

The Applied Metaphysic of the Somatic Code

I. Introduction and Overview

The topic of this monograph is in one respect as audacious as it is far-reaching for theoretical neuroscience. It is nothing less than this: the real *Existenz* of, objectively valid ground in Nature for, and applied metaphysic of the somatic code (historically called the neural code). The existence of a somatic code was hypothesized by von Neumann almost sixty years ago. This paper establishes that the somatic code exists in Nature and provides the *Realerklärung* (real explanation) of its *Existenz*. When one considers that the Nature of the somatic code has been sought by theoretical neuroscience almost since the day this field of research was established, "audacious" is not too strong a word to apply to the claim I am making here.

A few words of explanation are in order as to why the Object of the theory presented here is called the *somatic* code rather than the neural code. When von Neumann presented his ideas in 1956 that later came to be collected under the umbrella label of the neural code, the field of theoretical neuroscience (also called computation neuroscience) was in its infancy. The inspiration for these ideas appears to have come, on the one hand, from the publication of the McCulloch-Pitts model of the neuron [McCulloch and Pitts (1943)] and, on the other hand, from von Neumann's own ground-breaking work in automaton theory and the digital computer. It was not without reason that in the 1950s and on into the 1960s electronic computers were popularly called "electronic brains." This phrase is rare today, and is recognized now for the mere romantic poetry that it is, but the idea was taken quite seriously by scientists in von Neumann's day. Von Neumann spoke of the ideas of "the language" and "the message system" that "the central nervous system is using" [Neumann (1956), pp. 80-82], and there is little reason to think he was being either romantic or metaphorical when he spoke of the "code" and "language" of the brain.

At that time there were two major presuppositions in vogue in what later would come to be named neuroscience. One of these still dominates mainstream thinking. The other has begun to be opposed by some changes in attitudes since the 1990s. The first presupposition is that the central nervous system (CNS; the brain and spinal cord with exclusion of the peripheral nervous system) is the cause of the phenomenon of mind, and the second is that only neurons need to be considered for the study of the "message system" and "language" subsumed under the idea of a neural code. The first presupposition is flawed on three accounts. First, it ignores any possibility that the endocrine system might have a non-negligible role in the phenomenon of mind. Second, exclusion of the peripheral nervous system is a mere offspring of pseudo-metaphysical prejudice. Third, the presupposition is nothing but a dogmatic institutionalization of an old thesis, originating from the philosophies of Descartes and Plato, that anything in the body that is not part of the anatomy and physiology of the brain is just a "machine" having no connection with the phenomenon of mind. This metaphysical prejudice has come under pressure today through recognition that, as neurologist A.R. Damasio put it,

The idea that it is the entire organism rather than the body alone or the brain alone that interacts with the environment is often discounted, if it is even considered. Yet when we see, or hear, or touch or taste or smell, body proper *and* brain participate in the interaction with the environment. . . The idea that mind derives from the entire organism as an ensemble may sound counterintuitive at first. Of late, the concept of mind has moved from the ethereal nowhere place it occupied in the seventeenth century to its current residence in or around the brain – a bit of a demotion, but still a dignified station. To suggest that the mind itself depends on brain-body interactions, in terms of evolutionary biology, ontogeny (individual development), and current operation may seem too much. But stay with me. What I am suggesting is that the mind arises from activity in neural circuits, to be sure, but many of those circuits were shaped in evolution by functional requisites of the organism,

and that a normal mind will happen only if those circuits contain basic representations of the organism, and if they continue monitoring the states of the organism in action. [Damasio (1994), pp. 224-226]

Damasio's observation is wholly correct except for one thing. The idea that "mind arises from body" is also a metaphysical presupposition – one that is based on an ontology-centered metaphysic that itself lacks objective validity. In this paper, as in all my others, the metaphysical foundation for theory is the epistemology-centered metaphysics of the Critical philosophy. Damasio is correct to erase body-proper/brain as a *real* division and to treat it as a merely logical division. Critical metaphysics goes one more step by erasing the mind-brain division as a real division and regards it as the merely logical (mathematical) division that it is. The metaphysics of this is covered in great detail in Wells (2006) and in textbook form in Wells (2009). The phenomenon of mind and the phenomenon of body (the whole body, including the CNS) are two sides of *one and the same organic whole*, namely the Organized (human) Being. This recognition is the starting point for the nascent science of mental physics¹. Mental physics is the scientific foundation of this paper. Maintenance of the ontology-centered prejudice that the mind-brain division is a real division (with the subsequent inference that mind must be regarded as a mere epiphenomenon of body actions) is a kind of metaphorical "photographic negative" of Berkeley's error (in which "body" is the "epiphenomenon" and "mind" the "real entity") [Berkeley (1710)]. If a present-day neuroscientist experiences a feeling of discomfort at the idea that the materialist attempt to get away from Descartes' error has produced a mutated form of "Berkeley-ism" in science, all I can say is that this recognition is long overdue.

Reformulating the topic under the idea of a somatic code (rather than merely a neural code) is the first step in overcoming the fundamental objections just cited. Because the mind-body division is a merely logical division, it is an ontological fiat to declare at the start that brain (much less the CNS or even the nervous system as a whole) is the topical object of our inquiries. Rather, as I contend here, we begin by understanding the real explanation of what the idea of a somatic code means, and only after that do we make our first moves towards identifying what part of the body (if it should be less than the body as a whole) is the proper physical object of the science.

The Organized Being (OB) model treats our object-of-inquiry (the entire human being) by means of a mathematical division into four parts (figure 1). *Nous* is the epistemological Object under which all ideas of mental phenomena are gathered. *Soma* is the epistemological Object under which all ideas of the physical Nature of being a human being are gathered. The Critical epistemology of organized being then requires a third division, *psyche*, for which the functional role is enforcement of thorough-going mind-body reciprocity [Wells (2009), chapter 1]. *Nous* and *psyche* constitute what Kant called the *homo noumenon* aspect of being a human being. *Soma* constitutes what he called the *homo phaenomenon* aspect of being a human being. The OB is regarded as an object among other objects in Nature, and all in Nature that is not-the-OB is called its environment. Of the four divisions depicted in figure 1, only the environment-*soma* division can be regarded with objective validity as a division having ontological significance, i.e., as a real division. The other divisions have epistemological but not ontological significance and are, for that reason, called logical divisions.

The physical special sciences of biology, biophysics and biochemistry are properly concerned with phenomena of *soma* and with the environment-*soma* boundary. The special science called neuroscience, on the other hand, takes for the idea of its topic the objects of the OB proper, namely those of *nous*, *soma* and *psyche*. Nobel laureate Eric Kandel wrote,

¹ The *science* I call mental physics is not to be confused or associated with the *cult* of New Age hogwash headquartered in California that calls itself by this same name. Mental physics has nothing whatsoever to do with the mystic creeds of that organization, nor they with it.

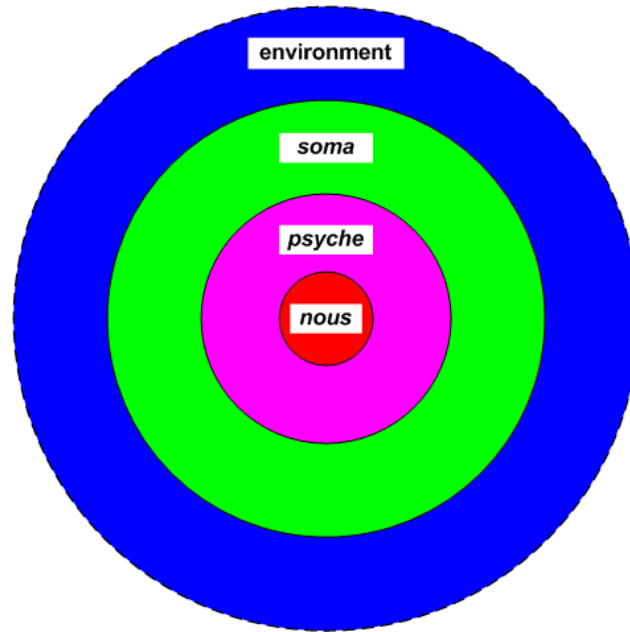


Figure 1: Illustration of the mathematical divisions of the Organized Being model. Of these divisions, only the division between *soma* and environment is an objectively valid real division. The others are merely logical divisions with no ontological significance whatsoever.

The last frontier of the biological sciences – their ultimate challenge – is to understand the biological basis of consciousness and the mental processes by which we perceive, act, learn, and remember. . . . The next and even more challenging step in this unifying process within biology . . . will be the unification of the study of behavior – the science of mind – and neural science, the science of brain. . . . The task of neural science is to explain behavior in terms of the activities of the brain. [Kandel (2000)]

Neural science, rather than *neuroscience*, is an appropriate name for the special science Kandel describes here. This paper takes a broader view of the topic of neuroscience, admitting that this broader view does render the "neuro" in neuroscience a bit inappropriate. In particular, it is concerned with the unification of the physical aspects of *soma* that stand in reciprocity with the mental aspects of *nous* through *psyche*. This break with the current view of neuroscience, made necessary by Critical epistemology, is radical in the context that it calls for a fundamentally revolutionary change in how we think about and approach the topic. But although the change is radical, the break with past paradigms is not a complete severing, and it is to acknowledge the remaining continuity that I keep to the traditional term "neuroscience" and only slightly alter the name of the somatic object from "brain" to brain-*object*. After all, if past and present neural science did not regard brain as the fundamental corporeal associate of mind, it would long ago have re-christened its physical object by some different name.

That brings us to the topic of this paper. Why is the idea of the somatic code our jumping off point? The reason is simpler than it might first appear. The special science ("new" neuroscience) contains under its general topic what Kandel called "the biological basis . . . of mental processes." But to associate some part of *soma* with phenomena of *mind*, there must be a real connection that serves to ground the association being sought. We have on the one side of the issue the physical appearances studied in biology, and on the other side the human experiences we call "mental" experiences. One succinct way to state the issue is to say that we seek the bridge between material objects of biology and mental objects of mind-phenomena, and the point of contact is nothing else than the *meaning* of interrelationship between biological objects and mental objects.

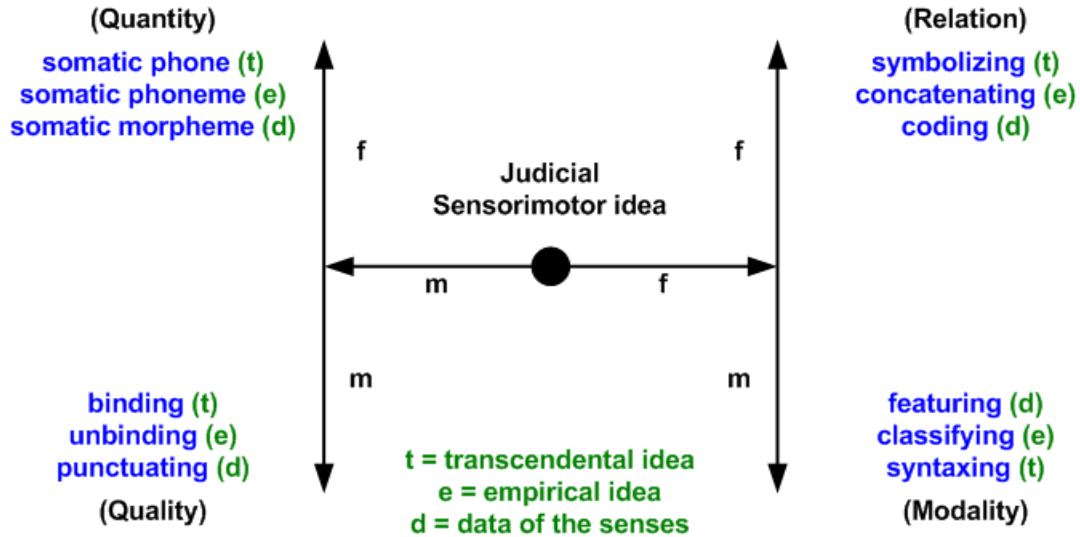


Figure 2: The 2LAR structure of the judicial sensorimotor idea.

But by introducing the *contextual* idea of "meanings" we do nothing less than to introduce a generalized theory of *real semantics*. The import of this introduction is discussed in a previous paper in this series [Wells (2011d)], and the reader should regard that paper as propaedeutic for the discussions that follow in this paper. What is meant by "real semantics" is explained in this paper.

To anchor any special science properly, an applied metaphysic is necessary [Wells (2011c)]. It also requires that this applied metaphysic be *Critical*, which is to say that its deduction conform to the general Critical doctrine of method in metaphysics [Wells (2011a)]. Before we can begin to properly understand the real somatic object of neuroscience, we must understand the linkage between it and the noetic objects of mind-phenomena. This linkage is effected in the logical division of *psyche* in the OB model. Because our focus is upon somatic objects, however, this also means that the logical boundary that must be bridged by the applied metaphysic is the *soma-psyche* boundary. The name given here to this applied metaphysic is *the judicial sensorimotor idea* (J-SMI). It is the counterpart from the judicial Standpoint of Critical metaphysics to the applied metaphysic hereafter called the *theoretical sensorimotor idea* (T-SMI). The T-SMI was first introduced under the name *the sensorimotor idea* in Wells (2006) and was further discussed in Wells (2009) and, more recently, in Wells (2011c). In this monograph, some rudimentary understanding of mental physics and its constructs must be required of the reader because if this is not assumed this monograph would be required to be a very thick book. Every applied metaphysic has a mathematical representation of its structure. For the J-SMI this structure is the 2LAR structure² illustrated by figure 2. The structure has four headings (Quantity, Quality, Relation, and Modality), and under each of these are listed three functional *momenta* (synthesizing functions). A Critical *function* is defined as *the unity of the act of ordering different representations under a common representation*. The *momenta* of figure 2 constitute the *Realerklärung* of the somatic code.

The plan of this paper is as follows. I summarize the *momenta* of the somatic code now. In the next section I explain the methodology, formalism and general structure of the J-SMI. The section

² This paper necessarily employs many specific technical terms of mental physics. The reader is advised to consult the glossary of technical terms provided in Wells (2009) for their explanations. 2LAR is one such term. The acronym stands for second-level analytical representation.

after that introduces the specifying ideas that are required for the deduction of a Critical applied metaphysic. There follows sections covering the deductions of the *momenta* in each of the four heads shown in figure 2. These deductions will be made concise. Additional remarks and commentary pertinent to the deductive reasoning and its implications are postponed to the section following the deduction sections. The monograph concludes by identifying the next paper in this series, which continues with the development of the theory begun here.

II. Method, Formalism, and Structure of the J-SMI

A. Method. The need for and method of deriving an applied metaphysic was discussed in Wells (2011c). In that paper, Palmquist's 12CR method (figure 3) was introduced and its use in the T-SMI derivation was detailed. The methodology used in deducing the J-SMI here is the same and is based on following the 12CR method. The subject-matter of the J-SMI (① in figure 3) is the same as that of the T-SMI, namely the logical division of *psyche*, except that for the J-SMI the focus is on the *psyche-soma* boundary rather than the *psyche-nous* boundary of figure 2. *Soma* is an object of sensuous experience. Therefore, under Kant's Critical system, all our knowledge of *soma* is knowledge of its appearances. *Understanding* natural order in appearances is a product of reflective judgment in *nous*. This means that the Critical acroam governing understanding of sensuous objects is the principle of formal expedience of Nature: *All acts of reflective judgment legislate for formal unity in Nature according to the expedience of representations for the categorical imperative of pure practical Reason* [Wells (2006), Wells (2009)]. This means that the grounding capacity for understanding *soma* falls under the *judicial* Standpoint of Critical metaphysics. The T-SMI, by contrast, is deduced under the theoretical Standpoint. This change in Standpoint is the reason why the *momenta* of the J-SMI differ from those of the T-SMI.

The J-SMI and the T-SMI structures obviously must combine because they both are applied metaphysics of the same object (*psyche*). When the J-SMI and the T-SMI 2LAR structures are combined, the result is a 3LAR structure that constitutes the general structure of the metaphysic of *psyche*. The J-SMI pertains to the psychic matter of composition while the T-SMI pertains to the psychic form of *nexus*. This means the J-SMI synthesis is a synthesis of *homogeneous* objects

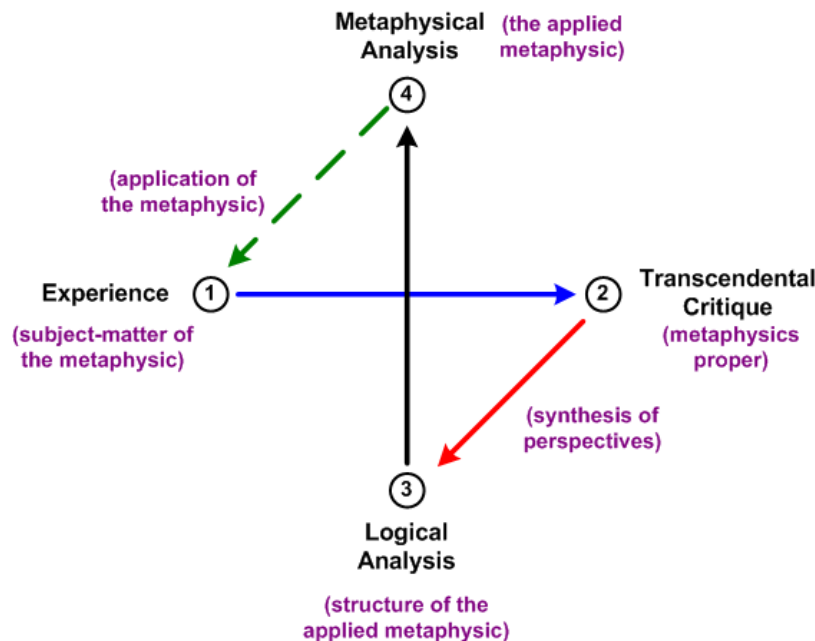


Figure 3: Palmquist's 12CR structure of metaphysic deduction.

that do not necessarily belong to each another [Kant (1787), B201-202 fn]. These objects are all objects of *soma*, the *homo phaenomenon* aspect of being a human being. Therefore the *master perspective* of the derivation [Wells (2011c)] is the acroam of the transcendental Idea of Rational Psychology in Critical metaphysics proper: *absolute unity of the OB*. The four headings of Quantity, Quality, Relation and Modality for the psychological Idea are taken from the judicial Standpoint. The psychological Idea is also the acroam of the master perspective for the T-SMI, but in that case the headings of the psychological Idea are viewed from the theoretical Standpoint. Again, this is why (and how) the J-SMI and the T-SMI differ from each other.

The derivation of any applied metaphysic calls upon the following set of factors [Wells (2011c)]:

- acroams, ideas and notions of Critical epistemology used as portable concepts and as orienting acroams;
- specifying concepts by which the metaphysic is structured;
- the representation of all four Critical reflective perspectives (the logical reflective perspective under Rational Physics, the transcendental reflective perspective under Rational Psychology, the hypothetical reflective perspective under Rational Cosmology, and the empirical reflective perspective under Rational Theology), with one of these employed as the master perspective and the other three serving as orienting perspectives.

It is a theorem of mental physics that human beings learn from the particular to the general, i.e., that new and more general abstract concepts are synthesized *from* specific particular examples. Only *after* a generalization is obtained *in this way* is it possible for us to apply the general idea to understand new lower concepts by other processes of judgment³, e.g. by a synthesis of episylogisms [Wells (2011b)]. The specifying concepts of the metaphysic deduction are obtained from such particular examples. The examples provide the basis for making *inferences of analogy* in the process of reflective judgment. Analogy must *not*, however, be used *naively*. It must be explicitly brought under the context of the theoretical question, a process by which abstraction is made of all that is incongruent with that context and by which the objects of the theory are *made homogenous* so that they can be correctly combined in synthesis.

It is this last point that guides the proper selection of particulars to be employed as analogs. In the case of the J-SMI, the pertinent question in regard to *nous-soma* reciprocity (because *psyche* is the logical division of this) begins at: What particulars do *nous* and *soma* share in common? All the objects of the former are supersensible and mathematical. The objects of the latter, those of most concern to biology and neuroscience, are objects of sensuous experience⁴. There could scarcely be a greater gap than that which seems to lie between *soma* and *nous*. Yet we know that this gap must be illusory because *soma* and *nous* are merely logical divisions of one and the same real Object, namely the individual human being. The bridging idea required is the Critical idea of *information*.

Yet information, as an object, is itself a supersensible object. It is incorrect (an ontological

³ The Bourbaki-Hilbert paradigm now in use in the teaching of mathematics in the U.S. violates this theorem. Abstract mathematical ideas are presented first and often no particular examples are provided in the mathematics textbooks. *All by itself* this contra-psychological pedagogy accounts for the poor levels of mathematics achievement exhibited by U.S. students. Until this paradigm is utterly abandoned, it is a trivial lemma that mathematical incompetence in the U.S. will grow worse and worse over time.

⁴ including those sensuous experiences that are made possible by scientific measuring instruments; bacteria were not objects of possible experience prior to the invention of the microscope but became objects of possible experience after this invention.

error) to point to any particular actual experience and say, "Here is an example of information." Rather, correct epistemology forces us to say, "Here is an example in which a property of information inheres." Furthermore, this latter statement is without real meaning unless what we mean when we say "a property is presented in the example" is that there is something transeunt about the example (because otherwise such an abstract property could have no effect on *us* and, having no effect, could not be known *by us*). This consideration led me to the particular example of *communication systems* as an analog and to Weaver's proposal. This is why I said earlier that Wells (2011d) is propaedeutic for this paper.

At first blush, this might seem a strange starting point. It is quite natural to presume that the applied metaphysic of the *psyche-soma* boundary would begin directly with biological objects. But this cannot be so because our understanding of the objects of biology contains nothing at all that connects immediately to any mental object *whatsoever*. Again we seem to be confronted with a formidable gap in Nature, yet again we know that this gap can only be illusory. A human being is *known* to possess characteristics both mental and physical. There can therefore be no *real* gap between the *homo phaenomenon* and *homo noumenon* aspects of being a human being. The J-SMI is not an applied metaphysic for biology. It *is* a necessary forerunner for the objectively valid connection of biology and psychology, and in this context the *general* SMI 3LAR is an applied metaphysic for what is usually called *psychophysics*.

The ideas of communication and information are tightly linked, and communication systems are far easier to understand than is neuroscience. Wells (2011d) explored this connection and out of it led me to identify the general topic of *semantics* as the territory where proper analogs are to be sought and found. By "semantics" I do not (and cannot) mean semantics in the context used by, e.g., Tarski or other logical positivists (including von Neumann and Chomsky). The analogy must not be naive or overly broad. The appropriate analogical context is much more restricted than this and could properly be called *soma-semantics* because its topic of inquiry is: *what is necessary for the possibility that biological appearances could pertain to meaning implications?*

Once the idea of semantics is introduced into the context of the correct subject-matter, this identification points straightaway to other sources of possibly fecund analogies: linguistics, grammar, syntax, language. It also introduces into the topic the ideas of *code* and *coding*, as the entries for these terms in Reber's *Dictionary of Psychology* attest. Thus it is that the title of this paper refers to the somatic code.

B. Formalism. If it is not already obvious, the formal theory of the J-SMI is, by the Nature of its topic, a mathematical theory. However, due to a peculiar and widespread misunderstanding, it is important to begin by explaining something most people find difficult at first encounter to accept. In its practical real essence, *mathematics is nothing more and nothing less than a language for saying things very precisely and in such a way that consequences of what one has said can be derived*. In the eighteenth, nineteenth and even into the first half of the twentieth centuries, authors of scholarly works frequently dropped out of whatever their native language was and briefly into Latin before returning once more to their native tongues. No translation of the Latin passage was given in a footnote, either. This was not mere blue-nosed hubris. Natural languages constantly undergo changes as new connotations are added to their words, new similes are employed that eventually add new dictionary definitions, and over time words once clear and specific in their meanings become soft, vague and ambiguous. Latin, on the other hand, was a *dead* language, in the sense that it was no longer evolving, and so when an author wanted to say something precisely and in such a way as to preserve his meaning over time, he would say it in Latin. Today *we use mathematics in precisely the same way and for precisely the same reason*, and the superior practical effectiveness of employing the language called mathematics instead of Latin can hardly be gainsaid. The word "mathematics" takes its etymological root from the Greek words *mathēma* ("that which is learned") and *manthanein* ("to learn"). *Any* representation – be it

an equation, a graph, a sketch, a figure or whatever else – that is employed to learn about or to teach something *is* a mathematic. Mathematical language is our modern version of Latin. You are reading a mathematics paper and *have already* encountered some math. Did you know that?

Mathematics as a discipline is, in this context, the study of a language and its *practical* employment – less romantic than poetry to be sure, but a language nonetheless. And for that reason one should not take the word "formalism" as I have used it here in the context of the Bourbaki-Hilbert formalists, whose entire paradigm renders mathematics little more than a system of esoteric hieroglyphics that hinders rather than helps learning and contains vast patches of works as incomprehensible even to other mathematicians as Mayan hieroglyphics are to most of us⁵. As a language, mathematics itself is yet another fecund source of analogies for the derivation of the J-SMI.

Following the method of Wells (2011c), the major acroam for the 12CR synthesis is the transcendental Idea of Rational Psychology (denoted by IRP). The minor acroams are the remaining three transcendental Ideas (denoted by TI). Let the symbol \subset denote "subsumed under." Let the symbol $+$ denote "synthetically combined with," and let the symbol \Rightarrow denote "provides the." For each of the twelve *momenta* of the J-SMI a *metaphysical axiom* (MA) is required. These axioms must be made appropriate for the context of the metaphysic and must be such that the idea of the axiom is an idea capable of standing as a principal quantity of Critical mathematics [Wells (2011a)]. The formula of the axiom deduction is

$$TI \subset IRP \Rightarrow MA. \text{ ("a transcendental Idea subsumed under the IRP provides the MA")} \quad (1)$$

By the term "axiom" I express an idea much closer to the ancient Greek mathematicians than to the usual connotation of that word that centuries of habits-of-thinking in mathematics have given it today. Moderns tell us that to the Greeks an axiom was a "self-evident truth." They implicitly or explicitly censure them for that allegedly-naive view, and usually go on from there to explain that *today* we know that an axiom must *properly* be regarded as "a statement used in the premises of arguments and assumed to be true without proof" [Nelson (2003), "axiom"]. This modern qualification is the direct outcome of what was known as "the crisis in the foundations" of mathematics that occurred at the end of the nineteenth and early decades of the twentieth centuries – a crisis that the mathematicians failed to resolve and eventually gave up on trying to resolve [Davis and Hersch (1981), pp. 330-338]. But our moderns have no grounds to lay claim to an understanding of axioms superior to the ancient Greeks (except one of history ignórance).

The poster boy example of a system of axioms is the set of Euclid's axioms. These consisted of five *aitēmata* ("postulates" in the connotation of "things demanded by the possibility of knowledge") and five "common notions" [Thomas (1939), vol. I, pp. 442-445]. The idea of "self evidence" is owed to the "common notions" element of Euclid's axioms, while the idea of "truth" is owed to the "postulates" element. The Euclidean "common notions" were indeed premises accepted without proof – what most people would call "common sense notions" – but modern mathematicians and philosophers are *wrong* to criticize the Greeks on this issue. The reason they are wrong is because the Greeks knew very well what they were doing, and it wasn't all that different from what modern mathematicians found themselves forced to concede in the twentieth century after failing to resolve their rationalist crisis. The attitude the Greeks *actually* adopted was described by Plato in *Republic* and in *Epistle* in the following way:

I think you know that those who deal with geometrics and calculations and such matters take for granted the odd and the even, figures, three kinds of angles and other things cognate to these in each field of inquiry; assuming these things to be known, they make them hypotheses, and henceforth regard it as unnecessary to give any explanation of them

⁵ The interested reader might enjoy reading Davis and Hersh (1981), pp. 339-344, for more on this.

either to themselves or to others, treating them as if they were manifest to all; setting out from these hypotheses, they go at once through the remainder of the argument until they arrive with perfect consistency at the goal to which their inquiry was directed. . .

Therefore I think you also know that although they use visible figures and argue about them, they are not thinking about these figures but of those things which the figures represent; thus it is the square in itself and the diameter in itself which are the matter of their arguments, not that which they draw; similarly, when they model or draw objects, which may themselves have images in shadows or in water, they use them in turn as images, endeavoring to see those absolute objects which cannot be seen otherwise than by thought. . .

For everything that exists there are three things through which knowledge about it must come; the knowledge itself is a fourth; and as a fifth we must posit the actual object of knowledge which is the true reality. We have, then: – first, a name; second, a description; third, an image; fourth, knowledge of the object. Take a particular case if you want to understand what I have just said, and then apply the theory to all objects in the same way. There is, for example, something called a circle, whose name is the very word I just now uttered. In the second place there is a description of it, made up of nouns and verbs. The description of the object . . . would be: that which has everywhere the same distance between the extremities and the middle. In the third place there is the object which is drawn and erased . . . In the fourth place there are knowledge and understanding and correct opinion about them . . . Of these understanding approaches nearest to the fifth in kinship and likeness, while the others are more distant. [Thomas (1939), vol. I, pp. 390-393]

The flaw in the Greek thinking was its ontology-centeredness and the naive realism that was part of this. Our own moderns are, for the most part, guilty of the same flaw. The Critical system sets this aright and, as a dividend, also resolves the mathematicians' "crisis in the foundations." Mathematicians are correct to say that one is free to choose whatever system of axioms one wishes, and that the choice made will then determine the rest of the mathematics system that follows on this choice. However, if one aims at having mathematics apply to Nature, the axioms that govern principal quantities of mathematics *must be deduced on the basis of the Critical acroams of epistemology*. I call the mathematics structures raised up upon such axioms *Critical mathematics*. The results yielded up by Critical mathematics structures are *true (real* in the context of natural phenomena). Axioms governing secondary quantities of mathematics are not immediately constrained by the Critical acroams (because secondary quantities have no overlap with natural phenomena), and mathematical structures raised up upon these I call *hypothetical mathematics*. If the hypothetical axioms do not contradict Critical acroams, the hypothetical system yields results that are *formally undecidable (non-real* in the context of natural phenomena). If they do contradict the acroams, the results are *unnatural (unreal* in the context of natural phenomena). Hypothetical mathematics correctly done aims at formally undecidable objects of mathematics⁶. The Critical doctrine of mathematics requires principal quantities obtained from secondary quantities to be insensitive to small changes in the latter [Wells (2011a)].

The metaphysical axioms for the J-SMI are Critical axioms. To deduce the specific *momenta* of figure 2 (step ③ of figure 3) requires explicit specifying concepts and also *momenta* of what mental physics calls the *transcendental topic* (TT) of the theory [Wells (2009), chap. 8, §4.1]. The general ideas of representation (identification, differentiation, etc.) and the transcendental topic comprise the matter and form, respectively, of the 3LAR structure of *general knowledge representation*. Let SC denote a particular specifying concept of the metaphysic. Furthermore, let the symbol

⁶ One important example of proper hypothetical mathematics is displayed in the physics of quantum electrodynamics theory by the process of renormalization.

SC
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read "when combined under the condition of the SC produces". The general formula for synthesis of a *momentum* of the J-SMI is then

$$TT + MA \xrightarrow{SC} \text{the J-SMI } \textit{momentum}. \quad (2)$$

C. Structure. Any applied metaphysic must serve as a bridge that connects rational science and empirical science and makes one whole of the special science for which it is the applied metaphysic [Wells (2011c)]. This bridgework is always threefold and consists of: (1) transcendental principles on the side of rational science; (2) empirical principles on the side of empirical science; and (3) transitive principles spanning the Object of the science and joining the other two together to make a *system*. The names given to these three constituents of the J-SMI are called, respectively, the judicial-transcendental sensorimotor idea (J-TSI), the judicial-empirical sensorimotor idea (J-ESI) and the judicial-data of the senses (J-DOS). Each of these is understood from a particular reflective perspective set by the particular heading of Critical metaphysics proper from which its minor acroam (transcendental Idea) is drawn.

In this way, the applied metaphysic is covered in regard to all four headings of metaphysics proper (Rational Physics, Rational Psychology, Rational Cosmology and Rational Theology). These four headings deal with, respectively: objects of external experience (sensuous physical objects); objects of inner sense (psychological objects); Objects of reasoning pertaining to the material *nexus* of Nature; and Objects of reasoning pertaining to the metaphysical *nexus* of Reality-in-general⁷. The reflective perspectives set by each of these are called, respectively: the logical reflective perspective; the transcendental reflective perspective; the hypothetical reflective perspective; and the empirical reflective perspective. This architectonic structure is called "Kant's system of perspectives," a key interpretation of Kant's philosophy first recognized by Palmquist (1993). Let $IR\Phi$ denote a transcendental Idea of Rational Physics, IRC a transcendental Idea of Rational Cosmology and IRT a transcendental Idea of Rational Theology. Let TT_T denote a *momentum* of transcendental topic applied to the J-TSI, TT_E denote one applied to the J-ESI, and TT_D denote one applied to the J-DOS, respectively. Combining (1) and (2) above, the general structure of the J-SMI is then constructed as

$$\begin{aligned} TT_T + [IRT \subset IRP] \xrightarrow{SC} \text{the J-TSI} \\ TT_E + [IR\Phi \subset IRP] \xrightarrow{SC} \text{the J-ESI} \\ TT_D + [IRC \subset IRP] \xrightarrow{SC} \text{the J-DOS} \end{aligned} \quad (3)$$

with the bracketed terms denoting the particular MA employed in the synthesis. The explicit positioning of the transcendental topics is illustrated in figure 2. This ordering is the same as that previously discussed for the T-SMI in Wells (2011c) and for precisely the same reason that was explained in that earlier paper.

⁷ Rational Theology has nothing to do with ideas of gods or with religious theology. Its subject-matter can be more or less adequately described by saying it is the Critical metaphysic that addresses the question, "What does 'to be real' mean?" Its acroams are the regulative principles necessary for the possibility of the OB's capacity for conceiving of Reality and real things. Its reflective perspective is *empirical* insofar as the connotation of "empirical" is taken to refer to the mental phenomenon of *knowing by experience*.

□ I now wish to conduct you through a brief digression, the point and import of which for our topic at hand I will explain immediately after it. Philosophers and natural scientists tend to wax poetic about the endlessly Protean character of mathematics that provides it with its amazing scope of applications. All this is true enough but it also points to a fundamental aspect of the work of professional mathematicians, of which they are all keenly aware but in regard to which most non-mathematicians operate entirely in the dark. It is this: There are two fundamental aspects in the composition of mathematics. The first involves *the design of structured systems* of mathematics. This is Quantity in the practice of mathematics. The second involves exploration of ever-deepening details of the consequences of these mathematical structures. This is Quality in the practice of mathematics. The latter is illustrated by the topical arrangements of mathematics education, e.g., arithmetic, geometry, calculus, topology, etc. &etc. Students seeking to become professional mathematicians are taught both the Quantity and Quality aspects of mathematics, but, and unfortunately, the *exoteric* teaching of mathematics focuses exclusively on the Quality aspect. In my own personal opinion, the Quantity aspect of the mathematical experience is by many orders of magnitude the more fun of the two, but it is precisely about this aspect where the *traditions* of teaching mathematics leave most people in the dark. I often speculate that we might have more (and better) mathematicians (and, so far as this goes, more and better scientists as well) if the Quantity aspect of math were taught to more pupils and students. To put it colloquially, it is sometimes better to "roll your own mathematics" in order that your mathematics (which is, I repeat, a *language*) is *made to fit the problem*, rather than distorting, mutating and performing amputations on the problem until it can be jammed into some already-existing mathematical structure.

In flat contradiction to a bit of propaganda sometimes put out by professed adherents to the pseudo-metaphysics of mathematical formalism, mathematics is *always* about something, and professional mathematics is *never* just "a game with rules ('axioms') that isn't about anything; change the rules and you change the game." Most mathematicians do not themselves believe this slogan; they just use it to shoo away pests (and the pest in particular is usually a philosopher):

Most writers on the subject seem to agree that the typical working mathematician is a Platonist on weekdays and a formalist on Sundays. That is, when he is doing mathematics he is convinced that he is dealing with an objective reality whose properties he is attempting to determine. But then, when challenged to give a philosophical account of this reality, he finds it easier to pretend that he does not believe in it after all. [Davis and Hersch (1983), pg. 321]

Most philosophers do not do mathematics, and most non-philosophers/non-mathematicians tend to regard the usual already-developed mathematical systems in much the same way as Augustine regarded *Genesis*. This is to say that "math" is held in an almost religious awe (as if its systems were laws laid down by God rather than the human inventions they are) and in ways that exhibit in adult behaviors lingering traces of a universal psychological phenomenon exhibited by children that Piaget termed "moral realism" [Piaget (1965), pp. 109-196].

For example, in the mid-1970s there was an enormous growth of interest among engineers in a technical field known as digital signal processing. This was prompted by the revolution in micro-computer technology that took place at that time. The technology of the day was, by today's standards, very performance-limited, and this led some (including me) to develop an interest in an esoteric little sub-specialty called "number theoretic digital filtering." The method employs mathematical systems that most engineers are never exposed to in any part of their education⁸. My proposal that we employ number-theoretic methods in designing our product was initially met

⁸ I had just been exposed to it in a graduate course at Stanford. It was what originally exposed me to the Quantity aspect of mathematics.

by almost all of my colleagues with what can properly be called "shock and outrage." One of my co-workers on the project expressed the reaction perfectly. After hearing my proposal, he blurted out in horror, "You can't do that! You're messing with *the number system!*" No priest in medieval Europe was ever more aghast upon hearing a heresy uttered than Willy was that day⁹. □

The point of this little digression is this. Mathematics is a precise language. When new sciences are undertaken, which always requires the new ideas and methods to be precise, the vocabulary and structures of mathematics must be constructed so that this is accomplished. For any scholarly endeavor to *be a proper science*, an appropriate *mathematical* system for it must be found or built. Piaget put it this way:

Physics is primarily an experimental science concerned exclusively with the study of the material world, and its criterion of truth is agreement with empirical fact. Mathematics, on the other hand, is not based on experiment nor explainable by reference to physical facts; it is a formal science whose sole criterion of truth is the internal consistency appropriate to a rigorous deductive system. The need for explanation in physics itself has led to the application of mathematics to physics and thus given rise to mathematical physics, which has for its object the construction of a deductive theory which will explain experimental findings.

Without pressing the parallel too far, and without concealing the fact that psychology is some centuries behind physics, we can say that, like physics, it is an experimental science, but one concerned with the study of mental life, whilst its criterion of truth is also agreement with empirical fact. Logic based on the axiomatic method is, on the other hand, a formal science whose sole criterion of truth is deductive rigor.

The need for explanatory schemes in psychology leads us to apply axiomatic logic to psychology itself, and in this way to construct a psycho-logic¹⁰. Its task would not, however, be to base logic on psychology, but rather to construct by means of the algebra of logic a deductive theory to explain some of the experimental findings of psychology. [Piaget (1953), pp. 25-26]

Piaget's "*tertium quid*" (mathematical physics; psycho-logic) [*ibid.*] is precisely the end objective of any Critical applied metaphysic, and of the J-SMI in particular. This monograph deals with the *particular* details for the case of the J-SMI.

III. The Specifying Concepts of the J-SMI

All meanings are practical in their root fundamental Nature, and this means that every special science has practical applications in some number of particular special cases. Furthermore, every special science, before it attains to the status of a natural science, originates from some historical doctrine of Nature, often a technical art or craft [Wells (2011c)]. This propaedeutic historical doctrine is the jumping-off point for *context concepts*, by which I mean concepts of metaphors or similes (analogies) sufficiently well-known that limitations can be placed upon the analogies so that inference by analogy is guarded from being made naively. For the J-SMI, I use the OB-Weaver model of communication [Wells (2011d)] as the source for context concepts. These context concepts, subsumed under the major acroam (the psychological Idea in this case), produce the idea of the *principal specifying context* of the applied metaphysic. For the J-SMI this idea is *the OB's power of self-organization*. This is because the focus of the J-SMI has nothing to do with the ontology of *psyche* (which is the topical focus of the T-SMI) but, instead, with the holistic outcome of *nous-soma* reciprocity in the Organized (human) Being in regard to the epistemology of meanings. As Piaget put it,

⁹ If you are wondering, the method did work splendidly for a particular class of engineering problems.

¹⁰ When approached properly from mental physics, a more accurate term is *psyche-logic*.

From the biological point of view, organization is inseparable from adaptation: They are two complementary processes of a single mechanism, the first being the internal aspect of the cycle of which adaptation constitutes the external aspect. With regard to intelligence, in its reflective as well as in its practical form, this dual phenomenon of functional totality and interdependence between organization and adaptation is found again. Concerning the relationships between the parts and the whole which determine the organization, it is sufficiently well known that every intellectual operation is always related to all the others and that its own elements are controlled by the same law. Every scheme is thus coordinated with all the other schemes and itself constitutes a totality with differentiated parts. Every act of intelligence presupposes a system of mutual implications and interconnected meanings. The relationships between this organization and adaptation are consequently the same as on the organic level. . . It is by adapting to things that thought organizes itself and it is by organizing itself that it structures things. [Piaget (1952), pp. 7-8]

The specifying concepts delimit the context of applying inference by analogy on the basis of restrictions demanded by the particular Critical logical functions of understanding in judgments and the specific categories of understanding in Critical epistemology [Wells (2009), chaps. 5, 6; Kant (1787), B95-113]. These deductions are generally neither trivial nor self-evident at the start of the process. If the metaphysic engineer is going to make a mistake, it is more likely to happen during the deduction of the specifying concepts than anywhere else in the process. This process *is* mistake-prone (it is for me, at least), and this reinforces the prudence of conducting a "reality check" following step ④ of the 12CR process in figure 3 (the ④-① transition shown there).

Fortunately for the metaphysic engineer, there are only four specifying concepts – one for each of the four headings in the 2LAR structure of the metaphysic. Furthermore, because SCs are used to help tie *momenta* of the metaphysic to principal quantities of Critical mathematics, the specifying concepts of the J-SMI are tied to Rational Physics by principles of the Critical metaphysical rudiments of natural science and the Critical transcendental Aesthetic of sensibility [Kant (1786); Wells (2006), chap. 18, §4; Wells (2009), chap. 3]. SCs are *anchors to experience*. Using Kant's terminology, the metaphysical rudiments are called Critical *phoronomy*, *dynamics*, *mechanics*, and *phenomenology* [Kant (1786)]. The transcendental Aesthetic is the Critical metaphysics of *topological structuring* (subjective space) and *order structuring* (subjective time), the processes of pure intuition in the synthesis of apprehension in sensibility.

A. The Specifying Concept of Quantity. The specifying concept of psychosomatic Quantity is: ***the structuring of aggregations of somatic activities***. Let it be denoted by the mathematical symbol SC(A).

Critical Quantity is always representation in the form of some composition of matter¹¹. For psychosomatic Quantity this form of composition must be some form of composing appearances in *soma*. Within the general context of the J-SMI, the concept of this must have some relationship to semantics. On the side of empirical science, this concept must also stand in some relationship to Critical phoronomy in general¹². Context with the OB-Weaver model of general communication [Wells (2011d)] also requires that the specifying concept stand in some relationship to the idea of a *message*. The phoronomy aspect points to the mathematical idea of a *topological space* – more specifically, to an understanding of this as a material message space¹³.

¹¹ "matter" in the wider metaphysical connotation, not merely the narrow connotation physics uses in such ideas as that of a "corpuscle."

¹² Phoronomy is the doctrine of composition of the motions of a point in an objective material space according to the speed and direction of this motion. Physics employs a tightly restricted partial doctrine of phoronomy known as kinematics.

¹³ Kant's *Metaphysical Rudiments etc.* [Kant (1786)] distinguishes between *objective* material space (a *relative* space) and *subjective* absolute space (the pure intuition of space). The theory is a *relativity theory*.

The biological idea of *somatic activity* is an idea where all these context requirements can be brought together for a synthesis of ideas. By *somatic activity* I understand *any quantitative measure of metabolic rate in an organized system of biological cells*. By *metabolic rate* I understand *the rate at which energy and materials are transformed within an organism and exchanged between the organism and its environment*. As for "energy," "materials" and "organism," these terms are employed as their standard usages in physics, chemistry and biology. The SC of psychosomatic Quantity serves to establish a link between the *homo noumenon* and the *homo phaenomenon* aspects of being a human being. As for *topological space*, I understand this term as the usual mathematical definition of topological space [Nelson (2003)] but with some restrictions on how the ideas of sets and a null set are *metaphysically* understood¹⁴.

One specific, singularly identifiable and measurable activity can be associated with the mathematical idea of "an element of a set" as well as with the idea of a "point in a topological space." This is the Critical intersect between sensible objects of facet A and principal quantities in facet B in Critical mathematics [Wells (2011a)]. Critical epistemology requires that we regard the notion of an "element of a set" as a notion of *intensive* magnitude¹⁵ and for that reason an activity is said to "have a degree" of activity ranging from imperceptible (the practical meaning of "none" or "zero") upward.

It is tempting to make the leap from the idea of an activity to the idea of a signal, but this is not correct. In signal processing theory, a signal is *any physical phenomenon exhibiting temporal variations that is said to carry information*. The idea of activity does not contain the idea of information, and so an activity in and of itself is insufficient for the idea of a signal.

B. The Specifying Concept of Quality. The specifying concept of psychosomatic Quality is: *accretion and dissipation of activity fields*. Let it be denoted by the mathematical symbol SC(B).

Critical Quality is always representation in the matter of some composition¹⁶. Quality in general refers to the composition of a manifold by coalescence. Analogies suitable for this idea include psychological syncretism (i.e., "everything that *can* be fused together *is* fused together"), chunking¹⁷, and James' Object-of-thought [James (1890), vol. 1, pg. 275]. These analogies, quite obviously, are psychological analogies standing on the "left bank" side of rational science in the organization of the applied metaphysic bridgework [Wells (2011c), figure 2].

On the empirical science side, however, Quality in a metaphysic refers to the Critical physics of *dynamics*. Kant explained his Critical physics terminology with the following words:

The *metaphysical* rudiments of natural science are therefore to be brought under *four* main-pieces wherein: *first, motion* is regarded as a pure *quantum* in accordance with its composition, without any Quality of the movable, and may be called **phoronomy**; the

¹⁴ Critical epistemology requires that fundamental constructs in mathematical structures, such as "element of a set," "set," "null set," (also called an empty set) etc., have meanings as *principal quantities*. This affects whether or not a mathematical axiom is *objectively valid*. The considerations involved here are discussed in depth in Wells (2006), chapter 23. The notion of a null set signifies *ontological contradiction*, as in "the set of all cattle that are also dogs."

¹⁵ Intensive magnitude is a unity in which the idea of multiplicity can be represented only by an approximation to negation. *Extensive* magnitude is a magnitude in which the representation of the parts precedes and makes possible the magnitude of the whole. *Magnitude* is a determination of an object according to which the apprehension of its intuition is represented as possible only through the repeated positing of homogeneous parts. *Aggregation* of activities is extensive magnitude, but an *individual* activity is an intensive magnitude. A poet might say it is the "twinkle, twinkle little star" in the night sky.

¹⁶ cf. figure 2. Quantity & Quality are composition, Relation & Modality are *nexus*.

¹⁷ the organization process whereby distinct "bits" of information are collected together perceptually and cognitively into larger, coordinated wholes ("chunks") [Reber (2001)].

second takes into consideration motion as belonging to the *Quality* of matter, under the name of an original moving power, and is therefore called **dynamics**; the *third* regards matter with this Quality as in Relation to another through its own inherent motion, and therefore appears under the name of **mechanics**; the *fourth*, however, determines its motion or rest merely in reference to the mode of representation or *Modality*, and thus as appearance of the outer senses, and is called **phenomenology**. [Kant (1786), 4: 477]

The second and third terms are familiar to anyone who has studied physics, although the broader metaphysical contexts of these terms usually are not. The typical pupil of physics knows a little bit about the first term under the name kinematics. Disciplinary physics does not contain the fourth term (and, therefore, there is a hole in its doctrine right at this place). Physics defines "dynamics" as "the branch of mechanics concerned with the motion of bodies under the action of forces." It also defines another object, a *field*, as "a region in which a body experiences a force as the result of the presence of some other body or bodies. A field is thus a method of representing the way in which bodies are able to influence each other" [Isaacs (2000)].

Split dynamics from mechanics (physics fails to do this), replace "body" with transcendental object and "force" by moving power¹⁸ and we get an acceptable real description for what a field is. Getting more specific still in the context of the J-SMI, by the term **activity field** I understand a *manifold of somatic activities*. Note that this is still a *spatial* concept and refers to an objective material space. With somatic activity regarded as a "point" in a topological universe (= the set of all possible combinations of somatic activities), an activity field corresponds to what point set topology theory calls a *topological neighborhood* [Baum (1964), pg. 20].

A specific set of measurable somatic activities, regardless of the intensities of the individual activities other than that they be sensational¹⁹, is what I mean by the idea of the spatial *manifold*. Sensation in *nous* is the mental associate of somatic activity in *soma*. The idea of a spatial manifold introduces the ontological idea of information ("that which is common to the data of both somatic activity and noetic representation") into the system of the metaphysic. We can now, with objective validity, call an *activity field* a somatic representation but we cannot yet call it a signal because the idea of one specific topological neighborhood does not yet contain any notion of objective *time*. Critical Aesthetic is a doctrine of *space-time*.

By **accretion** I understand *an increase in accumulated matter* – degree of activity in this case.

¹⁸ Moving power is the power to be a cause of a change in an object's external relationships. Leibniz seems to have been the first to introduce this idea into metaphysics. In Kant's day neither the idea of a field nor the idea of energy had yet been established in physics. Ontology-centered translators of Kant's *Metaphysical Rudiments etc.* [Kant (1786)] often go to a lot of effort to try to get Kant's theory to read as some sort of apology for Newtonian physics. It is not. The fact is that Kant found Newton's system to be *flawed*. Some of the mistranslations I have seen are so fundamental that I question the translator's physics background. Kant (1786) is the rudiments for a relativistic field theory and the Newtonian concept of "force" (the typical mistranslation of moving power) does not actually appear anywhere within it. In Kant's system, if we had the idea of wave functions, ψ (as quantum physics today does), it is not only possible but *necessary* that objects interact through what, for want of a better term, I will call a " ψ -field." This includes those otherwise puzzling action-at-a-distance-like interactions modern physicists characterize with terms like "coherence" and "incoherence." A wave function or a ψ -field exerts *no* "fundamental force" as understood in physics' Standard Model (the electromagnetic, gravitational, strong and weak forces). The interested reader might enjoy an old paper by Rohrlich (1983) pertaining to this aspect of quantum physics.

¹⁹ This qualification reflects the fact that measuring instruments and methods, such as a PET scan, always measure activities relative to some instrument gauge. There is always some "ground reference voltage" or "normal background level" (e.g., in brain scan techniques) every physical quantity is measured relative to. Thus we have no physical *absolute* standard and must, epistemologically, reference back to sensational effects registered in *nous*. A transcendental object is the matter of what Kant calls *the real in sensation*.

By *dissipation* I understand *the diminution or disappearance of matter* – again, degree of activity in this case. Here it is important to note that phoronomy and dynamics are composition of motion. In Critical epistemology "motion" is understood in the old Greek context of *kinesis*, i.e., *change of any kind*. In congruence with the understanding of somatic activity in terms of metabolic *rate*, the specifying concept of Quality specifies degrees of *variation* and not absolute degrees of somatic activity intensities.

C. The Specifying Concept of Relation. The specifying concept of psychosomatic Relation is: *soma-syntactical generator function*. Let it be denoted by the mathematical symbol SC(C).

The context of *meaning* – which is entirely a noetic concept – steers the metaphysic in a rather obvious way towards an analogy with language and linguistics. By language I do not understand here the idea of any spoken human language to be used as a metaphor or simile. To over-broaden the analogy in this way is tantamount to declaring that a two-day-old human infant lacks the phenomenon of mind, and such a declaration is utterly without objective validity even if one finds a way to not regard it as a ridiculous premise. The *real Object* of our science is the Organized Being (human being) *holistically*. With this important limitation of context firmly in mind, we can then examine the analogy of language in more formal yet practical terms. Let us begin by examining the terminology of the analogy. Chomsky wrote,

The fundamental aim in the linguistic analysis of a language L is to separate the *grammatical* sequences [of phonemes] which are sentences of L from the *ungrammatical* sequences which are not sentences of L and to study the structure of the grammatical sequences. The grammar of L will thus be a device that generates all of the grammatical sequences of L and none of the ungrammatical ones. [Chomsky (1957), pg. 13]

In linguistics a phoneme is defined as the smallest unit of sound that makes a difference in meaning. It is easy enough to anticipate that the metaphysic will require some somatic Object that has the same practical role, i.e., a smallest unit of something that makes a difference in meaning. To prevent the analogy from spilling over too much into those objects we call natural languages, it is prudent to substitute another term used by linguists in place of "phoneme." This term is the *formative*, so named because formatives "form sentences." Before we can do anything with this still vague idea, though, we must also understand the analogy of a "grammar" because a "sentence" is a grammatical sequence of formatives. The idea of a sentence (a grammatical sequence of formatives) as a contributor to the analogy is perhaps obvious enough, but if it is not we are reminded that

The central fact to which any significant linguistic theory must address itself is this: a mature speaker can produce a new sentence of his language on the appropriate occasion, and other speakers can understand it immediately, though it is equally new to them. [Chomsky (1964), pg. 7]

The capacity to produce a *new* sentence and *have others understand it* belongs to the same genus as the idea of *generating* a meaningful message and equally clearly has a relationship to meaning. For the topic of this metaphysic, the connection with these species is clearly the idea that it is possible for somatic representations (as defined in B above) to *be* or *be made* meaningful. What, then, can be productively gleaned from the idea of a grammar? Chomsky wrote,

[A] generative grammar must be a system of rules that can iterate to generate an indefinitely large number of structures. This system of rules can be analyzed into the three major components of a generative grammar: the syntactic, phonological, and semantic components.

The syntactic component specifies an [unbounded *a priori*] set of abstract formal objects, each of which incorporates all information relevant to a single interpretation of the

particular sentence²⁰. . . I shall use the term "sentence" to refer to strings of formatives rather than to strings of phones²¹. . .

The phonological component of a grammar determines the phonetic form of a sentence generated by the syntactic rules. That is, it relates a structure generated by the syntactic component to a phonetically represented signal. The semantic component determines the semantic interpretation of a sentence. That is, it relates a structure generated by the syntactic component to a certain semantic representation. Both the phonological and semantic components are therefore purely interpretive. Each utilizes information provided by the syntactic component concerning formatives, their inherent properties, and their interrelations in a given sentence. [Chomsky (1965), pp. 15-16]

Chomsky is famous for his work on transformational generative grammars. His theory posits two ideas, the deep structure of the syntactic component and the surface structure of that component. However, we cannot make use of these latter two ideas in the analogy because these ideas are ideas of apriority that experiments in developmental psychology have refuted. Even were this not so, these structure ideas are *transcendent* as objects, i.e. these ideas go beyond the horizon of possible experience, and therefore cannot belong to facet A at all nor serve as *principal* quantities of Critical mathematics. In point of fact, deep and surface structures are the necessary consequences of ontology-centered metaphysical thinking and in our epistemology-centered system we will not need them at all. It is, however, keenly to be noted that Chomsky's model employs three synthetic *capacities* (rather than "components"), which is precisely the number of functional capabilities required for the possibility of synthesis in Critical Logic.

The above analogy set provides us with metaphorical notions on the rational science side of the applied metaphysic, but does not speak at all to the empirical side (because we are taking the ideas of formatives, etc. as mathematical ideas and discarding their connotations of sounds, etc.). We must also find a conceptual analogy dealing with the empirical side of the metaphysical bridge. Let us take a closer look at the notion of a "generator." What does a generator do? Obviously it "generates something" but what? For this we turn to the connotation of Relation as a doctrine of mechanics for our specific context. What is Kantian mechanics?

The merely dynamical concept could regard matter²² also as at rest; the moving power brought up in consideration there had merely to do with the filling of a certain space without the matter filling it needing to be seen as itself moved. Power of repulsion²³ was therefore an originally-moving power for *imparting* motion; in mechanics, by contrast, the power of a matter set in motion is regarded as communicating²⁴ this motion to another [matter]. But it is clear that the movable would have no moving power by means of its motion²⁵ if it did not possess originally-moving powers by which it is active in every place where it is found prior to any inherent movement of its own. . . Thus all mechanical laws

²⁰ In Chomsky (1965), Chomsky actually wrote "infinite set" rather than unbounded set. However, it is unlikely he meant mathematical infinity in the Cantor connotation and, even if he did, in order for the idea to be objectively valid we must take "infinite set" to mean a set with no limit to its size prescribed *a priori*. Such a set must be called "unbounded" rather than "infinite."

²¹ Here a phone is any discrete speech sound having specifiable language-independent characteristics.

²² Here Kant uses the following definition of matter: Matter is the movable so far as it has moving power.

²³ Kant's more general idea of power of repulsion specializes in the context of this metaphysic to dissipation of somatic activities. He has another general idea, power of attraction, that specializes to accretion of somatic activities. Remember, too, that motion means "change of any kind."

²⁴ Kant here uses "communicating" in the context that "to communicate" is taken to mean "to have a connection or passage from one place to another." An activity field regarded as a topological neighborhood is a "place."

²⁵ This is because objective space is a *relative* material space and the motion of matter is indistinguishable from the motion of the space if moving power is not considered. This is a Kantian theory-of-relativity idea.

presuppose dynamical laws, and a matter, as moved, can have no moving power except by means of its repulsion or attraction, on which, and with which, it acts immediately in its motion and thereby communicates its own inherent movement to another. [Kant (1786), 4: 536-537]

"Attraction" and "repulsion" in our present context is accretion or dissipation of activity fields. An excitatory or inhibitory action-potential-event relationship among neurons is one concrete example of this. The quote above is a rather densely packed explanation, particularly so for someone who is not accustomed to working in physics. The *crucial point* to be taken from it, for purposes of the present metaphysic, is that mechanics deals with moment-by-moment *changes of activity fields* in objective time *where these changes are caused by moving powers at the antecedent moment in objective time*. Put another way, mechanics is a doctrine of material cause-and-effect phenomena that obeys the principle of *physical* (efficient) causality. In mechanics we at last see the introduction of the *temporal* dimension in space-time representation.

However, we must also take sharp note of Kant's statement that a moved matter "is active in every place where it is found prior to its own motion." The moment-by-moment temporal changes we are here dealing with are changes of activity fields, and a single activity field is only a particular topological neighborhood. A different activity field is a different topological neighborhood, i.e., *another place in objective somatic space-time*. Not to put too fine a point on it, but this sort of thing is usually called "action at a distance" – a notion that even many physicists find disturbing. More disturbing still is the implication that an activity field as a topological neighborhood at objective *time* coordinate t_1 is somehow "present" at some other time coordinate $t_2 \neq t_1$. What we confront here is one of those situations where ontology-centered thinking carries us off into a transcendent fogbank but where epistemology-centered metaphysics provides an objectively valid answer.

The difficulty that attends this aspect of SC(C) is this: How can an activity field, which is a somatic space-time neighborhood at one particular moment in objective time, be said to "be present" at a *past* moment in the objective time dimension of somatic space-time? The specifying concept appears to call for an element of *teleology* to be introduced into the metaphysic. If we were dealing here with an applied metaphysic of *soma* this would be an entirely unacceptable notion because teleological causes cannot be admitted in *physical* Nature (where only efficient causes have objective validity). However, the J-SMI is an applied metaphysic of *psyche*, not of *soma*, and *psyche* is the logical division of the OB pertaining to *nous-soma* reciprocity. Teleological causes are called *purposes*, and the notion of a purpose is entirely valid within the logical division of *nous*. I will show later that the apparent difficulty raised here is resolved by the transcendental Idea that pertains to the generator function in the J-SMI. It will result in a metaphysical axiom for activity field theory that can be called a *Hamilton's principle of psychomechanics* by analogy with Hamilton's principle of classical mechanics in physics [Goldstein (1980), chapter 2].

Mechanics in the sensorimotor idea deals with changes in activity fields that must be regarded as trajectories from one topological neighborhood to another in a space-time. It deals with activity field sequences and thus introduces an objective time into the mathematical theory. With the introduction of objective time we have the additional factor needed in order to regard activity field sequences as signals.

D. The Specifying Concept of Modality. The specifying concept of psychosomatic Modality is: *soma-phonological coordinator function*. Let it be denoted by the mathematical symbol SC(D).

Modality in judgment is always the judgment of a judgment and specifies the way in which

the OB is cognizant of his concept of the object of the judgment. *Psyche* is not a faculty of judgment but it is the faculty for enforcing coherence between representations of *nous* and *soma*. In the context of the somatic code, this is the coherence of Meaning, which is both the objective of and the meaning of semantics. Chomsky described the semantic component of a generative grammar as an interpretive function that relates a structure generated by the syntactic component to a particular semantic representation. For the J-SMI, the notion of this interpretive function amounts to same thing as the action of bringing the somatic *nexus* of activity field signals into such a unity that the representation of messages is possible.

By *message* I understand the persistent Object of a succession of somatic appearances. An example of this is illustrated by William James' explanation of how the term "Object" was to be used in psychology. James wrote,

In popular parlance the word object is commonly taken without reference to the act of knowledge, and treated as synonymous with individual subject of existence. Thus if anyone ask what is the mind's object when you say "Columbus discovered America in 1492," most people will reply "Columbus" or "America" or, at most, "the discovery of America." They will name a substantive kernel of nucleus of the consciousness and say the thought is "about" that – as indeed it is – and they will call that your thought's "object." Really that is usually only the grammatical object, or more likely the grammatical subject, of your sentence. It is at most your "fractional object"; or you may call it the "topic" of your thought, or the "subject of your discourse." But the *Object* of your thought is really its entire content or deliverance, neither more nor less. It is a vicious use of speech to take out a substantive kernel from its content and call that its object; and it is an equally vicious use of speech to add a substantive kernel not articulately included in its content and to call that its object. Yet either one of these two sins we commit whenever we content ourselves with saying that a given thought is simply "about" a certain topic or that that topic is its "object." The object of my thought in the previous sentence, for example, is strictly speaking neither Columbus, nor America, nor its discovery. It is nothing short of the entire sentence, "Columbus-discovered-America-in-1492." And if we wish to speak of it substantively, we must make a substantive of it by writing it out thus with hyphens between all its words. Nothing but this can possibly name its delicate idiosyncrasy. [James (1890), vol. 1, pg. 275]

Although Chomsky described the semantic component as "interpretive," it is more or less clear from the James example that this part of the makeup of the J-SMI is not a passive instrument but rather an active *coordinator* of activity field signals.

The word "signaling" as typically used in engineering and in biology is used without being defined, and its typical usages are almost always synonymous with "generating" or "sourcing" a "signal." However, these sciences also typically presuppose that the physical phenomena being labeled as "signals" contain "information" without concerning themselves with the question of "information about what?" To put this another way, to the electrical engineer or the biologist, the physical phenomenon is a "signal" only because it has some connection to his *theory*, not because he supposes the phenomenon *per se* to have a *physical* meaning.

If the term "physical meaning" is not to be an elegant oxymoron, one must be clear about the *practical* context in which the appearance of a physical phenomenon is regarded as a carrier of information and also clear about who *makes* the meaning implication and how he makes it. Only an Organized Being *makes* meaning implications. Consider the phenomenon of a change in barometric pressure recorded by a barometer in conjunction with the phenomenon of air pressure variations that one's auditory sense conveys as the representation of the sound of thunder. If I put these two dead-matter phenomena together in my mind and tell you, "That means it is going to rain," I am in effect telling you "nature is saying it is about to rain." Well, that is nothing but simple animism. Nature *as* nature *tells* us nothing. If "it" did, we would have no use for science

and the Oracle of Delphi could take its place and probably be a more reliable substitute.

A somatic signal is a signal because the psychic capacity of the OB *makes* a succession of activity field appearances *be* a signal, which is to say it enforces a coherence between somatic events and noetic representations by which noetic meaning implications are possible. Here we find the real explanation of the idea of signaling. **Signaling** is *the structuring of the metaphysical nexus of coexistence in subjective time*²⁶ *as a latent in a succession of appearances of somatic activity fields*. By the noun **latent** I understand *an organized coherence in events made possible by the mental capacity for anticipation*. In Critical metaphysics, anticipation is knowledge through which the OB can recognize and determine *a priori* what belongs to empirical cognition. As an Object, anticipation is an Object of *nous*. Information subsists in the *organized* coherence of somatic activity fields.

This brings to light a particularly interesting and even surprising character of the somatic code. The Objects of somatic appearances *regarded as* the dead-matter objects of biology proper²⁷ contain nothing in their concepts that can properly be called a signal or signaling. Somatic signals *as* signals are the product of *nous-soma* reciprocity. This means that whether or not some particular somatic appearance is a signal depends on the co-development of reciprocal mental structures through empirical experience. I can hardly put it plainer than to say *somatic activities become signals by means of a learning process* and that, prior to this learning experience, a somatic activity is *non-semantic*. Chomsky's concepts of an innate deep structure and an innate surface structure are transcendental illusions. What *is* innate in an OB is the *structuring capacity* of organized being. To study the somatic code is to study its *construction*.

This brings us to Critical phenomenology. What is *phenomenological* matter and what does the heading Critical Phenomenology in applied metaphysics mean? Kant answers both questions:

Matter is the movable insofar as it can be an object of experience as such.

Motion, like everything else that is represented through sense, is given only as appearance. For its representation to become experience we require, too, that something be thought through understanding, namely, besides the mode in which the representation inheres in the *subject*, also the determination of an Object thereby. Hence, the movable, as such, becomes an object of experience when a certain *Object* (here a material thing) is thought as *determined* with respect to the *predicate* of motion. But motion is change of Relation in space. Thus there are always two correlates here, such that either: *first*, the change can be attributed in the appearance to one [of the objects] just as well as to the other, and either the one or the other can be said to be moved because either is equally

²⁶ It is particularly important here to remain aware that subjective time is not the same thing as the objective time that is part of the relative *material* space-time of the mathematical theory of somatic appearances. The former is the pure intuition of inner sense in noetic apprehension and apperception, and this mental capacity is what *makes possible* the representation of an objective (mathematical) time.

²⁷ A dead-matter object is an object for which its concept contains no concept of *life*. Prior to the mid-nineteenth century, biological theory had a long history of vitalism, a view holding that the physics of "living things" (people and, by analogy, animals, plants, etc.) differed in kind from "inorganic matter" because "living" things "possessed" something called "life." The history of vitalism stretches all the way back to Galen the Physician in the second century A.D. and had its roots in Aristotle's philosophy. Life was an occult quality that was regarded as the cause of locomotion, reproduction, respiration, etc. in "living things." But this occult quality explained *nothing*. Claude Bernard ridiculed its usage as "explaining darkness by even greater darkness" in his ground-breaking work *An Introduction to the Study of Experimental Medicine* (1865). Bernard's work established physiology as a science. Today biology is in possession of a nominal definition of life [Thain and Hickman (2004)], but this definition merely states a *convention* of biological conditions under which the term "life" can be employed. Modern biology properly studies biological systems *as dead-matter systems*, and does not study "life" *per se*.

valid; or, *second*, one must be thought in experience as moved to the exclusion of the other; or, *third*, both must be necessarily represented through reason as moved together. In appearance, which contains nothing but the Relation in the motion (with respect to its change), none of these determinations are contained; but if the movable *as such*, namely with respect to its motion, is to be thought as determined on behalf of a possible experience, it is necessary to indicate the conditions under which the object (matter) must be determined in one way or another through the predicate of motion. At issue here is not the transformation of semblance into truth, but of appearance into experience; for by semblance understanding, with its object-determining judgment, is always in play, although it is in danger of taking the subjective for objective; but in appearance no judgment of understanding is to be met with at all [Kant (1786), 4: 554-555].

It is important to understand here that when Kant talks about one or the other object being moved, *material space-time is an object*. That it is the object of a mathematical representation makes not the least difference in regard to Critical phenomenology. The applied metaphysic for objects of outer sense is a relativistic system in a very Einstein-like connotation. Indeed, the topology-structuring character of the pure intuition of space *necessitates* Einstein's basic tenet that the laws of physics must always be expressed in such form as to be invariant to changes in the coordinate system of any metric space geometry used to mathematically express them²⁸.

Phenomenology applied to the psychosomatics of *nous-soma* reciprocity leads to the concept that Modality in the J-SMI pertains to a general process of message construction inasmuch as it is possible for messages *to be* represented through somatic appearances (activity field sequences). However, *functions* of Modality never add one whit of knowledge about the object *as* an object. They always pertain instead to the metaphysical *nexus* of object representation, which is to say that the functional capacity is a capacity for connecting object representation with *subjective* empirical cognizance. Consider one of Chomsky's examples of an ungrammatical sentence:

Furiously sleep ideas green colorless. [Chomsky (1957), pg. 15]

How do I know this sentence is "ungrammatical"? Clearly I can say the words. I would even be capable of generating this string of sounds (or letters). This means I am capable of representing it, which in turn means there is some activity field sequence that is a psychosomatic correlate of the mental Object Furiously-sleep-ideas-green-colorless. Furthermore, all root meanings are practical and this means that this ungrammatical sentence "means something" to *me*. In my case, the object of Furiously-sleep-ideas-green-colorless is, metaphorically speaking, something I toss into a mental wastebasket labeled "gibberish" ("utterances-that-don't-really-mean-anything"). Thus it does appear that this ungrammatical concatenation *does have* a semantic interpretation after all, i.e., "it is gibberish." My (written) utterance of it just now *is* purposive: I *used it* as an example.

We can assume (or at least hope) that no adult who is aware that there are other natural languages besides his own would say that Japanese is "ungrammatical." Consider the following Japanese sentence along with its "literal" (direct word-for-word) translation and one of its "correct" (acceptable English) translations:

²⁸ It is a long-held fallacy that Kant's pure intuition of space implies that "geometry" can only be Euclidean geometry. This is not true and never was true. What is true was that Euclidean geometry was the only one known in Kant's day, he did not himself have the mathematical training to deduce non-Euclidean geometries, and his friend and sometimes mentor, the Berlin mathematician Johann Heinrich Lambert, had studied the problem of the mathematical *Existenz* of non-Euclidean geometries unsuccessfully (that is, without resolving the question). Kant's position was not that non-Euclidean geometries did not exist; his position was he could think of no use for one – a non-mathematician's attitude quite understandable when Euclidean geometry is the only game in town. The pure intuition of space is not an *a priori* geometry; it is a capacity for topological structuring. These two things are not at all the same thing.

Japanese sentence:	<i>Boku no namae wa Kitagawa desu.</i> (Object)
Literal English translation:	I of name as-for Kitagawa is. ("gibberish")
One acceptable English translation:	My name is Kitagawa. ("not-gibberish")

I call this *one* acceptable translation because "Kitagawa is my name" is *also* an acceptable English rendering of this sentence. These translations *represent the same information*.

What Chomsky called a "mapping" of "a syntactically generated structure onto a 'concrete' interpretation" [Chomsky (1964), pg. 9] we can here recognize as a complex determination of Modality in psychosomatic co-representation, in which two sensible utterances are assigned a structure that can be expressed in the form

Boku-no-namae-wa-Kitagawa-desu **means** *My-name-is-Kitagawa* .

In mental physics a *coordinator function* is a constitutive function that links successive actions deriving from the same sensorimotor scheme. An action is a change in appearance. The somatic appearances (activity fields) pertinent to the J-SMI are phonological (in the general context), and for that reason the specifying concept of Modality is called the *soma-phonological coordinator function*. It coordinates activity fields by bringing to them a unity of *nexus* of meaning.

IV. The J-SMI *Momenta* of Quantity

This and the three main sections that follow present the deductions of the *momenta* of the judicial sensorimotor idea. Each section presents three deductions (the J-TSI, J-ESI and J-DOS *momenta*) carried out according to the formulas (1)-(3) stated earlier. The specific psychological Idea, IRP_Y , governing the entire heading is presented first, where $Y \in \{A, B, C, D\}$, and the letters denote Quantity, Quality, Relation and Modality, respectively. Next the relevant *momentum* of transcendental topic, TT_X with $X \in \{T, E, D\}$, is presented (c.f. figure 2). Then the minor transcendental Idea, TI_X , and metaphysical axiom, MA_X , are presented according to the formula

$$TI_X \subset IRP_Y \Rightarrow MA_X .$$

Next the synthesis

$$TI_X + MA_X \xrightarrow{SC(Y)} F_{XY}$$

is presented, where F_{XY} is the J-SMI *momentum*. The *Realerklärung* of the *momentum* F_{XY} is then provided, followed by a synopsis of the deduction.

For Quantity the **major acroam of Quantity** is IRP_A : *unconditioned functional unity of affective and objective perception in sensibility*. The specifying concept is structuring of aggregations of somatic activities, $SC(A)$.

A. The J-TSI *Momentum* of Quantity [$X = T$; $Y = A$].

- TT_T = the intentionally systematic = *the focusing of the energetics of affective perception into the expression of a singular action scheme*.
- TI_T = *judicial entis realissimi = synthesis of all possible aesthetic predicates for expedience for happiness*.
- $TI_T \subset IRP_A \Rightarrow MA_T$: *the somatic activity field at a moment in objective time defines a topological neighborhood set in a soma-phonological topology space*.

- $TT_T + MA_T \xrightarrow{SC(A)} F_{TA} = \text{ somatic phone.}$

Realerklärung: A somatic phone is a determined activity field mathematically represented as a topological neighborhood set. The J-TSI *momentum* F_{TA} determines a neighborhood set of somatic activities to produce a singular activity field.

Synopsis of the deduction: I begin with some definitions. Let x denote a specifically identifiable place in the appearance of *soma* with which a determinable activity (metabolic rate) is associated. The aggregation X of all such places is defined to be the *somatic universe*. The activity at x is called an *element*. A *set* is a singular aggregate of elements. A set $U(x)$ of activities at x and other places, $y \in X$, associated with x is called an activity field. $U(x)$ is by definition a **neighborhood of place x** in a somatic topology \mathfrak{T} [Baum (1964), pg. 20].

In mental physics, a *place* is the innermost boundary, in the empirical space of a real matter regarded as a substance filling this material space, for which actual empirical outer determinations (*measurements*) are possible and within which no empirical outer determinations are possible. The boundary of a place is mathematically fixed by the *empirical uncertainty* of the measurement capacity [Wells (2011a)]. A place is *in* space but cannot itself be regarded as a space because its actual representation requires a Relation of community between two or more empirical places. One cannot, with objective validity, predicate *anything* within the boundary specifying a place because such a predication requires an inner determination that is not measurable. A place in *representation* is therefore in the sort of role played by the notion of a point in geometry and can be regarded as a "point" in set membership theory.²⁹

The acts implicitly referred to in the Idea of *entis realissimi* are acts of reflective judgment in *nous*. In particular, these are the acts of sense of culmination in aesthetical reflective judgment and scheme implication in teleological reflective judgment [Wells (2009), chap. 8]. Judicial *happiness* is the consciousness of the OB of the pleasantness of life uninterruptedly accompanying its whole *Dasein*. Its affective representation is the negation of the feeling of *Lust per se* by a balanced canceling of feelings of *Lust* and feelings of *Unlust* [Wells (2009), chap. 7, pp. 243-247]. Such a cancellation is the judicial condition of equilibrium in organized being. Happiness has been called "the neutral gear of the nervous system" [Aron and Aron (1987)].

Soma has no immediate context with these noetic *momenta*. The somatic *action* corresponding to these noetic acts and representations is, functionally, the focusing of activities into a singular set (the neighborhood set of activities). In Critical metaphysics, *action* is change in appearance of accidents. In the context of Quantity, action implies change in the form of composition of a sensible Object of experience. But the possibility of this necessarily presupposes *a capacity to effect changes*, and this is what is meant by energetic. An *energetic* is *anything that is characterized by having a capacity to be efficacious*.

By the phrase "focusing of activities into a singular set" I mean *determining a specific state of the somatic system* (an activity field) expressed mathematically such that this mathematical state can stand as a principal quantity of Critical mathematics for representing *soma* insofar as this representation pertains to *soma*-semantics. This focusing is, psychologically, affective rather than objective. It corresponds to affective perception and reflective judgment in *nous* because by this

²⁹ The Critical explanation of *place* is derived by applying Kant's Copernican turn to Aristotle's definition of place (*topos*). This is discussed in depth in the transcendental Aesthetic of space in Wells (2006), chapter 17, pp. 1558-1565. Aristotle's idea is very different from Plato's geometrical notion of place and, in point of fact, far more resembles the idea of an "orbital" in quantum mechanics or the idea of a "geodesic" in Einstein's theory. "Place" does not readily admit to description in terms of analytic geometry. Topology is sometimes poetically called "rubber sheet geometry," but a better description of topology in mental physics is "doctrine of place-space."

focusing of somatic activities it becomes possible to express (through motoregulatory expression) a singular somatic action scheme.

The terms semantic and phonological are ideas belonging to the logical division of *nous* and not to the physical Nature of *soma*. The idea of somatic correlates to these ideas is a coordinating *noumenon* of Critical mathematics [Wells (2011a)]. This is why the metaphysical axiom MA_T posits a topology space of somatic appearances. The *momentum* F_{TA} specifies topological neighborhood because the idea of transcendental topic, TT_T , is the singular idea of Quantity in transcendental topic. In topology the neighborhood set is a singular object. It is, metaphorically speaking, a "molecule" of a topological space. The J-TSI *momentum* is therefore a singular function. A **somatic phone** is a determined activity field neighborhood set and F_{TA} is the function for determining somatic phones.

B. The J-ESI *Momentum* of Quantity [$X = E$; $Y = A$].

- $TT_E =$ the intentionally contextual = *differentiation of empirical meanings as a structure of sub-schemes of sensorimotor actions*.
- $TI_E =$ judicial Axioms of Intuition = *all intuitions are extensive magnitudes*.
- $TI_E \subset IRP_A \Rightarrow MA_E$: *aggregating contextually associated somatic phones composes the extensive magnitude of a meaning differential*.
- $TT_E + MA_E \xrightarrow{SC(A)} F_{EA} =$ **somatic phoneme**.

Realerklärung: A **somatic phoneme** is the somatic appearance of a meaning differential, i.e., the appearance makes a difference in meaning implications. F_{EA} composes somatic phonemes.

Synopsis of the deduction: The deduction of the J-TSI establishes topology as the form of composition for the somatic code. However, the conventional view of topology can be called a static view in the sense that mathematics provides definitions and theorems by which one can *recognize* a topology when presented with one but, so far as I know³⁰, does not present a doctrine for *how to construct* a topology. Quite obviously mathematicians *do* construct topologies. *How* they do so is a dark craft so far as the rest of us are concerned. It is, however, quite easy to see the hole in formal topology theory that prevents this theory from expressing how topologies are constructed *by an OB*. In Quantity, topology theory's basic definitions contain ideas of singular Objects and integrated Objects but not the idea of differentiation, even though the possibility of differentiation is implicit in the axiom of subsets and the fact that mathematicians make routine *use* of subsets in topology theory. The axiom of subsets is:

For any set s and any predicate \wp which is meaningful ("definite") for all elements of s , there exists the set y that contains just those elements x of s which satisfy the predicate \wp (the condition $\wp(x)$). [Bernays (1968), pg. 11]

In view of the smothering effects of authoritarian Bourbaki-Hilbert orthodoxy in formalism, it is not difficult to understand why topology doctrine stands mute on the subject of a doctrine of topology generation. Fraenkel tells us,

The weak point in this formulation of the axiom [of subsets] is the term "meaningful predicate" (or property) . . . Informally this term may be understood to mean that, for each

³⁰ I am not a professional mathematician but, rather, a professional applier of mathematics. It might well be true that tucked within the community of mathematicians somewhere there is some anonymous community of specialists whose expertise is devoted to how to generate topologies. If so, it would be to the benefit of a great many of us if this community would make its *Dasein* known to the rest of us, and an even greater benefit if it would produce a basic textbook on the topic – one *not* written in the style of formalism.

$x \in s$, $\exists(x)$ should be either true or false, without demanding that the decision ought to be reached at the present stage of scientific development. Thus, " x is transcendental" is meaningful when s is a set of numbers, but not " x is finitely definable" or other semantic conditions, as those appearing in the antinomies of the semantical type. Clearly, such deductions cannot satisfy the requirements of a formal deductive theory. [*ibid.*]

To this I will add as a side note that " x is true" and " x is false" = " x is-not true" is not a complete set of Quality functions. They can suffice for analysis but not for synthesis because synthesis always requires three *momenta* of representation under each heading of Quantity, Quality, etc. In this case, the missing function is the subcontrary function, " x is not-true/false" (i.e., x is formally-undecidable). Critical mathematics is a mathematical doctrine for *synthesis*. The "antinomies of the semantical type" refer to, e.g., the Russell paradox and other magnetic mines that finally sank the efforts of Russell, Hilbert, *et al.* to achieve that mathematical *certainty* which was the long-standing ideal of the ontology-centered rationalist metaphysics at the core of the "crisis in the foundations" mathematics suffered at the end of the 19th and first few decades of the 20th centuries. With that failure, the official orthodoxy of mathematics became *skeptical* ("math isn't about anything; it's just a game with rules") and mathematicians unwittingly made themselves companions to David Hume and George Berkeley as targets for the ridiculing witticisms of those 18th century British comedians who lampooned Berkeley and Hume with the jest, "No matter; never mind." The history of mathematical formalism and that of British empiricism are, oddly enough, twin histories in many ways. As Santayana famously wrote, "Those who cannot remember the past are condemned to repeat it" [Santayana (1905), pg. 284].

TT_E is called the anatomical idea and is the idea of particular aggregations. The judicial form of the Axioms of Intuition, TI_E, speaks to the composition of intuitions in sensibility. Now, the applied metaphysic of the somatic code does not *immediately* deal with the composition of intuitions but it does have to deal with the undetermined *object of appearance* an intuition represents in sensibility. TI_E obtains its connection with somatic objects through being subsumed under the psychological Idea, IRP_A. *Unconditioned* functional unity of affective and objective perception reaches out, through *psyche*, to require that the coordinating *noumena* of *soma* also fall under the requirement for functional unity. In particular, the connection is required by the animating principle of noetic organization in *psyche* [Wells (2009), chap. 4, §3.6], the idea of which is illustrated by the cycle of affective interactions illustrated in figure 4. The term *kinaesthetics* in figure 4 refers to the receptivity of *psyche* for determinations in sensibility, particularly in the synthesis of the pure intuition of subjective space³¹, regarded as originating in appearances of *soma*. Loosely speaking, kinaesthetics refers to what one can call *body feedback*.

The synthesis of perception in sensibility can be functionally regarded as an active process of accretion in the formation of intuitions and the empirical consciousness of affective perceptions. Figure 5 illustrates this accretion process idea. The synthesis occurs as a three-step process of acts

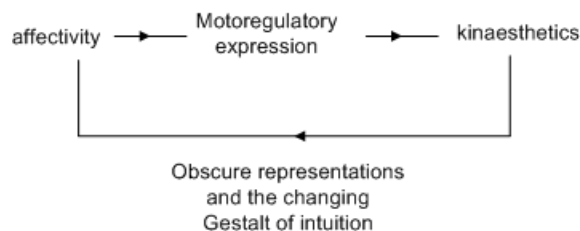


Figure 4: The cycle of affective interaction for noetic organization in *psyche*.

³¹ Again, the pure intuition of subjective space is a *topological* synthesis.

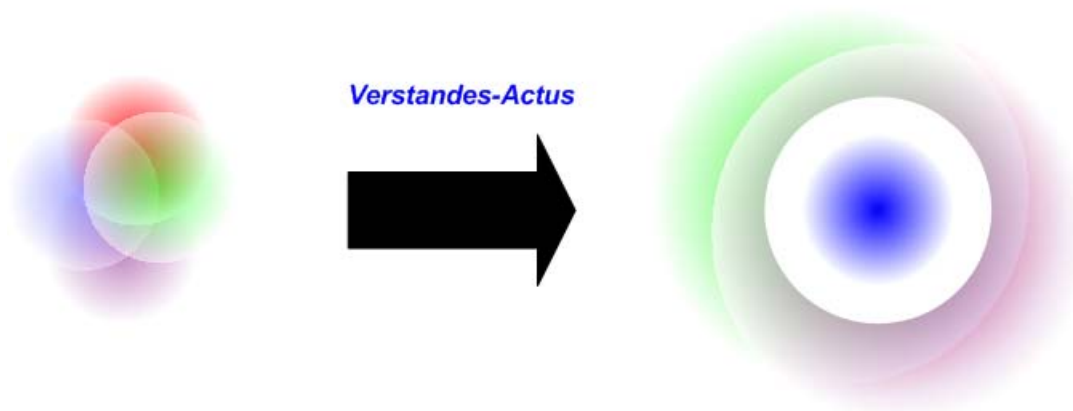


Figure 5: Illustration of the idea of the synthesis in sensibility as an accretion process. The representational *materia* undergoing accretion are obscure representations of sense (unconscious representations). The acts of understanding (*Verstandes-Actus*) refers to a three-step process of: (1) constructing mathematical compatibility classes; (2) constructing, from these, mathematical equivalence classes; and (3) performing an abstracting process (dissipation, a kind of "repulsion"). The process is judged by reflective judgment.

of understanding (*Verstandes-Actus*). These are briefly explained in the figure caption. Accretion as represented in this figure corresponds to the obscure representations and changing *Gestalt* of intuition in figure 4.

What one might call the "semantic comets and asteroids" of this accretion process are the somatic phonemes. In linguistics a phoneme is the smallest unit of sound that makes a difference in meaning. For example, the sound denoted in the English alphabet by the letter *r* is a phoneme. That linguistic phonemes have semantic context is nicely illustrated in an example provided by Kolln and Funk:

Every language has its own inventory of distinctive sounds, or phonemes. Many of our three dozen phonemes are the same as those of other languages, but the sets for even closely related languages are not identical. Imagine the following conversation with a student from Venezuela:

Joe: How was your trip, José? Did you fly?

José: No, I came by sheep.

Joe: You mean "ship."

José: That's what I said – "sheep."

In pronouncing *ship* exactly like *sheep*, José is imposing the phonemes of Spanish on his pronunciation of English. In English the vowel sound in *ship* is different from the vowel sound in *sheep*. But Spanish does not have both of these vowel sounds, so the difference between them makes no difference in meaning. [Kolln and Funk (1998), pp. 401-402]

One thing the phenomenon of "foreign accents" demonstrates is that vocalization by human beings involves learned sensorimotor schemes. Intuitions play a necessary role in the synthesis of such schemes because the action of expressing the scheme is the expression of a meaning implication. Intuitions are *made symbolic of* meaning implications in the noetic synthesis of comprehension in sensibility, and this illustrates the context of TI_E and the significance of MA_E for the J-ESI of Quantity. The *Realerklärung* of F_{EA} follows immediately from this.

C. The J-DOS Momentum of Quantity [$X = D$; $Y = A$].

- TT_D = the intentionally organized = *intent can serve only to organize perception through the generalization of action schemes.*

- $TI_D =$ judicial cosmological Idea = *absolutely complete equilibrium in judgmentation through the suppression or equilibration of innovations.*
- $TI_D \subset IRP_A \Rightarrow MA_D$: *empirical apperception in sensibility at a moment in time occurs if and only if a representation in sensibility is made significant.*
- $TT_D + MA_D \xrightarrow{SC(A)} F_{DA} =$ **somatic morpheme.**

Realerklärung: A **somatic morpheme** is an aggregation of activity field appearances in objective time for which a semantic representation in *nous* has been signified. The aggregation is called a neighborhood system structure. The J-DOS *momentum* F_{DA} composes this structured system of somatic activities in producing an activity field topology \mathfrak{T} .

Synopsis of the deduction: The first two *momenta* of Quantity are the identification and differentiation functions. Because any *momentum* under a specific heading can always be regarded as the synthesis of the other two, the J-DOS *momentum* is an integration function. TT_D regulates for universality in Quantity and so is a structuring function for form of composition. The TT_D bases its *Realerklärung* on the transcendental category of totality (which is a primitive function of representation in Critical epistemology [Wells (2009), chap. 5, §4]). It is a *momentum* for structuring an aggregate of activity fields as an integrated and systematic whole.

An **innovation** is a condition of *Existenz* in which there is an incongruence of fact with anticipation. A **fact** is a phenomenon for which the representation in the manifold of concepts (in *nous*) is connected with the assertoric logical *momentum* of Modality to other concepts that give it a context. *Anticipation* is knowledge through which the OB can recognize and determine *a priori* what belongs to empirical cognition. An anticipation is a **parástase** [Wells (2011e)], that is, the determined outcome or "depiction" of a noetic act of representation. In particular contexts, an anticipation can be called an expectation, an empirical categorization, a classification or a characterization.

TI_D mandates actions by which: (1) the continuation of an innovation is not tolerated by the dynamics of the process of judgmentation; and (2) disturbances felt in affective perceptions constitute energetics in stimulating the judgmentation cycle. Motoregulatory expression is part of this judgmentation process and so the two animating principles of self-organization (in *psyche*) are brought into action by this process [Wells (2009) chap. 4, §3.6]. The first is the animating principle of somatic organization: **motivation** is *accommodation to perception and motoregulatory expression is its assimilation*. The second is the animating principle of noetic organization: **equilibration** is *the activity leading to closure of the cycle of affective interaction in a state of equilibrium*. The equilibration activity ceases when the disturbance is removed or suppressed, a condition that marks what Piaget called "perceptual signification." **Significance** is the form in which perception is subsumed under a meaning implication. The synthesis of its composition (of objective partial representations with aesthetic feeling as matter of desire) is called a **signification**. The representation (*parástase*) in sensibility is therefore said to be *significant*. It is through these principles of mental physics that the MA_D implicates *somatic* actions in conformity and co-determination with *noetic* acts of judgmentation.

A *parástase* in sensibility is a represented unified manifold of a complete phoronomic context. Its appearance is called a **Semantic** [Wells (2011d)]. This means it is an appearance of *soma* for which there is a reciprocal signification represented in cognition in *nous*. The representing intuition is an aggregation of antecedent intuitions and reproduced concepts from a string of prior moments in subjective time. Now, the somatic object corresponding to each of these is an activity field, each activity field is a topological neighborhood, and so the aggregation of activity fields in a composed whole is a constituting act of composing a *system of neighborhoods* – a topology.

In linguistics a morpheme is a sound or combination of sounds with meaning. Using this as an analogy, the combined whole of a neighborhood system *structure* is called a somatic morpheme. The F_{DA} function is the function composing this structure.

V. The J-SMI *Momenta* of Quality

The psychological Idea of Quality, IRP_B , is the major regulative acroam of Quality in the J-SMI. The psychological Idea is: unconditioned unity in compatibility, i.e., *the division between objective and affective perceptions is merely a logical division and only their combination makes up a complete state of conscious representation*. On the empirical side of science, the specifying concept of Quality in the J-SMI (accretion and dissipation of activity fields) is a concept belonging to Kantian dynamics, as explained earlier.

A. The J-TSI *Momentum* of Quality [$X = T$; $Y = B$].

- $TT_T =$ demand for agreement = *the placing of the demand for judicial happiness in an act of reinforcement of an already existing state-of-being*.
- $TI_T =$ judicial *ens originarium* = *happiness is the original Quality in the affective state-of-being from which all desires are derivative as limitations*.
- $TI_T \subset IRP_B \Rightarrow MA_T$: *the OB experiences a positive learning event when the synthesis in apprehension produces a coalition of activity field appearances in which an affective state of satisfaction accompanies a recognizable intuition*.
- $TT_T + MA_T \xrightarrow{SC(B)} F_{TB} = \mathbf{binding}$.

Realerklärung: **Binding** means to make an association of one or more activity fields to produce a somatic phone, phoneme or morpheme. The J-TSI *momentum* F_{TB} is the psychosomatic binding function of *nous-soma* reciprocity.

Synopsis of the deduction: Critical **satisfaction** (in German, *Wohlgefallen*) is a feeling that, although positive in its affective perception, is satisfaction regarded in a somewhat negative context, namely, as a feeling describable as "not-bad." Although we habitually tend to think of the idea of "satisfaction" in terms of something "being good," in Critical epistemology this positive affirmation is invalid because it presupposes the OB has innate *objective* ideas (which was the flawed metaphysical presupposition of ontology-centered rationalist philosophy). This is not so; the OB has *no a priori innate objective ideas or concepts whatsoever*. A newborn human infant has not yet developed any manifold of concepts (other than whatever concepts might be possible for it in the weeks immediately prior to birth). Infants do not reason; they *feel*. Affectivity initially drives cognition until the manifold of concepts is sufficiently built up so that the co-determinations of reflective judgment and determining judgment contain more balanced contributions of both subjective and objective representation in the free play of imagination and understanding. Without original objective concepts, the originating source of objective understanding can come from nowhere else but the subjectivity of the OB's earliest perceptions. Put in simpler terms, the OB has no original objective ideas of "what *is* good" but does have a *subjective* capacity for affective equilibrium – hence satisfaction is "feeling not-bad"³². The

³² In transcendental Logic there is an important distinction between the predications $\langle X \text{ is-not bad} \rangle$ and $\langle X \text{ is not-bad} \rangle$. The first predicates that "being bad" *contradicts* "being X" and, therefore it must be true that $\langle X \text{ is good} \rangle$. The second merely predicates that "being bad" is *contrary* to "being X" but does not necessarily imply that $\langle X \text{ is good} \rangle$. The first makes a transcendental affirmation about the logical subject X, the second merely *limits the sphere of predications* that can be made about the *Existenz* of X.

distinction is a subtle yet important one in Critical epistemology.

Judicial happiness is, again, the negation of feelings of *Lust per se* and the judicial condition of equilibrium for the OB – the Arons' "neutral gear of the nervous system." When this condition is not met, it means that either the feeling of *Lust* or else the feeling of *Unlust* is more intensive (has a greater degree) than the other feeling. The demand for agreement (TT_B) orients the actions of the OB as a sort of positive-feedback regulation. This is to say that perfection of the balance between the feeling of *Lust* and the feeling of *Unlust* is sought through "more of what already is" and, when the balance is achieved, "maintaining what already is." In terms of appearances of *soma*, this means a particular and already-partially-presented configuration of somatic activities is to be reinforced and coalesced into the unified activity configuration. The activities are then said to be "bound together." Achievement of this binding is a condition on appearance expedient for apperception of a state of equilibrium and, therefore, for the presentation of an empirical intuition that is associated with the condition of formal expedience for equilibrium. Such an intuition is a *recognizable* intuition, which means it is an intuition suitable for being synthesized (by the synthesis of re-cognition) to produce a concept in the manifold of concept.

It is noteworthy that Freud postulated a principle, his famous *Lustprinzip*³³, similar in many ways to the principle being discussed here. Freud wrote,

In the psycho-analytic theory of the mind, we take it for granted that the course of mental activities is automatically regulated by the *Lust*-principle: that is to say we believe that any given activity originates in an unpleasant state of tension and thereupon determines for itself such a path that its ultimate issue coincides with a relaxation of this tension, i.e., with avoidance of *Unlust* or with the production of *Lust* . . .

We are not interested in examining how far in our assertion of the *Lust*-principle we have approached to or adopted any given philosophical system historically established . . . We cannot, however, profess the like indifference when we find that an investigator of such penetration as G. Th. Fechner has advocated a conception of *Lust* and *Unlust* which in its essentials coincides with that forced upon us by psycho-analytic work. Fechner's pronouncement . . . reads as follows: "In so far as conscious impulses always bear a relation to *Lust* or *Unlust*, *Lust* or *Unlust* may be thought of in psycho-physical relationship to conditions of stability and instability, and upon this may be based the hypothesis I intend to develop elsewhere: viz. that every psycho-physical movement rising above the threshold of consciousness is charged with *Lust* in proportion as it approximates - beyond a certain limit - to complete equilibrium, and with *Unlust* in proportion as it departs from it beyond a certain limit; while between the two limits which may be described as the qualitative thresholds of *Unlust* or *Lust*, there is an area of aesthetic indifference [Freud (1921)].

The Critical difference between Freud's principle and mental physics is that **both** *Lust* and *Unlust* are disturbances of equilibrium and that equilibrium subsists in their affective co-cancellation. One can regard the feeling of *Lust* as a moving power of attraction (positive feedback regulation) and the feeling of *Unlust* as a moving power of repulsion (negative feedback regulation). The latter is discussed in the next sub-section. Affectively, equilibrium is a balance of attraction and repulsion.

Binding is the "attraction" idea of Quality in the J-SMI. A somatic phone is a binding of activity places in an activity field. A somatic phoneme is a binding of activity fields. A somatic

³³ It is also important to be aware that the German word *Lust* (pronounced "loost") does not mean the same thing as the English word "lust," nor does it properly translate as "pleasure" – which is one of the most common mistranslations of both Kant and Freud that one encounters. Like *Gestalt*, *Lust* does not "travel well" into English and the English language has no equivalent word for it. This is discussed at length in Wells (2006), chap. 15. It takes this paper too far afield to go into those details, so the reader should consult this citation if he wishes to learn more about this.

morpheme is a binding of a structure of activity fields.

This mathematical idea can be exhibited by calling upon a neurological picture proposed by Damasio. He called this architectonic schema "convergence zone" (CZ) architecture [Damasio (1989a, b)]. Damasio wrote,

The experience of reality, in both perception and recall, is spatially and temporally coherent and "in-register." Features are bound together in entities, and entities are bound in events. The properties of these entities and events, however, are represented in many different regions of the brain that are widely separated. The degree of neural parcellation is even greater when we consider that the perception of most entities and events also requires a motor interaction on the part of the perceiver (such as eye movements and hand movements) and often includes a recordable modification of the perceiver's somatic state. The question of how the brain achieves integration, starting with the bits and pieces it has to work with, is the binding problem. [Damasio (1989b)]

Figure 6 is an illustration of Damasio's architectonic schema. He proposes a number of brain regions located in the neocortical lobes, sub-cortical structures associated with cognizance of affectivity (e.g. limbic system structures), and cortical, sub-cortical and non-cortical regions associated with motor actions [Damasio (1989a)].

Although there are many details of the Damasio architectonic schema that still remain vague in regard to specific neural anatomy, the model is congruent with mental physics and illustrates the ideas discussed here. The ovals and connecting lines depicted in the figure represent connected brain regions and Damasio's hypothesis specifically names learning events, which he views in terms of establishing neural connections, as a necessary component of the architecture. His neurological picture of "binding" is compatible with the idea of binding in the J-SMI.

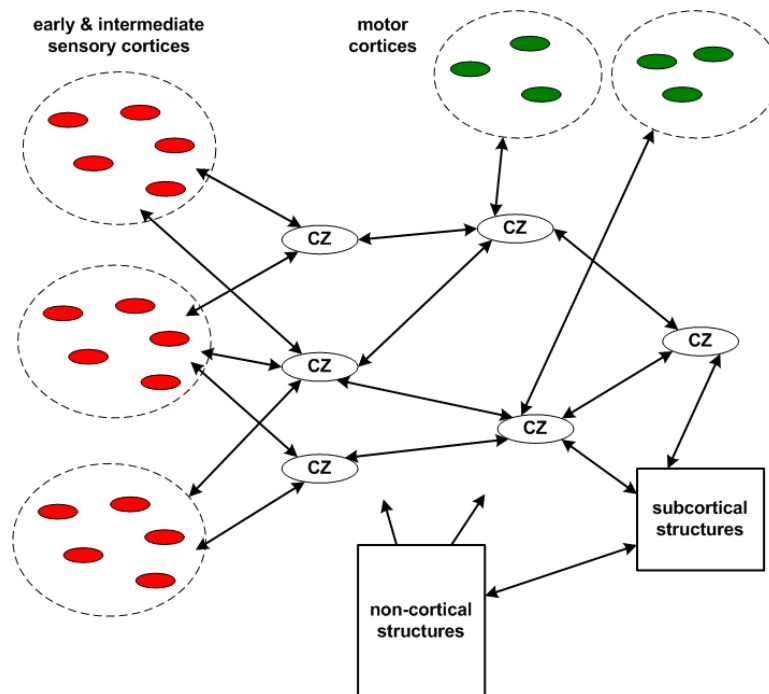


Figure 6: Illustration of Damasio's convergence zone architecture hypothesis. CZ = convergence zone. The subcortical and non-cortical structures include structures associated with the reticular activating system and the limbic system. Note that the model incorporates perceptual, motor, and affective brain structures.

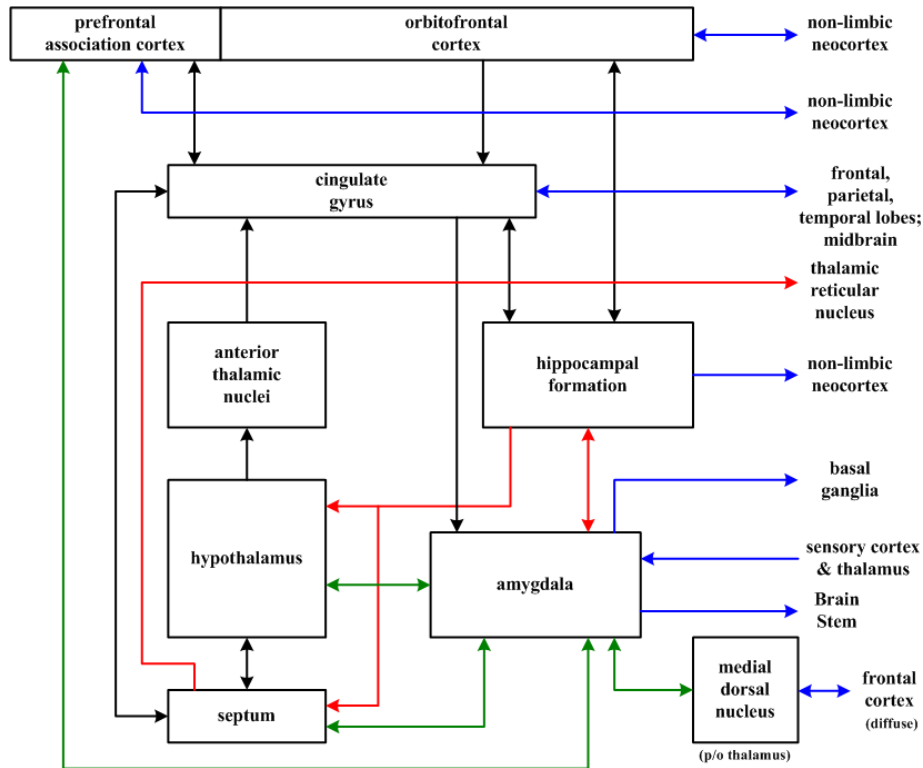


Figure 7: One neurological model of the limbic system in the human brain.

One point I wish to specifically emphasize here is the inseparable role in Damasio's model played by brain regions that are psychophysically linked (by empirical neuropsychology) to both learning capacity and subjective cognizance (i.e. "emotions" and "feelings" so-called). In particular, that part of brain anatomy called the *limbic system* (figure 7) is featured quite prominently in Damasio's hypothesis. The applied metaphysic of the J-SMI requires that affective processes be regarded *necessarily* as part of the binding (and, also, of the unbinding) dynamics of *nous-soma* reciprocity. The J-SMI supplies what neurological modeling by itself cannot, namely the semantics of somatic appearances. It also says that binding connections are dynamic rather than merely static (fixed) connections. This is a point raised by Malsburg in his mathematical hypothesis of "dynamic link architectures" [Malsburg (2003)]. Also worth noting is that Malsburg's mathematical picture of the coding problem conjectures that connectivity (that is, binding) is topological in its mathematical character [Malsburg (1981)].

In closing this sub-section, there is one more point I wish to note. The Damasio architectonic is *congruent* with mental physics but this is not the same thing as saying it is the *complete* somatic model nor even that neurological aspects of the anatomical brain comprise the complete model. One thing that neural science omits from its topic is the endocrine system of *soma*. There is no *a priori* Critical ground for presuming the endocrine system and non-central-nervous-system parts of the anatomy and physiology of *soma* can be ignored as possible somatic correlates in the somatic coding system.

B. The J-ESI Momentum of Quality [$X = E$; $Y = B$].

- TT_E = demand for opposition = *the placing of the demand for judicial happiness in an act of negation of an already existing state-of-being.*
- TI_E = judicial Anticipations of Perception = *the intensive magnitude (degree) of sensation*

presents the complete condition for marking sensibility at a moment in time.

- $TI_E \subset IRP_B \Rightarrow MA_E$: *the condition for perception is produced by a process of competition among activities in the activity field by which some somatic activities are quenched and others are not.*
- $TT_E + MA_E \xrightarrow{SC(B)} F_{EB} = \mathbf{unbinding}$.

Realerklärung: Unbinding means to make an activity field association by means of competition among activities. The J-ESI *momentum* F_{EB} is the psychosomatic unbinding function of *nous-soma* reciprocity.

Synopsis of the deduction: The measure of an activity is its empirical degree. Competition among activities means that a degree of activity in one place acts to reduce the degrees of activity in other places (co-inhibition of activities). In the language of neural network theory, this idea is presented by what are called competitive networks. The idea of the need for competition as a consequence of psychological postulates was first proposed by Grossberg in a mathematical theory called *embedding field theory* [Grossberg (1968, 1969, 1971)]. The mathematical formalism of MA_E is more or less the same as Grossberg's other than for the explicit role of set membership theory in Critical mathematics. In most respect, Grossberg's work can and should be regarded as a concrete instantiation of the metaphysical axiom stated here. Grossberg's theory produces a number of mathematically interesting consequences and conditions that he detailed in another work [Grossberg (1973)]. It is more truth than pun to say Grossberg did Quality work.

The act of negation expressed in TT_E implicates for somatic appearances a pruning operation. Known facts about brain development, especially during childhood, are consistent with this. One of the primary consequences of the Quality *momenta* of the J-SMI is emergence of semantic representations from somatic events that, mathematically, are continuous in objective time. That experience implicates such a representation of somatic *continua* by discrete symbols was a topic Grossberg (1969) treated at length in the context of language. He wrote,

One of the most vital uses of language is to report our sensory experiences, such as variations in tactile pressure, light intensity, loudness, taste, etc. Many of these sensory impressions seem to vary in a continuous way both in space and time. A basic characteristic of much sensory experience is that it seems to be *spatio-temporally continuous*.

Yet, we successfully use language, which seems to be quite spatio-temporally discrete, to express – or represent – sensory experiences which seem to be spatio-temporally continuous. The representation by language of sensations requires that the two kinds of phenomena interact, and so, mathematically speaking, we must envision the interaction of spatio-temporally discrete and continuous processes of such a kind that the relatively discrete process provides an adequate description of the relatively continuous process. Moreover, although each sensory modality seems to provide us with essentially different varieties of experience, the very same language tools are adequate for describing at least the rudiments of all these various modalities. Thus, the discrete representation of continuous processes must be a *universal representation* of some kind. For this reason, we expect conclusions about the dynamics of language behavior to generalize to many other psychological phenomena. [Grossberg (1969)]

Grossberg concluded that the phenomenon of learning is to be regarded as a bridge from continuity in representation to discreteness in representation. He posited what he called a "pyramid of discrete acts" through which progressively more abstracted and complex phenomena emerge as a natural consequence of learning. This hypothesis is not only in full accord with a basic thesis of Piaget's development theory but is also grounded by the J-SMI metaphysic. If one

steps back a little from the details, this process of pyramiding successive discretization is in appearance the appearance of unbinding operations ("cuts") in the structuring of semantics.

C. The J-DOS *Momentum of Quality* [$X = D$; $Y = B$].

- $TT_D =$ demand for equilibration = *the placing of the demand for judicial happiness in the balancing of the demands for agreement and opposition.*
- $TI_D =$ judicial Idea of cosmological Quality = *absolute completeness in a common ground of beliefs in all reflective judgments.*
- $TI_D \subset IRP_B \Rightarrow MA_D$: *absolute completeness in a common ground of beliefs in all perceptions is possible if and only if meaning implications are specific limitations of Meaning in general by means of the suppression or equilibration of innovations.*
- $TT_D + MA_D \xrightarrow{SC(B)} F_{DB} =$ **punctuating.**

Realerklärung: **Punctuating** means to make an association of somatic phones, phonemes or morphemes that reflect *unbinding marks within a unified activity field sequence* that limit the scope of meaning implications for the sequence as a whole. F_{DB} composes punctuations.

Synopsis of the deduction: In Critical terminology a **belief** is a conscious representation with *unquestioned* holding-to-be-binding on grounds of a subjectively sufficient condition. Beliefs, in other words, are products of subjective (which is to say, reflective) judgment. Every intuition, at the moment of its making, can be called a *belief of the moment* in subjective time. Belief representations are afterwards employed as *anticipations* until upon some occasion the anticipation is met by an innovation. When that occurs, the belief is said to be *questioned*. However, the possibility of having an innovation cognized as an innovation necessarily presupposes that the scope of meaning implications contained under a belief has limitations. The issue then is: how are limitations to be represented?

We tend to take punctuation marks (blanks, periods, commas etc.) for granted in written Western languages. The same is true phonetically in spoken languages (breaths, changes in pitch or intonation, etc.). Yet without punctuating marks that break up ("chunk") the components of language, we encounter many ambiguities and a considerable level of equivocation. By reducing equivocation, punctuating *symbols* delimit the real meanings that a particular *message* conveys. This is the role of the punctuating function F_{DB} in the J-DOS of Quality.

VI. The J-SMI *Momenta of Relation*

The psychological Idea of Relation, IRP_C , is the major regulative acroam of Relation in the J-SMI. The psychological Idea is: *unconditioned unity of all relationships is grounded in the a priori anticipation of the form of connection of perceptions in time according to the modi of persistence, succession, and coexistence.* On the empirical side of science, the specifying concept of Relation in the J-SMI (*soma-syntactical generator functions*) is a concept belonging to Kantian mechanics. Relation in the J-SMI can be called **psyche-semantic Nature**. The transcendental topics of Relation pertain to the *point of origin* of sensuous perception, i.e., determination of sense [Wells (2009), chap. 8, pp. 324-325]. Reflective judgment *affectively contextualizes* sensibility. It does so through either motoregulatory expression, receptivity, or through the ratio-expression of pure Reason. This is to say that transcendental topic in Relation is concerned with constituting the function of judgmentation and the motivational dynamic of *nous*. To "place" the point of origin means to determine where the conditioning agency of actions of the Organized Being lies: (1) internal (*nous* → *soma*, psychosomatic expression); (2) exterior (*soma* → *nous*,

psychonoetic receptivity); or (3) interior ($nous \rightarrow soma \rightarrow nous$, psycho-reflective reciprocity).

A. The J-TSI Momentum of Relation [$X = T$; $Y = C$].

- TT_T = the internal agent-patient Relation = *the conditioning ground of action lies in nous as agent for changes in soma as patient.*
- TI_T = judicial *ens summum* = *aesthetic context in the presentation of Reality is connection in a manifold of Desires.*
- $TI_T \subset IRP_C \Rightarrow MA_T$: *the anticipation of symbols is necessary for the possibility of regarding activity fields as appearances of somatic objects.*
- $TT_T + MA_T \xrightarrow{sc(c)} F_{TC} = \text{symbolizing.}$

Realerklärung: A **symbolizing** Relation is the making of a material *nexus* of activity fields that grounds the notion that somatic activities carry information. The J-TSI momentum F_{TC} is the psychosomatic agency function of *nous-soma* reciprocity.

Synopsis of the deduction: A **symbol** is an intuition insofar as it is a means of expressing a meaning through concepts. A symbol is given a meaning through the presentation of an object. With respect to *nous*, the presentation of an object is an intuition at a moment in subjective time. To say this presentation is given a meaning means that its representation is connected, through affective perceptions, to the expression of some motor action. Action, however, denotes change in appearances and so its somatic appearance necessarily presumes an objective time-trajectory in the material space-time of activity fields.

Activity fields undergo changes in objective time, but meaningful representation (symbolism) depends on these changes being so mechanically linked to one another that the establishment of one activity field $F_A(t_A)$ at objective time t_A leads to the emergence of another one, $F_B(t_B)$, at objective time $t_B > t_A$. It is this *imparting* of activity field change that somatically accompanies the possibility of the *cognitive* persistence in *subjective* time that is called *object cognizance*.

However, it must be emphasized that symbolizing does not pertain to succession in time (as causality & dependency) but pertains instead to persistence in time (substance & accident). In this regard, it is crucial to keep in mind that objective time is merely a mathematical parameter – a coordinating *noumenon* of transcendental theory – and objective time *per se* is constituted from *secondary* quantities in facet B (the "mathematical world"). The principal quantity of objective time consists of *measurements* belonging to a common set membership solution set [Wells (2011a)]. This has two consequences that mathematical physicists are likely to feel comfortable with but which non-physicists are likely to feel very uncomfortable with.

The first is: because objective time belongs to facet B and is not a physical entity of any sort, there is nothing that prescribes *a priori* either a *direction* in time (past-to-future) *nor even that objective time must be one-dimensional* (a "timeline" instead of a "timescape"). Objective time, which is an object of rational *theory* rather than empirical *experience*, can "run forward" (past-to-future) or, just as readily, "run backwards" (future-to-past). It makes no difference whatsoever which way theory treats it because objective time is not an object of any possible human experience. There is, however, a constraint this imposes on *theory*, namely: if a theory produces *measurable* differences of principal quantity – measurable difference meaning that a forward-in-time solution belongs to one solution set and a backwards-in-time solution belongs to a different solution set – *then the theory itself is wrong*. This is nothing more and nothing less than a *general relativity principle* imposed on mathematics by Critical metaphysics. Every objectively valid somatic symbol is bound to this principle.

This brings us to the second mathematical consequence. It is mathematically possible for a single mathematical theory to produce *mathematically* different secondary quantity trajectories in activity-field space-time. There are many nonlinear equations that exhibit this property. One of the simplest examples of non-uniqueness is the equation $\sqrt{4} = \pm 2$. Associated with each such mathematical secondary-quantity-trajectory is some principal quantity (otherwise the trajectories could not be measurable). If the theory produces measurably different principal quantities, quite irregardless of whether objective time is "run forward" or "run backward," then, again, *the theory is wrong*. Objectively valid mathematical theories produce results for which the principal quantities all belong to the same set theoretic solution set. This, too, is a general relativity principle imposed on mathematics by Critical metaphysics³⁴. Hypothetical mathematics is already in possession of a theoretical doctrine that should be capable of expressing this principle in mathematical form, namely Robinson's theory of non-standard analysis [Robinson (1996)].

Getting back to the topic at hand, the symbolizing Relation is the transcendental ground for saying "somatic activities carry information." In this context it can be regarded as a law of spatio-temporal substance in the connotation of "substance" as "the heart of the matter; the central, most meaningful aspect of a situation or a communication" [Reber (2001)].

B. The J-ESI Momentum of Relation [$X = E$; $Y = C$].

- TT_E = the exterior agent-patient Relation = *the conditioning ground of action lies in soma as agent for changes in nous as patient*.
- TI_E = judicial Analogies of Experience = *experience is possible only through the representation of a necessary connection of perceptions*.
- $TI_E \subset IRP_C \Rightarrow MA_E$: *natural trajectories in material space-time of topological activity fields obey the psychic principle of Margenau's law*.
- $TT_E + MA_E^{SC(C)} \rightarrow F_{EC}$ = **concatenating**.

Realerklärung: A **concatenating** Relation is the synthesizing of a union of topological structuring and order structuring that defines an activity field trajectory in the material somatic space-time of activity fields. The J-ESI momentum F_{EC} is the psychonoetic agency function of *nous-soma* reciprocity for connecting somatic appearances in the *modus* of succession in time.

Synopsis of the deduction: When the necessary connection of perceptions is placed in the context of soma-syntactical generator functions, the schema of transcendental Idea for Analogies of Experience is that expressed by the judicial Second Analogy, *viz.*, *all actions of an OB follow a principle of acting to extinguish the intensive magnitude of Lust per se*. The principle of *Lust per se* is the fundamental principle of the division of *psyche* governing adaptation to a state of equilibrium in the OB [Wells (2009), chap. 4]. The implications of this context of the Rational Physics of Relation are somewhat subtle.

First, this transcendental Idea seems to speak to the idea of "final outcomes" (a teleological "because") but also seems to stand silent on *how* such an outcome is to be effected. At the same

³⁴ So far as I know, physics' theory of quantum electrodynamics is in accord with this relativity principle. Also, again so far as I know, it is the only major existing scientific theory that can make this claim. QED theory employs a host of exotic secondary quantities, e.g. "virtual photons" not restricted to the velocity of light and which "exist" (mathematically) for so brief an interval in objective time that they are not measurable. QED also employs the backwards-in-time concept, e.g., a positron is an electron moving backwards through (objective) time. QED theory obtains its principal quantities through a process called "renormalization" [Isaacs (2000)].

time, the transcendental topic for the J-ESI *momentum* places the conditioning ground of actions in the logical division of *soma* where teleological causes are impermissible and only so-called efficient causes can have objective validity. At first glance this seems to present an antinomy, but the clue for resolution of this issue also lies inherent in the *momentum* of transcendental topic when transcendental topic is taken into the context of succession in time.

The synthesis of transcendental topic with the transcendental Idea produces a condition constraint on the concept of the J-ESI *momentum*. The transcendental Idea is a regulative principle of *nous* and, in the context of the specifying concept, a regulative principle of generator action. Concurrently, the transcendental topic pertains to Relation involving multiple objects of sense because TT_E is bound to *action* and, thus, to *change*. The condition constraint pertains to *what is necessary for the possibility* that a teleological cause (a "purpose") could *present in appearance* as an efficient cause.

This, however, is not the first time science has had to face this question. The situation has been understood in and illustrated by physics for a very long time. In physics many physical laws, including some of the most fundamental ones, are expressed in the form of integral equations. This happens quite a bit, for example, in field theories. Probably the finest example of this is the law of physics originally known as "the law of least action" and more typically known today as Hamilton's principle [Goldstein (1980), pp. 36-37]. The precise statement of this law is best made using the language of mathematics, but an explanation accessible to those without the background training in this mathematical form of expression was given by physicist Henry Margenau:

[Certain] differential equations with time-free coefficients are the hallmarks of causality. But physical science also contains laws which are expressed as integral equations, and these can be regarded as the modern carriers of the Aristotelian final cause, now called purpose. To see this, consider Hamilton's principle,

$$\int_{t_1}^{t_2} L dt = \text{minimum} .$$

L is a function of the mechanical variables of state, the velocity (v) and position (x) of a particle now (at time t_1) located at a point P . These variables in turn are functions of t , the time, and one wishes to know *what* functions they shall be; for when v and x are given as functions of t , the path of the particle is determined. [Hamilton's principle] says that these variables depend on t in a manner that will make the time integral of the quantity L as small as possible while the particle proceeds from t_1 into an unknown future. More briefly put, nature "wants to" conserve its precious L , and she adjusts the particle's motion with this "end in view." That is indeed the closest contact made anywhere between physical science and purpose. Hence the question of teleology in its most nearly scientific form reduces to this: Are certain aspects of physical nature to be described in terms of integral rather than of differential principles? . . .

To gain a partial answer we note what the physicist does when he applies [Hamilton's principle]. By means of a trick well known to mathematicians (finding Euler's equations, which are necessary conditions for having the integral a minimum or maximum) he converts the integral relation into a set of differential equations called Lagrange's equations, and these are of the causal type. He has thus – this may come as a shock to metaphysicians – *transformed a purpose into a cause*. [Margenau (1950), pp. 422-423]

In mental physics – where *nous* is absolutely governed by the regulations of pure practical Reason and a teleological law called the categorical imperative, yet must simultaneously cohere with laws of *soma* (all of which have objective validity *only* under physical causality) – noetic laws in integral form are *required* to be such that they be convertible to causal differential form for *soma*, thus "transforming a purpose into a cause." This is called **Margenau's law**.

The variations in objective time implicated by the synthesis of the J-ESI pertain to the phenomenon of adaptation, which is defined as the equilibrium between assimilation and accommodation in organized being. The *theoretical* construct of an activity field when considered *statically* (as topology theory does) is the construct of a topological space. But this static construct is incomplete with respect to principal quantities in Critical mathematics. Its completion requires *ordering structures* in objective time to provide for the metaphysics of *mechanics*. It is not unfair to say that topology theory in mathematics is a job left undone because it is missing a crucial half of its proper doctrine, namely the *generation* of topological space-time. In a way, it seems as if the community of topologists is populated exclusively by Eleatics.

The earlier example of William James' "hyphenation" explanation of a psychological Object is a nice illustration of what the concatenating function of the J-ESI means. When we couple this to the idea of *meaningful* accidents of *soma*, we go straight to the heart of one of the great fallacies of current language theory, namely the innateness hypothesis:

[Chomsky] believed that linguistic competence was largely innate. Among the reasons for believing in this innateness hypothesis was the notion that the speech to which a small child is exposed is an inadequate data base from which to abstract the structure of language . . . This is sometimes called the *poverty of the stimulus* argument . . . because it claims that the stimulus for language (which is other people's language) is too deficient to enable children to learn to use it effectively. Children acquire their first language too rapidly for them to start from scratch when they acquire a language. Consequently, the children must possess a **language acquisition device** or LAD. . . LAD contains principles of **universal grammar**. . . Among the things that LAD "knows" are that languages contain such things as noun phrases and verb phrases and that they are arranged in particular ways, such as subject and predicate. . . LAD is a theory of language that a child can use to discover the structure of the particular language community into which he or she happens to be raised. LAD must be a very powerful theory because it enables children to quickly make sense out of the language to which they are exposed. . .

Chomsky's view of language generated a great deal of psychological research. Research during the 1970s resulted in several criticisms of the **innateness hypothesis** . . . One criticism is that the innateness hypothesis has not been spelled out sufficiently to be tested. Another criticism follows from the observation that the language data to which the child is exposed are often quite straightforward. Adults appear to speak to children using simpler sentences than they would use with other adults. This means that children may often be provided with precisely the kind of linguistic input they need in order to build an understanding of their language. In spite of criticisms like these, various forms of the innateness hypothesis have survived. [Benjafield (1997), pp. 209-210].

The LAD hypothesis is nothing but rationalist metaphysics writ large: the child is born with an entire innate *theory*, not just with innate ideas! The notion of a LAD device is a transcendent and baseless illusion. Such a device is unnecessary for the possibility of language development or for language-transmitted semantics. All that *is* necessary is that the OB possess *the capacity to practically construct* a language, a grammar, a syntax, etc. *from experience*. That capacity is what we are discussing in this monograph. There are no innate "deep structures" in the OB. What the OB does "come equipped with" is an innate *practical capacity to construct structures*.³⁵

Because all meanings are at root practical (based on actions), this means that the capacity to concatenate representations in sensibility, of which the somatic matter is exhibited by activity field sequences, necessarily implies a motoregulatory capacity to produce ordered sequences of

³⁵ Consider the example of a child who is born deaf yet nonetheless learns a sign language. We know this happens. The LAD device, if it really existed, would have to be omniscient indeed to transfer its innate theory from the audition modalities of sense to the vision modalities – a most handsome gift from God.

activity fields in somatic appearances. Chomsky's term transformational *generative* grammar is well-chosen. This does *not* imply that the OB must prepossess an objective *theory* for expression of motor action to be possible. Regulation of motoregulatory expression by pure practical Reason doesn't work that way. The acts of Reason upon motoregulatory expression take the form of what can properly be called *veto*s of impetuous acts of reflective judgment (which are all based on subjectivity rather than objectivity). This was one of the key points Kant made in his Critical metaphysics of pure Reason. In recent years some interesting experimental findings have been unearthed that are wholly consistent with this principle [Obhi and Haggard (2004)]. This has led some scientists to propose replacing the phrase "free will" by "free won't" – terminology that is a better fit to mental physics. Veto actions by practical Reason are grounded in actual experience. Classical "free will" is, in contrast, a mystic notion of ontology-centered prejudices.

The capacity for determined concatenations of somatic activity fields is a necessary *psyche* function, so much so that it can be called a *psyche*-physical space-time principle. Concatenation function is the function of synthesizing a union of topological structuring and order structuring.

C. The J-DOS *Momentum* of Relation [$X = D; Y = C$].

- TT_D = the interior agent-patient Relation = *the conditioning ground of action lies in nous as agent for the self-organization of organized being.*
- TI_D = judicial cosmological Relation = *the causality of freedom (psychological causality) is the absolute beginning of all appearances.*
- $TI_D \subset IRP_C \Rightarrow MA_D$: *the synthesis of somatic messages is a necessary capacity of transcendental anticipation.*
- $TT_D + MA_D \xrightarrow{SC(C)} F_{DC} = \mathbf{coding}.$

Realerklärung: A **coding** Relation is the transformation of a somatic message from its somatic form of appearance to a form of comprehension. The J-DOS *momentum* F_{DC} is the psycho-reflective agency function of *nous-soma* reciprocity.

Synopsis of the deduction: The transcendental Idea of the causality of freedom is the master regulative acroam of all non-autonomic acts and actions of the OB and it follows a universal formula called the categorical imperative of pure practical Reason. The formula mandates equilibrium as the aim of all non-autonomic OB activity. But, as just discussed, the practical form this regulation takes on is that of an experience-based "free won't." Metaphorically, the reasoning principle is one where we can picture the OB "saying to itself, "This situation is not-right; make it be not-wrong!" " Specific *practical* maxims stimulated by a situation are experience-based, and the mental rules used to compose these maxims come from innate sensorimotor reflexes and innate affective preferences (such as the affectivity of preferred experience by which carrots taste better than dirt). William James wrote,

Why do men always lie down, when they can, on soft beds rather than on hard floors? Why do they sit round the stove on a cold day? Why, in a room, do they place themselves, ninety-nine times out of a hundred, with their faces towards the middle rather than towards the wall? Why do they prefer saddle of mutton and champagne to hard-tack and ditch water? Why does the maiden interest the youth so that everything about her seems more important and significant than anything else in all the world? Nothing more can be said than that these are human ways, and that every creature *likes* its own ways, and takes to following them as a matter of course. . . [It] is not for the sake of their utility that they are followed, but because at the moment of following them we feel that that is the only appropriate and natural thing to do. Not one man in a billion, when taking his dinner, ever thinks of utility. He eats because the food tastes good and makes him want more. If you ask

him *why* he should want to eat more of what tastes like that, instead of revering you as a philosopher he will probably laugh at you for a fool. The connection between the savory sensation and the act it awakens is for him absolute and *selbstverständlich*³⁶, an 'a priori synthesis' of the most perfect sort, needing no proof but its own evidence. [James (1890), vol. II, pp. 386-387]

Transcendental topic adds to this the idea that the transcendental place of this practical regulation is essentially noetic. In judgmentation the noetic act belongs to the synthesis of the motivational dynamic [Wells (2009), chap. 10]. The animating principle of somatic organization in *psyche* is: *motivation is the accommodation of perception and motoregulatory expression is its assimilation.*

The Idea of Rational Cosmology (the minor acroam subsumed under IRP_C) is a regulative principle of comprehending Nature. In the present consideration, perhaps more than in any of the others in the J-SMI, it is important not to lose sight of the role of IRP_C as the major regulating acroam or of its stated ground for the unconditioned unity of all relationships. A *message*, judicially considered, is the persistent object of a succession of appearances for which the objective *nexus* depends upon the comprehension of these appearances all in the same intuition. This is a transformation of the succession of appearances to a form in which all of these are represented in one intuition at one particular moment in subjective time – *coexistence* of partial representations. The acroam is not a message principle but, rather, the principle of anticipating a form of such a connection.

Now, psychology already possesses a technical term that applies to this, *coding*, for which the definition is *the process of modifying or transforming a message from its input form to some other form* [Reber (2001)]. The *logical message* in *nous-soma commercium* is the information persistent in both the noetic form of representation and the data of appearance in the activity field trajectory. The noetic transformation must likewise, because of the principle of thorough-going reciprocity between *nous* and *soma*, have its counterpart in the transformations of the activity fields of *soma*. The J-DOS principle of Relation thus holds that: (1) somatic coding is real; and (2) the somatic code subsists in *learned* structures of sequenced appearances of the activity field in objective time. We are now in a position to understand the *Realerklärung* of signaling as the structuring of the form of coexistence latent in a succession of activity field appearances.

VII. The J-SMI *Momenta* of Modality

The psychological Idea of Modality, IRP_D, is: *unconditioned unity in apperception of all perceptions in the interrelationships of meaning.* On the empirical side of science, the specifying concept of Modality (*soma*-phonological coordinator functions) is a concept belonging to Kantian phenomenology. The *system* of the determinations of Modality in the J-SMI constitutes **psyche-semantic Reality**. The transcendental topics of Modality pertain to synthesis of the metaphysical *nexus* of the OB's *Existenz* in Nature.

The Modality heading differs from the other three in the order of presentation of the *momenta* (refer to figure 2). For that reason, this section begins with the J-DOS *momentum*.

A. The J-DOS *Momentum* of Modality [$X = D$; $Y = D$].

- TT_D = synthesis of matter = *materia in sensibility is the determinable for perception.*
- TI_D = judicial cosmological Idea = *the I of transcendental apperception is the unconditioned condition for thinking the Dasein of any object.*

³⁶ "self-understandable"

- $TI_D \subset IRP_D \Rightarrow MA_D$: *the existence of soma-phonological coordinator functions is necessary for the possibility of self-organization.*
- $TT_D + MA_D \xrightarrow{SC(D)} F_{DD} = \text{featuring.}$

Realerklärung: Featuring is the constituting of a somatic signal. A *somatic signal* is a delimited spatio-temporal trajectory in the system of activity field neighborhoods.

Synopsis of the deduction: Every OB is, for itself, its own *absolute* standard for judging the reality of everything else. It "knows Reality" by virtue of its transcendental apperception "*I am.*" But this *I* of transcendental apperception is never anything more than the OB's awareness of its own *Dasein* with utterly no knowledge *a priori* of its own *Existenz*. The OB's knowledge of its own *Existenz* is learned empirical knowledge, and the object of this knowledge is called *the self*. The Nature of the *Dasein* and *Existenz* of everything else is empirical and is *predicated* through inferences of analogy with the OB's own self. The most significant educational epoch in the life of an infant comes when the infant first begins to make that *real division* in judgment we all call "*me and not-me.*" With this first cognizance the infant ceases, in a manner of speaking, to be the entire universe and becomes merely its king – the most self-important object among all other objects³⁷. The ancient Greek philosopher Protagoras³⁸ was, in this context, correct in saying, "Man is the measure of all things."

In the terminology of Kant's Critical metaphysics the matter of perception is called sensation. The *materia* of perception is that which stands as a cause with perception as its effect. Kant wrote

The effect of an object on the faculty of representation, so far as we are affected by it, is *sensation*. That intuition which is related to the object through sensation is called *empirical*. The undetermined object of an empirical intuition is called *appearance*.

I call that in appearance which corresponds to sensation its *matter*, but that which makes the manifold of appearance to be intuited as ordered in certain relationships I call the *form* of appearance. Since that within which sensations can alone be ordered and placed in a certain form cannot itself be in turn sensation, the matter of all appearance is only given to us *a posteriori*, but its form must lie in readiness for it in the mind *a priori*, and can therefore be considered separately from all sensation. [Kant (1787), B34]

The term *faculty of representation* (*Vorstellungsfähigkeit*) means *the organization of representations in the manifold of representations*. Sensation is part of this mental capability, the part of it regarded as being made actual ("realized") through the receptivity of *psyche*. One says receptivity is *stimulated by the materia* of the object of appearance to *impress* the outcome of this receptive act in sensibility. (It is important to note that this impression is *not* held to be a copy of the *materia* of the object. There is no objective validity in any "copy of reality" hypothesis.) The *materia* belongs to physical Nature, sensation to mental Nature. TT_D places the transcendental origin of the *materia* in physical Nature. Our only knowledge of this *materia* is empirical and understood *a posteriori* (that is, it is an understanding of experience). In the context of the applied metaphysic, this conceptualization of the *materia* is the idea of the space-time activity field.

The term phonology is being used in this metaphysic in the general connotation of the study of representational phonemes and their structures. In grammar theory, syntax is the structure of sentences (the relationship of the parts of the sentence). **Soma-syntax** is the relationship of space-

³⁷ Looking at one's own life from this perspective, it would seem that experience is a long process of self-demotion. It is merely a question of how far from here one demotes himself in his own self-esteem.

³⁸ So far as we can tell from history, Protagoras was unique among the ancient Greek philosophers for centering his theory of metaphysics on epistemology rather than on ontology.

time activity fields insofar as these are regarded as producing meaningful signals. To organize sensibility in terms of successive activity field appearances requires acts of coordination, and this is what is meant by *soma*-phonological coordinator functions. A mere sequence of activity fields is not a signal until the fields are linked in a syntax-generating scheme. But to so coordinate activity fields to make the form of a signal is to represent a particular sequence as a phonological *feature* (i.e., that which stands for transcendental object of *information* in perception). Featuring is the *act* of doing so, hence the F_{DD} of the J-DOS is featuring.

B. The J-ESI Momentum of Modality [$X = E$; $Y = D$].

- $TT_E =$ synthesis of forms = *the determination of forms is the placing of materia in sensibility in specific relationships.*
- $TI_E =$ second judicial Postulate of Empirical Thinking in General = *that which coheres with the material conditions of meanings (motoregulatory expression) is actual.*
- $TI_E \subset IRP_D \Rightarrow MA_E : \text{somatic symbols exist necessarily.}$
- $TT_E + MA_E \xrightarrow{SC(D)} F_{ED} = \text{classifying.}$

Realerklärung: A **classification** is an assimilation of features in one object. **Classifying** is the *a priori* ability to construct feature classifications (i.e., to form somatic symbols).

Synopsis of the deduction: Motoregulatory expression is the assimilation of perception. A perception can be immediately assimilated into a sensorimotor scheme if a suitable scheme has already been constructed, but if such is not the case then either some existing scheme must be accommodated to receive it or else the sensuous representation cannot be objectively represented (which means the representation is meaningless). To follow the deduction here it is necessary to clearly understand the terms "assimilation" and "accommodation" in terms of sensorimotor schemes. Figure 8 is an illustration of this.

Adaptation is an equilibrium of assimilation and accommodation. Equilibrium of a scheme means the OB can form closed scheme cycles, represented in the figure by the cycle of schemes α - β - γ . The sensuous *data* to be assimilated are called *aliments* (because they "feed" the cycle) and are represented in figure 8 by x , y , z and x' . In figure 8(A) scheme β can immediately assimilate aliment x when x is presented during expression of scheme α but cannot assimilate aliment x' . If x' is presented, as shown in figure 8(B), scheme β must be modified until it can assimilate the new aliment. This modification is called the accommodation of the scheme. If the accommodation succeeds, a new β -scheme structure, denoted $[\beta, \beta']$, is formed that: (1) can still immediately assimilate x ; and (2) can now also assimilate x' . The acts and actions of the OB are *conservative*, i.e., accommodations are made that conserve the prior ability to assimilate while at the same time making the scheme able to assimilate the new aliment.

This understanding of the Nature of adaptation in organized being has two "fathers." Its father in empirical psychology is Jean Piaget and is explained in his landmark work *The Origins of Intelligence in Children* [Piaget (1952), pp. 5-7]. Its father in mathematical neural network theory is Stephen Grossberg, who raised the mathematical issue in the context of learning machines in Grossberg (1969) and treated the mathematical problem of conservation in more detail in Grossberg (1976a). His approach to solving this *stability-plasticity dilemma* in Grossberg (1976b) led to the discovery of adaptive resonance theory.

Semantically, a classification of features *makes* a symbol. By definition, a symbol always has a meaning implication connecting it with motoregulatory expression. Therefore the act of classifying features into symbols is necessary for equilibrium. F_{ED} is its J-ESI function.

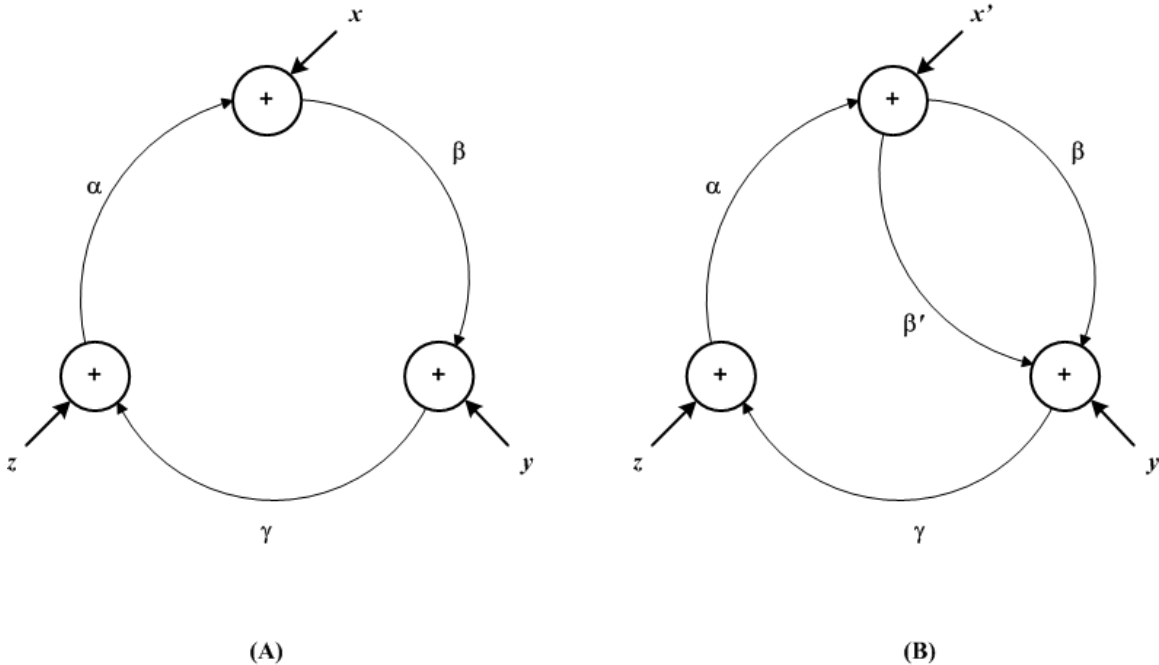


Figure 8: Equilibrium cycles. In (A) aliments x, y, z are assimilated into schemes α, β, γ without the need to modify these schemes. In (B) aliment x' cannot be immediately assimilated into scheme β . The scheme is modified (accommodated) by forming a new substructure β' so that the accommodated scheme $[\beta, \beta']$ can assimilate x' without losing its previous capacity to assimilate x .

C. The J-TSI Momentum of Modality [$X = T; Y = D$].

- $TT_T =$ presentation in belief = *the presentation of a condition of expedience for judicial happiness.*
- $TI_T =$ judicial *ens entium* = *perfection of the judicial Ideal of happiness is the coherence of satisfaction, expedience, desire, and the binding of these in the Ideal.*
- $TI_T \subset IRP_D \Rightarrow MA_T : \text{ somatic sentences exist necessarily.}$
- $TT_T + MA_T \xrightarrow{SC(D)} F_{TD} = \text{syntaxing.}$

Realerklärung: **Syntaxing** is the *a priori* ability to construct somatic sentences. F_{TD} constitutes binding codes that produce the *nexus* of Meaning for somatic messages.

Synopsis of the deduction: Satisfaction and desire refer to types of affective perceptions represented in sensibility and judged by the process of reflective judgment. The master regulation of the judgmentation cycle seeks for practical completion of a system of equilibrating actions so far as such a completion can be known through experience. Because experiential events are contingent (that is, the OB can never know when some previously unexperienced event will happen), perfection is a practical idea that can only be meaningfully viewed as a process. This is to say that *perfection is a process of making something more complete.*

The judicial Ideal of happiness is: *the process of judgmentation in general realizes (makes actual) a disposition to act on the basis of the matter of desire with an a priori aim of achieving a robust state of satisfaction by means of equilibration of the feelings of Lust and Unlust.* Such a state constitutes the judicial meaning of happiness and the activities of the OB are oriented to the achievement of perfection of its *Existenz* in this state [Wells (2009), chap. 7, pg. 267].

We can therefore see from the TI_T that adaptation on the side of empirical science, in the context of assimilation and accommodation just discussed, has, on the rational side of science, what one might call the "set points of control" in the process of Reason's master regulation of all non-autonomic activities of the Organized Being. In this context, the J-TSI of Modality has the *practical* function of a control law generator (as a control system engineer understands this concept). In mental physics, such a function is called a *determining factor*. To continue the metaphor under specifying concept SC(D), such a "set point" factor is a condition for holding-to-be-binding that a specific affective state is expedient for the realization (making actual) of a state of judicial happiness. Belief is unquestioned holding-to-be-true-and-binding and thus, by the TT_D , the placing of the determining factor is with the affective presentation of a belief.

What remains, then, is to answer the question of what sort of presentation this must be. This is regulated by the major acroam IRP_D (unconditioned unity in apperception of all perceptions in the interrelationship of meanings). It follows from this that the requisite presentation is represented as a complete semantic structure in equilibrium – a *somatic sentence*. In grammar theory a sentence is a group of words based on one or more clause patterns (e.g. a subject-predicate clause). A somatic message is a grouping of somatic symbols that in logical structure makes a meaning predication on a logical subject (a specific action). But for a somatic message to be regarded as a *complete* semantic structure in equilibrium – a somatic sentence – its *soma* syntax must be *provided* a structure. The OB has no such structures prior to experience (*a priori*), and so the capacity to construct them is necessary for the possibility of Meaning. The *momentum* F_{TD} follows directly from this.

VIII. Remarks

The role of any applied metaphysic is to supply the bridgework that makes possible a stepwise transition from the metaphysical foundations for understanding Nature to the practice of natural science properly so-called. I claim that the task of providing that bridgework for the somatic code is now completed. But this does not mean the whole job of transition is completed. To build a bridge is one thing; to walk across it is something else.

Critical metaphysics is epistemology-centered and so likewise is the applied metaphysic of the somatic code. Now, if a metaphysical system is *itself* properly constructed as a *science*, then its principles have implications for phenomena and, consequently, it can be put under the scrutiny of scientific testing. If not, all it leads to is a whirl-away into some mystic fogbank. This was the fatal flaw of Hegel's rationalist philosophy and is also the fatal flaw of scientific materialism. No system that ends up having to call upon the agency of some god (e.g., the god of probability) can ever stand up under this kind of scrutiny and achieve scientific closure. When, as is the case for the Critical system, the system is epistemology-centered, this has some specific implications for the method of scientific scrutiny.

Piaget wrote,

What I have said so far may suggest that it can be helpful to make use of psychological data when we are considering the nature of knowledge. I should now like to say that it is more than helpful; it is indispensable. In fact, all epistemology refers to psychological factors in their analyses, but for the most part their references to psychology are speculative and are not based on psychological research. I am convinced that all epistemology brings up factual problems as well as formal ones, and once factual problems are encountered, psychological findings become relevant and should be taken into account. The unfortunate thing for psychology is that everybody thinks of himself as a psychologist. . . . As a result, when an epistemologist needs to call on some psychological aspect, he does not refer to psychological research and he does not consult psychologists; he depends on his own reflections. . . . The first principle of genetic epistemology, then, is this – to take psychology

seriously. Taking psychology seriously means that, when a question of psychological fact arises, psychological research should be consulted instead of trying to invent a solution through private speculation. [Piaget (1970), pp. 7-9]

Now, this is a rather fine *dictum* with an especially glaring set of flaws. Is psychology to be the judge and arbiter of epistemology? Psychology is itself merely one of the special sciences. What sort of thing constitutes a "psychological fact"? *This is a question of epistemology*. What we have here is not an issue of prioritizing one doctrine vs. another but, rather, a problem of *coherence of doctrines*. In this regard, mental physics is the organized discipline of this coherence and it is this *practical role* that distinguishes it from Kantian metaphysics proper. All synthesis requires three components, and in Relation the third of these is always the community Relation whereby reciprocity between the other two is sought (and without which we have no *system* overall). Piaget's *dictum* also must face the troublesome fact that *we currently have no system* of a science of psychology. What we have instead are a collection of differing schools of psychology that do not even share a common set of metaphysical *or even pseudo-metaphysical* principles. Science writer Morton Hunt made the correct but unpleasant observation that

[What] we have seen . . . document this sprawl and diversity [of psychology]. But to get a still better idea of how diversified and chaotic a field psychology has become, one has only to leaf through a half a dozen volumes of *Annual Review of Psychology*. . . In the course of half a dozen years, the *Annual* covers roughly a hundred different fields, each with its own subtopics, any of which could consume a researcher's full time and effort. Can any discipline so untidy, multifarious, and disorganized be called a science? . . . Psychology . . . is rife with what Jerome Kagan calls "unstable ideas" – concepts and theoretical statements that do not refer to fixed and unchanging realities but are subjective and variable. . . None of this means that psychology is not a science. But it is not a coherent science with a coherent and comprehensive theory; it is an intellectual and scientific jumble sale. [Hunt (1994), pp. 640-641]

Kant would rather more bluntly say that psychology at present is not a *natural* science. He would call it an historical doctrine of nature, which is a form of science but not a natural science. It is unified only by a rather vague notion of its topic, but under that topic there is no systematic general unity to be presently found. Leafing through the pages of Reber's *Dictionary* provides an ample number of examples to demonstrate this. Even Piaget's own system, acknowledged by most to be a towering edifice in its own right, finds no shortage of other schools of thought that dispute its foundations. Like the other special sciences of the present day, psychology is suffering the debilitating effects of the old Greek one-sided commitment to more and more specialization. Without the generalist, however, ever-increasing specialization leads to disintegration, not integration, of scientific knowledge. This is a lesson of history (and one where the history of *philosophy* is one of the best illustrating examples).

But Kant would also say that psychology *can become* a natural science; the possibility is there. It will differ *in kind* from the dead-matter sciences of physics, chemistry and biology because psychology (like the other scholarly endeavors called "social sciences") has the individual human being as the essential Object of its studies. Psychology, in other words, can be made a ***social-natural science***. But to accomplish this we must be aware of what William James called "the snares of psychology." James wrote,

[The] mind which the psychologist studies is the mind of distinct individuals inhabiting definite portions of a real space and of a real time. . . To the psychologist, then, the minds he studies are *objects* in a world of other objects. Even when he introspectively analyzes his own mind, and tells what he finds there, he talks about it in an objective way. He says, for instance, that under certain circumstances the color gray appears to him green, and calls the appearance an illusion. This implies that he compares two objects, a real color seen

under certain conditions, and a mental perception which he believes to represent it, and that he declares the relation between them to be of a certain kind. In making this critical judgment, the psychologist stands as much outside of the perception he criticizes as he does of the color. Both are his objects. And if this is true of him when he reflects on his own conscious states, how much truer is it when he treats those of others! . . . It is highly important that this natural-science point of view should be understood at the outset. Otherwise more may be demanded of the psychologist than he ought to be expected to perform. [James (1890), vol. I, pp. 184-185]

The *great* snare of the psychologist is the *confusion of his own standpoint with that of the mental fact* about which he is making his report. I shall hereafter call this the 'psychologist's fallacy' *par excellence*. [*ibid.*, pg. 196]

I do not intend these remarks to cast a shadow of gloom and doom over science, but if there are foundational limitations and issues, we had better recognize that they exist. This brings me back to the metaphor of walking across the bridge. There is no favored special direction for taking this walk, either from metaphysics to natural science or from natural science to metaphysics. Systematic science must venture both directions and do so cyclically. Every applied metaphysic does, it is true, imply particular factual tests; but, more than this, it inherently implicates details of the *commercium* between the practice of the special science and the Critique of science overall by a systematic metaphysics that speaks to *all* the special sciences. By "details" I here refer to what Kant called *Metaphysische Anfangsgründe* or "metaphysical rudiments" of science. Put another way, an applied metaphysic holds within itself more detailed consequences of the metaphysical variety just as the axiom system used by a school of mathematics holds within itself those follow-on consequences mathematicians call *theorems*.

Of the three synthetic components of natural science – Critical metaphysics, applied metaphysic and the special science proper – none of these can be naively presumed to be *absolute*. They are all *theories* and all theories are manmade constructs. It is not a question of picking one of them by fiat and issuing the science equivalent of a Papal bull pronouncing it the dogma of *orthodoxa* ("right opinion"). As theories, mistakes in judgment are *possible* in all three because *all concepts originate from subjective judgments*.

But this does not mean that all three are equally reliable. Critical metaphysics covers the broad stage: physics and psychology and biology and anthropology and chemistry and economics and etc. The implication of this is that there is a maxim for open-minded evaluation in science. Isaac Newton stated it:

In experimental philosophy we are to look upon propositions inferred by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate or liable to exception. [Newton (1726), Bk. III, Rule IV]

Kant's Critical metaphysics begins from one single hypothesis (called Kant's Copernican hypothesis) and follows one master acroam: that every idea it contains enter into the system by no other criterion than that it meet the standard of being necessary for the possibility of experience. The real phenomenon of human experience is the essential basis of its general inductions and deductions, and so it is to be "looked upon" as the most "accurate or very nearly true" component in the three-fold synthesis of *general* natural science. No *one* issue in any *one* special science, by Newton's maxim, is sufficient to challenge it (although challenges from various *different* special sciences *can* and *should* challenge it). And *no* special science can challenge it at all so long as that special science lacks the structure of an applied metaphysic that bridges the gap that otherwise exists between them. The acroams, lesser principles and notions of Kant's system set the conditions for objective validity in science. In this context, mental physics can be regarded as

a systematic doctrine of *Metaphysische Anfangsgründe* for the *practice* of applying Kant's Critical metaphysics in deducing the applied metaphysic for a special science.

As for the J-SMI, this monograph has focused on the deduction of its fundamental structure and *momenta* as well as the real explanations of these. It establishes the Nature of the objective validity of the somatic code (a mathematical, i.e. facet B, Nature), shown how these constructs are to be linked to appearances of *soma* through principal quantities, and pointed out some areas in, e.g., mathematics where more work is needed. In particular regard to the latter, the theory shows that an objectively valid theory of signals and signaling *requires* a mathematical doctrine for *the construction of topologies in the manner in which an OB must accomplish this*.

Earlier I mentioned that mathematicians do in fact construct topologies but that for the rest of us this is a dark art. Professional mathematicians to whom I have put this very question, "How do you construct a topology?" have, to date, returned a more or less uniform answer. They begin with some previously given mathematical structure (typically a Hilbert space or a Banach space) and *work backwards* to arrive at the topological space. Now, this is not a criticism of how they go about their business. It is a theorem of mental physics that we learn from the particular (a Hilbert space) to the more general (a topological space). It is *also* a theorem of mental physics that before one goes to the trouble of making the general concept (how to construct a topological space generally) *one has to have a reason to take the trouble to do so*. The practice they describe can, in one context, be called "the method for constructing a topological space" and if a mathematician were to say this, he would be stating the truth *in that context*.

But the context changes when our focus of interest is centered on the somatic code. A newborn infant *has the capacity* to find a way or ways of doing this. If it were otherwise, the infant could never develop a capacity for language, exhibit the progression through what Piaget called the sensorimotor intelligence, pre-operational thought, concrete operations and formal operations stages of child development [Piaget (1953)], or even develop the human capacity for mathematics and formal logic (because mathematics is a *language*). One of Piaget's observations illustrates quite vividly the capacity in infancy for what can be properly called *mental physical semantics*. Piaget reports,

Another mental invention, derived from a mental combination and not only from a sensorimotor apprenticeship was that which permitted Lucienne to rediscover an object inside a matchbox. At 1;4 (0)³⁹, that is to say, right after the preceding experiment, I play at hiding the [watch] chain in the same box used in Observation 179. I begin by opening the box as wide as possible and putting the chain into its cover (where Lucienne herself put it, but deeper). Lucienne, who has already practiced filling and emptying her pail and various receptacles, then grasps the box and turns it over without hesitation. No invention is involved of course (it is the simple application of a scheme, acquired through groping) but knowledge of this behavior pattern of Lucienne is useful for understanding what follows.

Then I put the chain inside an empty matchbox (where the matches belong), then close the box leaving an opening of 10 mm. Lucienne begins by turning the whole thing over, then tries to grasp the chain through the opening. Not succeeding, she simply puts her index finger into the slit and so succeeds in getting out a small fragment of the chain; she then pulls it until she has completely solved the problem.

Here begins the experiment which we want to emphasize. I put the chain back into the box and reduce the opening to 3 mm. It is understood that Lucienne is not aware of the functioning of the opening and closing of the matchbox, and has not seen me prepare the experiment. She only possesses the two preceding schemes: turning the box over in order to empty it of its contents, and sliding her finger into the slit to make the chain come out. It is of course this last procedure that she tries first: she puts her finger inside and gropes to

³⁹ 1 year and 4 months of age.

reach the chain, but fails completely. A pause follows during which Lucienne manifests a very curious reaction bearing witness not only to the fact that she tries to think out the situation and to represent to herself through mental combination the operation to be performed, but also to the role played by imitation in the genesis of representations. Lucienne mimics the widening of the slit.

She looks at the slit with great attention; then, several times in succession, she opens and shuts her mouth, at first slightly, then wider and wider! Apparently Lucienne understands the existence of a cavity subjacent to the slit and wishes to enlarge that cavity. The attempt at representation which she thus furnishes is expressed plastically, that is to say, due to the inability to think out the situation in words or clear visual images she uses a simple motor indication as "signifier" or symbol. Now as the motor reaction which presents itself for filling this role is none other than imitation (that is to say, representation by acts, which, doubtless earlier than any mental image, makes it possible not only to divide into parts the spectacles seen but also to evoke and reproduce them at will), Lucienne, by opening her mouth thus expresses, or even reflects, her desire to enlarge the opening of the box. This scheme of imitation, with which she is familiar, constitutes for her the means of thinking out the situation. . . . Soon after this phase of plastic reflection, Lucienne unhesitatingly puts her finger into the slit and, instead of trying as before to reach the chain, she pulls so as to enlarge the opening. She succeeds and grasps the chain. [Piaget (1952), Observation 180, pp. 337-338]

It is likely unnecessary for me to re-emphasize the obvious context of semantics – in this case, sensorimotor intelligence semantics – that the last paragraph above could hardly express more clearly. The capacity to *express* it in actions necessarily presupposes the capacity to *construct* this semantic content in the first place. Were this not so, the only other recourse for explanation we could come up with (from ontology-centered presuppositions), when taken in context with Piaget's numerous other observations, eventually lead to the oldest of explanations: magic. My point is not that there are not similarities between what baby Lucienne did and what mathematicians do when they construct topologies; indeed, I can easily see at least one of these. My point is *she knew how to do it* and she knew this without a conceptual innate "how to" *theory* and without a teacher. She exhibited, in other words, a *practical capacity* for construction. A mathematical description of this capacity *in this context* is what I mean when I say mathematics is called upon to supply a mathematical explanation of "how to construct a topological space."

Another need that comes out of the deduction of this applied metaphysic is the need for constructing a mathematical field theory of topological space-time phronomy, dynamics and mechanics. Many of the concepts brought out here have their close analogs in the standard method employed by neural network, namely, graph theory. Here I say "close analogs" because it is not yet clear to me that the two methods (topology theory and graph theory) do not coalesce in some one common theory. I rather suspect, in fact, that they do. But a suspicion is only a starting point for theory and not the theory itself when there is a specific psychophysical context involved. To engage in theory-making calls for more distinct expositions of the requisite *Metaphysische Anfangsgründe* for connecting with the context. This will be the focus of the "part II" sequel to Wells (2011e).

Mathematical modeling in computational neuroscience (e.g., neural network theory) faces the formidable challenge of having to figure out how mathematical neural networks correspond to anatomical structures of *soma* and what functions those structures perform. Because the aim of these modeling efforts is what we saw Kandel describe earlier, the metaphysical understanding of the somatic code presented here *provides the Critical orientation for neural network modeling work*. The importance of this orientation becomes immediately clear when we stand it up against what William James called "the ultimate problem of psychology." James wrote,

The ultimate of ultimate problems, of course, in the study of the relations of thought and

brain, is to understand why and how such disparate things are connected at all. But before that problem is solved . . . there is a less ultimate problem which must first be settled. Before the connection of thought and brain can be explained, it must at least be *stated* in an elementary form [James (1890), vol. I, pg. 177].

I propose to you that this monograph has now stated that problem.

Finally, throughout the derivation of this applied metaphysic we have come back again and again to making clear distinctions between mathematics, which is resident in the noetic division of organized being, and sensuous objects in the physical dimension of *soma*. The point of intersect between mathematical concepts and experiential concepts is a practical intersection point at the horizon of possible experience, and this intersection is found in principal quantities of Critical mathematics. We do not, as of this date, have an adequately-worked-out system of Critical mathematics, but the approach to getting one was discussed in Wells (2006), chapter 23. When this system is in place, it will provide the real resolution for the "crisis in the foundations" that stymied mathematicians in the early decades of the twentieth century. That mathematicians will have to cease to follow Plato and instead become followers of the Critical philosophy is a small price to pay for this when viewed in the larger context of the benefits it will bring.

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