: The "schematic brain" is a "big hunk", admittedly! And there are still larger hunks of the puzzle not yet in place. Specifically there are the considerations of "cognitive closure", (Maturana), "logical closure", (Quine), and "scientific epistemological relativism", (Cassirer), that must be addressed to validate plausibility. I do not ask that you accept the truth nor even the plausibility of this admittedly radical first hypothesis at this juncture therefore. That must await the presentation of the rest of the argument in Chapters 2 through 5. What I do ask, however, is that you be willing to acknowledge its biological and evolutionary and operative strengths and be open to at least seriously consider it in the context of the larger problem of consciousness.)

Evolution faced an engineering problem of profound proportions, and I propose it solved it exceedingly well. I propose that it was evolution's progressive *coordination* of the reactive neural ensembles of primitive organisms that created the "objects" of those organisms. But I further propose something far stronger. I propose it created those objects -even the "perceptual objects" of those organisms- specifically as *coordinative* nexuses[2] of disparate and distributed atomic response *rather than* as explicit referents to environment![3] I propose that those objects are *internally* and *organizationally* significant, not referentially so. They are virtual and schematic only. Representation is the "*parallel postulate*" of evolution!

I conclude therefore, as an evolutionary consequence, that even the *human brain's* "objects"[4]—*our* objects, i.e. the objects of knowledge and perception- are specifically virtual and coordinative as well. I conclude that they are evolutionary optimizations -and artifacts- for the coordination of internal process. We, after all, are biological organisms too. I propose that even the human brain's objects, then, are schematic. I propose that even *our* ordinary objects of perception are schematic artifacts of process. They are in *no simple correlation* with objective reality![5]

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[1] cf Appendix A. Appendix A was originally incorporated here, but I removed it to an appendix as I felt it interrupted the flow of the argument. Edelman argues to the same end, (as Appendix A), that the human genome is insufficient by many orders of magnitude to the purposes of "information".

[2] i.e. intersections and coordinators

[3] I will distinguish this more clearly from Maturana and Varela's thesis in Chapter 3.

[4] See Chapter 4 to resolve the seeming obvious self-contradiction

[5] I will postpone raising the obvious objections that occur here, (i.e. non-referentiality and a seeming self-contradiction), until I have developed the context to do so. A Copernican

This conclusion, though startling, (and at first even bizarre), drastically simplifies the profound logical problem of the "percept"[1] however. Its origin[2] and function is no longer enigmatic and epistemologically self-serving. It becomes instead a clear and foreseeable consequence of ordinary, (rather than extraordinary), evolutionary process. It is the simple, cumulative, and linear result of incremental organizing and optimizing refinements to structure. (In the next chapter I will demonstrate how it radically simplifies the logical paradoxes of sentiency as well.)

I have argued that[3] it is not important that the "operator"[4] of such a (complicated) process knows *what* it is, (specifically), that he is doing, (only that he does it well). It *is* important that he does it diligently, however. It is important that he be *locked* into the loop of his virtual reality -that he "pay attention". This introduces the necessity of an inbuilt realistic imperative -i.e. a mechanical guarantee of his dedication.[5] The universal and dogmatic belief in the (simple) reality of our natural world is thus itself a consequence of my thesis -and the greatest obstacle to its acceptance.

This (first) thesis supplies an immediate and naturalistic biological rationale for "mind". "Mind",[6] (the "objects" and their computational relationality), becomes a natural and, for the first time, (in contrast with the Naturalists' story), a *necessary* rather than an incidental[7] consequence of evolution. It is the consummation of evolution's incremental extension and organizational optimization of primitive (reactive) neural arrays.[8] Given my thesis however, its

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revolution in our very conception of "knowledge" is necessitated by this hypothesis, (as developed in my third hypothesis). It will turn out, however, to have very *positive* implications for science. Please bear with me for a little. This is a very large and complex thesis.

[1] (and of “presentation”)

[2] This is a point in standard theories where, using Dennett's phrase, "then a miracle occurs". For P.S. Churchland, it is “the good trick”.

[3] from the designer's standpoint

[4] I will exorcise this "homunculus" shortly by virtue of my second thesis.

[5] Hume postulated such an imperative long ago, (cf P.S. Churchland, 1988, p.247). But this "realistic imperative" will be seen, (by virtue of my second thesis), to be an *inherent* of operative function rather than being imposed *upon* it.

[6] I am keeping the connection between "mind" and "brain" quite loose at this point. I feel it is admissible at this early stage of an attempt at explicating precisely this distinction. I will specify my definitions at the end of Chapter 2, and in Chapters 3, 4 and 5.

[7] i.e. Naturalists say that an organism, at some stage, began not only to *react to* its environment, but to *embody* that environment in parallel! Cf P.S. Churchland, for example.

[8] The "How?" of this is supplied in the second thesis, and the "Where?" and "What?" of it is supplied in the third.

"objects" now clearly function as *metaphors of process*, and not as informational units of environment. The "large database" and the related problems of "information"[1] encountered in the field of artificial intelligence, for instance, are thus not problems for the human brain at this level -save internal to the metaphor itself.[2] This thesis greatly simplifies other crucial aspects of the mind-body problem as well,[3] and, contrary to all current paradigms, suggests the beginnings of, (i.e. a legitimate context for), a definite "Galilean mechanics" appropriate to neuroscience.[4] The "objects" of our perceptual world are no longer metaphysical "givens", but, rather, are operationally continuous with, and open to explicit and precise resolution in terms of the overall (operative) brain function of which they form a part.[5] I propose, then, brain as an operational continuum! In the next chapter, we will find a close parallel -and a synergism- with the continuum which we will discover in mind and logic.

Contra:

Conversely however, this (first) hypothesis significantly complicates our conceptions of objective reality! It violates, (or rather, stretches), almost every paradigm in our current intellectual universe as well.[6] But why, given the level of "strangeness" in modern science, would we expect that our *most fundamental* problem of "measurement", i.e. that of human cognition itself, would fall to a simple "naturalistic", (and naive realistic), approach in the first place? Why would we expect that its solution would have only *minor* repercussions? My answer admittedly leaves us in a dilemma however, because the "events", the relationality of experience embodied in the Naturalistic picture -and its rendering of empirical science- are the very subject of our discussion - *or any other discussion!* It raises, as well, the question of the consistency of my own arguments. I have based them in Darwinian evolution and *that* presumes the

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[1] (and reference) cf chapters 3, 4 & 5

[2] cf Appendix B

[3] It is a key element in the resolution of the problems of the "Cartesian theater", (see Chapter 2), and has profound implications for the fundamental epistemological problem as well, (Chapters 3,4 and 5).

[4] And for the foundations of the first scientific psychiatry!

[5] My "object" might be likened to the second, purely internal and procedural component of Hofstadter's "symbol" but discounting or at least drastically subordinating his primary, representative component. Hofstadter appreciates that his "symbol" has a large, purely internal and operational function besides its representational role.(Hofstadter 1979, P.570) I will address the issues of "representation" and "isomorphism" presently.

[6] I will develop these aspects in Chapters 3, 4 and 5

legitimacy of our naive view. My third thesis will address this problem directly, building on arguments of Kant, Cassirer, Maturana,[1] and Quine to justify my usage and suggest a convincing and plausible conclusion consistent with the perspective of modern science.

Briefly, the solution I will propose, (in my third thesis), is that, though we must preserve the invariant relationality, (the predictivity), of empirical science and of common experience, we needn't preserve their primitives, their "objects", nor even their hierarchical organization[2] as ontic referents.[3] I will suggest a very different correspondence between mind and "externality" than isomorphism, (and reference). I will propose that our human world is a blind working algorithm, implicit in the optimizing organization of process. Mathematics, biology, and epistemology suggest alternatives more plausible than simple parallelism.

The very complications of this (first) thesis, however, are commensurate with, they are of the same order and the same type as, the complications already necessitated by the conceptual dilemmas of modern physics, (and are subject to the same resolving strategies as well).[4] They force us to look at the ground and even the very meaning of "a theory of reality", (as do their counterparts in physical science). They force us to a revised view of science itself. Science and theories of reality generally, are, ultimately I will propose, *operative* rather than descriptive, (i.e. referential), enterprises. This is hardly a new suggestion, but was the conclusion of many of the pioneers of modern physics. In the context of the "schematic object", however, it takes on a new clarity and force. Science, (with its "objects"), becomes an immediate corollary of my theorem for our

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[1] and of Edelman

[2] Returning to the "Macintosh" analogy I used earlier, because "the letter is in the trashcan" does *not* imply that that aspect of computer process which *is* "the letter" is physically or logically inside that aspect of computer process which is the "trashcan". It does not imply that they are *hierarchically organized*.

[3] Just as a good Copernican was obliged to accept the data of the Ptolemean astronomer before him, (the angles and times recording the motion of Venus, for instance), so are we required to accept the relationality of experience -the data of naive cognition, i.e. apples, tigers and railroad trains and all the things they do. But we are *not* required , (no more than he), to accept the ontology in which it was understood! I propose, then, a *real* "heterophenomenology", (cf Dennett, 1991), i.e. a neutral ontic commitment!

[4] I am most definitely *not* arguing a QM, (quantum mechanics), solution to the mind-body problem. Rather, I will argue that our *perceptual* world stands in the same relation to reality as does modern physics, (including QM). *Both*, I argue, are algorithms! The latter is an intellectual algorithm, the former an organic one. Both algorithms coordinate response. But the dynamic algorithm embodied in naive realism, (which is the computational calculus), -and perception, (the objects) - is the one that evolution supplied us with. (I will resolve the obvious difficulty in my third thesis.)

perceptual world. It is just our ultimate, (and, ultimately, schematic), scheme for coordinating reactive process. It is *our species'* ultimate strategy, and ultimate metaphor, of biological response.

Naive-realism, (and Naturalism as well -at *whatever* level of sophistication), as a world-view, demands our belief because it makes our existence simple and our "objects" real -really![1] My hypothesis is disturbing, however, because it makes them *unreal* -really! I propose that our ordinary objects of perception are convincing, and the relations we find between them simple, *precisely because* the brain's calculus has been evolutionarily optimized[2] for them![3] They are the utilitarian artifacts effective in our prior evolutionary history.[4] But now this is changing. They no longer adequately serve their prior role. The calculus they optimized can no longer utilize them as proper "objects" in the larger experience -the experimental and theoretical context of current science, nor in the technology it enables. Ordinary objects will not serve quantum physics, (or the transistor television it generated), -nor do they allow the solution of the mind-body problem!

I wish to propose the schematic model, rather than the representative model, as a serious alternative for our perceptual world. Would evolution "equip its creatures" with a representational model of reality? Could it?[5] I think the case for a schematic model is the stronger one. Primitive neural systems are, in point of fact, operational and reactive rather than representative. The incremental refinement of an operational, (schematic), model is, then, linearly consistent with the principles of evolution. It is a simple consequence of evolutionary process, a progressive organization and optimization of reactive response. The origin of a representative, (Naturalistic), model, however, involves significant logical discontinuities. No one credits representative models to evolutionary primitives. Who will posit such a model to the nervous system of a hydra or a planarian worm, for instance? Representationalism must maintain, therefore, that at some discrete point in evolutionary history an organism's internal process somehow came to parallel its environment[6] rather than simply reacting to it -which is quite a different case. This is a very *large* assumption, -a *very good* "trick"- lacking any

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[1] cf Fine 1986

[2] This is not the self-contradiction it might seem. I accept the relationality, (i.e. the predictivity), of evolution, but not necessarily its ontic primitives. I will develop this theme in Chapters 3 and 4.

[3] Cf. Lakoff on Rosch's "basic level categories".

[4] Compare Lakoff's discussion of "prototypes".

[5] see the argument of Appendix A

[6] this is P.S. Churchland's "good trick"!

incremental or physical rationale other than "it must have" or "it would be beneficial if it had". But is this not simply petitio principii, (assuming what you have to prove)? *How*?

The case for the reactive role of brain throughout evolution is overwhelming, but nowhere is there any case at all for a representative role.[1] Indeed, there is not even a viable conception of such a role -it is the essence of the mind-body problem itself.[2]

My first hypothesis seems to fit very well with what we know so far. Do we perceive mathematical magnitudes, (wavelengths), of light waves or "colors"? Do we perceive molecular density or "hardness"? Do we perceive mean molecular energy or "heat"? We *are* dealing with a model. I propose that it is even more of a model than we suspect -to include *our "objects*" as well! My conception is a direct and linear extension of the historical progression of science away from naive realism. Our sensations are no longer "knocking at the surface of our brain", but, rather, affect it at the *system level* to yield schematic artifacts - the "objects of perception". The "perceptual object", I argue, is a schematic artifact of process!

[1] other than the one which assumes its own conclusion. If our perceptual world were, in fact, representative of reality, then the representation of the brain would, therefore, be efficacious! The argument confuses consistency with necessity.

[2] See Chapter 2, "The Logical Problem".