Chapter 6

The Data of the Senses

If you fight against all your sensations, you will have no standard to which to refer.
Epicurus

§ 1. Sense in the Faculty of Organized Being

In discussing the Organized Being model we have emphasized that the division between *nous* and *soma* is merely a logical, not a real, division. This, of course, is a negative statement – what this division in our model is *not*. However, to make use of this division we must provide a positive statement as well – in what subsists the nature of this logical division and how we are to use this idea. What place can the theory of *soma* occupy in our exposition of the phenomenon of mind and, conversely, what place can the idea of *nous* occupy in biophysical neuroscience? In view of the centuries-old controversy between idealist philosophy and materialist science, these are questions of some significance. It has become popular, and even a standard point of debate, for each of these two camps to deny to the other *any* place within their respective realms.

I called this a point of debate just now, but perhaps this is not actually correct. It often seems as if there really is no debate taking place. This is not because the question is settled; it is because the two sides seem to no longer talk *with* each other at all. Perhaps it is not surprising that the harshest tones in this non-discussion seem to come out when research funding is at stake. In a now outdated book pleading the case for increased funding for artificial intelligence research (a book which, in my opinion, tended to a number of over-inflated claims still unrealized more than twenty years later), the following statement appeared:[1]

> Critics over AI's [artificial intelligence] quarter-century of existence have ranged from computer specialists who were struggling with the difficulties of making a primitive new technology do the simplest operations of addition and subtraction . . . to philosophers, who might not know much about computing but knew thinking took place only inside human heads (and also sensed that one more piece of their turf was being claimed by the pesky empiricists, even as natural philosophy had been carted away to be physics, chemistry, and biology).

Unfortunately, this sort of puerile rhetoric is what too often passes for debate today. What to me seems most obnoxious in this quote is its tone of arrogance in impugning and belittling the motives of those who honestly disagree with the authors' position (the philosophers who might

[1] E.A. Feigenbaum & P. McCorduck, *The Fifth Generation*, Reading, MA: Addison-Wesley, 1983, pg. 33.

not know much about computing) as if the authors possessed such amazing insights of psycho-analysis as to be able to know, at a distance, and then to share with the rest of us, where the detractors 'are really coming from.' After having spent most of my own life in science and engineering, I happen to be one of the many people who think that the field of artificial intelligence is less a science than it is a craft. As for the "pesky empiricists" mentioned, I think the word "materialist" is a more accurate name, and I would question whether their positivism has indeed "carted away" natural philosophy rather than merely stolen its hubcaps.

Robert M. Hutchins once wrote[2]

> The tradition of the West is embodied in the Great Conversation that began in the dawn of history and that continues to the present day [1951] . . . The goal toward which Western society moves is the Civilization of the Dialogue. The spirit of Western civilization is the spirit of inquiry. Its dominant element is the *Logos*. Nothing is to remain undiscussed. Everybody is to speak his mind. The exchange of ideas is held to be the path to the realization of the potentialities of the race.
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> At a time when the West is most often represented by its friends as the source of that technology for which the whole world yearns and by its enemies as the fountainhead of selfishness and greed, it is worth remarking that, though both elements can be found in the Great Conversation, the Western ideal is not one or the other strand in the Conversation, but the Conversation itself.

With this tradition in mind, let us take a fresh look at the mind-body issue – from the viewpoint of *nous* and *soma* – and see what we can find. We will take as the starting point for this examination the idea of the data of the senses.

Everyone is familiar with the Aristotelian five senses: seeing, hearing, touching, tasting, and smelling. Much of our common vocabulary in this area – the five senses, sense organs, etc. – has changed very little from Aristotle's doctrine of the senses in his *On the Soul* and *Sense and Sensibilia*. Aristotle held that the five senses were the only senses we possess [ARIS9, Bk III] and that all "objects of sense" derive from these. Locke largely adopted Aristotle's "wax tablet" view of the senses, which Aristotle regarded as the potentiality of receptivity:

> Sensation depends, as we have said, on a process of movement of affection from without, for it is held to be some sort of change of quality . . . Here arises a problem: why do we not perceive the senses themselves, or why without the stimulation of external objects do they not produce sensation, seeing that they contain in themselves fire, earth, and all the other elements[3], of which - either in themselves or in respect of their incidental attributes - there is perception? It is clear that what is sensitive is so only potentially, not actually. The power of sense is parallel to what is combustible, for that never ignites itself spontaneously, but requires an agent which has the power of starting ignition; otherwise it could have set itself on fire, and would not have needed actual fire to set it ablaze [ARIS9: 663 ($416^{b}30$-$417^{a}10$)].

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[2] Robert M. Hutchins, *The Great Conversation*, Chicago, IL: Encyclopedia Britannica, Inc., 1952.

[3] The classical Greeks in Aristotle's day thought everything on earth was composed of earth, air, fire, and water. The stars and heavens were thought to be composed of a fifth element (the "quintessence").

Properly speaking, when we refer to the empiricist's view of the senses it is something like this Aristotelian-Lockean view to which we refer. "Sense" is said to be a "power" for "receiving impressions"; this "power" may be vested in a "sense organ" of some sort, but "sense" itself only refers to the "power" of being affected by external "impressions." I shall attempt to outline what the difference is between this empiricist's view of sense and the materialist's view shortly. The two views are more closely related than is either view to the rationalist's view of sense, but, despite this, the empiricist's and the materialist's views do have their differences. Chief among them is that the empiricist's view rather naturally develops into an *idealist's* view while the materialist's view does not. Let us compare the rationalist and materialist viewpoints.

§ 1.1 The Rationalist View of Sense

The rationalist tradition follows very much in the spirit of Descartes. The starting point, we recall, is taken from the attitude of taking nothing for granted except only those things we "know for certain to be true." For Descartes this is the doctrine of "I think, therefore I am." Descartes draws a sharp distinction between *perception* and *sensation*. The ability to perceive that "I think" must necessarily be supposed because if this is denied then Descartes cannot know "he thinks."

> But what then am I? A thing that thinks. What is that? It is a thing that doubts, understands, affirms, denies, wills, refuses, and that also imagines and senses [DESC1: 20].

To affirm "I perceive myself thinking, therefore I think, therefore I am" follows from such a trivial syllogism that it merits no in-depth discussion. To perceive, however, and to have sensations are two different matters.

> I suppose, then, that all the things I see are false; I persuade myself that nothing has ever existed of all that my fallacious memory represents to me. I consider that I possess no senses; I imagine that body, figure, extension, movement and place are but fictions of my mind. What, then, can be esteemed as true?
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> I myself, am I not at least something? But I have already denied that I had senses and a body. Yet I hesitate, for what follows from that? Am I so dependent on body and senses that I cannot exist without these? But I was persuaded that there was nothing in all the world, that there was no heaven, no earth, that there were no minds, nor any bodies: was I not then likewise persuaded that I did not exist? Not at all; of a surety I myself did exist since I persuaded myself of something (or merely because I thought of something). But there is some deceiver or other, very powerful and very cunning, who ever employs his ingenuity in deceiving me. Then without doubt I exist also if he deceives me, and let him deceive me as much as he will, he can never cause me to be nothing so long as I think that I am something. So that after having reflected well and carefully examined all things, we must come to the definite conclusion that this proposition: I am, I exist, is necessarily true each time that I pronounce it, or that I mentally conceive it.
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> But what am I, now that I suppose that there is a certain genius who is extremely powerful, and, if

> I may say so, malicious, who employs all his powers in deceiving me? Can I affirm that I possess the least of all those things which I have just said pertain to the nature of the body? I pause to consider, I revolve all these things in my mind, and I find none of which I can say that it pertains to me [DESC1a: 77-78].

We can easily see the corner Descartes is painting himself into as a result of his decision to doubt everything; this looming solipsism will be escaped only through Descartes' specious "proof" of the existence of God. However, even after he opens this escape hatch for himself, the "true" status and "nature" of the body will remain in doubt. The vivisection of mind and body he has just performed above will remain even afterwards. The senses, therefore, can be regarded *only as an idea* which is posited for the purpose of describing what is perceived regarding the *res extensa* of the "physical" world. Descartes' view is rationalist idealism.

Note, however, that in at least one thing we find a common point between this rational idealism and empiricism. For both, "the senses" *is an idea*. For rationalist idealism, this is stated more or less explicitly. For empiricism, let us take note of Aristotle's comment, "we do not perceive the senses themselves." The proper *empirical* view of the senses is that they are "powers"; the scientific task is to explain these "powers" in terms of "organs" that "receive the impressions" stamped on the mind. Sense is merely the ability of these organs to be "impressed"; under Locke, this impression is the vehicle by which the mind "receives ideas." Sense is not a "thing"; it is the idea of a particular "quality" possessed by "organs of sense." Locke attempted to preserve the "physical reality" of sense through his theory of the distinction between "primary" and "secondary" qualities. Berkeley moved, convincingly, to demolish this distinction, and as a result took empiricism over into the form of his radical idealism, keeping the mind (as spirit) and idealizing away the "corporeal matter" as a substratum of "reality". For Berkeley the material world is real only in being 'realized' by the living being, for whom sensible knowledge is merely the interpretation of an 'intelligible natural language' such that all our intercourse with the sensible world is 'really' an intercourse with an all-pervading 'active Intelligence' (i.e., God)[4]. Hume, of course, completed the destruction by abolishing the certainty of the mind's existence as well.[5] As the witty men of Britain summarized it at the time, "No matter, never mind."

Regardless of where we choose to stop in this reasoning chain, the point is this: both empiricism and rationalism end up with a mind-body separation for which the connection, if indeed any connection can be maintained at all, takes place through an *idea*, namely the senses. Empiricism and rationalism therefore both end up in idealism of one kind or another. What separates empiricism from materialism is that the latter refuses to go to this destination. Let us

[4] see Berkeley's *An Essay towards a New Theory of Vision*.

[5] Hume's position is *skeptical*. He does not say that body, sense, or mind *do not* exist, for this would amount to a definite assertion (*X* is-not *Y* is just as much an assertion as is *X* is *Y*). Hume's point is that, whether these things exist or not, neither you nor I can *know the truth of it for certain*.

now examine the materialism viewpoint.

§ 1.2 The Materialist View of Sense

In a manner of speaking, rationalism takes up residence in *nous* and regards *soma* as a distant land. This land is seen only through the distorting lens of a poor telescope; the rationalist wonders whether if, after all, what he sees through this lens might be nothing more than a mirage. Empiricism, on the other hand, is an adventurous traveler who would journey between these lands. In the Lockean tradition the journey is held to be an actual journey; for Berkeley the journey is spiritual; for Hume there is no place to go so one need not journey at all.

The materialist, on the other hand, not only lives in *soma*; he holds that the land of *nous* does not exist at all except as a fairy tale. That which we call *the mind*, and all the seeming manifestations we call mental, are nothing but the emergent properties of a vast and complex biological system. This system is electro-chemical, is made of atoms, and obeys only the laws of physics.[6] The task of science, in this view, is to *explain* the phenomena we collectively call "mental phenomena" by reducing what we can observe of these phenomena to an explanation under strictly physical laws.

Only a fool would argue that this view has not achieved enormous practical success over the course of the last two centuries. Our understanding of Nature (i.e., the complex of things we have succeeded in connecting in a theory) has increased tremendously since the beginning of the nineteenth century. Bacon would be proud of this progress. However, a scientist must admit that all science is dubitable, that the laws as we understand them today might not stand forever without radical reformulation. To deny this is to adopt a "religious" attitude of scientific dogmatism and to ignore the history of science itself. *Science does not fear being questioned at its roots*. Indeed, it welcomes such inspection and it responds honestly to the questions any such inspection raises (including sometimes the admission that it is not presently able to give an answer) *or it ceases to be science*. The goal of all science is truth – the congruence of the object with its concept in *all* its consequences – not certainty. Science is not synonymous with materialism, for materialism is nothing but the name of a set of principles and attitudes that are used *for guidance in pursuit of the goal* of understanding the truth of the objects in Nature.

Bearing this in mind, let us take a look at how the attitude of materialism views the problem of the phenomenon of mind. In this topic of study, materialism finds itself presented with a vexing problem. On the one hand, the central nervous system (brain and spinal column) can be probed, tested, excited, and so on using physical instruments and yielding directly observable

[6] Chemistry is itself a doctrine "under" physics in this view. Chemical "laws" are to be explained from the laws of quantum physics. Biology, likewise, is to be subject to rule by the "queen of the sciences." Physics does not presently claim to have explained *all* of the phenomena of chemistry and biology in detail; it merely claims that when these details *are* explained, the explanation will come from physics.

findings on a material level. On the other hand, the psychological phenomena – anger, perception, motivation, and so forth – are observable only on the behavioral level. Indeed, the words we use to describe the phenomenon at the psychological level are words that reference ideas. We cannot stick a probe into the brain and measure "anger" or "ambition" as *entities*.

What *can* be done – and this is what *is* done – is measurements of brain activity can be made in conjunction with behavioral observation, and hypotheses are then formulated which attempt to uncover and explain correlations between these physical measurements and the psychological behaviors that seem to accompany the occurrence of these measured events. We can distinguish two methods of investigation. When the investigation confines itself strictly to the making of physical measurements and observations on anatomical structures that appear to be involved in particular facets of mental phenomena, the approach is called the *physiological* approach. This approach seeks to understand the underlying material structure and how it works. The second method of investigation is called the *psychophysical* approach, and it is the one that attempts to discover the link between the purely physical phenomena of measurable brain activity and observable psychological behaviors. This method is concerned, for instance, with the study of the relationship between stimuli from the environment and what people and animals can tell us (either directly or through their behavior) about how they seem to perceive these stimuli.

The Physiological Method

The physiological method, strictly speaking, does not address sense or perception as such. It is concerned with questions of anatomical structure, physiology, embryology and pharmacology. The mind-body problem is not of concern in the physiological approach because in this approach "mind" is not within the scope of its topic. However, the findings that come out of this science are used in psychophysical studies and so it is worthwhile to briefly summarize some of its key fundamental results.

Insofar as physiological studies involve "the senses" our interest here lies with that part of physiology that concerns the nervous system. Most of us are probably familiar with the word "nerve" and have a general idea that "nerves" are the parts of our bodies by which we sense things. We also may have a vague idea that "nerves" are also somehow linked with "feelings" and "emotions" – as when we say a person is "nervous" or has had a "nervous breakdown." This vague idea is fine so far as it goes, but scientifically it is not very accurate. "Nerves" in the context of this usage are in fact rather complex structures made up of tens or even thousands of more fundamental "building blocks" called nerve cells or *neurons*.

There are many different types of neurons (possibly as many as ten thousand distinct classes by one estimate) but all neurons share some common structural features. Many neurons consist of

three principal “components”: 1) the cell body, 2) an axon or “nerve fiber”, and 3) dendrites. The cell body (which is usually called the “soma”) consists of a cell nucleus and various other organelles and metabolic mechanisms needed to keep the cell alive. The axon is a protruding fluid-filled “tube” that carries chemical agents and electrical signals (called “action potentials”) from the cell body to its connections with other neurons. The dendrites are protrusions that branch out from the cell body and receive signals from other neurons.

Neurons are often regarded as the elementary “signal processing units” of the nervous system. This terminology is more or less borrowed from electrical engineering, and if it makes the nervous system sound rather like an enormously complicated telegraph network, it is nonetheless quite descriptive of what appears to take place. A ***signal*** is, in the most general sense, any physical phenomenon that exhibits variations of some kind that can be said to carry “information.” For example, sound is carried by variations in air pressure, light can be regarded as variations in the intensity of electric and magnetic fields, and so on. We see from this that the idea of a “signal” is somewhat abstract; for that reason a signal is usually defined *mathematically* as “a single-valued function of time[7] that carries information.” There are two principal kinds of signals that are important in describing the function of neurons: electrical signals and chemical signals.

There are four types of signals that are important in the model of the neuron. First, each neuron can receive an *input signal* (e.g., a “receptor potential” in the case of a sensory neuron or a “synaptic potential” in the cases of interneurons and motor neurons). Most often this input signal is “received” at the neuron’s dendrites or its soma. Second, there is an *integration signal*. Most neurons respond only when they receive a number of different input signals coming in from different sources. These individual signals are “integrated” (summed) at a particular point in the neuron (e.g. at the first node of Ranvier in sensory neurons or the axon hillock in interneurons and motor neurons). At this “summing point” when the integrated signal reaches a particular threshold value there occurs an inrush of positively-charged sodium ions, from the fluid surrounding the neuron, that penetrates the membrane of the neuron. (This phenomenon is called the “sodium channel”). This influx of sodium ions into the potassium-rich intracellular fluid generates a small electrical signal, called the action potential, that subsequently travels down the cell’s axon to other neurons. The action potential constitutes the third type of signal, generally called the *conducting signal*. Finally, the neuron has an *output signal*. When the action potential reaches the terminal region of the neuron, it stimulates the release of packets of small molecules known as *chemical transmitters*. It is the release of this transmitter that allows one neuron to “communicate” with another.

[7] "Single-valued" does not mean that a signal can have only one value; it means that a signal can have only one value at any given moment in time; at the next moment, it can take on a quite different value.

These neurons are the basic building blocks of the nervous system. Strictly speaking, a *nerve* is a *group* made up of many nerve fibers (the axons) bundled together in the same general location in the peripheral nervous system. We can envision nerves as a sort of "cable harness" in which the axons play the role of the "wires" in the cable. In the anatomy of the nervous system we conventionally make a distinction between those structures involving the spinal cord and brain (the central nervous system) and everything else (the peripheral nervous system). Nerves are found *only* in the peripheral nervous system and they "connect" the central nervous system to the body's muscles, glands, and sense organs. Strictly speaking, there are *no* 'nerves' in the central nervous system. A group of nerve fibers within the central nervous system is called a *pathway*, a *tract*, or a *commissure* depending on where it is and what it does.

Neurons are relatively simple organic structures and we know a great deal about them. The difficulty in understanding the nervous system comes about because there is an enormous number of them. By one estimate the brain alone contains on the order of 100 *billion* neurons. Furthermore, this vast array of neurons is highly interconnected. The junction where one neuron connects with another is called a *synapse*. At most synapses the "communication" between neurons takes place by means of a chemical transmitter, and this transmitter substance alters the receiving neuron by binding with specific membrane receptors. In general there are two types of effects that can take place at a synapse. In the first case, the signal received may be *excitatory*, that is, it tends to stimulate the receiving neuron to "fire off" an action potential of its own (provided enough other such excitatory signals are also received by that neuron). In the second case, the signal may be *inhibitory*, i.e., may tend to *prevent* the receiving neuron from firing.

There are an enormous number of these anatomically specialized junctions in the neural network of the body. By one estimate the brain alone contains on the order of 100 *trillion* synapses. A single neuron may have as many as *four hundred thousand* synapses, although most have no more than "only" a few thousand. It is not without reason that the brain has been called the most complex structure in the known universe. Faced with a system of such almost unfathomable complexity, it is also quite easy to imagine how almost anything might be possible, including the emergence of the phenomenon of mind as a "property" of this incredibly complex system. If I accidentally gave the impression earlier that I was mocking neuroscience for "having faith" that mind can eventually be explained by brain function, now is the time for me to make amends. Try to imagine how hard it would be to meet and get to know every person on earth and multiply this by a thousand. Learning every detail of the brain is harder than that. Hope does not spring from what we *know* to be so; it takes root in that which we think *might be so*.

The only practically feasible way we can even begin to approach the study of such a complex object as the brain is to try to find out how (and if) it is *functionally organized*. All our progress in neuroscience, insofar as the phenomena of sensation and perception are concerned,

has come forth by applying two basic ideas: 1) *localization of function* – the idea that specific areas of the brain serve specific functions, and 2) *sensory coding* – the idea that the activity patterns (firings of groups of neurons) in the brain *represent* characteristics of the environment. However, in order to use these ideas, we must employ the psychophysical approach.

The Psychophysical Method

Many years ago, shortly after receiving my engineering degree, I was puzzling over the schematic diagram of a radio receiver circuit someone else had designed, trying to understand how the circuit worked. I knew what it was supposed to do but I couldn't figure out why the designer had included several specific components in the circuit. Since components are not added to a circuit's design for no reason, I figured there had to be some subtle function these components performed or some problem that they fixed. What this might be, however, was a mystery to me. It was not until I had built the circuit for myself (both with and without these components) and measured how it behaved that I began to see why the designer had included them and what each one of them did in the overall design.

In spirit this sort of investigation is what psychophysics is all about (magnified in difficulty by many orders of magnitude). If we knew everything there was to know about neurons we would still be no closer to understanding perception because there is nothing remotely like perception contained in the theory of neurons. *Neurons do not perceive*. Just as my knowledge of every individual resistor, capacitor, transistor and transformer in my radio circuit so long ago was not enough to tell me what I wanted to know about the entire *circuit*, so it is that knowledge of the physiology and biophysics of neurons alone does not suffice to explain the *brain*.

The psychophysical method compares physically observable brain activity with observable and communicable behaviors of the living subject. This method has been a fruitful one for increasing our understanding of neuroscience. From it we have learned that particular locations in the brain do indeed seem to correlate with particular psychological phenomena. This method has been so fecund that we cannot do even the smallest justice to it in even a summary form within this treatise. A better overview can be found in [GOLD], and some very detailed descriptions are given in a host of articles contained in [KAND]. Here we shall have to be content with just a few examples that illustrate some of the facts obtained through the psychophysical method.

The Brainstem: The brainstem is anatomically the point where the brain and the spinal cord meet. Its three major substructures are the medulla oblongata, the pons, and the midbrain. It is known to control respiration, blood pressure, gastrointestinal functions, and has centers that regulate arousal and wakefulness. The midbrain plays a dominant role in the direct control of eye movement and

contains essential relay nuclei of the auditory and visual systems. Even small injuries or lesions in the brainstem can cause coma and death.

The Cerebellum: The cerebellum (literally, "little brain") occupies about 10% of the total volume of the brain but contains over half the brain's neurons. It is involved in the planning and execution of bodily movements, appears to be a key center for motor learning, and integrates information for coordinating the planning, timing, and patterning of skeletal muscle contractions during movement. It receives sensory feedback information it is somehow able to compare with internal signals that reflect *intended* movements and, thereby, acts as a motor control system. It also has a role in maintaining posture and in coordinating head and eye movements. The cerebellar "circuits" are modified by experience, leading to more fluent motor skills requiring less conscious attention from the "higher" brain centers.

The Diencephalon: The diencephalon ("middle brain") is located at about the center of the brain and consists of two major structures: the thalamus and the hypothalamus. The thalamus processes and distributes almost all the sensory and motor signals going to the cerebral cortex. It seems to regulate levels of awareness and the emotional aspects of sensory experience. It seems to play a key role in focused attention.

The hypothalamus is the primary regulator of the autonomic nervous system and it regulates hormonal secretion by the pituitary gland. Its primary task is the regulation of homeostasis (the constancy of the physical and chemical "internal environment" of the body). In addition to electrical inputs and outputs, the hypothalamus also has humoral inputs and outputs (i.e., blood-borne chemical messengers called hormones) and, as a consequence, has widespread effects throughout the body via the body's endocrine (gland) system. It is also thought to integrate and coordinate the behavioral expressions of emotional states. Laboratory stimulation of the hypothalamus can elicit an anger response; lesions in it produce placidity. There is some evidence that it also is involved somehow with "motivation" although the physiological "circuits" for "motivation" are as yet not understood.

The Hippocampus: The hippocampus is a deep-lying structure beneath the cerebral cortex. It is thought to be the primary site where plastic changes (known as "long term potentiation") in neural tissue occurs that provides the brain with the ability to store long term memories.

The Sensory Cortices: The processing of "sense information" takes place in the sensory cortices located in the parietal, occipital, and temporal lobes of the cerebral cortex. We find here a division of function in terms of the *primary* sensory cortex, which directly receives sensory inputs

from the body's various sense organs, and the *higher-order* sensory cortex, which integrates signals coming from the primary sensory cortex and seems to perform complex signal processing. The primary and higher-order sensory cortices process information from the somatic sensory system, the visual system, and the auditory system.

The Higher-Order Motor Cortex: The higher-order motor cortex is located in the frontal lobe of the cerebral cortex. Within it we find the supplementary motor cortex and the premotor cortex. These motor areas receive inputs from various other locations in the brain and are thought to provide the structure for what has been called the body's "motor vocabulary." The higher-order motor cortex is not concerned with the details of movement – it leaves these to the cerebellum – but is thought to globally plan and coordinate posture and movement. It is thought that "intention" is translated into "action" in the premotor cortex and another area in the parietal lobe known as the parietal association cortex. The premotor area seems to "plan the strategy" of a voluntary movement while the supplementary motor cortex plays a role in "programming" complex sequences of movements. The primary motor cortex participates in the initiation of movements and "encodes" the amount of force to be used in moving the limb.

The Association Cortex: The association cortex is made up of three *association areas*, namely the parietal-temporal-occipital area, the prefrontal association cortex, and the limbic cortex. Whereas the sensory cortices are each concerned with a specific sensory modality (e.g., vision), the association cortex integrates these different sensory modalities. It is the association cortex that is thought to be the area most directly involved with the control of the four higher brain functions: perception, movement, motivation, and thinking. The parietal-temporal-occipital association cortex is involved with higher perceptual functions related to somatic sensation, hearing, and vision. It is thought to be the area where complex perceptions are formed. The prefrontal association cortex is thought to be responsible for the planning of voluntary motions and with signal processing related to the processes of thought. The limbic association cortex is thought to be concerned with complex processes involving motivation and emotion.

The Materialist Viewpoint

This brief overview of the accomplishments of the modern approach to neuroscience helps to illustrate one very important empirical result: there can be no doubt from an empirical perspective that brain function and "mind function" are indeed related. The issue is not with these findings (which are not in the least surprising); rather, the issue is whether we are to regard the idea of mind as an idea subordinate *to* that of brain or as an idea coordinate *with* that of brain.

Let us look very carefully at what is fact and what is supposition. First, from the standpoint of epistemology, the Copernican hypothesis demands that we regard our knowledge of the brain as knowledge of its appearance. What we find contained in our theory of the brain is, on the one hand, expressed in terms of organic structures and, on the other hand, theoretical ideas such as *signals*, *communication* between neurons, *information*, and, finally, *correlation* with observable behaviors. Now, the idea of a signal is, at one level, a sensible phenomenon. We have certain observable physical phenomena that appear to have a causal relationship with other physically measurable phenomena (the "stimuli" of the environment) and the empirical correlation between them seems to justify our regarding of action potentials and chemical transmitters as physical manifestations of a signal. Furthermore, the observation of what seems clearly to be a cause and effect relationship between these signals and the response of neurons to them seems to provide good empirical justification for saying that "communication" takes place between neurons.

On the other hand, there are two disquieting elements in this picture. The first is the idea of the correlation between these observable physical phenomena and behaviors. When we examine this relationship what we find is that at no point do we directly observe any kind of transformation that clearly marks the passage *from* electrical impulses and chemical reactions *to* "behavior." This link is an inference – an idea – and is supersensible. Second, we have the idea of "information" itself. What *is* "information"? This, it turns out, is an extremely difficult question to answer. One might think we could turn to information theory for guidance, but if we do so we will find that information theory makes no effort to define what information *is*. Rather, information theory concerns itself with operational definitions phrased in the language of probability theory. This is a point we must come back to later, but what is important to see here is that the object we call "information" is supersensible. "How much information is in a message?" is a question information theory asks; "What is information?" is not. The supersensible 'nature' of "information" permeates the entire empirical theory of brain function.

Our second point has to do with the *supposition* that there is a cause-and-effect relationship between neural activity and behavioral activity. It is a fact that the neural theory appears to explain some phenomena of perception quite well. It is also a fact that there are other cases where explanations based on neurological signaling theory utterly fail or where the experimental evidence seems to present at least the appearance of an outright contradiction. Among these are the Mach card demonstration and the Knill-Kersten surface curvature and light perception demonstration (see [GOLD: 77-78]). Now, the fact that there are some experimental phenomena not currently explained by the neurological theory does not mean that the theory is wrong. Such instances are not infrequent in the course of normal science, and the successes of neurological theory more than justify the continuation of the approach. *However*, it also means that we cannot regard the cause-and-effect hypothesis as empirically *established* as a fact.

The question, once again, is how we are to regard *nous* with respect to *soma*. Either the one must be subordinate to the other, or else they must both be regarded as coordinate ideas, neither taking precedence over the other. The materialist view is that *nous* must be subordinate to *soma*, that the *body* (e.g., brain function) is primary and "mind" is merely our name for the complex manifestations of brain function. Put another way, "the mind is not a thing" and the idea of the mind can therefore play no *fundamental* role in theory.

If the idea of mind made it necessary for us to equate "mind" with "soul" I could not bring myself to disagree with the materialist position. However, it should be clearly apparent by now that this is in no way necessary and, indeed, is an equation forbidden to us by the Critical Philosophy. Materialism deals with the mind-body problem by denying the immaterial mind. However, the psychophysical approach itself suffers from the introduction of an immaterial factor – namely the idea of ***sense***.

In making the link between neurological "circuitry" and observable behavior we must necessarily presuppose that neurological activity is the carrier of something called "the information of the senses." We must further suppose that this "information" is somehow transformed to manifest its effect as behaviors, emotions and, above all, knowledge. *Information is the idea of something every bit as immaterial as the idea of a mind*. When information theory "measures and weighs" *how much information* a signal "carries" it does not do so by referring to atoms or any other material substance. Rather, it does so by reference to something called a "probability." The "less probable" is the occurrence of an event, the more "information" that event is said to carry when it happens. Something that is "certain" contains no information whatsoever. If an event that is regarded as "impossible" were to actually occur, the "information carried in" that event would be without bound.

But a "probability" is equally the idea of a supersensible object. Where do we get our idea of "probability"? Putting it as simply as possible, *probability is what we suppose to exist that makes statistics "work."* Suppose we take a coin and flip it a few hundred times. If we do so (and we do not cheat), we find that "heads" occurs almost exactly the same number of times as "tails" occurs. Keep doing this a few hundred more times, and we find that the ratio of the number of occurrences of "heads" to the number of occurrences of "tails" is almost one and the more coin tosses we make, the closer this ratio tends to get to one. From this, we conclude that "heads is just as *probable* as tails" in a fair coin toss. We explain an empirical finding, for which we have assigned no "physical" cause, by supposing that there must *be* some reason for our result; we call our idea of this reason *probability*.

So, then, where does all this leave us? The problem facing strict materialism is quite simple to state. On the one side (*soma*) we can observe physical phenomena which, within the bounds of its own special topic, we are able to encompass in a systematic physical theory. This theory, of

course, does involve a number of rational deductions and ideas, but we will see later that for these rational deductions and ideas we can find a transcendental ground for their objective validity. Neuroscience in this sphere is as well-grounded as any empirical doctrine can be. On the other side, we also have observable phenomena of behavior and, within *this* topic our knowledge of its appearances is also well grounded in transcendental principles (again, we'll have to show this is so later on, but for now let us simply accept this as a working premise). The rational deductions and ideas in this behavioral sphere are not as firm as is the case for the neural phenomena, however, because psychology does not yet approach physics in the exactitude of its systematic doctrine. Even so, this is not the most fundamental point of concern because if a firm transcendental ground can be deduced for the idea of "behavior" there seems to be no apparent reason to think the rest of behavioral phenomena will not fall under the objective validity of the idea of "behavior" *per se*.

The *fundamental* problem facing strict materialism lies in the *transition* from neural theory to behavioral theory. Putting it another way, we must have a ground for thinking the "link" between the objective validity of neural theory and the objective validity of behavioral theory is one which is itself objectively valid. Scientific materialism rules out the introduction of "soul" into its theory because there is no possibility of establishing "soul" as an *objectively valid* idea. It is quite right to do this because a science must be a systematic doctrine in which all its ideas of objects must be objectively valid.

When strict materialism takes the attitude that "the mind is not a soul implies the mind must be an idea made secondary to the body," it makes an unfounded leap. Such a supposition is rather as if a physicist were to say, "mass is a property of atoms therefore the idea of mass must be secondary to the idea of atoms." In fact physics somewhat reverses this order; the idea of mass is used to *help understand* the idea of atoms. Rather than trying to derive the idea of "mind" *from* material premises, what if we used the idea of "mind" as an idea *that unifies the ideas of neuroscience with the ideas of behavioral science*? We have already shown that the "link" between neuroscience and behavioral science, as presumed in the psychophysical method, is in fact the idea of a supersensible object, which we might call the 'causality of information'. But both causality and information – if they are to be objectively valid ideas – must look for the grounds of their objective validity in the rational substratum of knowledge because this objective validity cannot be obtained from that which is merely empirical.

The error scientific materialism makes lies not in the methods of its investigations but in the attitude of positivism that lingers on in it like a bad habit. There is nothing wrong with the materialist approach as a method for conducting the *process of empirical scientific discovery*; its flaw is when this materialism tries to become a philosophy, for philosophy is *the pure science of establishing rational objective validity* for the applied sciences.

§ 1.3 The Idea of Sense

We have seen that the rationalist, empiricist, and materialist views all ultimately come up against the same fundamental issue. Whatever it is that we say "links" body and mind, that object is one that is supersensible. All three schools have historically responded to this by either supposing this necessitates the making of a real division between body and mind (and subsequently attempting to subordinate one of these "realities" to the other) or by denying outright the objective validity of one or the other of body or mind (which is, in its own way, the drawing of a real division between them).

There is, however, another option open to us. It seems as clear as anything can be that we must regard mind and body as being somehow "different" from each other. The question is: different *how*? Is it necessary we regard the one as "material substance" and the other as "immaterial substance" in the historical tradition of this distinction? No. We are free to look at the mind-body distinction as two coordinate aspects of the *same* phenomenon, namely the Organized Being. Indeed, no other way of looking at this problem can meet the constraints imposed on what can be objectively valid by Rational Psychology. We have already argued that there is no objective validity in regarding the *I* of transcendental apperception as "soul." If, however, we say that this transcendental *I* is nothing other than "body" (the *I* as a "meat machine"), this supposition is equally without objective validity. We can make *no* objectively valid statement of the "essential nature" of the *I* of transcendental apperception, neither spiritual *nor* corporeal. All we know *objectively* is that the appearance of one's Self in empirical consciousness includes *both* the corporeal phenomenon (*soma*) and the mental phenomenon (*nous*). Our task is to unite these phenomena in the idea of *one* Object.

Now, if Rational Psychology warns us that we may not draw a *real* division between *nous* and *soma*, it also tells us that there is nothing wrong with drawing a *logical* distinction between them. What we must take care to do is to see to it that whatever logical distinction we draw is not drawn in such a way as to be inherently contradictory *with appearances*. The question then becomes: What logical idea or ideas of organization can serve *both* the appearances of the aspect of *soma* and those of *nous*?

Such an idea must be an idea of *reciprocity* between *nous* and *soma*. If this were not so we would not have two coordinate objects (*nous* and *soma*) but, instead, an idea of a relationship in which one of these must be subordinate to another. It is in reciprocity, and not in cause-and-effect, that we must seek for our unifying idea. It must be an idea inherent in both aspects, and it must be an idea of a relationship that "runs both ways." Seen from this *transcendental* perspective, this unifying idea is readily apparent: We will call it the ***sensorimotor idea***.

There are two *modi* by which we can view *nous* and *soma* in coordination with each other. When *nous* acts in the place of agent and *soma* in the place of patient, we call this the *motor*

mode of reciprocity. It is the idea that mental acts can be actualized in physical activity. When *nous* acts in the place of patient and *soma* in the place of agent, we call this the *sensory* mode of reciprocity. It is the idea that physical events (stimuli) can produce an actual conditioning of the mental state of the Subject.

The sensorimotor idea is present and plays a fundamental role in both psychophysical neuroscience and in the theory of the faculty of Organized Being. Its place with regard to the faculty of pure consciousness is, hopefully, evident from the discussion in Chapter 5: it is to *psyche* what unity of apperception is to *nous*. Its place with regard to *soma* is reflected in the very language of neuroscience: the premotor cortex, the primary sensory cortex, and so on. It is the idea that represents the *constitution* of reciprocity between *nous* and *soma*.[1]

In this chapter we will first give our attention to the metaphysical requirements of the sensorimotor idea and postpone the discussion of its faculty until later. Now, the idea of the sensory mode is the idea that the phenomena of neural activity and the phenomena of empirical representation are *coordinated phenomena*. What this means – and this is one of the principal differences between the Copernican model and those of rationalism, empiricism, and materialism – is that neural activity and mental representations share a common, unifying idea *which understands both equally*. In Quantity, this idea is an idea of integration; in Quality, it is an idea of subcontrarity[2]; in Relation, it is transitive; and in Modality it is the determinable. We will call this idea **the data of the senses**.

We need to be clear about the nature of the idea of sense. This is not the idea of, say, the sense *of smell* or the sense *of loneliness* or the sense *of* any other specific sensation or feeling, although *as appearances* all such *senses of X* fall within the scope of the idea of sense. It is interesting and noteworthy that while neuroscience speaks in technical terms of such things as sense organs, sensory coding, and sensory modalities, it does *not* use the word “sense” all by itself in a specific *technical* context. “Sense” is already treated as a sort of ‘given’ in neuroscience in the way this science is actually practiced. From this perspective all we are doing here is making the idea of sense *clear* with respect to where it stands in our science.

The object of the idea of sense is supersensible. This is perhaps one of the richest ironies of the Critical Philosophy: “sense” is not itself *sensible*. Rather, the idea of sense is an idea that *grounds* the validity of the logical connection between the power of receptivity and the sensible appearances of the phenomena in neuroscience. As strange as this conclusion may be, it is in accord both with Aristotle’s observation – that we do not perceive the senses themselves – and

[1] The *regulative* idea of the reciprocity between *nous* and *soma* is also a principle of *psyche*. We will discuss the regulative principle later in the treatise.

[2] It is subcontrary because we wish to both distinguish neural activity from mental representation and, at the same time, regard this distinction as only a logical and not a real distinction (e.g., "if *nous* then mental representation or if *soma* then neural activity").

with a key factor in the psychophysical approach to neural science – that neurons do not perceive.

Consequently, we have to be concerned with two aspects of the idea of sense. In the first place, we must establish the transcendental ground for the objective validity of the idea of sense; this is the transcendental aspect of sense. In the text above, we gave our reason for the introduction of the idea of sense. Having a reason for introducing an idea is not the same thing as having a transcendental ground that establishes the objective *validity* of that idea. The latter is something to which we must yet attend. In the second place, we must examine the idea of sense from the *empirical* side in experience. The empirical representation of an object can be nothing other than the representation of its appearance. Because "sense" as an object is a *noumenon*, its *empirical* validity can only be lodged in viewing the idea of sense as an idea of a necessary *form* in which representations of the sensible matter of appearances must be cast. This representing form must be equally suitable for representation in *soma* and *nous* alike because the idea of sense pertains equally to both. As the idea of a *necessary* form, the idea of sense must be the idea of a *pure* form of representation since no *empirical* form can have this essential property of necessity. With this outline of our task before us, let's get to work.

§ 2. Kant's Anthropology of Sense

Kant defined "anthropology" as "a systematic doctrine containing our knowledge of man" [AK7: 119]. As a systematic doctrine, we can see Kant intends for anthropology to be a science, one which has *Homo sapiens* for its topic. It is in Kant's *Anthropologie in pragmatischer Hinsicht* [AK7] that we find the idea of "sense" treated as a special topic in its own right (rather than as a sidebar within another discussion, as is the case in the great *Critiques* and in his lectures on metaphysics).

Given the state of medical science at the end of the eighteenth century, encumbered as it was by vitalism and not yet raised to the status of a true experimental science (as Bernard would so elevate it a few decades later), the great advances in our empirical knowledge of the nervous system that modern neuroscience has made must have been nearly unimaginable in Kant's day. Even so fundamental an idea as "electricity" was poorly understood – Kant, after all, lived before the time of Faraday's scientific work and Ben Franklin had only recently established that lightning was electricity – and so it is little wonder that Kant's *Anthropology* confines itself to "pragmatical" rather than "physiological" considerations of the idea of sense:

> The physiological knowledge of man goes toward the investigation of what nature makes of man, the pragmatical to what he, as a freely acting being, makes or can make or should make of himself. He who ponders about natural events, e.g. what may be the root of the power of memory, can reason speciously to and fro (following the Cartesians) over the traces of impressions which residual sensations leave behind in the brain, but must in addition acknowledge: that he is a mere spectator in

> this game of his representations and he must abandon nature whilst he knows not the cerebral nerves and fibers nor their operation to make out his intent; consequently, all theoretical hair-splitting regarding this is sheer waste [AK7: 119].

We should not take Kant to mean that physiological science is a waste of time; rather, we should bear in mind that, for all practical purposes, there *was no* physiological *science* in his day – merely philosophy, the practice of medicine, and the rudiments of anatomy.[3] We should take Kant quite literally and view this statement as meaning that it is useless to *speculate* on physiological anthropology without the firm support of the empirical wing of science. Kant's great achievement in philosophy often overshadows the fact that his early education and interests were in science.[4]

If, however, the physiological side of anthropology was unattained in Kant's time, the same is not true of what we might call its psychological side – our knowledge of the appearances of those elements of experience we call the senses. Kant used the word "sense" (*Sinn*) both in a general fashion – as the "genus" of everything that falls under what we call "the senses" – and in several particular specifications. The general idea of "sense" is presupposed in the power of receptivity and, especially, with the manner in which we are affected through this power (our sensibility):

> Sensibility in the faculty of knowledge[5] (the capacity for representations in intuition) contains two parts: sense and imagination. The first is the capacity for intuition in the presence of the object, the second without its presence[6] [AK7: 153].

If we examine Kant's use of *Vermögen* in this description what emerges is this: Sense contains the *possibility* of employing the power of intuitive representation, that intuition standing in an immediate relationship to an appearance, wherein the Subject is viewed as the patient who is affected; the undetermined object of appearance is viewed as the agent acting to affect. This description of sense is that of a transcendental factor, i.e., something necessary for the possibility of one becoming conscious of being affected by a transcendental object.

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[3] There was a science called physiology then; but it was primarily based on vitalism and little resembled today's science.

[4] In 1755 Kant published his *Universal Natural History and Theory of the Heavens* in which he was the first to propose a theory of evolutionary cosmology where he argued that the system of heavenly bodies could have developed from an unformed nebula. This work did not receive much attention outside of Germany and Laplace is today more generally given credit for the "nebular hypothesis." However, Kant was the first to propose it. In addition to his courses in philosophy and logic, Kant taught mathematics, physics, physical geography, and anthropology. Unlike most philosophy professors of today, Kant was a "man of science."

[5] *Erkenntnißvermögen*. Recall that *Vermögen* means power or ability in a "potential" context and so "*Vermögen*" in Kant's theory always refers to the "possibility" of exercising a power (*Kraft*). In this case, it is the potential for producing knowledge.

[6] *Das erstere ist das Vermögen der Anschauung in der Gegenwart des Gegenstandes, des zweite auch ohne die Gegenwart desselben*. Some translate this as 'the faculty of intuition' but this is not quite right.

Sense in general is therefore a term for that which grounds the possibility of our power of receptivity and the manner of representing through receptivity (that is, sensibility). Sense is an idea of the faculty (i.e. the organization) of receptivity in the Organized Being. It is an idea of a 'something' necessary for the possibility of making a conscious representation (perception). In *Critique of Pure Reason* and elsewhere Kant often speaks of sensibility as "passive" and the power of understanding as "active." This has sometimes been taken to mean that receptivity is a kind of "wax tablet" but, in view of our previous discussions, we can easily see this is not the case. Sense and sensibility are "passive" only from the perspective that receptivity occupies the role of "patient" with that-which-acts as "agent" regarded as something "external" to this representing power. The power of spontaneity, on the other hand, is "active" from the perspective that the spontaneity is seen as the "agent" for activity. Even though receptivity is "passive" it nonetheless is viewed as the "maker" of its representations. However, its activity must be *stimulated* through the agency of something other than itself.

Within this general idea of "sense" we can logically subdivide our description of it in terms of the transcendental place of the object acting as the agent or stimulus for receptivity. This division quite naturally falls along the lines of the noetic Self – i.e. stimulation by *nous* – and the non-noetic Self – i.e. stimulation by the environment through the mediation of *soma* or by the state of the *soma*. When the transcendental place of the stimulating agent is *nous* we refer this division of the idea of sense to ***inner sense***. When the place of the stimulating agent is other than *nous*, we call this division of the idea of sense ***outer sense***.

We have previously discussed the inner sense, albeit briefly, as the idea of the totality of the internal "state" of the Subject. We are now in a position to refine that description. Strictly speaking, the subjective state is represented by its representations; inner sense is the idea of the possibility of making such "internal representations" inasmuch as *nous* is the agent which affects this state. But if we further take into account this representation as one which is actually or potentially a *perception* (a conscious representation), the idea of inner state submits to a further division: 1) as *sensus internus* – the receptivity of effects registered in the *soma* which are stimulated by *nous* – and, 2) *sensus interior* – the receptivity of a wholly subjective representation wherein the receptivity for being affected is registered in *nous* by the agency of *nous* acting upon the power of receptivity. For *sensus interior*, the representation takes place through the feelings of *Lust* and *Unlust* [AK7: 153-154]. Kant tells us:

> Inner sense is . . . what [a man] suffers, as far as he is affected by his own play of thought. Inner intuition is due to it, hence to the grounds for the relationship of representations in time (so far as they are conjoint or following one another). The perceptions of inner sense and inner experience resulting from composite connection (genuine or apparent) is not merely anthropological . . . but psychological, whereby we believe that we perceive such a sense within ourselves [AK7: 161].

Outer sense is likewise open to further subdivision. In each case, outer sense holds *soma* to be the agent (either immediately or mediately) of the effect. For this reason, the outer "senses" may be said to produce *physical sensation*:

> The effect of an object on the faculty of representation[7], insofar as we are affected by it, is sensation [KANT1a: 155 (B: 34)].

As sensations enter into the manifold of all representations they become the potential matter for objective and affective perceptions. *A sensation is not itself a perception.* Rather, it is the mental "raw material" from which empirical perceptions might possibly be constructed. Sensations add to the ability to make representations by altering the organization of the manifold.

The "nature" of this effect can be divided into: 1) *sensus vagus* – the "sensation of vitality"[8] – and, 2) *sensus fixus* – "organic" sensation [AK7 §15]. The "vitality sensations" pertain to the general state of *soma*. Feeling warm or cold and the feeling of pain are examples belonging to this division. Likewise, one's "sense of balance" and "feeling dizzy" are *sensus vagus*. Kant apparently stayed with this terminology because such feelings, as they were understood in his day, did not seem to be tied to any particular "sense organ" in the known anatomy of the body. Thus, such sensations are "vague". (Today these are much better understood by physiology).

Organic sensation, on the other hand, is sensation "fixed" to one of the five classical "senses": touch (*tactus*), sight (*visus*), hearing (*auditus*), taste (*gustus*), and smell (*olfactus*). Of these five, Kant points out that objective perception seems to rely much more heavily on touch, sight, and hearing than on taste or smell. This, of course, seems to be the case for adults; Piaget and other psychologists point out that the situation appears to be quite different for infants. Much of what babies first learn about the world comes through the sucking reflex, as evidence of which we have the baby's well-known habit of sucking his fingers, pacifier, and anything else he can get into his mouth.

While interior sense has the character of *nous* affecting itself (*nous* → *nous*) and internal sense has the character of *nous* affecting *soma* (*nous* → *soma*), outer sense with its immediate character of *soma* → *nous* has a more or less direct logical implication of a connection with the

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[7] *Vorstellungsfähigkeit*. This is yet a third variation in Kant's terminology of "faculties" and "powers." *Fähigkeit* is "capability, ability, faculty, power." In [KANT1a], the quote above is rendered as "the capacity for representation," although one might suspect this to be a device for distinguishing the *Fähigkeit* term from *Vermögen* and *Kraft* in the translation. Of these three terms, *Fähigkeit* is the one which best corresponds to "faculty" as used in this treatise (an idea of organization). "Faculty of representation" in this context, in the quote above, is *the organization of representations in the manifold* of representation, i.e. the effect is an effect registered *in the manifold* of representations, insofar as it affects what is able to be done *by* the power of representation as a consequence. Sensation potentially increases the sphere of representations that are possible - without sensations of any sort, no empirical representation would be possible at all.

[8] Literally, 'diffuse' or 'wandering' sensation.

physiological idea of the nervous system [AK7: 153-154] and especially with that aspect of the nervous system that involves the "sensory subsystem" of the peripheral nervous system, the primary sensory cortex, and so on. The idea of internal sense, on the other hand, carries with it logical implications of a connection to the motor idea and the motor subsystem as well as to homeostasis. Indeed, the idea of internal sense can be viewed as the synthesis of the ideas of interior and outer sense since its effect on *soma* is in turn an effect that "feeds back" to affect *nous* through sensation. Kant, of course, draws no such parallels in his *Anthropology* since our detailed empirical knowledge of these things was not known in his day. Still, we can entertain no serious doubt that Kant viewed "mind" and "body" as forming a real unity of organized being. We have from Kant's anthropological classification the following summary:[9]

1) interior sense *nous* → *nous*
2) outer sense *soma* → *nous*
3) internal sense *nous* → *soma*.

§ 3. The Metaphysics Proper of Rational Physics

We obtain our ideas of neurological physiology and of anthropological "sense" from experience, and the character of experience is quite different for these two cases. The ideas of neuroscience are obtained from empirical laboratory findings and are bought only with the most painstaking scientific labor. The anthropological ideas of sense, on the other hand, require no special tools and methods to unearth and are readily apparent to self-observation. Yet we seek to unite these ideas of vastly differing character and origin in *one* system. That we are required to do so is obvious from the metaphysics proper of Rational Cosmology which permits to us only *one* Nature. It is, however, only too obvious that Rational Cosmology does not speak to a question of great fundamental importance, namely how such a uniting *can be possible*. Much like certain "existential" theorems of mathematics, Rational Cosmology speaks of the "existence" of a solution but does not point us to the solution itself.

This question is not limited merely to our current task at hand. I think it must be the case for everyone who works in a scientific field that, from time to time, one is struck with a certain sense of wonder. We are presented, on the one hand, with "nature" in all its order within diversity and, on the other hand, with cold, clinical, rational theories – often of a mathematical "nature" – that describe this natural order-within-diversity. Yet, knowing as we do how we come by our

[9] We can logically ask ourselves whether this table should not also include an entry which reflects the relationship of *soma* → *soma*. However, since this idea is one confined wholly to *soma*, it belongs to the study of empirical physiology and hence has at best an indirect interest for mental physics.

mathematical constructs – a process seemingly as divorced from physical science as any process can possibly be – the wonder arises: How can mathematics, which seems to take nothing from "nature herself", come to enable us to explain the natural phenomena?[10] How, for that matter, can science itself even be possible?

Approached either from a strictly rational or a strictly empirical philosophical framework, questions such as these have never yielded a satisfactory answer. Hume left little room for us to doubt that he was calling all of us learned fools. If Socrates actually resembled in any degree his depiction by Plato and Xenophon, he was not content to merely call his fellow Athenians learned fools; he seems to have delighted in making them actually *feel* foolish. It is only under the Copernican hypothesis that questions such as these find an answer.

Let us be clear on what we do when we formulate a scientific theory. Theories make the connection between phenomena of experience and give, through scientific ideas, this connection as both universal and necessary so far as the facts at hand – our actual experiences – permit. This is not to say that scientific theory is apodictic; all empirical representations are contingent upon the data of experience. But it *is* to say that within a given sphere of experience an established scientific theory is *true*. If today two parts hydrogen and one part oxygen under a specific range of temperatures and pressures make liquid water, they will do so under these same conditions tomorrow, the day after, and, so far as we know, forever. Our detailed ideas of what hydrogen, oxygen, pressure, temperature, and water *are* may change, but the phenomena to which they *refer*, e.g. $2H_2 + O_2 \rightarrow 2(H_2O)$, do not. This is what we mean when we say a scientific theory has universal and necessary *objective validity*.

Every science contains its empirical elements. Science is, after all, the doctrine of phenomenal experience. But a science *proper* must also include the pure and *rational* element that is the ground of its objective validity. It must, in other words, make the connection (through its applied metaphysic) with metaphysics proper: Rational Physics, Rational Psychology, Rational Cosmology, and Rational Theology. The latter three have been discussed previously. If we make a 2LAR of metaphysics proper, these three occupy the titles of Quality, Relation, and Modality, respectively. We now will discuss the form of the matter (Quantity) of metaphysics proper. This is Rational Physics.

Kant's discussion of his deduction of the principles of Rational Physics is found in *Critique of Pure Reason*. This discussion necessarily involves the elements of transcendental ontology, which we have not yet discussed, since all of metaphysics proper is concerned with and intimately tied to this ontology. However, for our purposes it is better for us to grasp the idea first, the details later.

[10] We will go into this question in fairly great detail in the doctrine of method in Chapter 24.

The topic of Rational Physics is the object of experience. In the *Prolegomena to Any Future Metaphysics*, Kant set down the domain of Rational Physics as follows:

> Nature is the *Dasein* of things, so far as it is determined according to universal laws. Should nature mean the *Dasein* of things in themselves, we could never know it either *a priori* or *a posteriori*. Not *a priori*, for how can we know what is due to things in themselves, since this never can be done by the dissection of our concepts? . . . But knowledge of the nature of things in themselves *a posteriori* would also be impossible. For, if experience is to teach me *laws* under which the *Dasein* of things stand, these laws, if they have reference to things in themselves, would have to hold for them *necessarily* even outside my experience. But experience teaches me what there is and how it is, but never that it must necessarily be of such a manner and not otherwise. It therefore can never teach the nature of things in themselves.
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> The word *nature* assumes yet another meaning, which determines the Object, whereas in the above meaning it only denotes the *conformity to law* of the determinations of the *Dasein* of things generally. Nature considered *materialiter* is the *quintessence of all objects of experience*. With this only have we to do here, for otherwise things that could never be objects of experience, if they had to be known as to their nature, would compel us to concepts whose meaning could never be given *in concreto* (by any example of possible experience) and of the nature of which we must make nothing but concepts whose reality, i.e. whether they actually referred to objects or were mere things of thought, could never be decided. The knowledge of what cannot be an object of experience would be hyperphysical, and with such a thing we have here nothing at all to do, but only with the knowledge of nature, the reality of which can be confirmed by experience, whether it is directly possible *a priori* and precedes all experience.
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> The *formal* in nature in this narrower sense is therefore the conformity to law of all the objects of experience and, so far as it is known *a priori*, their *necessary* conformity . . . Here we have to do not with things in themselves . . . but only with things as objects of possible experience, and the quintessence of which is what we here properly call nature . . . It is all the same whether I say: "A judgment of perception can never rank as experience without the law that, whenever an event is observed, it is always referred to something preceding from which it follows according to a universal rule," or whether I express myself thus: "Everything of which experience teaches that it happens must have a cause."
>
> It is nevertheless more suitable to choose the first formula. For since we can *a priori* and prior to all given objects have a knowledge of those conditions on which alone experience of them is possible, but never of the laws to which they may in themselves be subject without reference to possible experience . . . [we] shall therefore have to do here only with experience . . . and determine nature as the whole object of all possible experience [KANT2a: 89-92 (4: 294-297)].

This lengthy quote repeats what we have already said previously in this treatise: that Nature is the "world model" mind constructs according to *a priori* rules for the construction of concepts, and that these rules of construction or pure notions – being necessary for the possibility of experience – constitute the *pure rational part* of natural law. These notions constitute Kant's transcendental ontology, which we will discuss in the next three chapters. It is, however, important for us to clearly appreciate right now that their character is so primitive that they cannot in any way be regarded as or likened to the rationalist theory of innate ideas. Their sole concern is with the construction and combination of concepts, and concepts are nothing other than the rules for the reconstruction of intuitions. They "make" our cognitions of experience, and in doing so "give" us the objects of our experience.

But they do not pre-make for us a science. A science – a systematic doctrine of nature – is built out of diverse experiences welded together by empirically-based ideas to make a whole of experience. Not to put too fine a point on it, but science develops *theory* as a complex of ideas, and those ideas, which are the matter of theory, are so far advanced in the complexity of the manifold of their cognitive contents, relative to the primitive notions of transcendental ontology, that to compare these ideas with the notions of understanding is like comparing an ocean to a drop of water. It requires years of education and practice for a person to become an able scientist; an infant is born with the 'know-how' to construct cognitions.

Our present interest lies not with the notions but with, one might say, the "nature of a science" (and with an eye to the eventual development of a science of mental physics). Now, every science aims at establishing truth (the congruence of the object with its cognition) and every science strives to attain as great a degree of certainty in its findings as possible. Absolute certainty is an ideal and we do not expect to attain it; but the competent practice of science requires us to try to perfect our theories as much as possible, to be as certain *as we can*. It is here we encounter the value and importance of Kant's definition of science *proper*.

Because it is objective truth science strives to attain, the perfecting (i.e., the making more perfect) of a science is promoted by the guidance of principles which ensure the *objective validity* of those hypotheses, models, and guesses in which theories of *empirical* Nature are incubated and developed. Objective validity, however, means that our theoretical reasoning is in accord with the *conditions* which alone give us objects and experience. We must bear in mind that science does not merely labor to catalog observations; that would be nothing more than an historical doctrine. Rather, science strives for *predictive power*, i.e., to make statements concerning *possible* experiences not yet observed and, hence, *a priori*. And, to a degree we must admit is truly remarkable, *it succeeds*. The question is: *how*?

§ 3.1 Pseudo-Metaphysics

I think it likely any educator will be willing to agree that thinking is a skill that improves with practice. The primary goal of academic pedagogy is to find ways to promote the development of critical reasoning skills in one's students. Teaching is not an activity that involves pouring knowledge into the students' heads like one might pour coffee into a cup. Nor is it correct to view schools as some kind of knowledge factories where teachers "build an education." Nor is an education some sort of warehouse erected on the vacant lot of a student's mind for the housing of facts and trade skills. If one is to use such silly analogies, the most appropriate model is probably agricultural. A farmer does not "grow" his crops any more than a teacher "learns" his or her students some arithmetic; corn grows by itself and students learn by themselves; all the farmer or the teacher can do is to prepare the field, plant the seeds, cultivate the process, and protect the

"produce" from harmful insects and vermin.

If thinking well is a skill, and if it is furthermore a skill that one *develops*, then we must admit that learning to think well involves the development of *maxims of thinking*. Everyone who thinks does so according to particular (and personal) maxims which that person has developed for him or her self from childhood up. In the course of doing so, we each develop our own way of "looking at the world" and our own "strategies for reasoning" about that world. We develop habits of thinking and oftentimes dignify these habits of thinking with the name "common sense." What one acquires in the course of a *science education* is a set of such maxims worked out over the years by scientists who came before us. We call this collection of maxims the *paradigm* of the science. Richard Feynman once remarked:

> I would like to emphasize something. The theories about the rest of physics are very similar to the theories of quantum electrodynamics: they all involve the interaction of spin 1/2 objects (like electrons and quarks) with spin 1 objects (like photons, gluons, or W's) within a framework of amplitudes by which the probability of an event is the square of the length of an arrow[1]. Why are all the theories of physics so similar in their structure?
>
> There are a number of possibilities. The first is the limited imagination of physicists: when we see a new phenomenon we try to fit it into the framework we already have - until we have made enough experiments, we don't know that it doesn't work. So when some fool physicist gives a lecture at UCLA in 1983 and says, "This is the way it works, and look how wonderfully similar the theories are," it's not because Nature is *really* similar; it's because the physicists have only been able to think of the same damn thing, over and over again.
>
> Another possibility is that it *is* the same damn thing over and over again - that Nature has only one way of doing things, and She repeats her story from time to time.
>
> A third possibility is that things look similar because they are aspects of the same thing - some larger picture underneath, from which things can be broken into parts that look different, like fingers on the same hand. Many physicists are working very hard trying to put together a grand picture that unifies everything into one super-duper model. It's a delightful game, but at the present time none of the speculators agree with any of the other speculators as to what the grand picture is [FEYN1: 149-150].

The point to all this is that these maxims of thinking are constructed upon a set of ideas – vague, clear, or so commonplace that they are rarely scrutinized – that tend to color how one thinks about "everything." This set of underlying ideas is sometimes called the individual's "personal metaphysics" – although the incorrectness of this terminology is hopefully quite evident to us at this point and it is more accurate to call this set of empirically-formed underlying maxims *pseudo-metaphysics*. The positivists were able to drive philosophy from the tent of the sciences but they were unable to rid themselves from the influence of their own unsystematic, accidental, and unexamined maxims of pseudo-metaphysics.

When a fact clashes with a person's subjective pseudo-metaphysics, he calls this fact a

[1] In the lecture in which this remark was delivered, Feynman was using the word "arrow" to mean a mathematical object known as a "vector"; his audience was a non-technical one whose members could "relate" to "arrows" but not to "vectors."

paradox and says it "defies common sense." The history of science provides many examples of such things. Among them are: the twin paradox of special relativity theory, the wave-particle paradox of quantum physics, the Russell paradox of axiomatic set theory in mathematics, Brown's paradox in the theory of micromagnetics, and the bandwidth paradox in communication theory. The occasion of a paradox is of great interest in science because a strikingly good paradox tends to attract a great deal of attention and effort. A paradox is a discord between the object of experience and its concept and therefore strikes at the heart of scientific truth; consequently, the paradox is scrutinized until a way is found to resolve it.[2]

It is one of the principal achievements of Kant's Critical Philosophy that he was able to explain the possibility of such paradoxes in terms of the functions of judgment, understanding, and reasoning. The second division of *Critique of Pure Reason*, entitled the "transcendental dialectic," is devoted to the analysis of how our thinking becomes *transcendent*, i.e., ventures beyond the boundaries of possible experience. The outcome of this analysis shows that transcendent thinking is not only possible but *natural*, i.e. the propensity for it is built into the process of human reasoning. The process of judgment, which is the seat of cognition and the source of objective validity in knowledge, is not its own master. Its *employment* is regulated by the principles of pure Reason. But the power of Reason does not stand in immediate relationship to objects of experience. Rather, it works towards the perfection of the unity of the manifold of cognition. It is in pursuit of this goal that we are subject to the thinking of transcendental *illusions* – the construction of ideas that lack objective validity and from which the possibility of the paradox is arises.

> The outcome of all dialectical attempts of pure reason not only confirms what we have already proved in the Transcendental Analytic, namely that all inferences that would carry us out beyond the field of possible experience are deceptive and groundless, but it also simultaneously teaches us this particular lesson: that human reason has a natural propensity to overstep all these boundaries, that transcendental Ideas are just as natural to it as the categories[3] are to understanding, although with this difference: that just as the latter lead to truth, i.e., to the congruence of our concepts with their Objects, the former bring out a mere, but irresistible, semblance, illusion from which one can hardly hold back even through the keenest critique [KANT1a: 590 (B: 670)].

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[2] Of the examples cited here, Brown's paradox still remains without a satisfactory explanation. Brown's paradox is this: the existence of magnetic domain walls in iron explains the low magnetic coercivity of bulk iron *but* our present *quantitative* theory tells us that these domain walls (which can be experimentally observed) should not be able to form in the first place. It is presently assumed that "defects" in the crystal structure of iron are the cause of domain walls, but this has not been shown to be a fact. The bandwidth paradox, on the other hand, has a resolution we will discuss in Chapter 24. The paradox is this: no signal that is limited in time can also be limited in bandwidth and vice versa. The problem was: all *real* signals seem to be finite in both time *and* bandwidth. One might suspect there is something fundamentally wrong with the mathematics of communication theory, since the paradox is essentially a paradox between physics and mathematics, but we will see in Chapter 24 that the problem is ontological and has a Critical solution.

[3] Categories is another name for the pure notions that govern the construction of concepts.

This is the danger inherent in the positivists' program. The unsystematic aggregation of pseudo-metaphysics not only lends itself to transcendental illusion; it practically invites it. This is why Kant called science *proper* only that systematic doctrine in which its rational paradigms are grounded in a system of pure metaphysics proper. One role assigned to metaphysics proper is that of a sort of trail guide, knowledgeable in the terrain of objective validity, and competent to guide us away from dialectic inferences in our theories.

§ 3.2 The Pure Science of Nature

Let us now look at that division of metaphysics proper which is directly concerned with the issue of objective validity for concepts of the objects in Nature. This is the pure doctrine of Rational Physics. Kant called this doctrine the *pure science of Nature*.

In Kantian terminology a "pure" concept, judgment, or inference is one that contains no empirical element of sensation. It is obvious that if Nature is viewed through the lens of Aristotelian realism no such thing as a "pure science of nature" would be possible; the very phrase would present us with an oxymoron. However, under the Copernican hypothesis Nature is the world model each of us comes to build for ourselves. Now the truly marvelous thing is that in the vast majority of commonplace ideas, all of us end up producing more or less the same "world view" of things. This complex of ideas we usually call "plain, ordinary common sense" and if it were not for this enormous complex of commonly-held ideas we would not even be able to communicate with one another. But the very *possibility* of this marvelous phenomenon is grounded in something we all share, namely our common organic structure and the accompanying common mental structure of the pure notions of understanding (which Kant calls the categories of understanding). Because these are the structures that make experience possible, a doctrine of the pure science of Nature becomes possible through the study of this structure.

> [We] cannot study *a priori* the nature of things otherwise than by investigating the conditions and the universal (though subjective) laws under which alone such knowledge as experience (as to mere form) is possible, and we determine accordingly the possibility of things as objects of experience . . .
>
> We shall therefore have to do here only with experience and with the universal conditions of its possibility which are given *a priori*, and thence determine nature as the whole object of all possible experience. I think one would understand me, that here I do not mean the rules for the *observation* of a nature that is already given, for these already presuppose experience; thus I do not mean how (through experience) we can study the laws of nature, for these would not then be laws *a priori* and would give us no pure natural science, but how the conditions *a priori* of the possibility of experience are at the same time the sources from which all universal laws of nature must be derived [KANT2a: 92 (4: 297)].

The development of any *empirical* science involves the development of a *discipline* by which we make for ourselves particular rules or develop particular habits for how we shall look at things, what the objects that unify our theories shall be (e.g., "mass" in physics), and, in general,

what the paradigm of the science shall be. These are the maxims by which the “rules of empirical nature” will be sought, and a good deal of science education is devoted to teaching these maxims to the science students. Without these maxims there would be no deductive and rational part of science.

Now, the objects around which these maxims are built are objects of ideas – i.e., are supersensible. Therefore they are not “given” to us empirically but deduced *by* us as generalizations from concrete empirical examples. To develop such ideas we proceed by a process of reasoning and we utilize induction and analogy in this process. This process is clearly observable in children during the sixth stage of sensorimotor intelligence, as the following example illustrates:

> *Observation 180.* - 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), that is to say, right after the preceding experiment, I play at hiding a 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 grabs 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 the 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 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 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 operations to be performed, but also to the role played by imitation in the genesis of representation. 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 . . . 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 in 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.
>
> During the following attempts (the slit always being 3 mm. wide), the same procedure is immediately rediscovered. On the other hand, Lucienne is incapable of opening the box when it is completely closed. She gropes, throws the box on the floor, etc., but fails [PIAG1: 337-338].

It is patently obvious that nothing in direct sensible experience could have informed this sixteen-month-old baby that there was any connection of any sort between her mouth and Piaget's matchbox. Yet she had a problem to work (getting at the chain in the matchbox), and her behavior clearly illustrates the process of reasoning by analogy at work. Mouths can be opened, so perhaps matchboxes can, too! She then "reduced her theory to practice," performed the experiment, and verified that it worked. (Of course, Lucienne almost certainly did not think of it in these terms, but I'm trying to help the adults reading this to see the connection with how science operates). It is worth the reader's while to compare Lucienne's babyish simile with Feynman's comment earlier regarding how pleased the physicist at UCLA was with the similarity between physical theories.

A science, of course, develops its maxims with the intent of attaining through them the widest possible generality, and it seeks laws it can hold to be necessary and universal. (Rational deduction always presupposes the necessity of the conclusion given the truth of the premises). But under what conditions can we *rationally* expect necessary universal judgments to result?

> (When) a judgment agrees with an object, all judgments concerning the same object must likewise agree among themselves, and thus the objective validity of the judgment of experience signifies nothing else than its necessary universal validity. And conversely when we find a reason to hold a judgment as by necessity universally valid . . . we must hold it as objective also - i.e., that it expresses not merely a reference of our perception to a subject, but a property of an object; for there would be no ground for other judgments necessarily agreeing with mine if it were not the unity of the object to which they all refer, with which they agree, and hence they must all be congruent with one another.
>
> Therefore, objective validity and necessary universality . . . are exchangeable concepts, and though we do not know the Object in itself, yet when we look at a judgment as generally admitted and hence necessary, we thereby understand it to have objective validity. Through this judgment we know the Object . . . by the universal and necessary connection of the given perceptions; and as this is the case with all objects of sense, judgments of experience take their objective validity . . . merely from the condition of the universal validity of empirical judgments, which, as already said, . . . rests upon . . . a pure notion of understanding[1]. The Object itself always remains unknown in itself; but when by the notion of understanding the connection of the representation which it gives to our sensibility is determined as universally valid, the object is determined through this relationship, and the judgment is objective [KANT2a: 92-93 (4: 298-299)].

The requirements for a "pure natural science" follow from this analysis of what it means for judgments to have objective validity (once we also have the primitives of Kant's transcendental ontology). Rational Physics is a doctrine and a canon for explaining to us what properties our empirically-derived ideas must have if these ideas are to be constructed so as to be products of the objectively valid employment of those primitive functions of determining judgment. Let us bear in mind that the "gap" through which transcendental illusion enters our ideas is not due to

[1] *reinen Verstandesbegriffe*. The term "pure notion of understanding" is equivalent to the term "category" used in this treatise.

determining judgment but to the process of reasoning (e.g., reasoning by analogy) which employs and directs the process of determining judgment. Rational Physics is therefore not a canon for determining judgment (for this is always *formally* objectively valid); it is a canon for *reasoning* in regard to objects of experience. Reasoning is a process that directs judgment in regard to the concepts that are to go into the matter of the judgment.

> Judgments, so far as they are regarded merely as the condition of the union of given representations in a state of consciousness, are rules. These rules, so far as they represent the union as necessary, are rules *a priori*, and, so far as there are no more beyond them from which they are derived, are first principles. Now since in regard to the possibility of all experience, when viewed merely as the form of thinking, no conditions of judgments of experience are higher than those which bring appearances, according to the varying form of their intuition, under pure notions of understanding, which render the empirical judgment objectively valid, these are therefore the *a priori* first principles of possible experience.
>
> The first principles of possible experience are then at the same time universal laws of nature which can be known *a priori*. And thus the problem of our second question, "How is pure natural science possible?" is solved. For that systematization which is required for the form of a science is met with perfectly here, because, beyond the above-mentioned formal conditions of all judgments in general (hence of all rules in general) offered in logic, no more are possible, and these are a logical system; the concepts established thereupon, which contain the *a priori* conditions of all synthetical and necessary judgments, accordingly constitute a transcendental system, and finally the first principles, by means of which all phenomena are subsumed under these concepts, constitute a physiological system, i.e. a system of nature, which precedes all empirical knowledge of nature, makes it possible, and may in strictness be called the universal and pure natural science [KANT2a: 99-100 (4: 305-306)].

Kant's deduction of these pure rational principles was carried out in *Critique of Pure Reason*. In order to follow his deduction we must first be armed with the pure notions of understanding. Fortunately, it is possible to describe this proper metaphysic without first taking the reader through Kant's lengthy and highly technical deduction, and this we shall do now.

§ 3.3 The Pure Principles of Rational Physics

Since Rational Physics is a pure system of metaphysical principles, and since a system is a "thing" in the broadest sense of that word, Rational Physics can be presented in terms of the four general titles of our 2LAR: Quantity, Quality, Relation, and Modality. The principles contained in these four titles are called, respectively, the Axioms of Intuition, the Anticipations of Perception, the Analogies of Experience, and the Postulates of Empirical Thinking in General.

Quantity and the Axioms of Intuition

The Quantity principle is the principle for the form of the matter in empirical cognitions. Since the objects of all such cognitions must be regarded as appearances, the principle of the Axioms of Intuition pertains directly to the idea of appearances themselves. The principle is:

> **Axioms of Intuition:** All appearances are (as regards their intuition) extensive magnitudes [KANT1a: 286 (A: 162)].

Let us recall that an appearance is the undetermined object of an intuition. (The object becomes a phenomenon when its intuition is re-presented through concepts). The Axioms of Intuition principle is a principle for how we may regard, in an objectively valid manner, our knowledge of objects as they appear to us. To understand this principle we must first understand what Kant meant by the term "extensive magnitude." Kant used the word "magnitude" (*Größe*) in a specific and more primitive technical sense than we commonly employ today:

> Magnitude is the determination of an object according to which the apprehension of its intuition is represented as possible only through repeated positing of one kind [KANT10: 6 (21: 454)].

Putting this another way, we apprehend an object as a "magnitude" if we must regard this object as a *homogeneous composition* composed of simpler "parts." The idea of a magnitude is closely related to the ideas of multiplicity (*Vielheit*: a plurality or "manyness") and measure (the idea of a unit of magnitude). "Five ducks" is an example of a multiplicity (in which "duck" is the measure), but "a flock of five ducks" is an example of a magnitude ("flock" is "the one which contains a homogeneous manifold", i.e., "five measures of duck").

> The above concept of magnitude is not an empirical concept for it contains the conditions of apprehension in general and the unity of the concept according to its rule, from which the very first empirical concepts can arise. Hence it also has *a priori* intuition and a notion of the understanding of the synthetic unity of its manifold in apperception [KANT10: 6: (21: 455)].

Magnitude in this definition is an idea directed at the *a priori* process by which we become conscious of our empirical representations *as appearances*. The idea is quite basic. An intuition is on the one hand a unification of diverse elements of the data of the senses. Seen in this strictly logical manner, we think of an intuition only as an aggregation – a set of "sense elements" that has been gathered together. But *metaphysically* an intuition is a *singular* representation, i.e., it is the representation of *one* object (the appearance). Within such a representation the "elements" of that representation lose their diversity and become a *homogeneous* manifold by virtue of being *coordinate parts* of one *thing*.

But the idea of an "extensive magnitude" goes farther than this. It is the idea that this endowment of homogeneity takes place through a *successive buildup* of the parts into the whole. In this viewpoint a "multiplicity" can be thought as the idea of this buildup while it is still in progress; when the buildup process is completed – and only then – a "multiplicity" becomes a "magnitude." ("Measure" is not an idea we require for this metaphysical view of "the many and

the one"; we require the "unit of measure" only if we wish to determine "how big" the magnitude is – which is an idea of mathematics and not of apprehension *per se*).

> That something is a magnitude (quantum) can be known from the thing by itself without any comparison [*Vergleichung*] of it with others: namely whenever a multiplicity of the homogeneous together make a unity. However, for *how large* it is we always need something else, which is also a magnitude, as its measure. But because the judging of magnitude depends not merely on *multiplicity* (number) but also on the magnitude of the unit (the measure) . . . we see that the determination of the magnitude of appearances can supply no absolute concept whatever of a magnitude, but only a comparative one [KANT5: 86 (5: 248)].

Magnitude is a general idea of composition and therefore of the general idea of the matter of representation. As such, it pertains equally to Quality as well as Quantity. Its specialization to the form of the matter of representation (Quantity) brings us to the idea of extensive magnitude:

> I call extensive magnitude that in which the representation of the parts makes possible the representation of the whole (and therefore necessarily precedes the latter) [KANT1a: 287 (B: 203)].

With this definition we have what we need to understand the Principle of Axioms of Intuition. Our consciousness of an object, as appearance, *necessarily* involves three things:

> 1. It presupposes a multiplicity of parts – "pieces" of sensible representation – that comprise the matter of the composition of the appearance;
>
> 2. It presupposes a *process of synthesis* – which Kant called the *productive* imagination – in which the parts are combined by being given a *form* and united in the unity of apperception; because this synthetic process is necessary for the possibility of intuition, we must regard this form as *a priori* – that is, prior to and necessary for experience – and as *pure* (i.e., taking nothing from the empirical data of the senses). This synthetic process consists of the step-by-step construction of a multiplicity of the combined parts;
>
> 3. It presupposes as an outcome of this synthetic process an objective representation – an empirical intuition – as a *singular* representation of the appearance; this outcome is an extensive magnitude, i.e., it is the outcome that *makes* the manifold of parts homogeneous (they are "the same" in that they all "belong" to the same intuition).

As noted previously in the development of our theory, we reject the copy of reality hypothesis in the Critical Philosophy. However, merely rejecting an hypothesis is a negative judgment; it only speaks to what our representations are not. The Principle of Axioms of Intuition is a *positive* principle for it is an exposition of what we are to regard all appearances *to be* insofar as their quantitative composition is concerned. A consequence of this principle is the following: insofar as we regard the idea of the parts of an appearance under the Axioms of Intuition, *these parts may not be regarded as appearances in their own right*. In relationship to the intuition that

contains them, these parts have no manifold and we are not conscious of them *as parts* in themselves. James was getting at something like this idea with his pack-of-cards-is-on-the-table examples.

However, the Axioms of Intuition is also a principle in which we find the ground of the possibility for the *decomposition* of phenomena in empirical *analytic* re-presentation. Every appearance *is* an extensive magnitude; therefore the idea that phenomena can be *reduced* – i.e., the idea of the composite thing – is given *objective validity* and the door is open for scientific reduction insofar as this reduction involves empirical and rational analysis of Quantity. This does not mean we are free to engage in unfounded speculation; to reduce an appearance means that we have successfully obtained an *appearance* of its "parts"; but *all* appearances are extensive magnitudes, and therefore to reduce an appearance means at the same time that we must regard its parts as themselves containing parts. But, as such a judgment must be empirical, the specific appearance of a part of a larger phenomenon must have its ground in an actual appearance and not merely in what we can imagine as a possible appearance.

To take an example, when Pauli proposed the idea of the neutrino as an explanation of the phenomenon of beta decay (a type of radioactive decay discovered early in the twentieth century), his idea was not regarded as "established" until neutrino action was actually "observed" in an experiment. According to the Axioms of Intuition, we can regard as valid the *possibility* that the neutrino "is made of parts" but, to date, physics has not succeeded in experimentally discovering any such parts of the neutrino. Unless and until this happens, the neutrino remains an "experimentally simple" object ('simple' in a scientific sense, not in the sense of the classical philosophical idea of "the simple"). This is likewise the case for the electron. The quark hypothesis of elementary particle physics is likewise an objectively valid *mathematical description* of elementary particles, but quarks as *entities* cannot be held to be an established *fact* so long as quarks remain unobservable. Quarks *as things*, in other words, are at present merely *noumena* and no theory of them that is divorced from the objective ground of their possibility (the phenomenon of the manifold diversity of hadron particles) can be objectively valid.

The name "Axioms" of Intuition is highly appropriate. The multiplicity of parts is not an objective thing by itself. Objectivity only enters the picture when we have the singular intuition of an appearance. Since we do not say that the parts define the whole (the definition of the whole is credited to the synthetical process that *gives* these parts their homogeneity), we regard the appearance of an object as "self evident" from the viewpoint that it is the Self which forms the representation (the intuition) of the appearance. Because this requires in the synthetic process the *a priori* "know how" of the forming of the intuition, the resulting representation can be nothing other than in congruence with its object – i.e., a "self-evident truth." This, however, is the classical idea of what defines and characterizes an "axiom." From a logical perspective the

apprehension of an appearance in a sensible intuition is a kind of proposition and if the "matter of the composition" (which we will discuss in the next section) involves what Kant called "the real of sensation" we can say that an intuition *is* an axiom in the classical definition of that word.[2]

Quality and the Anticipations of Perception

We have defined perception as representation with consciousness. The phenomenon of perception is consequently a mental phenomenon, i.e., it is something that pertains to the division of *nous* in our Organized Being model. We also take a further step and divide perception into affective perception (perception that pertains to the idea of interior sense) and objective perception (perception that pertains to the idea of outer sense). The matter of the matter of objective perception, insofar as it relates to outer sense, we call *sensation*.

Receptivity, as we said earlier, denotes a "passive" ability – that is, receptivity requires stimulation in order to produce a sensible representation. This idea, however, necessarily presumes the existence (in terms of *Dasein*) of something that we say stands in the place of the agent of stimulation. This we call the object of appearance. Sensation, therefore, can be regarded as the *effect* of the object on the faculty of representation. With Kant, we will call the *matter of the appearance* that which in the appearance corresponds to sensation. Put another way, we take the matter of the object to mean the power of the object to stimulate our receptivity. The idea of this power is what we mean by the phrase *the real of sensation*. We can establish the actuality (i.e. the *Dasein*) of an "external" object only by means of our representations of it, and the ground of our conscious representations of empirical objects of outer sense is sensation. Thus, that which links our consciousness of being affected (perception) with the appearance of an object is sensation, and the idea of the possibility of a relationship between sensation and the object is the matter of the object – hence, the real of sensation.

The Principle of the Anticipations of Perception is the pure principle of Rational Physics that speaks to how we may regard the physical matter of objects (insofar as we must regard these objects as appearances). The principle is:

> **Anticipations of Perception:** In all appearances the sensation, and the *real* which

[2] In present-day formal mathematics the word "intuition" has a bad reputation. Any competent modern mathematician will bristle and snarl if he is accused of "mere intuition" in the pursuit of his mathematical research. However, if we understand the term "intuition" in its *technical* usage in the Critical Philosophy rather than its vague and semi-psychological connotation in everyday language, there should be no objection to our calling sensible intuitions mental-physical axioms. Indeed, perhaps we shall find that by doing so we can recover for mathematics the objectively valid real grounds that for centuries it was believed to possess and which mathematics (that is, formalism) believes itself to have lost in the course of the logical positivism of the early twentieth century.

> corresponds to it in the object (*realitas phaenomenon*), has an *intensive magnitude*, i.e., a *degree* [KANT1a: 290 (A: 166)].

We discussed the idea of magnitude earlier. In what way does sensation differ from intuition so as to justify being, first, regarded as a magnitude and, second, regarded as a different kind of magnitude from the extensive magnitude in an empirical intuition? To understand this, let us first note that one's *consciousness* of being affected does not seem to come through a process of being "built up" – i.e., does not seem to be a successive process of construction. We describe this consciousness using phrases like "It came to me in a flash." Sensation is in a representation as it is "immediately given" in the very moment we *become* conscious of it. Indeed, it is this character that seems to specially distinguish sensation. Extensive magnitude, on the other hand, has precisely this property of being "built up" through a successive synthesis. Therefore if sensation *has* a magnitude it cannot be an *extensive* magnitude.

On the other hand, one's consciousness of sensation can and does exhibit *qualitative* differences from one moment to the next. Our consciousness is able to range from being clear and intense (e.g. I bang my knee on my desk and "get" a sensation of sharp pain) to being vague and semi-aware (e.g. hearing the fan in my computer as I'm typing this) to being wholly unconscious of something (e.g. getting up from my chair and only then noticing stiffness in my legs). If we call unconsciousness of sensation a "negation" and consciousness of sensation the "reality of sensation" then we find we can regard this qualitative aspect of magnitude in consciousness as an apprehended "unity in which multiplicity can only be represented through approximation to negation" [KANT1a: 291 (B: 210)]. Kant calls such a magnitude an *intensive magnitude*. He had a nice way of illustrating the connection between the idea of a degree of consciousness and the idea of a degree of sensation:

> But still there is between reality (representation of sensation) and the null, i.e. the complete void of intuition in time, a difference which has a magnitude, to wit between every given degree of light and of darkness, between every degree of heat and of absolute cold, between every degree of weight and of absolute lightness, between every degree of occupancy of space and of totally empty space, diminishing degrees can be conceived, in the same manner as between consciousness and complete unconsciousness (psychological darkness) ever-diminishing degrees take place; hence no perception is possible that can prove an absolute absence, e.g., no psychological darkness that cannot be considered as consciousness which is only outbalanced by a stronger consciousness, and likewise in all cases of sensation [KANT2a: 100 (4: 306-307)].

This brings us to the idea of ***anticipation***. Kant defines anticipation as "all knowledge through which I can recognize and determine *a priori* what belongs to empirical cognition" [KANT1: 159 (B: 208)]. Now, the idea of sensation is the idea of an *effect* and we regard the agency of this effect as vested in the object of appearance. Indeed, sensation is that in perception which *delimits* the perception *as being empirical*. Thus, sensation is precisely that in cognition

which we say *cannot be anticipated* before it happens.

Sensation is apprehended all in a single moment in time; it has this character of being apprehended as "immediately given." Its apprehension does not seem to involve a successive synthesis and for this reason cannot be called an extensive magnitude. The perception of sensation is consequently a *unity* and no sensation is ever perceived otherwise. On the other hand, we can distinguish different degrees of consciousness in rising from the unconscious (negation) to the conscious (reality of sensation). This is what allows us to *conceive* of sensation as a composition (i.e., as containing a multiplicity) even though we *never* perceive this multiplicity within *a* sensation. Since we never actually experience the multiplicity we can conceive within a sensation, our idea that sensation is a magnitude (an intensive magnitude) is *a priori* and thus can be rightly called an anticipation of perception.

Now let us see how this applies in turn to the appearance. As we must regard all objects as appearances only, we can form no objectively valid idea of the matter of an object except in accordance with the condition that makes our perception of the object possible. This condition is none other than the phenomenon of sensation and, as a consequence, the only objectively valid ideas we can make of the "materiality" of a physical object are those which agree with the anticipations of perception. However, the *only* anticipations of perception we have for sensation subsist in the idea that sensation has a degree of intensive magnitude. Therefore all objectively valid ideas of the matter of a physical object *can be grounded in nothing else than the idea that the matter of an object must be regarded in terms of intensive magnitude* (degree).

Based upon this principle, Kant was able to show that the prevailing view of physical matter in his time – namely the corpuscle model of matter – was not a necessary and universal idea. What is particularly interesting in his argument [KANT1a: 292-295 (B: 211-218)] is that in it we can see the forerunner of what today we call the "field concept" (which Maxwell introduced in his theory of electricity and magnetism). Consider Kant's observation in the quote given above that there is no perception that can prove an absolute absence. Because the matter of an object is the correlate of sensation, it immediately follows from this observation that we can never prove the absolute absence of the object (i.e., the absence of its matter) on the grounds of negation of sensation. Therefore, *the idea of a "simple" constituent of matter has no objective validity*. This is enough all by itself to demolish the objective validity of the corpuscle idea.

But Kant was able to take this argument forward an additional step: "The property of magnitudes according to which no part of them is the smallest possible (no part is simple) is called their continuity" [KANT1a: 292 (B: 211)]. This idea of "continuity" does not disagree with the principle of Anticipations of Perception and so, unlike corpuscles, does not lack objective validity.

To go with this, let us consider the case of an object, represented in intuition and conceptualized as being in a physical space in the company of other objects. This object may have the appearance of being limited to some particular region of this physical space and may also have the appearance of being separated by a void in space from other objects. How far are we to trust this interpretation of *locality* for the object in the overall appearance?

The Principle of Anticipations of Perception sets limits to this. The absence of sensation for the region outside the empirical representation of the object does *not* imply the non-existence of the matter of this object elsewhere in space. It is perfectly legitimate, Kant wrote, to conceive of this object as *possibly* occupying what appears to be the empty space between itself and other objects. *If* this is so, then it is also legitimate to conceive this object as affecting (and being affected by) other objects even though the *appearance* does not provide us with a perception of such interaction. In Kant's words, "a proof of empty space or of empty time can never be drawn from experience." The extensive magnitude of an appearance and the intensive magnitude of that appearance are two entirely different considerations insofar as what inferences can be drawn, and the perception of an object in its extensive magnitude (its extended representation in space) does not necessarily imply anything about its intensive magnitude (its ability to affect other objects).

> Thus an expansion that fills a space, e.g., warmth, and likewise every other reality (in appearance) can, without in the least leaving the smallest part of this space empty, decrease in degree *ad infinitum*, and nonetheless fill the space with this smaller degree just as well as another appearance does with a larger one. My aim here is by no means to assert that this is how it actually is concerning the specific gravity of the variety of matters, but only to establish, on the basis of a first principle of pure understanding: that the nature of our perceptions makes an explanation of this sort possible[1], and that it is false to assume that the real of appearance is always equal in degree and differs only in aggregation and its extensive magnitude, especially when this is allegedly asserted on the basis of a first principle of understanding *a priori* [KANT1a: 294 (B: 216)].

Newton had firmly entrenched the corpuscle idea in the physics of Kant's day. As a result the greatest problem and puzzle of the time was the "action at a distance" Newtonian physics seemed to require. Newton offered no explanation (other than the agency of God) for action at a distance, but he was firmly on record as holding corpuscles to be "real." Kant is sometimes viewed today, mostly by people who either are not familiar with the Critical Philosophy or with modern physics (or both), as being in some way an apologist for Newton and even of having deliberately tailored his metaphysic of natural science to fit the Newtonian model. But in the quote given above Kant is *explicitly* saying the corpuscle model lacks objective validity (conflicts with the metaphysical requirements of possible experience) through failure to consider the matter of the object as having intensive magnitude.

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[1] When Kant says something "is possible" he is not speaking problematically in the sense of, "oh, maybe such-and-such a thing is so"; rather, he is saying that the concept *meets the conditions required of a possible experience*. This specific example is aimed at the idea of gravity as an 'action at a distance.'

In his *Metaphysical Foundations of Natural Science*, we find Kant developing this idea of "continuity" as the material basis for physics. We would today call his view a "field theory" although it differs in some important ways from the idea of a "field" held by modern physics and the mathematics needed to develop this theory did not yet exist in Kant's day. Kant was quick to point out that "we cannot anticipate general natural science, which is built upon positive fundamental experiences, without injuring the unity of the system" [KANT1a: 293 (B: 213)]. The Principle of Anticipations of Perception is in this sense a *negative* principle; that is, it only tells us what we can *not* do if we are to maintain objective validity in our concepts and ideas of the objects in a physical universe. The *positive* doctrine of a natural science must come from experience. If we protest that this means we cannot be *certain* our ideas are correct, I can only remind the protester of what was said in Chapter 2: All sciences admit of dubitability.

Prolegomenon to the Dynamical Principles

The first two principles make transcendental assertions concerning the objects of appearance, namely that these appearances are to be regarded in terms of magnitudes. These principles must consequently be viewed as *constitutive* principles for they pertain directly to the constitution of appearances in the *making* of cognitions. Our perceptions are constructions and these first two principles pertain to the rules of this construction. The Greek root of the word "mathematics" is *mathema* – that which is learned – and so it is not inappropriate that Kant called these principles the *mathematical* principles of Rational Physics.

Our remaining two principles pertain to the form (rather than the matter) of experience. They are principles pertaining to the *empirical use* of our power of understanding (*learning* rather than that-which-is-learned) and so are principles for the *regulation* of one's use of his cognitive ability. Kant called these the *dynamical* principles.

The Principle of the Analogies of Experience is a principle of Relation (the form of the form of experience). The first question that confronts us in the exposition of this principle is therefore: what *is* the form of this manifold? Here I find myself, as an author, in something of a difficulty with regard to my presentation of this principle. We have not yet dealt with the details of the Critical ontology, but the exposition of the Analogies of Experience cannot be carried out without our having at least some explicit idea of the epistemological ontology that accompanies it. Yet it seems to me poor pedagogy to launch into what would be a very lengthy digression to establish and prove the part of transcendental ontology that establishes the nature of the form of the manifold of experience. It is better, I think, to treat that topic in full in its own appropriate place in this treatise. Consequently, I have decided that the best way to proceed is to offer a sketch of the ontology of the form of the manifold, postponing its full exposition until later. Therefore I am

forced to beg the reader for a little indulgence and, yes, a degree of trust concerning the validity of the ontological underpinning of the Analogies of Experience – to trust that the issues and questions that will almost certainly be raised in what follows will be duly addressed before our treatise is concluded.

The objects of experience are those objects we call phenomena. Let us remind ourselves of what we mean by this term. A phenomenal object is that which is represented by the synthesis of the representations of a multiplicity of *appearances* to produce a cognition. A cognition, in turn, involves an intuition in which this representation contains contributions arising from the re-presentations of *reproductive* imagination. Put another way, all phenomena involve concepts and the reproduction of the intuitions governed by these concepts. A phenomenon requires the combination of individual appearances, i.e., the phenomenal object is what the manifold of separate appearances is thought as having in common. The phenomenon unites the appearances.

Taken individually, the empirical intuition of an appearance is a singular representation – a "snapshot", so to speak, of a single moment in time. The *breaking down* of this representation, i.e. its analytic division into concepts, is objectively valid only because we must regard all appearances as magnitudes (a unity in which there is also multiplicity). Cognition requires us to re-unite this manifold of concepts in a new form and give this re-presentation as a new sensible intuition (the intuition of the phenomenon).

However, the idea of such a form cannot be regarded as the idea of something given to us by the agency of external matters. To so regard it would be to adopt the copy of reality hypothesis and this hypothesis is false. Rather, this form must be regarded as being owed to an inherent power determining the faculty of representation itself: the "know-how" for constructing the manifold of representations. As such, this know-how must be *pure* (since it can take nothing from empirical perception) and it must be *a priori* (since this capability is necessary for the possibility of experience and therefore antecedes all experience). Furthermore, since all our cognitions are *sensible* in their representations, this pure *a priori* form merits the title of ***form of inner sense***. It is likewise obvious that since this form is tasked with the formation (*Gestaltung*) of representations involving sensations, this form cannot itself be a sensation. Although it is clearly something that is part of an intuition (it is a *form* of intuition), the absence of any *empirical* element in this form justifies calling this know-how a ***pure form of intuition***.

Now, as a pure intuition that must necessarily be found in *every* empirical intuition, this form we seek must be something *universal* in all cognitions of every sort. This means that it must be something without which a cognition is impossible, i.e., *unimaginable*. If we take an inventory of our cognitions, we quickly find something that is present in each and that is indeed absolutely indispensable to our ability to represent anything *in concreto*. We will call the making of this universal form ***the pure intuition of* subjective *time***.

My use of the adjective “subjective” in the phrase “pure intuition of subjective time” demands an immediate explanation. After all, isn’t there only *one* kind of time? ***No, there is not***. The Critical Philosophy demands and requires we mark a clear distinction between what in this treatise will be called ***objective time*** and what will be called ***subjective time***.

When anyone *thinks* about ‘time’ in the normal course of living, the ‘time’ of which we think is objective time. Objective time is that which we measure using clocks of one sort or another. Objective time is that which enters the equations of physics dealing with the dynamics of phenomena. For the realist objective time is held to be a ‘thing’ or real entity in the physical world. We often describe it using metaphors such as “the arrow of time” to describe our idea of ‘time’ as “flying” uninterruptedly from the past into the future while we ourselves are perched firmly on this arrow in ‘the present.’ It does not, however, take a great deal of philosophical reflection to see the problems inherent in viewing time as a thing. It is never something we directly perceive nor is it ever presented to our senses. That of which we are cognizant is instead the consciousness of ***change*** – of ‘now’ being different in some way or another from ‘what things were a moment ago.’ We cut up time into intervals, e.g. a ‘day’ is ‘the time from sunrise to sunrise.’ All our determinations of objective time are based on the perception of changes and on the occurrence of coincident *events*. As Einstein pointed out[2]:

> If we wish to describe the *motion* of a material point, we give values of its co-ordinates as functions of time. Now we must bear faithfully in mind that a mathematical description of this kind has no physical meaning unless we are quite clear as to what we understand by "time." We have to take into account that all our judgments in which time plays a part are always judgments of *simultaneous events* [*gleichzeitige Ereignisse*]. If, for instance, I say, "The train arrives here at 7 o'clock," I mean something like this: "The pointing of the small hand of my watch to 7 and the arriving of the train are simultaneous events."

Einstein abolished the old Newtonian idea of absolute (objective) time. The theory of relativity makes it quite clear objective time is an idea, and that this idea is *defined* and not given by the data of the senses. Furthermore, there is a great deal more to the *objectively valid* determination of ‘time’ than our common everyday experiences suggest. Einstein showed that the measurement of objective time for one observer at one location can differ from that of another observer at a different location, and that therefore objective time is unswervingly *relative* to the observer *and his condition*. ‘Time’ as measured by one observer who is in a state of motion relative to a second observer “slows down” relative to ‘time’ as measured by the second observer. Clocks likewise “slow down” in the presence of a large gravitational field relative to clocks located in a region with ‘low’ gravity. Although results like this seem paradoxical to any person unfamiliar with the physics of relativity, these effects *have been verified by experiment* and

[2] Albert Einstein, "On the Electrodynamics of Moving Bodies," *Annalen der Physik*, 17, 1905.

modern physics is convinced Einstein "got it right."

There are additional puzzles concerning objective time that have come to light since Einstein's work. Whenever objective time enters in to the fundamental equations of physics, there is nothing in the form of these equations that prevents us from making time "run backwards" from the present into the past. Indeed, if viewed at a sufficiently microscopic scale, one can find no real difference in the physics of small scale phenomena if time runs backwards instead of forwards. This, of course, strikes the non-physicist as absurd, but physicists love to point out that our everyday experiences do not take place at such a small scale. A movie run backwards looks funny to us because we just do not encounter, say, a diver emerging from the water and flying backwards to the diving board while the water re-gathers itself from the air and returns to the unmolested quiet of the swimming pool. Physicists like to say that such an event, while *very improbable* is not actually *forbidden* by the laws of physics. Physicists, notably Feynman, have even used the idea of a 'particle' moving *backwards through time* to explain the phenomenon known as *antimatter* in the theory of quantum electrodynamics.

Now if the idea of objective time were of the *a priori* character that the pure intuition of subjective time demands, none of this would be thinkable. The feelings of skepticism or awe that the relativity theory or the QED theory raises in the mind of the non-physicist (and, for that matter, the *students* first learning these theories) would never arise because such theories simply could not have been imagined in the first place. If these ideas *did* correspond to the pure form of inner sense, these theories would have developed long before they did and no one would feel the least uncomfortable or doubtful of them. However, this is really no problem because the idea of objective time, far from being any sort of pure intuition, is not even *innate* to the functioning of understanding. Piaget has demonstrated very young children are completely without any idea of objective time whatsoever [PIAG6]. They do come eventually to construct this idea (in stages that Piaget has brilliantly documented), but the *fact* is: objective time is a *learned* idea.

But now we face a transcendental question. The idea of objective time is acquired; but there is nothing in any possible experience that can *present* such an idea to us because, as Einstein pointed out, objective time is a *made* (i.e., *defined*) idea. The very existence of the idea of objective time is impossible to understand *unless we presuppose a transcendental ground for its possibility*. As the idea of objective time is merely one idea among other ideas, its ground must ultimately be exactly the same as that of these other ideas.

The idea that objective time is *relative* provides the clue we require. All determinations of objective time necessarily involve the judgment of limits of some sort placed upon 'time.' If we say that an event is "in the past" we are drawing a boundary between "then" and "now." Likewise, to say something is "in the future" is a boundary between "now" and "later." If we say a stoplight was red for twenty-five seconds we draw two boundaries, the "beginning" and the

"end" of a 'time interval.' However, *every such determination is meaningless unless we presuppose some transcendental substratum on which these boundaries are marked out.* If this were not so we would find ourselves trapped in infinite regress: to mark a beginning and an end requires some larger framework that contains both this beginning and this end; but to examine this larger framework we require still another, even larger, framework, and so on.

To take another example: proponents of the "Big Bang" theory tell us the universe and everything in it "began" some (still variable) number of billions of years ago, perhaps as a "vacuum fluctuation" in an "absolutely empty space" (which isn't really "space" at all, somehow).[3] Now, when asked "What was there *before* the big bang?" *they give an answer*. "Before" the universe "began" there was, they may tell us, *nothing whatsoever, not even time*. If pressed on this point, most physicists (or at least those who hold with the Big Bang) will tell us it is "meaningless" to ask what came "before time began" and here they and I have something to agree upon. The question *is* meaningless but only because there is no possibility of answering it; the logic of the idea itself is self-contradictory *except for the fact* that objective time is the supersensible object of an idea *that has no context without a universe to give it one*.

Still, one can not help asking, if only in the privacy of one's own thoughts: what came 'before time began'? The pure and *a priori* substrate – the pure intuition of *subjective* time – that is the form of one's inner sense makes it inevitable that the question at least be raised. All our determinant judgments of objective time (as well as those of every other concept) require an *absolute* substrate (or point of reference) *necessary for the possibility* of finding unity ("meaning") in judging the manifold of all cognitions. Newton envisioned *one* "absolute mathematical time" and placed it "in the consciousness of God." Kant, so to speak, placed an absolute *subjective* time in the mind of the thinking Subject. The *character* of the pure intuition of subjective time reveals to us the experience of three *modi* [KANT1a: 296 (B: 219)]:

1) Persistence;
2) Succession, and;
3) Coexistence.[4]

The "nature" of these three *modi* of subjective time will become clear from the Analogies.

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[3] There is more than one big bang theory; see, e.g., C.H. Lineweaver and T.M. Davis, "Misconceptions about the big bang," *Scientific American*, vol. 292, no. 3, March, 2005, pp. 36-45. See also, H.A. Atwater, *Introduction to General Relativity*, pp. 160-187, N.Y.: Pergamon Press, 1974.

[4] *Zugleichsein* - literally "being at once." *Zugleichsein* is today a rather rare German noun and it may be helpful for us to think of it as a kind of subjective simultaneity (which is indeed how it is sometimes translated in English renderings of Kant's work). Before the reader acquainted with the relativity theory jumps hastily back to ideas that belong to objective time, I'd like to point out that Einstein's term for simultaneous events was *gleichzeitige Ereignisse*, not *zugleich Ereignisse* (*Zeit* is "time" in German). Kant and Einstein are not talking about the same thing. In modern German, "coexistence" is expressed either as *gleichzeitiges Dasein* or *gleichzeitiges Bestehen* - which maintains "coexistence" in a context and a manner compatible with Einstein's usage.

Relation and the Analogies of Experience

For an object to be real to us its concept must be given a context, i.e., a connection (*nexus*) in the manifold of experience.[1] It is through such connection that objects have *meaning* for us. The Analogies of Experience are the rational principles of physical objective validity in the connection of objects of experience in this manifold. The general principle is:

> **Analogies of Experience:** As regards their *Dasein*, all appearances stand *a priori* under rules of the determination of their relationship to each other in *one* [subjective] time [KANT1a: 295 (A: 176-177)].

In the second edition of *Critique of Pure Reason* [KANT1a: 295 (B: 218)], Kant gave an alternate but nonetheless instructive statement this principle: "Experience is possible only through the representation of a necessary connection of perceptions." Now all connection (*nexus*) in the manifold of objective representation pertains to the *form* of the object. For experience this connection among perceptions belongs to *inner* sense because the objective perception of outer sense (in the intuition of an appearance) must obviously be presupposed as already in place if we are dealing with a connection *among* appearances.

> The general first principle of all three analogies is based on the necessary *unity* of apperception with regard to all possible empirical consciousness (of perception) *at every time*; consequently, since that is an *a priori* ground, it rests on the synthetic unity of all appearances according to their relationships in [subjective] time. For the original apperception refers to inner sense (the quintessence of all representations), and indeed *a priori* to its form, i.e., the relationship of the manifold of empirical consciousness in time . . . This synthetic unity in the temporal relationship of all perceptions, *which is determined* a priori, is thus the law: that all empirical time-determinations must stand under rules of general time-determination, and the analogies of experience . . . must be rules of this sort [KANT1a: 296-297 (B: 220)].

The pure intuition of subjective time gives the *a priori* form of inner sense. Since it is with subjective time, and not objective time, that our theory is concerned, we will abbreviate the phrase 'subjective time' to simply 'time' in our discussions that follow. (When we have occasion to refer to objective time, the adjective 'objective' will always be used). It is this pure intuition of time that connects all our representations with each other, and since we can identify three *modi* of time, each of these *modi* requires a principle of connection "in accordance with which the [relationship of the real in the appearance][2] . . . can be determined with regard to the unity of all time" [KANT1a: 296 (B: 219)], [AK23: 47].

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[1] This is why an appearance is called the undetermined object of an intuition. It has not yet been made part of experience and is "unreal" until the intuition is re-cognized in a concept and that *concept* is determined.

[2] In *Critique of Pure Reason*, this phrase is actually "*Dasein*," but in Kant's personal copy of the book he struck the word *Dasein*, and replaced it with the phrase given here [AK23: 47].

A. First Analogy – Principle of Persistence: The perception of change in appearances from one moment to the next is ubiquitous. The ancient Greeks were in awe of this common fact of experience, giving it the name *kinesis* ("motion"), and the desire to understand *kinesis* drove their philosophies. We can hear an echo of this in William James' stream of thought theme, and the "problem of change" has been central to many other philosophical themes as well.

The central question raised by ever-changing appearances is easy to state: if everything is always changing, is there really anything permanent that underlies all this *kinesis*? Now, if we look at this question from the Copernican perspective we find that it is impossible to bring about the concept of any phenomenal object *unless we presuppose that beneath all this apparent change there really is something that persists* from one appearance to the next. That there is something "persistent" in appearances is clearly not given to us empirically (as Hume pointed out) because all our empirical intuitions are singular and the empirical data of the senses do not announce "these two different appearances are nonetheless appearances of the same thing." The 'sense' that two appearances are 'the same within their differences' is what is meant by the *modus* of persistence in the pure intuition of time.

In Aristotelian terminology this intuition of persistence within changes corresponds to the classical ideas of "substance" and "accident." Substance is that which is supposed to persist throughout the accidents of changing appearances. The automobile sitting in my garage today is "the same" automobile I bought twenty years ago despite the fact that the paint is scratched in a few places, the seat coverings are showing their wear, and the tires have been replaced several times. I myself am "the same person" as the little boy who started school during the Eisenhower administration, despite the changes in my appearance and biological composition that have taken place since then.

Observations such as these are rather commonplace and in the daily commerce of life seem hardly to be worth a thought. In science, though, it does happen often enough that considerations of this sort come up. Consider the following remark made by Feynman during one of his physics lectures:

> Any simple idea is approximate; as an illustration, consider an object . . . what *is* an object? Philosophers are always saying, "Well, just take a chair for example." The moment they say that, you know that they do not know what they are talking about any more. What *is* a chair? Well, a chair is a certain thing over there . . . certain?, how certain? The atoms are evaporating from it from time to time - not many atoms, but a few - dirt falls on it and gets dissolved in the paint; so to define a chair precisely, to say exactly which atoms are chair, and which atoms are air, or which atoms are dirt, or which atoms are paint that belongs to the chair is impossible. So the mass of a chair can be defined only approximately. In the same way, to define the mass of a single object is impossible, because there are not any single, left-alone objects in the world - every object is a mixture of a lot of things, so we can deal with it only as a series of approximations and idealizations [FEYN3: Ch. 12, pg. 2].

Now, shall we really say any person is deluded who thinks he knows what a chair is? Or shall we say only a professor does *not* know? Or shall we say that we all know what a chair is *in some particular contexts* but we do not know it in others? Behind the witty intellectual swordplay, Feynman was teaching his students an important lesson, namely that we cannot define the *substance* 'chair' because we have no perception of this *noumenon*. What we know about the chair we learn from its appearances. In this Feynman and Kant are in total agreement since Kant also holds that 'definitions' of empirical objects of experience cannot be made. We can make descriptions and we can make expositions but a definition (a "sufficiently distinct and precise concept") of an empirical object will always elude us.

But beyond this there still remains the fact that the connection of divers appearances in a *single* phenomenal object is impossible unless it is presupposed that such an object really exists. **Substance (of an object) is a *pure notion* of understanding** – a rule for the connection of concepts of appearances under the *modus* of persistence in time. Accidents of appearance inhere in the notion of the substance of the phenomenal object. This is the principle of the first analogy of experience (the Principle of Persistence):

> *First Analogy: All appearances contain the persistent (substance) as the object itself, and the changeable as its mere determination, i.e., a way in which the object exists* [KANT1a: 299 (A: 182)].

This principle is the Kantian correlate, under the Copernican hypothesis, of the classical Aristotelian principle of the matter and form of things.

B. Second Analogy – Principle of Generation:[3] The principle of persistence we have just discussed tells us phenomenal objects are known through their appearances and speaks to the idea of internal Relation (in terms of our general 2LAR of representation). Now, we recognize not only the phenomenal object of experience but its changes and alterations as well. In addition, Nature appears to contain *many* phenomena that are *not* regarded as 'the same' in substance. The unity of this *aggregate* of phenomena must *also* be connected in the manifold of experience – an idea corresponding to external Relation in our 2LAR.

Nature is itself the Idea of a singular thing; no matter what experience teaches us of the phenomena in Nature, we regard *all* phenomenal objects as part of this one-and-the-same Nature, and we regard *change* as the *successive* appearances of Nature. Succession is the second *modus* of the pure intuition of time and without this *modus* change (*kinesis*) is impossible.

[3] This is the name Kant gave to this principle in the first edition of *Critique of Pure Reason* [KANT1a: 304 (A: 189)].

Now here we find an interesting situation. A cognition of experience always involves concepts, and so 'change' does not consist merely of a succession of discrete empirical intuitions. Rather, determinant judgments and the synthesis of reproductive imagination always enter in to a cognition of experience. Viewed merely from the perspective of *logic*, this reproduction can take place in any of a number of ways so far as any connection of *succession* is concerned. For example, let us suppose a cognition has been produced that involves the reproduction of two intuitions of appearance, *A* and *B*. *Logically*, the *reproduced* succession can then take place in either of two ways, e.g. $A \rightarrow B$ or $B \rightarrow A$.

However, the *nexus* of the manifold of representations requires that any connection of real appearances under the *modus* of succession be a *necessary* connection. This necessity is not contained in the merely logical possibilities illustrated above because this purely logical arranging can take place in more than one way; hence the merely logical connection lacks necessity. This is in direct contradiction to our experiences from which we come to hold the idea that events in objective time are *ordered* in terms of a 'past' and a 'present' – i.e., that 'time' has a 'direction.' Since time *per se* is *not* an object of perception, we cannot say the succession of one state of appearance following another is 'given' in perception. Rather, the necessity of successive temporal connection in the manifold of experience requires a pure notion of understanding (a rule for the construction of concepts) and, furthermore, a regulative principle for the ordering of *determined* objective relationships in the pure intuition of time. If we call the appearance of Nature at a given moment the *state* of its *Existenz*, the *modus* of succession in time pertains to the necessary connection of one state as following another according to an *a priori* rule of order.

> I myself am therefore only conscious that my imagination places one state before and the other after, not that in the Object the one state precedes the other; or, in other words, through mere perception the *objective relationship* of the appearances that are succeeding one another remains undetermined. Now in order for this to be recognized as determined, the relationship between the two states must be thought in such a way that it is thereby necessarily determined which of them must be placed before, which after, and not vice versa. The notion, however, that carries a necessity of synthetic unity with it can only be a pure notion of understanding which does not lie in perceptions; and that is here the notion of the *relationship of cause and effect* [KANT1a: 304-305 (B: 233-234)].

Like the notion of substance, the notion of cause-and-effect has been frequently debated in both philosophy and science. For example, it is held by some that modern quantum mechanics 'violates' cause-and-effect because the equations of quantum mechanics deny us the ability to make specific *a priori* determinations of what will happen to specific individual 'particles'; it replaces classical determinism with a statistical rule. If we view the idea of cause-and-effect in terms of the old mechanistic view of classical physics, cause-and-effect relations of this sort indeed do not exist in quantum mechanics. This problem was sufficiently serious by the 1930s

that Einstein (who until then had been one of the pioneers in the development of quantum theory) had turned his back on the theory altogether. His famous remark was, "God does not play dice."

However, the old mechanistic view of cause-and-effect is *not* what is meant by this term under the Copernican hypothesis. The principle of the second analogy of experience is:

> *Second Analogy: Everything that happens (begins to be) presupposes something which it follows in accordance with a rule* [KANT1a: 304 (A: 189)].

Even quantum mechanics makes claims to speak to *what can happen* under given circumstances. Where it differs from classical physics is simply this: classical physics said that under a specific given circumstance, a specific event will follow *uniquely*; the quantum theory says that under that same given circumstance, any *one* of a *specific number* of events *can* follow *and the probability for each happening* is such-and-such. Modern physics does not cut the cord between past and present (or present and future); it greatly changed the rule but *it still has one*.

No science is possible if it does not presume that the changes in the appearance of Nature taking place *now* have a connection with a previous state of Nature. Indeed, most of scientific theory consists of nothing other than *predications* based on precisely such a connection. Physicist Henry Margenau put it this way:

> We wish to regard causality as a relation between constructs, in particular as a relation between *states*, or conditions, of physical systems. The principle of causality asserts that a given state is invariably followed, in time, by another specifiable state. Even without closer analysis this formulation will be seen to possess two virtues: It is precise and definite, and it reflects the best practices in the exact sciences. Later we hope to show that more customary views of causality, in so far as they are meaningful, can always be reduced to this [MARG: 95].

Margenau was no follower of Kant, yet on his own he reached the same principle stated in the second analogy of experience. Kant also provided an alternative wording of this principle: "All alterations occur in accordance with the law of the *connection* of cause and effect . . . *All change (succession) of appearances is only alteration*" [KANT1a: 304 (B: 232-233)].

However, the Principle of Generation contains yet another implication. We pointed out earlier that in the connection of the representations of reproductive imagination we require necessity *in the order* of temporal succession. The second analogy states not only that for every 'present state' there must be a 'past state' connected to it; it also states that a *particular* order of succession is necessarily required, i.e. that alterations of appearance are *determined in* subjective time. For example, we *never* observe the sun to set in the east, and so we must examine what it is *a priori* that determines the appearance that the sun rises in the east rather than sets. To appreciate what is involved here, we must examine the difference between *apprehension* and appearance.

Apprehension of outer sense is a successive synthesis of sensations. The word apprehension

means “to grasp mentally” and this successive synthesis *as a process* is only the formation of an *aggregate* of sensations. As such, the representations of apprehension are not yet intuitions and cannot be said to ‘contain’ an appearance. We *can* say the representation of apprehension is a *multiplicity* that has not yet become a *magnitude* because the idea of a magnitude is an idea that views the representation as being a *unity* that contains a multiplicity.

When and how does the successive synthesis of apprehension cease to be a mere ‘becoming’ and attain a real unity of representation in an intuition? This requires an *act of judgment*, and because the generation of an intuition always involves the uniting of particulars (i.e., the sensations) in the general (i.e., the singular representation of empirical intuition), this act of judgment is an act of *reflective* judgment. Now, the process of reflective judgment is grounded in the principle of the formal expedience (*Zweckmäßigkeit*) of Nature. As we recall from our discussion of this in Chapter 5, a reflective judgment is a judgment of the ‘fitness’ or ‘suitability’ of the mere *form* of a representation for a *purpose* of practical Reason. We call a representation of reflective judgment an affective perception. An affective perception is a perception that is not itself a part of the objective perception we call the intuition of the appearance. Rather, the ***presentation*** of an affective perception *marks* a singular state of sensibility as expedient for practical Reason; such a marking *defines* what we may term a clear *state* of sensibility. **We will call such a marking a *moment* in subjective time**. That which is objectively expedient in sensibility at a moment in time “crystallizes” into the objective perception of an empirical intuition.

This intuition is then subject to the synthesis of re-cognition in a concept (see Chapter 3, §6) and the ‘state’ it represents can thereby pass from being merely subjective to being *made objective*, i.e. brought under the process of determining judgment for understanding. This, however, in no way brings a halt to the on-going synthesis of apprehension. Apprehension, so to speak, “moves on” in its generation of sensible representation. In this on-going process apprehension will arrive at another expedient state of representation – which also will be marked by an affective perception where a succeeding moment is defined.

Now, the state marked by this succeeding moment is not the same state as the first because if there is nothing that distinguishes the latter state from the former we could have no ground for a new marking of sensibility and hence no ground for discriminating a second moment[4]. If we call the represented state at the first moment state *a*, and that of the second moment state *b*, then the difference between these states, *b* - *a*, is a *magnitude* [KANT1a: 314-315 (B: 253)]. We give this magnitude the name *alteration*.

The three *modi* of subjective time – persistence, succession, and coexistence – do not contain

[4] The word ‘moment’ comes from the Latin *momentum* (a movement, impulse, push; the exertion of power, force, effort). A ‘moment’ (*momentum temporis*) is in this context the outcome of such an exertion.

(in their ideas) the idea of a *duration*. The idea of duration belongs only to the idea of *objective* time. The alteration, therefore, is definable only in terms of a magnitude that represents the difference in the appearance at state *b* and the appearance at state *a*. However, as we saw earlier, we cannot regard any magnitude as containing a smallest or "simple" part. This is the property we call *continuity*. We must, consequently, view the state *b* and the state *a* as the *boundaries* of an alteration. But since there can be no smallest part *in the difference* between the real in appearance at moment *b* and that at moment *a*, we must regard the new state *b* as "growing out of" the former state *a* [KANT1a: 315 (B: 254)]. It is this *connection*, which in its formal representation in a concept is thought as a *real* and *necessary* connection, that we call ***the notion of causality and dependency***, and from which we obtain a necessary *temporal succession* (in subjective time) from the appearance in state *a* to the appearance in state *b*. This is the pure *a priori* principle of the second Analogy of Experience.

It is worthwhile to pause here and compare this Kantian theory with William James' ideas of the "substantive part" of thought and the "transitive part" of thought. James likened the latter to the flight of a bird and the former to the temporary perching of the bird at some resting point. It is quite easy to see this picture in the description given above. The process of apprehension is on-going and must indeed be seen in terms of the "sensibly continuous character of thought" that James described. Indeed, we can see the process of synthesis in apprehension as the Kantian correspondent to James' transitive part of thought. Likewise, the objective perception of an intuition marked at a moment in time, a representation which is the determinable matter for the synthesis of re-cognition in the concept, can easily be seen as the correspondent to James' substantive part of thought since such moments mark the transition from the merely subjective awareness of apprehension to the objective process of *thinking* (cognition through concepts). Also, the transition from one state of appearance to the next is *sensibly continuous* (Kant and James give us quite compatible descriptions of what it is to be "continuous"), which is a character of thought James insisted upon in his theory.

C. Third Analogy – Principle of Community: Appearance is the undetermined object of an intuition and an intuition is the *singular* objective perception marked at a moment in time. Now before any appearance can be raised to the status of a *phenomenon*, its representation must be subjected to the process of *determining* judgment because it is only through this process that we say the object is *determined* in understanding. But, as we saw in the first analogy, an object is determined as a phenomenon only by its representation in a concept in which the manifold of its representation is subsumed under the notion of *substance*.

By the principle of the Axioms of Intuition, all intuitions (and therefore all appearances) are extensive magnitudes. We pointed out in Chapter 3 that the process of the synthesis of apprehension in an intuition and the synthesis of reproduction in the imagination are *interacting* processes. What this means is that the representation of an intuition may contain in its extensive manifold contributions from both the immediate sensations of receptivity *and* from reproductions of imagination. The latter has its source from concepts and therefore we cannot assume that a particular empirical intuition does not contain representations arising from a multiplicity of 'substances.' *A singular appearance can contain a multiplicity of objects.*

It follows from this that, although the appearance of intuition is always singular, in the re-cognition of the intuition in a concept it is possible for the concept of the intuition to contain a plurality of representations of substance and therefore represent a plurality of phenomenal objects. Now, every intuition is placed at a singular moment in subjective time. If, therefore, the intuition contains multiple substances, the phenomenal objects of these substances are said to *coexist* in time. We take this as the definition of the *modus* of coexistence in the pure intuition of time.

In our consideration of coexistence, we find ourselves having to deal with the two aspects of the idea of existence. In the first place, the objects represented in the intuition have existence in the sense of *Dasein* – i.e. 'being present' in the appearance. In the second place, we must also look at their existence from the viewpoint of *Existenz*. The appearance of an intuition can only be regarded as singular in perception and therefore if a plurality of phenomenal objects are present within one and the same appearance we require a *necessary* connection between their substances in the form of the form of the manifold of concepts of the appearance. This is the principle of the third analogy:

> *Third Analogy: All substances, insofar as they are coexistent, stand in thorough-going community (i.e., interaction with one another)* [KANT1a: 316 (A: 211)].

The process of determining judgment applied to the outcome of the synthesis of re-cognition in a concept makes a determination on the object of appearance. This is grounded in the *necessary* connection between substances in the manifold of concepts. More explicitly, a substance *a* is *determined by* coexisting substance *b* and (at the same time) substance *b* must also be determined by substance *a*. From this perspective we can say that substance *b* is reciprocally both cause and effect of substance *a* and vice versa. To use one of James' favorite examples, we can make both the determination

The-pack-of-cards is-on the-table

and the reciprocal determination

The-table is-under the-pack-of-cards.

Here the relations (is-on) and (is-under) are reciprocal and positing the one requires positing the other. The subject noun and the object noun (the logical "substances") are completely interchangeable by merely exchanging the one relation for its reciprocal.

Now the representation of the specific reciprocal relationships *in concreto* must be left for empirical experience. The principle of community does not specify a *particular* empirical relationship; it only requires that a reciprocally-determining set of relationships exist (i.e., that the *Existenz* of the form of the manifold conform to the third analogy of experience). Thus the principle of community goes past simple spatial relationships of the sort illustrated in the example above and extends, as a formal condition of experience, to any general connection of coexistence. In the march of experience Relations of community that resemble one another (in intuition) among various appearances can eventually come to be objectified (united under the notion of substance) and generalized into ideas of abstract entities (e.g., the "potential energy" idea of physics, the idea of "number" in mathematics, or the idea of "societies" in history). In their beginning, however, all such abstract relationships are grounded in the necessary objective connection of substances in coexistence. The notion of community, like the notions of substance & accident and causality & dependency, is a fundamental and necessary rule of connection for possible experience in conformity with time as the *a priori* form of inner sense.

Modality and the Postulates of Empirical Thinking in General

As the matter of the form of representation, Modality is at its roots the representation of the relationship between any representation and the representing Subject's faculty of knowledge. The ideas of Modality in our general 2LAR – the determinable, the determination, and the determining factor – are all ideas that do not augment the representation itself in the least insofar as the matter of composition or the *Existenz* of the manifold of appearances is concerned. Yet it is also clear that the function of Modality – as the matter of the form of representation – cannot be dispensed with.

We have been making rather heavy usage of the terms *possible*, *actual*, and *necessary*. These are three very important words (and, in fact, they will appear again when we discuss the pure notions of understanding) and it is therefore of great importance that we have a clear understanding of what these terms mean. The meaning they are to hold for the *empirical use* of the Subject's capacity for understanding is what the Modality principles address.

(The) first principles of modality are nothing further than explanations of the notions of possibility,

> actuality, and necessity in their empirical use, and thus at the same time restrictions of all categories [pure notions] to merely empirical use, without permitting and allowing for their transcendental use. For if these are not to have a merely logical significance and be obliged to analytically express the form of *thinking*, but, on the contrary, are obliged to concern *things* and their possibility, actuality, and necessity, then they must pertain to possible experience and its synthetic unity, in which alone objects of cognition are given [KANT1a: 322 (B: 266-267)].

It is perhaps not too difficult to 'see' the relationship between the notions of possibility, actuality, and necessity and those of the determinable, the determination, and the determining factor, respectively. So far as the principles of Modality for Rational Physics are concerned, we can elucidate the meaning of these terms as three *postulates* employed *a priori* by the process of thinking in general. These are [KANT1a: 321 (B: 265-266)]:

> *First Postulate: What agrees*[1] *with the formal conditions of experience (in accordance with intuition and concepts) is* possible.
>
> *Second Postulate: What coheres*[2] *with the material conditions of experience (sensation) is* actual.
>
> *Third Postulate: That whose context*[3] *with the actual is determined in accordance with general conditions of experience is* necessary (exists).

Under the Copernican hypothesis an object must conform to our representations rather than the other way around. An object is *possible* if its representation conforms to the formal conditions of experience since it is only through these formal *a priori* conditions that experience itself is possible. The representation of a phenomenal object in an intuition can take place either through the reproductive imagination alone or in conjunction with receptivity. We do not regard mere products of our imagination (e.g. a goblin) as actually having *physical* existence. It is only those objects whose intuition contains *sensation* as an effect of outer sense that we view as having actual physical existence, i.e. as being grounded (in the *Dasein* context) in 'the real of sensation.' Finally, we can make a concept of an object prior to any actual experience of that object. When such a cognition can be linked to an *actual* object by means of objectively valid *general* conditions of experience (e.g. cause-and-effect relationships), and not merely through what is only empirically possible (i.e., contingent), then we say that an object cognized *a priori* exists necessarily.

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[1] *übereinkommt*. Literally the word means "reaches agreement". All first principles of Critical metaphysics proper, including those of Rational Physics, are regulative first principles of human reasoning. This means they pertain to the functioning of thinking, judgmentation, and reasoning. "Agree" in the context above therefore has the connotation of reaching agreement in the outcome of the synthesis.

[2] *zusammenhängt*. This is often translated as "connection" but "connection" (*Verknüpfung*) is a term we wish to reserve for technical usage, i.e. the *nexus* of the manifold of representation.

[3] *Zusammenhang*. This word is likewise often translated as "connection" but "context" describes much more accurately how we must view the modality of necessity. All thinking is objective, but no object can be real for us if it is without context.

§ 4. Logical Division and Real Division

We are now in a position to more precisely understand the distinction between a logical division and a real division in the representation of objects. At issue is the following question: If every object is real to us in *some* context and unreal in others, and since the division of any representation into parts would seem to make each part real in the context of the whole from which they were drawn, what does it mean to distinguish between "real" and "logical" division in a representation?

We take transcendental apperception as our starting point. Let us recall that transcendental apperception is the Subject's fundamental *a priori* 'sense' of its own *Dasein* prior to the elaboration of any representation of Self-*Existenz*. The *I* of transcendental apperception is a pure *noumenon*, but one which occupies a most privileged position. For each of us one's individual apperception of the *I* is the only *noumenon* for which each of us holds as *certain* its *real* and *actual* existence. All the subsequent elaboration of the Subject's world model takes the transcendental apperception as its ultimate ground. For the newborn infant none of this elaboration has yet taken place; everything the infant experiences is experienced in and through this absolute perspective. In Piaget's colorful phrase, the early perspective of the baby is one of narcissism without a Narcissus.

We know from the work of Piaget and others that the elaboration of the infant's world model is a gradual process from which slowly emerges the representation in empirical consciousness of the *empirical Self*. We will review the psychological evidence for this statement later in this treatise, but for now let us merely summarize this process of elaboration. The empirical representation of the Self arises concurrently with the elaboration of an objective world of the not-Self. It is difficult to determine with precision exactly at what point in the intellectual development of the child this division takes place, or even if there is a single "magic moment" when this occurs. What psychological evidence we have appears to be more consistent with a gradual transition in which we might say that there is an increasing *degree* of Self-consciousness (and not-Self-consciousness). This period of transition seems to take place from about 9 months to about 11 months of age and involves the simultaneous elaboration of an idea we shall call the idea of *empirical* causality[4] [PIAG2: 256-271].

The elaboration of a conceptualized boundary dividing the Self and the not-Self is directly tied to the child's activities and so has at all points a direct connection to sensuous experiences. In other words, this division carries the Modality of the *actual*. (In saying this, it is important for us

[4] The term "empirical causality" refers to the objectified idea of cause-and-effect relationships in the usual sense of the word "causality"; this is the type of causality Hume successfully attacked and we distinguish this idea from the *transcendental* notion of causality addressed in the second Analogy of Experience.

to keep in mind that the Modality of the actual does *not* imply *certainty*). Symbolically, we can express this division of Nature using the formula

$$Nature \overset{actuality}{\longleftrightarrow} \{ Self , not - Self \}$$

where the double-headed arrow indicates that *Self* and *not-Self* are concepts in a disjunction under the Idea of Nature. As we will discuss in more detail later, *actuality* is a notion of understanding, i.e., it is one of the *a priori* functions or "rules" for the construction of concepts. Its metaphysical principle is the second postulate of empirical thinking in general discussed in the previous section. A division that follows the above formula and which has the Modality of actuality is what we call a **real division**.

In the continuing elaboration of representations, the idea of the empirical Self will likewise be given a conceptualized structure in terms of its own disjunctive concepts. This construction is, of course, quite complex in its anasynthetic manifold. The idea of the empirical Self lends itself to many possible divisions. The one of interest to us right now is the division of the idea of the Self in terms of the concepts of *mind* and *body*.

In discussing this division, it is quite important for us to understand that the knowledge each of us has of one's own body is by no means innate. The newborn infant has at the outset no knowledge or understanding that he or she "is a body"; observations of the discovery process the baby undertakes in learning of its body make this *fact* quite clear. As one example, let us look at the following observation by Piaget:

> *Observation 70* - Jacqueline, at 0;4 (10) looks attentively at her right hand which she seems to maintain within the visual field. At 0;4 (8) she sometimes looks at the objects which she carries to her mouth and holds them before her eyes, forgetting to suck them. But there does not yet exist prehension directed by sight nor coordinated adduction of objects in the visual field. It is when the hand passes at random before her eyes that it is immobilized by the glance. -Sometimes, too, she looks attentively at her hands which happen to be joined. - At 0;5 (12) I observe that she constantly looks at her hands and fingers, but always without coordination with prehension. At 0;6 (0) she has not yet established this coordination. She watches her hand move; her hand moves toward her nose and finally hits her eye. A movement of fright and retreat; her hand still does not belong to her! Nevertheless the hand is maintained more or less successfully within the visual field [PIAG1: 103].

The representation of the Self in terms of body and mind seems to develop rather slowly. However, it *does* develop as the child increasingly elaborates the representations of experience that come to cognitively distinguish between these two objects.

> Two conclusions may be drawn from the preceding analyses. The first is that the child is no less conscious of his thought than we are of ours. He has noted the existence of thoughts, of names, and of dreams, and a quantity of more or less subtle particularities. One child stated that we dream of what interests us, another that when we think of things, it is because "we want to have them," another that he dreamed of his aunt because he was so glad to see her again. Mostly children think they dream because they have been frightened by something, etc. Further, there is present in the

> child a whole extremely delicate psychology, often very shrewd and pointing in every case to a keen appreciation of its affective life. In a preceding work (*Judgment and Reason* Chapter IV, §1) we maintained that the child's efforts at introspection are extremely crude, but this does not in the least contradict the present contention. It is possible to feel acutely the results of a mental process (logical reasoning or affective reasoning) without knowing how such a result came about. This is precisely the case with the child and is what is meant when the child's "intuition" is spoken of; a true perception of the contents of consciousness but no knowledge of how these contents were acquired, such is the paradox of this "intuition" [PIAG24: 124-125].

As we discussed earlier in regard to Rational Psychology, we find no sensible distinction of the *I* of transcendental apperception that grounds the division of the Self clearly into the coordinates of body and mind. Rather, in Relation these two ideas are in *community* (grounded in coexistence of the phenomena) and carry the Modality of *possibility* rather than actuality. In terms of our formula, this division is

$$Self \xleftrightarrow{possibility} \{\text{body, mind}\}.$$

Like actuality, possibility is a one of the pure notions of understanding. It is this Modality, the principle of which is the first postulate of empirical thinking in general, that we say is the characteristic of a **logical division**. This division of the Self into the concepts of body and mind is represented in accord with the conditions of experience but is the outcome of productive imagination (in terms of the intuition of the cognition) and not the result of a direct synthesis of apprehension involving the real of sensation.

The concepts of body and mind in this logical division are nonetheless cognitions of objects. Under both concepts is contained a manifold of representations that, collectively, are united in the objective concept of body or in the objective concept of mind. The representation of these two concepts is merely a process in which we can say a boundary is delimited that places one set of concepts under the one and another set of concepts under the other. By this partitioning of concepts we obtain the appearance of body and the appearance of mind.

We are now in a position to better understand the logical divisions of the Organized Being model. Since the concepts of body and mind – as concepts of Self – are concepts of appearances coexistent in subjective time, the third Analogy of Experience requires a Relation of community (which is a pure notion of understanding) between them. In terms of our 2LAR of the general representation of a thing, this Relation of community is the transitive idea of general Relation. It is, therefore, a representation viewed as contained in the concepts of both body and mind, i.e., the synthesis of the external viewed as the internal. The idea of this Relation is that which we call *psyche* in this treatise. Its representation, however, carries the Modality of *necessity* under the third postulate of empirical thinking in general. The idea of *psyche* is a necessary representation because it follows from a condition of empirical experience in general, namely the pure intuition

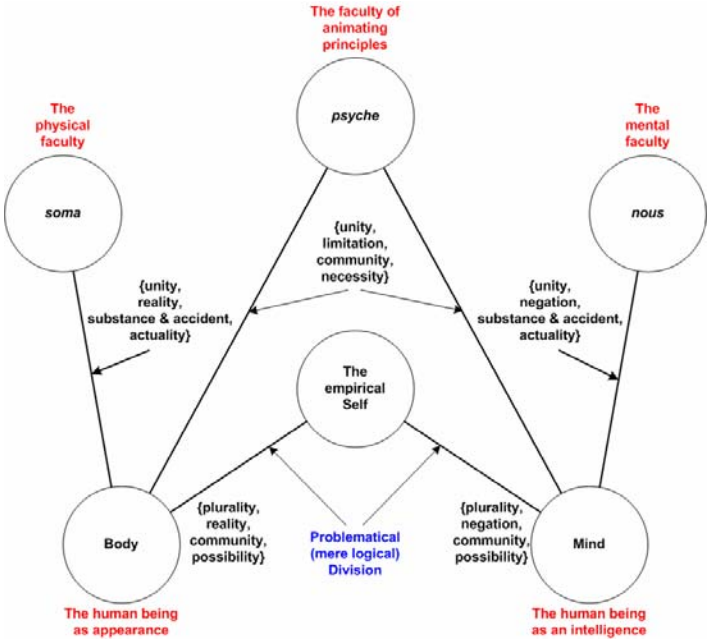

Figure 6.4.1: The Structure of the Phenomenal Self. The lines represent determinant judgments.

of coexistence in subjective time. The necessity of a representation of a Relation of thorough-going community between body and mind does not, of course, give us the specific cognition of what is *contained in* the idea of *psyche*; these details require the testimony of experience before we can fill them in. What is necessary for the possibility of experience is the existence of the Relation of community itself. The conceptual *objectification* of this idea – that is, the making of a *distinct* representation of *psyche* – we discuss in Chapters 15 and 16.

Now, the concept of the Self has the Modality of actuality but its representation in terms of body and mind is merely a possible (i.e. logical) division. Therefore, the concepts of body and mind both contain in their concepts characteristics of the actual in the Self. The actual, we recall, is that which coheres with the material conditions of experience (sensation). By increasing the degree of distinctness in the concepts of body and mind through the representation of *psyche*, we separate *psyche* from those other characteristics of body and of mind we say contain the actual in these concepts. What we must do, therefore, is provide a representation of the *persistent* in subjective time in the concepts of both body and of mind. The pure notion of the persistent in time is called the *substance* of the object. We give the name *soma* to the idea of that which is persistent and actual in the idea of body; the idea of that which is persistent and actual in the idea of mind we call *nous*.

Figure 6.4.1 provides an illustration of this organization of the concepts of Self insofar as the ontological Modality of this representation is concerned. Necessity (which corresponds to the determining factor in our general 2LAR) is the synthesis of possibility viewed as actuality. In the figure we see how the structure of this representation as the actual represented in *soma* and *nous*

is connected in the manifold to the Self by way of the possibility of body and mind.

As for the ideas of *nous* and *soma*, these representations arise in conjunction with the representation of *psyche* because a Relation of community *must always be a Relation among substances*. This brings us to the question of the ontological status of the notion of substance. We shall have to limit the present discussion to the illustration of the distinction between 'substance' under the Copernican hypothesis and 'substance' under the more commonplace non-Critical suppositions. The full discussion will be presented in Chapters 8 and 9.

Over the past few centuries the philosophical idea of "substance" has come to be regarded by the physical sciences as synonymous with the idea of "corporeal matter." This way of thinking about substance is, by now, a strongly entrenched *habit*, promoted by the realist outlook with which all human beings begin life. The grip of realism on all our maxims of thinking is particularly evident in young children.

> The child is a realist, since he supposes thought to be inseparable from its object, names from the things named, and dreams to be external. His realism consists in the spontaneous and immediate tendency to confuse the sign and the thing signified, internal and external, and the psychical from the physical [PIAG24: 124].

However, at its roots, the equating of substance with corporeal matter requires us to adopt the outlook that our mental representations must conform to the object rather than the other way around. This is precisely the viewpoint that the Copernican hypothesis forbids. The philosophical problem of "substance" is formidable and has always defied solution by any philosophy which refuses to base itself in Kant's Copernican system because whenever we have more than one kind of so-called "elementary substance" (e.g., several varieties of quarks, electrons, photons, the Higgs boson, and so on), we are always driven to ask: what is the substance of which these substance*s* are made and, if there is ultimately only one "true" substance, how can such a simple substance come to produce such an amazing variety of composite substances? The landscapes of the histories of both science and philosophy are littered with the ruins of past speculations on the "nature of substance" (Boyle's corpuscles, Leibniz' monads, mind dust, phlogiston, etc.).

The situation is wholly different under the Copernican hypothesis. The ground for the representing of *any* object *as an Object* is the pure *a priori* notion corresponding to the intuition of persistence in subjective time. 'Substance' is the notion of the persistent object in a manifold of objective appearances at different moments in time; it is the *functional* linchpin by which determining judgment objectively *connects* a diversity of appearances under *one* Object. Thus *soma* is the substance of body and *nous* is the substance of mind. *Ontologically* it is quite meaningless to ask "what is the substance of these substances?" because at root Kantian substance is nothing other than the pure *a priori* notion of a rule of determining judgment necessary for the possibility of experience. It is, in other words, ontologically *primitive* and

cannot be defined *by* phenomena because substance is the notion necessary for the possibility of our representations of phenomena – a rule for constructions of rules of persistence in time – under which objects of appearances are *made to conform* in cognition.

§ 5. The Transcendental Sensorimotor Idea

We come now to a core topic of this chapter, namely the transcendental sensorimotor idea. Let us begin by summarizing where the foregoing discussions have taken us. First and foremost, we have the principle of the *real unity* of the empirical Self. This principle holds that the division of our representation of the Self into a mind concept and a body concept is merely a possible – i.e. logical – division. We obtain this principle from the metaphysic of Rational Psychology, which forbids regarding the real division of mind and body as objectively valid and demands instead unconditioned unity in the four Ideas of Rational Psychology (unconditioned unity of relationships among appearances, unconditioned unity of the agreement of representation and appearance, unconditioned unity in the multiplicity in time, and unconditioned unity of *Dasein* in transcendental apperception). Self is the object of unity in one's *Existenz*.

In the second place we have the *empirical* idea of the sense and motor *modi* of receptivity in the interaction of body and mind. We expressed this in the anthropological ideas of outer sense (*soma* → *nous*) and internal sense (*nous* → *soma*), which express the relationship of agent to patient in this interaction. Now, this idea of the relationship of agent to patient is nothing else than the idea of a relationship between a *condition* and the *conditioned*. As such its ground in metaphysics proper lies in Rational Cosmology, which mandates that in our understanding of Nature we seek for the unconditioned in *the series of conditions*. Even though we regard the division of mind and body as merely logical, we must nevertheless require our theory to seek: 1) absolute completeness of the composition of the given whole of all appearances (cosmological Quantity), 2) absolute completeness in the division of a given whole in an appearance (cosmological Quality), 3) absolute completeness in the origin of an appearance (cosmological Relation), and 4) absolute completeness as regards the dependence of the *Dasein* of what is changeable in appearance (cosmological Modality). These four principles are the principles of the cosmological Ideas as we discussed in Chapter 4.

Third, we have the representation of Organized Being as the principle of the faculty (organization) of the empirical Self. The ideas of *nous* (the idea of the substance of mind), *soma* (the idea of the substance of body), and *psyche* (the idea of the Relation of community between mind and body insofar as these are represented as coexistent in time) arise from the requirements placed upon our theory by Rational Physics with regard to the form of the composition of objects. In particular, these elements of the Organized Being model are ideas of the form of the *nexus* in

the objective representation of the Self in conformity with the Analogies of Experience, which mandate the conformity of our representation with the subjective conditions of time (persistence, succession, and coexistence).

To complete this picture, we must address the requirements of the formal principles under which any representation of an appearance is to be regarded as objectively *real*. Specifically, our representation of the empirical Self in terms of an Organized Being is a *theory*, and we seek the material *nexus* of this theory in conformity with reality in Nature insofar as this *nexus* involves the real unity of Organized Being. The idea of this *nexus* is the transcendental sensorimotor idea. It belongs to Rational Theology and comes under its four Ideas.

§ 5.1 Quantity and the Unity of Faculties

The idea of Quantity in the sensorimotor idea comes under the jurisdiction of the Idea of *entis realissimi*. This Idea is that of the unity of all characteristics in the representation of an appearance. For our representation of the Organized Being, this is the Idea of the Self as the unity of its *faculties* - i.e., *Self-organization*. The pure transcendental apperception, we recall, is *Dasein* without *Existenz*. The empirical Self, as *phenomenon*, is the real in empirical apperception; but self-*cognition* is only possible through our representation of the manifold of appearances of the Self. The real unity of the Self requires these representations to be *organized*, which is merely to say the biological phenomenon of *soma* and the mental phenomenon of *nous* must be regarded in terms of coordinate faculties[1] subsumed under a common idea. This idea is the transcendental sensorimotor *faculty*.

This idea is one of *identification*. From neuroscience we are able to learn a great deal about the biological organization of the Self. From these empirical studies we have obtained (and continue to obtain) numerous concepts of anatomical organization which we structure in terms of identifiable biological faculties based upon what can be physically observed and rationally deduced from psychophysical observations. We know, for example, that there appears to be a relationship between the brain structure we call the amygdala and the behavioral manifestations we call *fear*. In recent years we have also identified other brain areas that appear to be related to cognitive development, and the study of the biological maturation of these brain structures may succeed in explaining the psychological observation of the Piagetian stages of intellectual development.

On the other side, a mental physics is concerned with the organization of mind and the faculties of mental life. The representations of these faculties are, of necessity, quite different from the appearances of the biological system. Nevertheless, the Idea of *entis realissimi* in the context of the sensorimotor idea is an acroamatic principle stating that despite the differences in

[1] Recall that in this treatise we use the word *faculty* to imply a principle of organization.

appearance between biological and mental faculties, *these faculties are merely coordinate representations of one and the same faculty*. In other words, there must be a *correspondence* between every mental faculty and some biological faculty and *vice versa*.[2] This principle, in all likelihood, will not be very surprising to the neuroscientist for it is a presumption of neuroscience that the link between biological structure and mind is real. However, I put it to you that this principle runs both ways: the faculties of *nous* likewise have their counterparts in biological structure and from this it follows that neuroscience can be given guidance by mental physics just as the empirical part of a science of mental physics can be guided by neuroscience.

Earlier in this treatise I commented that the reductionist method in science ought to guard against *too narrow* a scope. The biological investigations of neuroscience have clearly profited from the psychophysical method but empirical psychology as it is understood today is somewhat limited in the precision of its facts because it lacks a complete systematic doctrine for its rational principles. This has obvious implications for the difficulty of the task of understanding the psychophysical architectonic of the brain. Professor Horace Barlow of Cambridge has noted:[3]

> The reductionist approach to the brain shows promise of revolutionizing our ideas about what single neurons can do, but reductionism is limited because its drive is to look for explanations at lower levels in the organizational tree. The isolated preparations that have been so important for the success of the reductionist approach can tell us about extra-cellular and intracellular processes but not about subjective experience or the survival value of a gene. Obviously you cannot find out about what you have thrown away or deliberately chosen to ignore, and reductionism ignores a lot . . . To obtain more knowledge one may have to look up from the simpler, more basic levels of organization towards the complex higher levels.

The idea of the unity of the faculties provides the alternative of "looking sideways" – from the organization of mental faculties to the organization of biological faculties and vice versa.

§ 5.2 Quality and the Condition of State

The idea of Quality in the transcendental sensorimotor idea is obtained from the Idea of *ens originarium*. It is the idea of accordance of the condition of the faculties with the real in appearance. At every moment in time appearance is represented in the condition or *state* of the synthesis of apprehension in an intuition. From the perspective of *nous* this condition is defined by the representations of sensation and feelings. However, we must also consider the condition or state of the Self from the perspective of *soma*. Here our representations are *physical* and these representations are called *signals*. The idea of accordance of the condition of the faculties with the real in appearance is the requirement *as an acroamatic principle* that there exist a *one-to-one correspondence* between the apprehensive and the biological states. This correspondence is

[2] The word "faculty" is important here. Fingernails do not have a mental correlate but they are not a *faculty* of the Self.

[3] Rita Carter, *Mapping the Mind*, Berkeley, CA: University of California Press, 1998, pg. 18.

required because the mental and physical representations must be regarded as merely different representations of the appearance of the *same thing*.

It is therefore not inappropriate to call the idea of Quality the idea of the Condition of State. This idea brings with it a question of considerable importance, namely, *what is a 'state'*? Here we call upon system theory to provide us with the explanation of this term. In the context of mental physics, **a state is a coalition of representations which, along with the representation of the effect of a stimulus, is sufficient to uniquely determine empirical consciousness**.

Now any system as formidably complex as *nous* presents us with rather obvious difficulties in this idea of the Condition of State. Furthermore, the state is *empirically conditioned* and so its explanation in full is a task for empirical as well as rational investigation. We will be doing rather well in this treatise to merely succeed in uncovering the *a priori* principles of the idea of the state. We can, however, say something about it at this point.

First of all, in formal mathematics the representation of a state in terms of its elements (which we call state variables) is not unique. Put another way, there is more than one way to mathematically represent the state of a system *and these representations are isomorphic* to one another. The immediate consequence of this strictly formal idea is that it must be possible to represent the condition of state either in terms of physiological state variables (e.g., the collective local states of neurons and glia in terms of electro-chemical state variables) *or* in terms of representations of sensations and feelings. Furthermore, any pair of such representations must be isomorphic – that is, we must be able to go from either one to the other *and back again*.

If it is necessary for us to take as the state of apprehension the collective conditions of all the neurons present in the human brain, our scientific task could best be described as hopeless in any pragmatic sense, although the principles of Rational Theology assure us that if we could obtain such a representation it would certainly do the trick. However, we may with equal real validity examine the possibility of representing the Condition of State in larger terms – those of sensation and feelings. More to the point, the synthesis of apprehension is an *organized process* and the knowledge of the *structure* of this organization *limits the possibilities of representation*. We may therefore, with some high degree of confidence, anticipate that the representation of the Condition of State in terms of sensation and feelings may be less complex than the equivalent biological representation, perhaps enormously less complex. To borrow some more terminology from the science of system theory, we need only be concerned with the representation of *observable states* (a technical term which in its practical significance means that only those representations for which there are observable consequences need be considered in the Condition of State).

The idea of the Condition of State is an idea of agreement. That is, we may regard the state of apprehension in terms of biological variables in the context of *soma* as equivalent to a representation of this state in terms of constructions of representation in the context of *nous*.

Which of these we employ depends only on our perspectival vantage point – physical, mental, or a mixture of both. Regarded from the physical perspective, our observables are *signals*, or more accurately, *signaling states*. From the perspective of *nous*, our observables are *perceptions*. Collectively, we may call both the *matter of sensory state*.

§ 5.3 Relation and Information

The representations of *soma* and the representations of *nous*, in Relation to each other, can be thought as a unity only if we think of both as coordinate appearances of an object. In turn, the idea of an object can only be thought in terms of a limitation on Reality in Nature. Now, the idea of Nature is the unity in the complete embodiment of "everything" and, as such, can only be represented as persistent in time, i.e. under the notion of substance. This is required under Rational Theology by the Idea of the *ens summum*. All objects in Nature must therefore be conceptualized as under or derived from the notion of substance.

The object in which the representations in the divisions of *soma* and *nous* are united we will call the ***information of representation***. In everyday usage the word "information" carries the vague connotation of being something that "is informative" or "adds to our knowledge" or "reduces our uncertainty." The English dictionary definition of this word is scarcely more "informative" than these rather vague descriptions. It is rather more instructive if we look at the Latin root of this word, *informatio*. The word *informatio* means "a representation, an outline, a sketch" and is derived from the verb *informare*, "to give form to, to represent." The *idea* of information performs precisely this function of "giving form to" the otherwise disjoint representations of *soma* and *nous*, and so our use of this term in this context seems quite appropriate. One might loosely say "information" is the power to "in-form" representations.

The science of information theory draws a rather fine distinction between the concept of "data" and the idea of "information." Data is a representation and different representations may be used to represent the same object. For example, the letters C-A-T are used in written communication to denote a four-legged mammal that purrs and hunts mice. The same thing, when represented in an ASCII[4] computer file, is represented as 0100 0011 0100 0001 0101 0100. When transmitted over radio or telegraph using Morse code, the same thing is represented as (— • — • • — —). All three of these representations are called *data* representations. What they have *in common* is the information they represent. **Information is that which is persistent from one data representation to another**.

Signals are also used to represent information, although it is more common to say that signals "carry" information rather than represent it. In the general (technical) sense of the word data, a signal is just as much a data representation as a "bit" in a computer memory. In fact, the

[4] American Standard Code for Information Interchange

word signal always has the connotation of representing information. The battery voltage that powers your portable telephone is not a signal only because we usually do not think of the battery as a source of information.

It is not out of place at this point to digress briefly and make a comment or two concerning the word "communication." In common usage communication is defined as "the act of imparting, conferring, or delivering from one to another, as, the *communication* of knowledge, opinions, or facts." In engineering, the definition is made rather more specific: communication is "the transmission of information from a point of origin (the source) to a destination (the sink)." Biologists have adopted this engineering model and speak of "cell-to-cell communication"; the study of "cell signaling" is an important topic in biology. Perhaps one of the broadest descriptions was given by Weaver[5]: Communication is "any procedure by which one mind may affect another."

In every case, communication always involves a minimum of three constituents: an information source, a transmission or conveying of information, and an information sink. It is legitimate and perfectly reasonable for biologists to speak to "cell communication" and "cell signaling" since the phenomena they refer to fits snugly within the ideas of "communication" and "communication systems." On the other hand, philosophers have long labored over the "communication problem" that Cartesian duality (the specious 'real' division of mind and body) presents. The problem is: if mind and body are two different real entities, how do they communicate? Leibniz faced a similar issue with the problem of communication among monads; he solved his problem by using a "God monad" and the idea of pre-established harmony – a solution that basically did away with any need for communication. The communication issue within the mind-body problem gives rise to the fanciful idea of the homunculus.

After what has gone before in this treatise, we are in a position to see that there can be no "communication problem" between *soma* and *nous* because there is no *transmission* of information between them. The physical data of the *soma* and our mathematical data representations of *nous* are merely two sides of one and the same coin. It is perfectly okay to speak of the brain as "communicating" with the peripheral nervous system since the peripheral nervous system is *functionally* not a part of the *brain*. (This division of *soma* is anatomical and empirical). But it is nonsense to speak of "communication" between *soma* and *nous* because we cannot say with any objective validity that a "transmission" between different real objects takes place. In effect we would be saying the information source and the information sink are one and the same and there is no 'medium of transmission' separating them. The technical context for the term "communication" does not take into its scope this type of situation.

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[5] Claude Shannon and Warren Weaver, *The Mathematical Theory of Communication*, Urbana, IL: University of Chicago Press, 1964.

§ 5.4 Modality and Meaning

The idea of information is the idea of an 'in-forming' of the *nexus* between representations of *soma*/*nous*. Yet, by itself, information is merely an idea of the form of the form for this *nexus*. The Modality of the sensorimotor idea is the idea of the matter of this form. The idea of information is without content unless we also have an idea that this information is presentative of some *necessary* reality. This reality is to be sought in the connection of information with *knowledge* and can be justly called the ***sensorimotor meaning*** of the representation.

The science of information theory, being a mathematical discipline, does not concern itself with the issue of the "meaning" of information. In this it mimics formal logic (which makes abstraction of the material content of its premises and concerns itself with "truth values" instead of with "truth"). Shannon wrote[1]

> The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem.

The "meaning" representations are necessarily supposed to "possess" is a supposition of the *ens entium* Idea of Rational Theology. *Ens entium*, as we recall from Chapter 4, is the Idea of the unconditioned ground of the reality of all empirically contingent objects. We can say that meaning is the *essence* of that whose form is information.

What does "meaning" mean? The dictionary definitions of the verb "to mean" are given as

> **mean**, v.t. [ME. *menen*; A.S. *mænan*, to mean, intend, purpose]
> 1. to have in mind, view, or contemplation; to intend; to purpose; to design.
> 2. to intend to express, signify, or indicate.
> 3. to signify; to denote; convey; import.
> 4. to effect; to bring about; as, money *means* happiness.
> **syn** - intend, purpose, design, contemplate, signify, denote, indicate, suggest, propose.
>
> **mean**, v.i.
> 1. to have a purpose or intention in mind; to be minded or disposed; now chiefly in *mean well*, to have good intentions.
> 2. to have a (specified) degree of importance, effect, or influence; as, money *means* little to me.

From this, we arrive at the dictionary description of "meaning" as a noun:

> **meaning**, n. 1. that which exists in the mind, view, or contemplation as a settled aim or purpose; that which is meant or intended to be done; intent; purpose; aim; object [archaic].
> 2. that which is intended to be, or in fact is, conveyed, denoted, signified, or understood by acts or language; the sense, signification, or import of words; significance; force.
> **syn** - import, intention, design, intent, purport, sense, significance.

[1] Claude Shannon, "A mathematical theory of communication," *Bell System Technical Journal*, vol. 27, pp. 379-423, July, 1948.

These dictionary definitions, particularly (2), will do temporarily for now, although we will obviously need a deeper examination of the "what does 'meaning' mean?" question later.

Sensorimotor meaning can clearly pertain to the "meaning" of representations, in *soma* and *nous*, only insofar as these representations pertain to the empirical Self. In other words, meaning cannot be vested in external objects or agents but only in the appearance of the Self. The sensorimotor idea is an idea belonging to *psyche* as a principle of the essential unity of *soma* and *nous* and is an idea of *combination* – of physical faculty and mental faculty, physical representation and mental representation, etc. It follows that in the Organized Being model we must suppose a meaning for biological signals in terms of mental representations, for biological organization in terms of mental organization, etc., and of the *reverse*: mental representations in terms of biological signals, mental organization in terms of biological organization, and so on.

Modern neuroscience already presupposes mental phenomena can be explained in terms of biological structure, and we can see from our metaphysical principle of the sensorimotor idea that this presupposition is rationally grounded in metaphysics proper. However, the sensorimotor idea is also a principle telling us that the reverse view is equally objectively valid. Insofar as we can know *a priori* the organization and functions of *nous* from transcendental deduction, we must also presuppose that this rational organization has its correlate in biological organization. We can justly say that the theoretical representation of *nous* (insofar as this representation is necessary for the possibility of mental phenomena) is the *appearance* of *nous* and that for this appearance there must be a biological coordinate in the appearance of *soma*.

§ 6. The Empirical Sensorimotor Idea

We have been speaking of "the representations of *soma*" in our discussions above, but what exactly does this phrase mean? In the view of present day neuroscience, biological representation in the context of 'brain' is typically taken to be synonymous with observable brain activity – i.e., the complex patterns of action potentials and chemical changes of state empirically found to occur in the brain. Now, the usual ideas of "representation" carry, in one way or another, the connotation that a representation implies an *observer* – someone or something to whom the representation is *presented*. In the Cartesian view of mind-body duality this observer has come to be called the homunculus – the "little man in the head." However, unless this mythical homunculus is equated with soul, the homunculus idea suffers from a number of well-known contradictions; for instance, the homunculus "himself" would seem to need a "mini-homunculus" to do for "him" what "he" does for me, and this mini-homunculus in turn requires a mini-mini-homunculus, etc. *ad infinitum*.

The soul model is one that science is unable to treat and the homunculus model is simply too fraught with unanswerable paradoxes to be taken seriously. The lack of any objective validity in either of these models is readily apparent from Rational Psychology. A third model which has been proposed is that the representations of *soma* are made to the *brain*, i.e. to some part of the brain structure that acts as a kind of "knowledge organ." While this model bears at least an apparent kindred relationship with the mind-theory idea that "the mind makes its representations to itself," the "knowledge organ" hypothesis suffers from one quite damaging fact: neuroscience has looked for this centralized "knower" structure in the brain and has been quite unable to find any such thing. While it has been well established that particular regions of the brain correlate quite well with psychological phenomena historically called mental powers, the fact is that no one region of the brain appears to correspond to the idea of a "knowledge organ."

In light of this fact, many – perhaps most – neuroscientists take the view that the phenomenon of the Self must be viewed as being a kind of cooperative "large-scale" phenomenon, the result of the totality of brain activity. This view is in keeping with two of the fundamental tenets of biology. The first of these is the principle of *hierarchical order*. Commencing from the lowest levels of material structures (atoms and molecules), living organisms appear to be made up of functional levels and each level is in turn a "building block" of the next higher level. The progression is one from atoms to molecules to organelles to cells to tissues to organs to organisms (organ systems). This hierarchy can even be extended beyond the individual in terms of populations, the "biological community" and the ecosystem (which includes nonliving matter).

The second fundamental biological principle is the principle of ***emergent properties***. To quote one current biology textbook:[2]

> With each step upward in the hierarchy of biological order, novel properties emerge that were not present at the simpler levels of organization. These emergent properties result from interactions between components. A molecule such as a protein has attributes not exhibited by any of its component atoms, and a cell is certainly much more than a bag of molecules. If the intricate organization of the human brain is disrupted by a head injury, that organ will cease to function properly, even though all its parts may still be present. And an organism is a living whole greater than the sum of its parts.
>
> Because the properties of life emerge from complex organization, scientists seeking to understand biological processes confront a dilemma. One horn of the dilemma is that we cannot explain a higher level of order by breaking it down into its parts. A dissected animal no longer functions; a cell reduced to its chemical ingredients is no longer a cell. Disrupting a living system interferes with the meaningful explanation of its processes. The other horn of the dilemma is the futility of trying to analyze something as complex as an organism or a cell without taking it apart. Reductionism - reducing complex systems to simpler components that are more manageable to study - is a powerful strategy in biology.

[2] Neil Campbell, Jane Reece, and Lawrence Mitchell, *Biology*, 5th ed., Menlo Park, CA: Benjamin/Cummings, and imprint of Addison Wesley Longman, Inc., 1999, pg. 4.

This is, in my opinion, a forthright description and assessment of how biologists see the principle of emergent properties. Let us keep this description in mind. We will return to it in a little while after finishing with our discussion of the neuroscience view of brain representation.

To say that a complex organ such as the brain should exhibit "emergent properties" that are not exhibited by the constituent "pieces" of lower-level biological structures is really nothing other than to say that these pieces are reciprocally determining, i.e. that a Relation of community exists between them. The specific details of these emergent properties must be discovered empirically, but the *necessity* of the existence of emergent properties is required by the third Analogy of Experience. Thus, the principle of emergent properties is objectively valid since it is grounded in the metaphysics proper of Rational Physics. It is the *next* step taken by neuroscience (or, at least, by some neuroscientists) where we run into a dialectical *saltus*.

In the prevailing speculative view even the logical division between body and mind is denied. Rather, it is posited that all representations are solely representations of *soma* and that these representations are made *by* the brain *to* the brain. This view is really nothing other than a modern day functional automaton theory in which the word "mind" might be used as a convenient label for the behavior of the organism but is not to be construed as being "substantial" in any way. Dr. Antonio Damasio, an eminent neurologist from whom we will be hearing a great deal in this treatise, proposes we view "mind" in terms of "the feeling of what happens":

> I have been proposing that core consciousness depends on a ceaselessly generated image of the act of knowing, first expressed as a feeling of knowing relative to the mental images of the object to be known; and I also proposed that the feeling of knowing results in, and is accompanied by, an enhancement of the images of the object.
>
> Turning to the possible biology behind core consciousness, I proposed a set of neural structures and operations which may support the emergence of the sense of self and of knowing. The proposal, presented in the form of a hypothesis, was designed to meet the requisites outlined for the biological role of consciousness and for the description of its mental appearance as well as to conform to known facts of neuroanatomy and neurophysiology. The hypothesis states that core consciousness occurs when the brain forms an imaged, non-verbal, second-order account of how the organism is causally affected by the processing of an object. The imaged account is based on second-order neural patterns generated from structures capable of receiving signals from other maps which represent both the organism (the proto-self) and the object.
>
> The assembly of the second-order neural pattern describing the object-organism relationship modulates the neural patterns which describe the object and leads to the enhancement of the image of the object. The comprehensive sense of self in the act of knowing an object emerges from the contents of the imaged account, *and* from the enhancement of the object, presumably in the form of a large-scale pattern that combines both components in a coherent manner.
>
> The neuroanatomical structures required by the hypothesis encompass those that support the proto-self; those needed to process the object; and those needed to generate the imaged account of the relationship and to produce its consequences.
>
> The neuroanatomy underlying the processes behind the proto-self and object . . . includes the brain-stem nuclei, the hypothalamus, and somatosensory cortices. The neuroanatomy underlying the imaged account of the relationship and the enhancement of the object image . . . includes the cingulate cortices, the thalamus, and the superior colliculi. The subsequent image enhancement is

> achieved via modulation from basal forebrain/brain-stem acetylcholine and monoamine nuclei as well as from thalamocortical modulation [DAMA1: 192-194].

Damasio likens the complex array of brain activity to a “movie in the brain” in which the brain is somehow supposed to be simultaneously both movie and audience.

> With the movie metaphor in mind, if you will, my solution to the conscious-mind problem is that the sense of self in the act of knowing emerges *within* the movie and thus creates, within the same frame, the "seen" and the "seer," the "thought" and the "thinker." There is no separate spectator for the movie-in-the-brain. The idea of spectator is constructed within the movie, and no ghostly homunculus haunts the theater. Objective brain processes knit the subjectivity of the conscious mind out of the cloth of sensory mapping. And because the most fundamental sensory mapping pertains to body states and is imaged as feelings, the sense of self in the act of knowing emerges as a special kind of feeling - the feeling of what happens in an organism caught in the act of interacting with an object.[3]

§ 6.1 Objections to the Brain-Automaton Model

That brain function is inextricably connected to the phenomenon of mind is a *fact*, well confirmed by modern neuroscience. The objections to the brain-automaton model of mind do not arise from the principle of emergent properties (for this principle is grounded in rational metaphysics proper under Kant’s Copernican hypothesis), but from the *subordinate* role assigned to the phenomenon of mind by this model. The brain-automaton model posits the phenomenon of mind in a Relation to brain in the place of an *effect* for which brain function is the *cause*. However, such a cause-and-effect Relation *is not a Relation of community*. The objective validity of the emergent properties principle is founded on the third Analogy of Experience, which takes its *ontological* ground from the *modus* of coexistence in time.

A cause-and-effect Relation of brain function to the phenomenon of mind, however, would have to have for its basis the second Analogy of Experience and its ontological ground from succession in time. This connection, however, cannot be made by brain theory alone with objective validity; the phenomenon of mind is not observable at the level of brain function. What we can observe are the empirical correlations between brain function and those manifestations of behavior studied by psychology and called manifestations of *mental* activity. To unite these two heterogeneous phenomenal domains requires a synthesis and to unite them with *necessity* requires that their union take place according to pure rational principles since no union of heterogeneous phenomena that is strictly empirical can objectively be called necessary. It is the absence of any such rational principle of unity in the brain-automaton model that makes the subordination of mind to brain a *saltus*. Between the immediate apperception of an individual’s *Dasein* and the neurological model of his brain there is a great gap. Our scientific knowledge of brain function is sophisticated and calls upon a great many ideas in the journey from ignorance of biology to

[3] Antonio R. Damasio, "How the Brain Creates the Mind," *Scientific American*, Dec., 1999, pp. 112-117.

scientific knowledge of the brain. Among these ideas we find not only the ideas of chemistry, physics, anatomy, physiology, pharmacology, etc., but also such relatively "easy" ideas such as *objective* time, objective space, and objective causality.

In essence, the modern brain-automaton model replaces Locke's "chemist's lab" model of human understanding with an engineer's "information network" model of human understanding. Such a model is undoubtedly very valuable in our pursuit of understanding the brain but it is no less immune to Hume's attack than was Locke's philosophy because it proceeds from the presumption that one's representations must conform to objects rather than from Kant's Copernican hypothesis that objects must conform to one's representations of their appearances.

Can we regard mind as an emergent property within the framework of biology alone? The principle of emergent properties takes its rational ground from the principle of community between objects coexisting in time. Within the framework of biology the coexisting objects are those physical objects of biology – molecules, tissues, cells, organs, etc. – that lie within the topic of biology. These objects are, with the aid of instrumentation, objects of sensible appearances. *All biological Relations of community can be nothing other than Relations among these objects* – the Relations of their interactions we say reciprocally determine these objects. The *mind* object – whether we call it "mind" or employ Damasio's taxonomy of "core consciousness" etc. – is not one of these objects. We do not find "a mind" *within* the brain because the brain is a physical object and the mind is not. We do not even require the *idea* of mind (*nous*) in order to study the brain because biology studies only the sensible phenomena of the brain's appearance. Because we do not need the idea of a mind to study anatomy, physiology, and so forth, the mind is not at all the idea of reciprocal determinations among the objects of biology. From the perspective of biology alone, *mind is not an emergent property.* To so view it is without objective validity and is a transcendent over-stepping of the boundary of possible knowledge.

Mental phenomena are not exhibited at the level of the appearances of cells and organs but at the level of the appearances of the Self. In the *logical* division of the appearance of the Self into the concepts of mind and body, it is the *mind-body interaction* that is the rational and objectively valid emergent property. Reductionism in biology proceeds at its first step to discard the idea of "mind" – hoping that something like "mind" will re-enter the biological picture at some deeper level of understanding. The method of reduction, however, cannot learn about that which it throws away during the reduction. To integrate biology and the phenomenon of mind is not an act of reduction but rather of *construction* and requires synthesis rather than analysis. Were we to graph the study of the appearance of the Self, biology and neuroscience would be found on one branch of the "tree" and mental appearances would be found on another (Figure 6.4.1). The *proper* use of the principle of emergent properties is not in trying to relegate mind to a cause-and-effect Relation with body but, rather, in understanding the Relation of community between these

two main branches of the "tree model" of the Self.

All Relations of community are Relations between determinations (judgments) of *Kantian* substances. As we discussed earlier, the Kantian substance is not some sort of corpuscle or monad but rather is a notion of the Relation of appearances to an object. To call mind a substance in the Kantian usage of that term is not to say that we must posit a soul or an homunculus any more than to posit the force of gravity is to say that the sun and the Earth are "occupied" by some mythical celestial beings who reach out and grasp each others' hands in a cosmic game of twirl-around. To properly apply the principle of emergent properties to the study of the Self we must not attempt to rid ourselves of the idea of mind while trying somehow to keep the *phenomenon* of mind. To think that we must identify a "corporeal substance" with the phenomenon of mind is rather like physics thinking that mass could be equated with "the quantity of matter" in a corporeal body. Physics long ago abandoned the latter idea (although not without considerable difficulty); it is time for *human science* to similarly let go of its resistance to the idea of the supersensible and come to appreciate that the supersensible is not the same thing as the supernatural. What we should do, in applying the principle of emergent properties in human science, is construct a doctrine that *parallels* biological science and use the principle of community to bridge between them. For biological anatomy, we must have a "mental anatomy"; for biological physiology, we must have a "mental physiology," and so on.

Let us take a look at this approach using Damasio's hypothesis as an example. A *saltus* in the theory occurs if the idea of the "spectator" is subordinated to brain activity (the "movie in the brain"). This subordination requires us to regard the brain as presenting representations "to itself" – an idea that seems uncomfortable and vague. However, any objections we might raise on this account are likely to apply with equal force to an idea of the mind presenting representations to *itself*. Objectivity, as we noted above, requires whatever stands in the role of the spectator to be placed at the level of the Self rather than at the level of body or mind.

It would be strange indeed if there were not a considerable degree of truth and objective validity in the work of a renowned scientist such as Dr. Damasio. Let us look more closely at two of the threads of his hypothesis. In the first place, Damasio speaks of a "feeling of knowing" arising from brain activity. Since his hypothesis does not depend upon some "knowledge organ" but, instead, proposes that this "feeling of knowing" emerges from large-scale brain activity involving many parts of the brain, and since these parts in appearance are coexistent in time, it is permissible for us to regard Damasio's "feeling of knowing" as objectively valid *provided that we view it as the name for a Relation of community* among these brain structures.

In the second place, Damasio's hypothesis relies on (empirically) causal effects – "feedback" – where the future brain state is determined by the present brain state. This is the view taken in

the mechanistic ‘metaphysic’ common to physics, chemistry, and biology. Something called “core consciousness” is supposed to emerge when the brain forms “the contents of an imaged account” of how the organism is causally affected, etc. Let us note the object to which this idea of an “imaged account” refers. The hypothesis has moved past the sensible factors of brain structure and activity to an idea of a state of the Self (the whole organism). Something new has entered the argument at this point, namely some “emergency” or synergy of organism that is not presented in the appearances of its neural pieces in aggregation.

If we regard the “feeling of knowing” as the objectively valid idea of a Relation of community restricted to parts of the brain or its activities, the objects connected by such a Relation are not at all the same as the object of this synergistic thing-as-a-whole whose state is supposed to be “imaged” by the representing neural activities. Where did this new object come from?

To answer this, let us note that neither a Relation of community (e.g. the feeling of knowing) nor a Relation of cause-and-effect pertains to the persistent in time. Both, however, presuppose the existence of objects that *are* thought as persistent in time. In other words, the positing of the successive in time and the coexisting in time necessarily presupposes the positing of the persistent in time (substance). Damasio’s hypothesis does not equate this substance to some “knowledge organ”; rather, the substance his hypothesis requires is that of an object we cannot “lay our fingers on” and extract from the mass of brain tissues. In a word, this object is supersensible and is only *exhibited* in the appearances of brain states and brain activities.

We need not feel any more uncomfortable about the necessary positing of such a supersensible object than a physicist need feel uncomfortable with the idea of inertial mass. *Every* science that is not merely historical requires supersensible objects to knit together the fabric of its theories. We conceptualize objects by subsuming their accidents of appearance under a pure *a priori* rule and the pure notion of substance. That Damasio’s hypothesis requires the notion of a substance is not a criticism of his theory *because there is no other possible way* for us to do it. But if we require such a substance – and there is no possibility open to us for leaving it out – what is wrong with calling its object *mind*? Nothing. Mind is the object of the substance we call *nous*.

§ 6.2 The 2LAR of the Empirical Sensorimotor Idea

Kant’s anthropology of sense gave us our first look at the empirical sensorimotor idea, but it is obvious that this picture was incomplete. So far what we have are the ideas of the interior, outer, and internal senses and the ordering structure of *nous* and *soma* in terms of agent and patient. Examining these ideas in terms of the general 2LAR structure, what Kant’s anthropology gives us is: 1) an idea of external Relation, specifically an **agent-and-patient Relation** that can only be regarded as falling under the *modus* of the successive in time and; 2) an idea of Modality as

actuality of the *Dasein* of sense *per se* (the idea of **determination of sense**).

We still require an explanation of the anthropological (i.e. empirical) representation in terms of the titles of Quantity and Quality. In the composition of the empirical sensorimotor idea it is the form of composition that is most readily apparent and so this idea of a form of composition is where we shall resume our examination.

Quantity and the Anatomical Idea

Perhaps the most striking empirical character of that which we call the senses is their great diversity. We have long been accustomed to speaking of outer sense in terms of Aristotle's fivefold classification of seeing, hearing, touching, tasting, and smelling. As for internal sense, our experience with this is bound up with that complex of phenomena we customarily call emotions. Even though psychology does not speak with one voice in giving us a similar classification of emotions (or even in agreeing on how the term "emotion" should be used), it is nonetheless clear that in internal sense we also find a rich variety of apparently different types.

Thus on the empirical side the character of the form of composition in the sensorimotor idea falls under the general idea of differentiation in our 2LAR structure. Now in order to so represent the empirical sensorimotor idea, its Quantity must be viewed as the composition of a homogeneous aggregate of parts, yet the principle of the Axioms of Intuition also tells us that this is possible only if each of these parts is first recognized as a separate appearance. Recall that the multiplicity in an extensive magnitude is not itself an appearance; to view the empirical sensorimotor idea under the general idea of differentiation, we must break down the singular appearance of the sensorimotor idea by analysis and re-synthesize its particular constituents as cognitions of individual appearances.

Such a form of representation of the sensorimotor matter can rightly be called *anatomy* in the sensorimotor idea. The dictionary definition of this term is given as

> **anatomy**, n. [L. *anatomie*; Gr. *anatomia*, *anatome*, a cutting up, from *anatemnein*; *ana*, up, and *temnein*, to cut].
> 1. the dissection of an animal or plant in order to determine the position, structure, etc. of its parts.
> 2. the science of the structure of animals and plants.
> 3. anatomical structure; the arrangement of parts in an organism.
> 4. a textbook or treatise on anatomy.
> 5. any critical analysis of something.
> 6. a subject for dissection; a result of dissection.

Within our present context if we replace the word "organism" with the term "Organized Being" in definition 3, we have the idea of the arrangement or structure of parts in the empirical sensorimotor idea. We will call this ***the anatomical idea*** – the idea of the representation of the

complex of sensorimotor phenomena in terms of the arrangement of the parts.

This idea of arrangement is not restricted to the physical anatomy of *soma*. Rather, it is an idea we must apply equally to *nous* as the idea of the structure of a manifold of diverse and specialized capacities of sensation, feeling, perception, etc. Applied to *nous*, the anatomical idea is the idea of an *anatomy of mind*. This mental anatomy, as a science, will be partner to the physical anatomy of *soma* (when once we have a science of mental physics).

The presentation of this topic in biology or anatomy textbooks tends to make physical anatomy seem, so to speak, like a rather cut and dried affair. However, anyone who has ever actually *looked* at a dissected plant or animal can probably appreciate how fundamentally non-obvious the anatomical classification of the parts of an organism is to one untrained in this specialty. What is it that makes *this* lump of tissue "the cerebellum" while *that* lump is not part of the cerebellum but is instead "the pons"? Physical anatomy is not a kind of biological cartography; the usefulness in anatomical classification lies in its ability to draw distinctions within *soma* based on the possibility of *functional* as well as merely *structural* differences in the parts of an organism (although it is quite true that readily apparent physical differences often guide the study of physical anatomy). What a contrast this is in comparison with the task of the map maker.

Yet these two very different activities do share something in common. On the western outskirts of the town of Moscow, Idaho, there is a road sign that proclaims, "Welcome to Washington." To the motorist it is not at all clear at what point one passes from Idaho to Washington; the boundary line is drawn on a map but there is no corresponding geological line drawn on the ground. Yet the difference to a homeowner between a house situated one inch to the east of this invisible boundary line and one inch to the west is, among other things, the difference between having to pay or not having to pay a state income tax. Man made the boundary between "Idaho" and "Washington" but, despite the arbitrary nature of this delimitation, the practical difference it makes is quite real.

Man did not decree the boundary between the cerebellum and the pons (or at least we prefer to think he did not). The anatomist's justification in delimiting these two structures draws its pragmatic validity from the assumption that such a boundary *ought* to be drawn *because* there is a real functional difference between what the cerebellum "does" and what the pons "does." Historically, of course, this is not necessarily the way physical anatomy always proceeds. Differences in textures, morphology, and other sorts of "landmarks" often guide anatomical "map making" in much the same way as the presence of the Mississippi River provides a more or less clear boundary between Iowa and Illinois. But, for at least the pragmatist, the *reason* for drawing a distinction between cerebellum and pons is based on a pragmatic functional distinction between the two, and once a "geographic" boundary is drawn, the search can begin to discover how the

two delimited regions are functionally different.

Is an anatomical "boundary" a "crisp" and definite boundary? Viewed only as a mapmaking problem, the boundary *is* definite because we *define* it to be so. Such a definition, viewed functionally, is more or less arbitrary *if* the boundary is crisply defined. Let us recall Feynman's example of the philosopher and the chair. Is the paint part of the chair or not? If it is different, is "this particular atom" part of the "paint" or part of the "chair" properly so-called? In similar fashion, an anatomical boundary justified by a functional difference is going to be rather "fuzzy" (to use the language of the present day fuzzy logicians). All appearances are extensive magnitudes but we can not hold with objective validity the idea of a "simple" part that can "naturally define" an anatomical division. Thus, the anatomical idea is placed squarely within the *empirical* sensorimotor idea. We can make such a division and, from some viewpoint, call this division *real*, but we must be prepared to accept that appearances do not "naturally" present us with crisp borders.

In like fashion, I propose that the study of *mental anatomy* is an objectively valid undertaking in the doctrine of *nous*. That it may prove difficult to draw "crisp" boundaries between different "anatomical" mental structures is not a pragmatical nor even a theoretical impediment to this idea since, if it were, we should have to do away with physical anatomy on the same grounds. Mental anatomy, like physical anatomy, must be carried out on appearances – and not on a vain effort to first posit an unknowable mental thing-in-itself – and therefore likewise belongs to the empirical sensorimotor idea. Like physical anatomy, mental anatomy must draw its justifying reason for its divisions, ultimately, from the realm of *functional* differences.

Quality and Moving Powers

The idea of the Relation between agent and patient in the empirical sensorimotor idea is bound up with the idea of change in the appearances of *nous* and *soma*. More to the point, it is bound up with the idea of one object (e.g. *nous*) being affected *by* another object (e.g. *soma*). We will follow Kant and define the ***motion*** of an object as *any change in external relationships* between that object and the other objects with which it has external relationships [KANT14: 21 (4: 482)]. In adopting this definition we use "motion" in the general connotation with which it was viewed by the Greeks. Now, it is clear that any change in external relationship necessarily involves the consideration of two (or more) objects and that, consequently, all motion is *relative*. For outer sense (*soma* → *nous*) and internal sense (*nous* → *soma*) it is clear that the empirical sensorimotor idea involves precisely such a relationship. For interior sense (*nous* → *nous*), the situation may seem less clear-cut at first. However, the extensive magnitude (Quantity) of the empirical

sensorimotor idea is expressed by the manifold of faculties (mental and physical anatomy of Organized Being), and so even for the idea of interior sense we can speak meaningfully of change in external relationships[1].

There enters in to this idea of motion the notion of causality and dependency. To examine this we need to draw a fine distinction between ***causality*** and ***cause***. Let us look at Kant's explanation of the notion of causality:

> Causality is the determination of a change by which it is established according to general rules . . . Causality is the property of a substance insofar as it is regarded as cause of an accident . . . Acting and action can only be attributed to substances. The act is the determination of the power of a substance as a cause of a certain accident . . . We can recognize the powers of a thing through changes [KANT19: 328-329 (28: 564-565)].

Causality is not the idea of a power but, rather, the notion of a *determination* of a change in an object as a consequence of the power of either another object or of that same object insofar as this power establishes an external Relation. A *cause*, on the other hand, is the notion of the agency of a substance. As Kant put it:

> The cause is that which contains the ground of the actuality of the determination or of the substance . . . Every cause regarded as it is in itself must be something real . . . That which is grounded to the cause is the *causatum* [KANT19: 334 (28: 571)].

Kant's distinction between cause and ***causatum*** is a subtle one. *Causatum* is the idea of a reason for the occurrence of a change, i.e. the idea of a *rule of alteration*. A cause, then, is the condition for the assertion of that rule (hence, the *causatum* is *grounded to* the cause). Causality is what is asserted under the rule (*causatum*).

> (All) changes are *causata* of another [change] . . . That every state should be a *causatum* of another can no doubt be easily grasped . . . First [cause] is any cause inasmuch as hitherflow out of it other *causata* [KANT19: 201 (29: 844)].

> The idea . . . of the interrelation of the substance to the *Existenz* of accidents, insofar as it [the substance] contains their ground, is *power* [*Kraft*] [KANT19: 328 (28: 564)].

When the change is a motion – that is, is a change in external relationship – we will call the power to be a cause of this change in the object's external relationships a ***moving power*** of the object held to be the agent of that change [KANT14: 42 (4: 497)]. The idea of a moving power is an idea of a Quality of the representation of an object because motion is opposition to persistence of the sensible state. Thus, the idea of possession of moving powers is the idea of Quality in the empirical sensorimotor idea.

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[1] This is likewise the case for the idea of interior relationships of *soma* (i.e., *soma* → *soma*).

§ 7. The 2LAR of the Data of the Senses

We have discussed the sensorimotor idea with regard to both transcendental and experiential (empirical) requirements. To complete our applied metaphysic of the data of the senses we must next examine the synthesis of these two opposing positions. The empirical Self is phenomenon but the *I* of transcendental apperception is pure *noumenon* – albeit a *noumenon* which occupies (for each of us individually) a unique position among all the supersensible objects in Nature. The role of our applied metaphysic is concerned with the principles by which we are to view the connection of this empirical Self, the representation of which arises only through contingent experience, with the formless *Dasein* of transcendental apperception – the effect of which is represented in the idea of pure consciousness. We are concerned, in other words, with the idea of *psyche* that understands the possibility of the representation of empirical appearances, under the Copernican hypothesis, in the Organized Being model.

In using the phrase "data of the senses" to name this applied metaphysic, we should consider well the meaning of the word "data" in the context of the Copernican hypothesis. The noun *datum* literally means "the given." In using this word we must take care to not regard this "given" in terms of "external things" because our fundamental hypothesis is that all objects must conform to our representations (i.e., to the conditions of possible experience) and not vice versa. Metaphysically, the given is the "matter" or "stuff" that we say "constitutes" the substratum of the reality of things. This idea of "matter-as-stuff" has a three-fold character.

> Matter in the *physical* sense is the substrate of extended objects, the possibility of bodies. But in the *transcendental* sense every *datum* is matter, the relationship of *dati* is but the form. Transcendental matter is the determinable, transcendental form is but the determination, or the act of determining. Transcendental matter is the reality or the *datum* for all things. But the restriction of Reality makes out transcendental form. . .
>
> Matter is distinguished into *materia ex qua* [matter out of which], *in qua* [in which], and *circa quam* [around which]. *Materia ex qua* is the determinable itself . . . *Materia circa quam* means matter in the act of determination itself (e.g., the text of a sermon is not matter out of which but rather around which something else moves about). *Materia in qua* means the subject of inherence. *Materia circa quam* properly means the thoughts by which a thing [*Sache*] is given form. E.g., the plan of a building is *materia circa quam*, but the stone, wood, etc. are the *materia ex qua*. [KANT19: 338-339 (28: 575-576)].

Taking the given as "matter" in this metaphysical sense, we can say that the transcendental sensorimotor idea is the principle of the *materia circa quam* of the Self. Its four titles of representation are the unity of faculties (identification), the condition of state (agreement), information (the internal), and sensorimotor meaning (the determining factor). The form of *Existenz* of the Self is understood under these ideas of its representation.

The empirical sensorimotor idea, on the other hand, is the principle of the *materia in qua* of

Organized Being. Its four titles of representation – the anatomical idea (differentiation), possession of moving powers (opposition[2]), the Relation of agent and patient (the external), and determination of sense (determination) – are principles of the "matter in which" the construction of the actual *in* the Self is realized. To complete the applied metaphysic of the data of the senses we lack only the *materia ex qua* for contingent experience – the "building blocks" of the determinable in the "empirically given" representations of *Existenz* in Organized Being. This *materia ex qua* we will obtain out of the synthesis of the two other sensorimotor ideas.

§ 7.1 Quantity and the Physiological Idea

Integration in the general 2LAR is the combination as composition of the general ideas of identification and differentiation. We may represent this synthesis with the formula

$$identification + differentiation \rightarrow integration.$$

When specialized to the sensorimotor idea, this idea of integration is the idea of that which combines the diversity of representations in the anatomical idea into the thorough-going *oneness* we call the unity of faculties. Whether we call this by the name *functions*, *vital processes*, or merely *laws of quantitative combination*, the idea of this integration is a doctrine of the Nature of quantitative organization in the Organized Being.

Now, the word "physiology" suitably captures this idea of integration. In its common usage physiology has the following dictionary definition:

> **physiology**, n. [Gr. *physiologia*; *physis*, nature, and *logos*, discourse].
> 1. the branch of biology dealing with the functions and vital processes of living organisms or their parts and organs.
> 2. a book or treatise on this subject.
> 3. the functions and vital processes, collectively (*of* an organism).

In view of our earlier discussion of the logical division of mind and body, we need to generalize this idea of physiology to take into its sphere not only somatic (i.e., biological) functions and processes but mental functions and processes as well. In other words, we require in addition to the doctrine of biological physiology a doctrine of *mental* physiology that understands at a functional level, through exposition of the processes of representation, the laws by which the mental anatomy of the Self is governed. The *generalized* physiological idea is thus the idea of a doctrine of the entirety of the functional organization of Organized Being.

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[2] The idea of a moving power is inherent in the idea of the cause (not the causality) of change. Moving powers in this sense are in opposition to the existing condition of state.

§ 7.2 Quality and Seeming

The synthesis of Quality is the combination as composition of the general ideas of agreement and opposition. Subcontrarity is the product of this composition, which we may symbolize using the formula

$$agreement + opposition \rightarrow subcontrarity.$$

In the context of the sensorimotor idea, this synthesis is the idea of a condition of state viewed as a moving power for causing a change in this state.

In the deduction of this idea we must remind ourselves that the condition of state is an idea taking in representation in sensible apprehension. With regard to *nous*, apprehension is the mental "grasping" of the matter (in the context of *materia in qua*) of representation; thus this subcontrary idea we seek to understand is bound to representation as perception. Since perception, in turn, is representation with consciousness, and since a representation in the synthesis of apprehension becomes conscious through the process of *reflective* judgment, our idea of subcontrarity in the data of the senses must be one that also stands in a relationship to the idea of reflective judgment. In particular, it is the idea of a ground for the making of such a judgment (an act that clearly is one which occasions a change of state).

How shall we view this idea of subcontrarity from the empirical side of the *soma*? The physiological approach by itself is not of much help here since the objects of biological doctrine do not contain in their representations anything that can be rightly called apprehension. However, from the psychophysical viewpoint, an empirical correlate to the metaphysical picture described above can be identified. In the biological faculty of the brain, it is known that divers "sensory data" appear to be combined in those brain structures known as the association cortices. There are three such distinguishable structures: the parietal-temporal-occipital association cortex, the prefrontal association cortex, and the limbic association cortex. While we are far from having anything like a complete picture of the workings of these structures, neuroscience is nonetheless in possession of some well established facts that directly bear upon our current discussion. Let us briefly summarize these.

First and foremost, behavioral *manifestations* of perception are known to be accompanied by neural activity in the association cortices. Signal processing in the association cortices is known to be correlated with the phenomena of arousal, attention, emotions, memory and language. Lesions in these areas can have pronounced effects on sensory perception, memory, emotional response, and motor planning[1].

[1] see Irving Kupfermann, "Localization of Higher Cognitive and Affective Functions: The Association Cortices," in [KAND: 823-838].

Furthermore, the association cortices receive inputs from the various sensory cortices and the signal processing carried out in the association cortices appears combine or "integrate" the divers senses. Indeed, it is this function of combining diverse sensory inputs that is partly responsible for the name "association cortex." Finally, we have very strong evidence that present sensory inputs and "cognitions" from previous experience are first combined in the association areas of the brain. For this reason it is hypothesized that conscious representation (perception) "first takes place" in the association areas.

The point being made here is that neuroscience provides us with empirical evidence that there is a correspondence in *soma* with apprehension from the viewpoint of *nous* described above. Such a correspondence, of course, is *required* by the rational metaphysics proper of our Organized Being model. Were we unable to find in the physical representations of *soma* a correlation with the logical inference of a relationship between the idea of subcontrarity in the data of the senses with the idea of apprehension, we would have reason to doubt the rational connection of the subcontrary idea with the process of apprehension.[2]

Let us now draw the connection between the rational argument and the empirical facts obtained from neuroscience. The idea we seek is not the idea of the perception itself, for the perception is a construct of the state and holds by itself no connotation of a moving power. Rather, the subcontrary idea is an idea of an *inducement of reflective judgment*. The act of reflective judgment necessarily antecedes the perception. But to such an act we must necessarily presuppose a ground and it is in this connotation that I use the term inducement. The subcontrary idea is the idea of this inducement; we will follow Kant and give to it the name ***seeming*** (*Schein*):

> Seeming is not true and also not false, for it is the inducement for a judgment of experience. Seeming must thus be distinguished from appearance [*Erscheinung*]. Appearances lie in the senses, but seeming is only the inducement for judging from appearances. . . We note accordingly the proposition: the senses do not deceive. This happens not because they judge correctly, but rather because they do not judge at all, but in the senses lies the seeming [KANT19: 52-53 (28: 234)].

This idea of seeming may perhaps best be described as *the condition of state in which the representations of sensibility contain the possibility of perception under the principle of formal*

[2] I anticipate that some readers may object to (or at least feel uncomfortable with) this mingling of empirical scientific findings with the rational argument of *nous* in this *metaphysical* topic of the data of the senses. For a non-Kantian philosopher in particular, this line of argumentation may seem an egregious violation of correct metaphysical reasoning. To this charge I answer that we are presently engaged in examining the *applied* metaphysic of the data of the senses, not with metaphysics *proper*. Kant wrote of the need for a transition from metaphysics to physics; it is with this transition that we are presently concerned. In such a transition the ground for the metaphysical idea must be rational, but we must also require that any such idea of an applied metaphysic be exhibited in experience. "The transition from one sort of knowledge to another must be only a step, not a leap; that is, the doctrine of method requires one to *pass* from the metaphysical foundations of natural science to physics - from concepts of nature given *a priori* to empirical ones which yield empirical knowledge" [KANT10: 13 (21: 387)].

expedience [*Zweckmäßigkeit*[3]] in reflective judgment. Seeming is therefore the *materia ex qua* for an affective perception of reflective judgment that marks the representation of apprehension as an objective perception (intuition). Symbolically, we may write

$$\textit{condition of state} \; + \; \textit{moving power} \rightarrow \; \textit{seeming}.$$

This deduction stands in agreement (as it must) with the viewpoint of *soma* we discussed above. Recall that the representations of reflective judgment are affective perceptions. It is known, from empirical neuroscience, that the limbic association cortex is involved with the manifestations of emotion and other affective behaviors. It is furthermore recognized that the signal processing carried out in the limbic system (e.g. in the amygdala) produce behavioral effects more rapidly than cognitive effects appear to arise. This psychophysical empirical knowledge is, consequently, entirely consistent (so far as we yet know) with our rational deduction of the nature of the idea of seeming.

§ 7.3 Relation and the Idea of Generalized Emergent Properties

Ideas of Relation and Modality always pertain to the combination of the elements of composition in a connection as a dynamical manifold of the whole. For our third sensorimotor idea of Relation, we turn to the synthesis of the ideas of information and the agent-patient Relation according to the formula

$$\textit{the internal} \; + \; \textit{the external} \; \rightarrow \; \textit{the transitive}$$

and ask ourselves “What is information (the internal) viewed as agent-patient relationship (the external)?”

Now the agent-patient relationships (internal sense, outer sense, interior sense, and, for logical completeness, the idea of the *soma* $\rightarrow$ *soma* relationship) are relations of connection (*nexus*) in the succession of *accidents of information*. The *notion* that understands information is the notion of a Kantian substance. But by the word notion, as we use that word in this treatise, we mean nothing else than a rule for the construction of concepts. A notion, therefore, is a pure rule of understanding – a phrase by which Kant meant that no intuition can be found which can *directly and immediately* represent the notion *by itself*. By the term *substance* we mean only the *a priori* notion by which something is determined in terms of the *modus* of persistence in subjective time.

[3] see Chapter 5, §5.4.

It follows from this that all sensible representations of "a substance" can be nothing other than representations of its accidents.

> Accidents are mere *modi* of the *Existenz* of a substance and these [the accidents] cannot be apart from the substance; for they exist as predicates and these cannot be apart from the subject [KANT19: 177 (29: 769)].

> Accidents are manners of thinking the *Existenz* of a thing, and not different existences . . . the relationship of the accidents to the substance is not the relationship of cause to the effect . . . we are aware of the substance only through its accidents . . . All changes presuppose a subject, upon which the predicates follow [KANT19: 327-328 (28: 563-564)].

Information is the substance of the sensorimotor idea. The idea of the agent-patient relationship, on the other hand, is the idea of a Relation under the *modus* of succession in subjective time; as such, the agent-patient Relation pertains to the representation of the succession of accidents of information and not to information as the substance. The notion behind the agent-patient Relation is the notion of *causality and dependency*. (Causality, remember, is "the notion of a determination of a change by which the change is established according to general rules"). The pure notion of a *cause*, on the other hand, is the notion of the agency of a substance (information, in this case) in containing the *ground* of the actuality for the determination of change in the agent-patient Relation. We may call this the idea of an **impelling cause** (*causa impulsiva*). The agent-patient Relation, therefore, can be described as the idea of the causality of impelling causes.

The transitive idea of Relation, on the other hand, is grounded in the *modus* of coexistence in subjective time. It is therefore an idea of the reciprocity in the determinations of substances coexisting in the same moment. Every element of composition in the sensorimotor manifold may (and must) be understood by a notion of substance whenever we think of that element as an object. Now, any particular accident of information is presented in terms of both representations of *soma* and representations of *nous*. *Soma* and *nous* are the substances of body and mind, respectively, and contain in the spheres of their ideas all representations of their accidents. The idea of the transitive Relation is nothing more than the idea that all such accidents represented as coexisting in the same moment of time must be reciprocally determining, e.g. the representation *'A* is taller than *B'* necessarily determines that *'B* is shorter than *A'* and vice versa.

The representations of *soma* are exhibited in terms of biological structures and signals; those of *nous* are exhibited in terms of abstract logical constructs, e.g. concepts. Since the division of *soma* from *nous* is a product of the merely logical division of body and mind, the transitive idea of sensorimotor Relation is the idea of the thorough-going community by which these two diverse modes of representation must co-determine each other. Such an idea can be said to represent a *mapping* from the physical domain to the mental domain and vice versa. The nature of this mapping cannot be given *a priori* since this nature must necessarily involve our contingent

empirical knowledge of the *soma* and such knowledge must be purchased in the store of scientific experience. However, the existence (in the *Dasein* sense) of such a Relation *is* known *a priori* because this idea follows as the *rational* consequence of the *logical* mind-body disjunction.

Because only the *accidents* of a substance can be predicated, it follows that the transitive idea of sensorimotor Relation pertains only to the reciprocal determination of accidents *as these accidents are connected* in the sensorimotor manifold at the same moment in time. In this manifold some elements of its composition are called elements of *soma* and others are called elements of *nous*. We may symbolically represent the *modi* of the transitive idea of Relation by the following three formulae

$$soma \leftrightarrow soma,$$
$$nous \leftrightarrow nous,$$
$$nous \leftrightarrow soma$$

where the two-headed arrow denotes reciprocity of determination. The first of these, which we may call the *intra-soma* relation, belongs to the science of biology. The second, which we may call the *intra-nous* relation, belongs to the domain of mental physics and to that of empirical psychology. The third relation, which spans the logical gap between *soma* and *nous*, we may call *the general psychophysical idea*.

Taken together, these three logical classes of reciprocal co-determination make up a principle of the doctrine of the transitive sensorimotor Relation for the Organized Being as a whole. Because this idea is the idea that the parts of an Organized Being reciprocally co-determine each other in the whole, so that the accidents of every division depend upon the determination of the accidents in the others, and because this idea loses its ground when we separate the pieces from the whole of Organized Being, we may justly call this idea of the transitive Relation ***the generalized principle of emergent properties***.

§ 7.4 Modality and the State of Satisfaction

As the matter of the form of the sensorimotor manifold, Modality in our applied metaphysic of the data of the senses pertains to the connection of the accidents of the sensorimotor manifold with the *Existenz* of the empirical Self of apperception. To put this another way, we can regard this idea of sensorimotor Modality as the idea of the individual's "sense" or "state" of being. For our third idea of Modality we refer to our symbolic formula from the general 2LAR

$$the\ determinable\ +\ the\ determination\ \rightarrow\ the\ determining\ factor.$$

In the transcendental sensorimotor idea the determining factor is vested in the idea of sensorimotor meaning. Earlier we described sensorimotor meaning in terms of necessity in the connection of information with knowledge insofar as the meaning "in" the representations of an Organized Being pertain to the empirical Self. In the empirical sensorimotor idea the idea of empirical Modality is the determination of sense, i.e., the idea of the actual *Dasein* of the manifold of sensibility.

Because Modality is the matter of the form of the sensorimotor manifold (in our present context), we can make these first two ideas of sensorimotor Modality a bit clearer by asking ourselves what we are to regard as the matter *in* the sensorimotor *nexus*. As determining factor, we say that meaning is the *materia circa quam* for connecting the data of the senses in the Self. The manifold of representations is an idea quite devoid of content unless these representations *mean something* to the representing Subject. Precisely *what* this meaning might be is contingent upon actual circumstances, but sensorimotor meaning is an idea necessary for the possibility of any "experiences" whatsoever. Meaning is the "matter around which" various sensorimotor representations acquire Self-relevance.

The empirical determination of sense, on the other hand, is the *materia in qua* ("matter in which") inherent in this connection. It is the determined "what is given" or structural matter of the form of the data of the senses. Meaning is that which is the *necessary* in the data of the senses, but the determination of sense (i.e., the placement of *nous* and *soma* in the form of sensibility) is the *actual* in the data of the senses.

This brings us to the determinable, the *materia ex qua* or "matter from which" of sensorimotor Modality, from which we obtain "the matter in determination." The idea of the determinable is the idea of the *possibility* of the determination as a *meaningful* determination. This matter of the determinable is that which provides the possibility for something *to be* meaningfully determined.

With all this in mind, let us look at the *substance* of the sensorimotor manifold. We said earlier that the word information carries a connotation of uncertainty or surprise. Let us examine this idea more closely. One way in which data is said to be "informative" is when this data *removes* uncertainty in one's mind regarding something. Here we find an idea that we can describe as a "feeling of uncertainty" which is "settled" by the presentation or "giving" of information that resolves a doubt or answers a question. This way of regarding data as informative necessarily presupposes such a "state of doubt" or "state of puzzlement" *is possible* and, of course, it is clear from experience that both such states do in fact occur in each of us in the courses of our lives. A second way in which data is said to be informative is when the data evoke a "feeling of surprise" or "unsettles" or "puzzles" us. In this *modus* data has quite the opposite effect from the first connotation. Both *modi*, however, are regarded as "informative."

Both these cases are invariably bound up in the experiencing of some sort of "emotional" or *affective* reaction to some degree or another. Such a reaction is one that is entirely *subjective,* i.e. is a reaction that intimately "belongs" to the conscious Subject as a "sense" of overall well-being or ill-being that is perhaps best termed a ***state of satisfaction or dissatisfaction***. Such a state does not pertain to the *composition* of the sensorimotor idea, as in the Quality we call the condition of state. Rather, it pertains to an *overall* "sense of being" in the *Existenz* of the Self. Of a particular composition we can say *it is satisfying*; but of the overall *nexus* we say *I am satisfied*.

In *Critique of Judgment* and elsewhere Kant expressed this idea with two words, *Wohlgefallen* and *Mißfallen*, that do not "travel" well into English. Various English translations of Kant's work have rendered these words in a variety of ways. Bernard [KANT5], Ameriks and Naragon [KANT19], and Dowdell [KANT18] render these as *satisfaction* and *dissatisfaction*, respectively. Meredith [KANT5b], on the other hand, uses *delight* and *aversion*, while Pluhar [KANT5a] uses *liking* and *disliking*. Wood and di Giovanni [KANT12a] render *Wohlgefallen* as "good pleasure" and also "well-pleasedness" while rendering *Mißfallen* as "dislike." Heath [KANT11a] uses "satisfaction" for *Wohlgefallen* but "aversion" and "disliking" for *Mißfallen*. While all these renderings obviously share a common root somewhere, this diversity must lead us to ask what idea *Kant* had in mind.

As is often the case with Kant, we can refer to the Latin equivalents he used in accompaniment with the German phrase. In the case of *Wohlgefallen* and *Mißfallen* we find our clue in his university lectures. Kant's friend and student, Johann Friedrich Vigilantius, noted the following equivalences [KANT19: 482 (29: 1013)]: for *Wohlgefallen* we have the Latin *complacentia* (which is the root of our English word "complacency"); for *Mißfallen* he gives us *displicentia* – the state of causing dissatisfaction or displeasure. From this *metaphysical* perspective it would seem that *complacency* and *displacency* make equally good candidates for rendering Kant's two words into English. Be this as it may, the *idea behind* the words is one of a *determinable* state-of-being that we will call the "state of satisfaction-dissatisfaction." The idea of the possibility of determining this state provides the *materia ex qua* from which meaning is established. It is our third idea of sensorimotor Modality.

It is important for us to clearly grasp that the idea of meaning in sensorimotor Modality is not the idea of "a meaning" or "the meaning" of the data of sense, nor is the idea of the state of satisfaction[4] the idea of *a* particular satisfaction. Either connotation places the idea *outside* the Organized Being – i.e. vests it in the "external world". This we are forbidden to do under the Copernican hypothesis. Meaning is the subjective determining factor that links sensorimotor representation to the *Existenz* of the Self by determining a state of satisfaction made out as an

[4] When clarity does not seem to be compromised, I will abbreviate the phrase "state of satisfaction-dissatisfaction" with the briefer phrase "state of satisfaction."

actual determination of sense. The objects of the first two of these ideas (meaning and state of satisfaction) are *noumena* and pertain to the *necessity* in the sensorimotor manifold and the *possibility* that this manifold can be established by the *actual* determination of sense. The three ideas of sensorimotor Modality are thus anchored in the General Postulates of the metaphysics proper of Rational Physics as: 1) an idea of the formal conditions of experience (state of satisfaction); 2) an idea of the material conditions of experience (determination of sense); and, 3) an idea of necessary context in an actual determined in accordance with general conditions of experience (sensorimotor meaning).

§ 8. The Applied Metaphysic of the Data of the Senses

At the conclusion of a chapter with subject matter as diverse as this one, it seems well worthwhile to close with a few summarizing remarks on what we have accomplished through these lengthy deliberations. Our topic in this treatise is the phenomenon of mind and our objective is to obtain a scientific doctrine for understanding of this phenomenon. As we discussed in Chapter 2, such a doctrine must constitute a system, i.e., a unity of various knowledge under one idea. As we have seen in this chapter, we cannot divorce the idea of "mind" from the Self as a whole and, consequently, we are not free to deal merely with the idealistic and rational but must also take the contingent and corporeal into due consideration in the *architectonic* of the system.

> By an *architectonic* I understand the art of systems. Since systematic unity is that which first makes ordinary knowledge into science, i.e., makes a system out of a mere aggregate of it, so architectonic is the doctrine of the scientific in our knowledge in general, and therefore it necessarily belongs to our doctrine of method.
>
> . . . I understand by a system, however, the unity of manifold knowledge under one Idea. This is the rational idea of the form of a whole, so far as through this the scope of the manifold as well as the place of the parts with respect to each other is determined *a priori* . . .
>
> For its relationship the Idea needs a *schema,* i.e., an essential manifoldness and order of the parts determined *a priori* from the principle of the purpose. A schema that is not outlined in accordance with an Idea . . . but empirically . . . gives *technical* unity, but that which arises only in consequence of an Idea . . . grounds *architectonic* unity. What we call science . . . arises architectonically, for the sake of its affinity and its derivation from a single highest and inner purpose, which makes possible the whole [KANT1a: 691-692 (B: 860-861)].

Between empirical facts and evidence and the rational principles of Kant's ontology and metaphysics proper there lies a gap that cannot go unaddressed if our theory is to claim validity as a science. The need for the empirical element in science is obvious and needs no promotion from this treatise. The unavoidability of the *rational* element of science we have already discussed. But, in addition,

> There belongs to every science as a system *a priori* principles concerning its form, to which the matter, as the quintessence of its objects, is then subordinated and thereby knowledge becomes scientific [KANT10: 62 (21: 207)].

To establish this subordination of the matter of a science to the *form* of science in general – a form that must be *a priori*, i.e. prior to the empirical doctrine – we must have a transition from the fundamental principles of knowledge to the particular (and contingent) knowledge of experience. It is this transition we seek to make with an *applied* metaphysic – a structure which plants its roots in rational principles but grows in the light of actual experience.

> First, how can I expect an *a priori* knowledge, thus a metaphysics of objects so far as they are given to our senses, thus given *a posteriori*? . . . The answer is: We take from experience nothing more than what is necessary to *give* ourselves an Object, partly of outer and partly of inner sense. The former is accomplished through the mere concept of matter . . . the latter through the idea of a thinking being (in the empirically inner representation: I think). Otherwise, we must in the entire metaphysics of these objects abstain entirely from all empirical principles that might add any sort of experience beyond the concept in order to judge something about these objects [KANT1a: 699 (B: 875-876)].

The Cartesian doctrine of the mind-body division, with its *res cogitans* and *res extensa*, is a false doctrine – a transcendent illusion of a real division where no such real division can be known. Nothing, however, prevents us from making a *logical* distinction between the corporeal data of *soma* and the data of mental experience in judging the appearance of the empirical Self. Indeed, if we are to be able to speak of the phenomenon of mind at all we must make such a division for there is nothing in the corporeal appearances of biology that contains *in its concept* those mental experiences we call by such names as feelings, emotions, thoughts, etc.

Neuroscience knows this and the psychophysical approach taken by researchers is ample evidence of this. It errs, if one wishes to call it that, only when it attempts to make the idea of mind subordinate to the idea of body, for the subordination of mind to body requires that mental phenomena then be viewed as the effect of a physical cause. We cannot, however, call upon the idea of emergent properties to justify such a cause-and-effect relationship because the objective validity of the principle of emergent properties lies in the principle of the community of those things that are coexistent in time. Consequently, body and mind must be viewed as *coordinate* rather than in a subordinated relationship of the cause to the effect.

Since such a coordinate relationship necessarily requires an idea of the community of mind and body, we require in our model of Organized Being the idea of *psyche* as the representation of necessary animating principles of this *nous-soma* reciprocity. The idea of *psyche* is thus the transitive idea held in common within both the idea of body and the idea of mind. To view body and mind as objects requires each to be thought under a notion of a Kantian substance – which is nothing more than the pure notion of a rule for uniting the representations of appearances in the

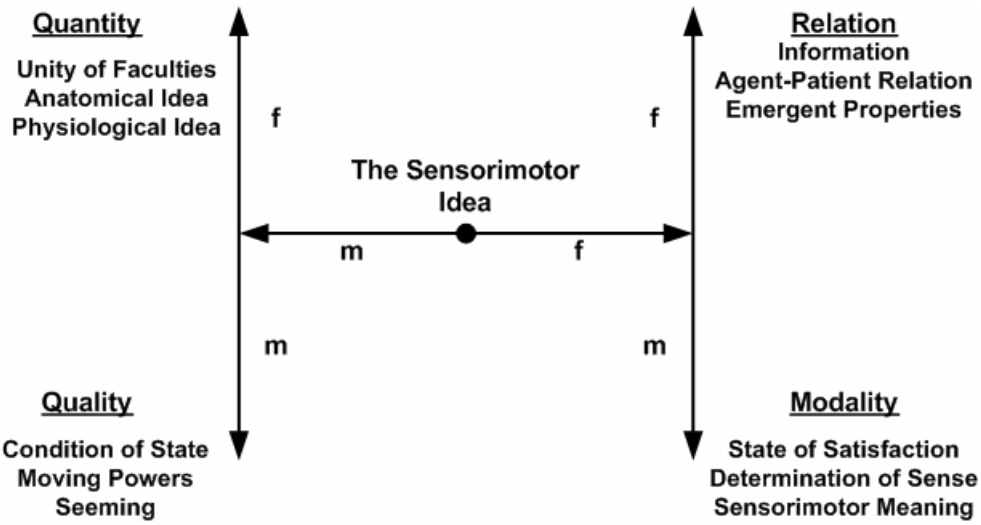

Figure 6.8.1: The Sensorimotor Idea

process of thinking. These substances we call *soma* and *nous*.

The task of any applied metaphysic is to combine knowledge gained empirically by its science with the ontology and rational metaphysics proper which alone provide the rules of objective validity in our knowledge and understand the possibility of experience itself. Such an applied metaphysic must *apply to experience* yet, at the same time, take nothing *from* the *matter* of experience. In other words, the applied metaphysic must provide only the *idea of the form* of the combination of empirical experiences under rational principles that underlie *all* experience. We call our overall applied metaphysic of the sensorimotor idea of *psyche* ***the data of the senses*** because it addresses, through the sensorimotor idea, the form of the Nature of the "given" in matters of experience.

Figure 6.8.1 summarizes the representation of the sensorimotor idea. As must always be the case for an applied metaphysic, it does not speak to the particulars of our science (for these must always belong to the experiential wing of a science) but merely to the doctrine of the form our science must take in its combinations of empirical knowledge under rational first principles and ontological primitives. We might liken the sensorimotor idea to an architect's blueprint for the construction of our science – e.g. as the plan *for* a building but not the building itself. The sensorimotor idea is put together from a synthetic representation of: 1) the transcendental sensorimotor idea; 2) the empirical sensorimotor idea; and 3) the *momenta* of the data of the senses.

The ideas exhibited in the sensorimotor idea apply with as much force to *soma* as to *nous*. This necessary community between physical neuroscience and the mental physics of *nous* was to be expected as soon as we recognized the division of body and mind as merely logical. A mental

physics cannot stand independently of neuroscience *nor can neuroscience stand independently of a mental physics*. The two are as tightly bound as the sciences of mechanics and electromagnetics in classical physics.

The ideas contained in our 2LAR of the sensorimotor idea are ideas belonging to the logical division of *psyche* in our Organized Being model. Of these ideas there is one – the idea of sensorimotor meaning – that requires one further comment at this point. The word "sensorimotor" is a delimiting adjective applied to the word "meaning" and we have not yet established a *Realerklärung* (real explanation)[1] in answer to the general question, "What does 'meaning' mean?" We can therefore expect this question to come again in this treatise. We will not settle this question until we address the relationship of *psyche* and judgment in Chapter 16. Between now and then we have much to do in preparation.

In the exposition of the data of the senses I have called upon principles from Kant's transcendental ontology that we have not yet discussed in detail. For those already familiar with Kant's philosophy this is perhaps not so serious a breach of procedure. But for the very large number of people who are unfamiliar with Kant's work, I expect this exposition has left the reader experiencing, to a greater or a lesser degree, some understandable level of doubt that can only be removed by clarifying the scope and nature of Kant's ontology. Let us, therefore, remedy this situation and move on to the heart of the theoretical Standpoint in Kant's Critical Philosophy: the ontology of the process of determining judgment (in Chapter 7), the ontology of determinant judgments (in Chapter 8), and the ontology of speculative Reason (in Chapter 9).

[1] A real explanation in Kantian terminology is an explanation of an idea that is in some way primitive insofar as empirical science is concerned. It is used to tie such ideas to metaphysical grounds that delimit the idea in Reality. For example, the explanation of information as the persistent (substance) in various equivalent data representations is a *Realerklärung* of the idea of information. Ontological primitives, on the other hand, require something more than this - namely, what Kant called a *Realdefinition* - since every *Realerklärung* is ultimately traced back to expression in terms of the ontological primitives. We will discuss this further in the following chapters.