Chapter 9 The Rudiments of Social Chemistry

§ 1. Tension and the Motivational Dynamic

According to mental physics, ***tension*** is a mental object referenced to the feeling of *Lust* or *Unlust* and subsisting in the motivational dynamic with the 2LAR structure

- Quantity: Expression of interest (want)
- Quality: Affirmation of reevaluation (drive)
- Relation: Enforcement of law (drive-state)
- Modality: Groping for equilibration (type-of-motive). [Wells (2009), chapter 10]

The motivational dynamic was introduced in chapter 7. Figure 9.1 repeats the illustration of the logic of the process of the motivational dynamic undertaken when the Critical drive (Quality) of the dynamic affirms the action of performing a reevaluation as a consequence of a conflict between the presentation of reflective judgment and the practical manifold of rules. This is the dynamic from which the idea of tension takes its real explanation. The task before us is to tie the mathematical explanation figure 9.1 presents with the character of semantic judgments of appearances in personal interactions illustrated by the Weaver's model depiction figure 9.2 provides.

All psychological theories of interpersonal interaction and of social personality presuppose at their roots the capacity of the individual to make meanings interpretations based on appearances of the words, posture, gestures, tone of voice, facial expressions, etc. of other people during their personal transactions. This is the practical definition of semantic representing in figure 9.2. The interpretation given to his perceptions of others' externalized expressions is the practical meaning of a semantic message. The semantic message is what is presented by objective intuitions and the affective perceptions that accompany them in the process of apprehension and apperception.

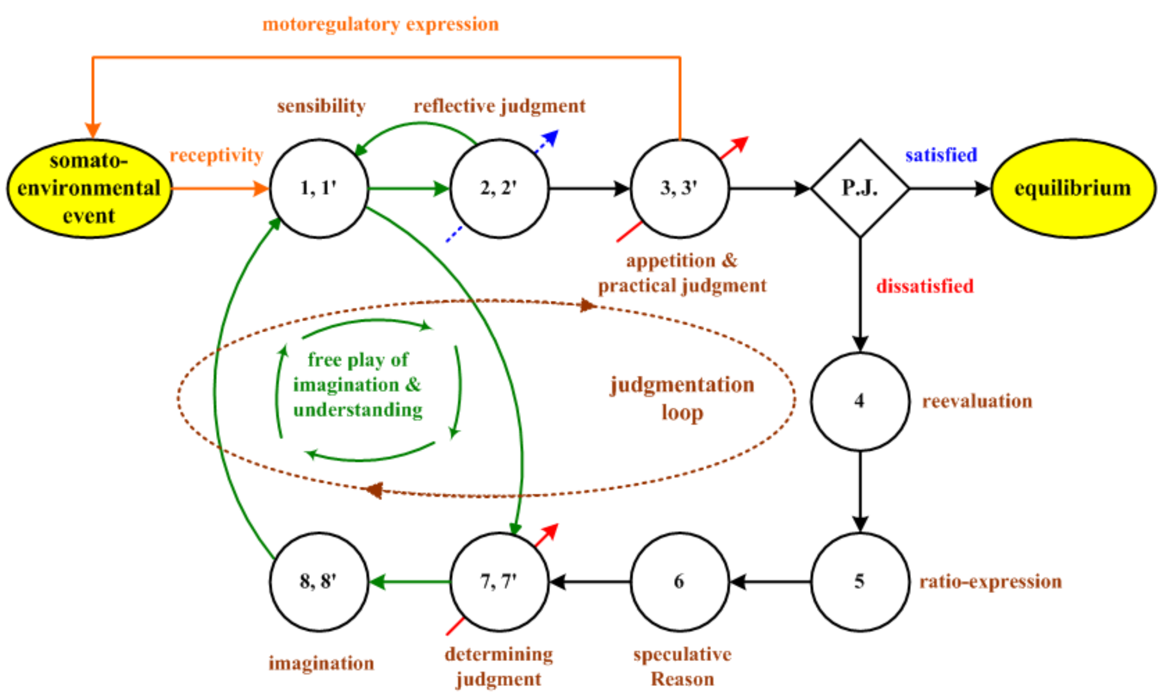

Figure 9.1: Synthesis in the motivational dynamic of judgmentation.

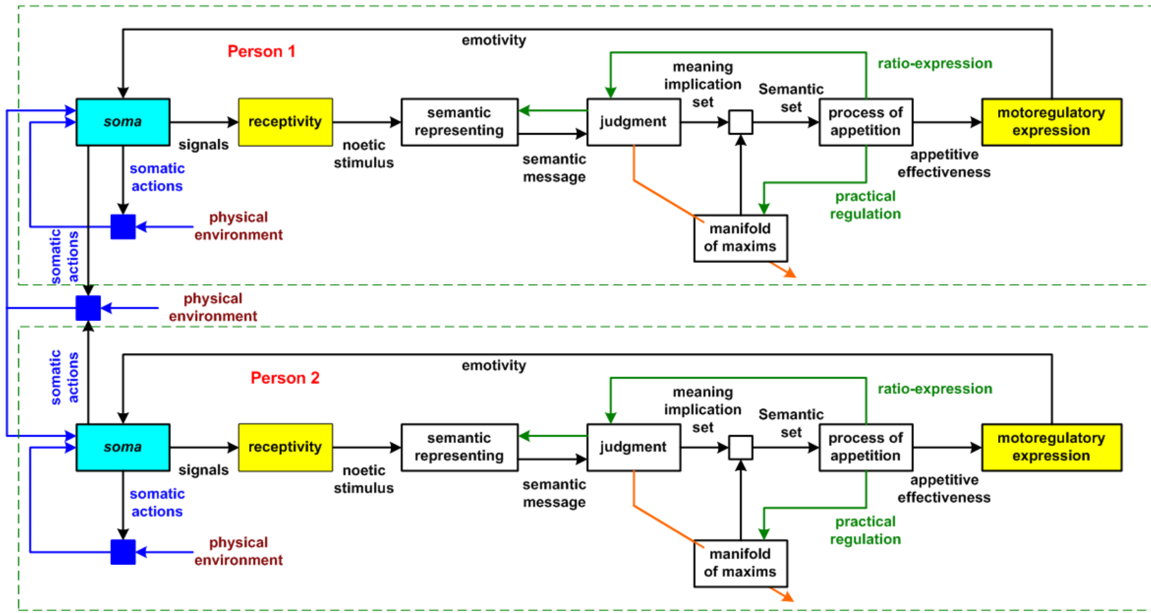

Figure 9.2: Weaver's model of two-person interaction.

Presentation of a meaning implication set and the subsequent winnowing-down of this to produce a Semantic set for appetition is the Critical ground for the somewhat vague idea of *impact messages* employed in personality psychology. Kiesler *et al*. briefly described that idea in the following way:

> A central proposition in the conceptualization of the [Impact Message Inventory, IMI,] was that a relationship is the momentary and cumulative result of the reciprocal *command messages*, primarily nonverbal, exchanged between two interactants. One half of a relationship is the encoder to decoder (ED) *evoking message*, by which an encoder imposes a condition of emotional, cognitive, and imaginal engagement on the decoder. As a result of the ED-evoking message the decoder is "pulled" to counter-communicate or respond as the encoder wishes without the decoder's being clearly aware of his or her compliance[1].
>
> The second half of a relationship consists of decoder to encoder (DE) messages registered covertly by the decoder in response to the ED messages. These emotional, cognitive, behavioral, and fantasy covert responses of the decoder were named the DE-*impact message*. The decoder's reciprocal covert responses represent the receiving end of relationship communication. They comprise the impacts or pulls-to-respond that are a direct result of the encoder's evoking messages. [Kiesler *et al*. (1997), pg. 222]

The explicit metaphor of "communication" used in this empirical theory is concretely tied to mental physics by Weaver's models [Wells (2011a)]. Note, however, that "what actually gets communicated" is not determined by the so-called "encoder" (*originator*) of a transaction event but, rather, is determined by the so-called "decoder" (*receiver*). One should also take note of the use of the word "covert" by Kiesler, *et al*. The semantic message, meaning implication set, and

[1] It should be added that the "encoder" (the person initiating a specific interpersonal transaction exchange) is not necessarily cognizant in concrete terms that he is trying to "pull" any specific interpersonal response from the "decoder" (the other interactant participating in the transaction). Mental physics tells us that both the "encoder" and the "decoder" will have made intuitive *anticipations* of how the other person is going to respond, but this in no way means either person is necessarily or consciously *trying* to bring about or effect a specific response from the other. However, a person can learn tactics for doing this, i.e., to be a leader.

the Semantic set are all representations of *nous* and are never externally expressed directly. The receiver's expressions (motoregulatory emotivity) are likewise interpreted by the originator and this, technically, actually marks the *next* interpersonal transactions, in which the person who was the receiver in the first becomes the originator of the second. As figure 9.2 implies, it is possible for two people to be co-engaged in "communicating" entirely different "conversations" if *each* of their respective acts of semantic representing are not judged (by the interactants) in objectively congruent *contexts*. Kiesler, *et al*. go on to remark:

> Several classes of impact messages can be distinguished: (a) *direct feelings* – when Interactant B is with Person A, Person A arouses distinct feelings and pulls specific emotions from him or her (e.g., bored, angry, suspicious, competitive, cautious, etc.); (b) *action tendencies* – Interactant B also experiences definite urges or pulls to do or not to do something with Person A (e.g., I should avoid interrupting him; I should leave her alone; I should defend myself; I have to be gentle with her; I have to find some answers soon, etc.); (c) *perceived evoking messages* – when with Person A, various thoughts run through Interactant B's head about what Person A is trying to do to him or her or what he or she thinks Person A wants Interactant B to do, including thoughts about what Person A is feeling or thinking about Interactant B (e.g., this person wants me to put him on a pedestal; she thinks I can't be trusted; he would rather be left alone; she is determined to be in control of me; he wants to be the center of attention; etc.); and (d) *fantasies* – when with Person A, Interactant B may experience more or less vivid images of himself or herself in concrete interactions with Person A (e.g., Persons A and B on separate rafts floating out to sea; Interactant B holding Person A in her lap in a rocking chair; Persons A and B playing poker, each wearing dark glasses . . .)[2]. [*ibid*., pp. 222-223]

Not every transaction involves tension. For example, the common folkway of saying, "Good morning," to someone as you pass each other on the sidewalk or in a hallway is usually responded to by some rote response (e.g., "Hi, how are you?") sanctioned by social custom. Responses of this sort are generally assimilated at once (affective perception of satisfaction) and the transaction would likely end there as you both went on your respective ways. If, on the other hand, the other person were to respond by pointing his finger at you and laughing hysterically, this appearance would likely be so contrary to your intuitive anticipations that you could not assimilate it immediately. Instead it would induce tension and provoke a judgmentation loop reevaluation. The other person's response is, in this case, called a *non sequitur*.

Let us review the logical sequence of the judgmentation loop figure 9.1 depicts:

1. perception of some somato-environmental event or possible circumstance occurs in sensibility;

[2] Fantasies such as these are, in mental physics terms, intuitive metaphors produced during the free play of imagination and understanding (figure 9.1) by which the person is groping for equilibrium during the course of his interpersonal interaction with another person. Metaphorical representations such as these are one of the "tools" the synthesis of judgmentation can call upon during the motivational dynamic. The semantic assessments conveyed by the Kiesler *et al*. examples are fairly vivid illustrations of how one person is understanding the context of the interaction and "where it is going." As an example leaning more toward the affective side of this context, I can share the following anecdote. A few years ago while I was visiting with some friends, their children were watching a cartoon movie on television that featured, among other characters, a group of talking sharks more or less represented as members of the mafia. The "boss" shark's voice was enacted by Robert De Niro. In one of the scenes as De Niro's character was saying something to the protagonist, the thought suddenly ran through my mind, "Why, that's Ken!" Ken was a manager I had worked for many years before. I liked him, but he was/is an habitual Driver in his interpersonal transactions at work. De Niro's "shark" persona suddenly reminded me quite vividly of some of my meetings I had had with Ken years before.

2. during the synthesis of this perception a manifold of Desires is assembled by impetuous reflective judgment;
3. some desiration presented by reflective judgment is evaluated during the synthesis and, because of this desiration, practical judgment encounters a conflict with the manifold of rules;
4. this failure to satisfy the mandate of the categorical imperative results in a disturbance to equilibrium and is accompanied by a practical judgment of reevaluation which
5. triggers ratio-expression aimed at carrying out an adaptation for resolving the conflict with the manifold of rules and restoring equilibrium;
6. speculative Reason is evoked by ratio-expression into re-directing and regulating the stimulation of thinking as a means of accommodating the manifold in perception;
7. determining judgment, brought into play by speculative Reason, initiates cyclic activity in the free play of imagination and understanding by reintroducing concepts into the synthesis of reproductive imagination;
8. imagination alters sensibility (1'), which in turn initiates a new round of synthesis in affective perception (2') and objective perception (7' and 8'); the resulting accommodations in the manifold of Desires brings on a new outer loop of judgmentation; this process continues cyclically, producing accommodations in the manifold of rules, continuation of ratio-expression, and accommodations in the manifold of concepts until eventually either
    a. an accommodation of perception, a manifold of Desires and a manifold of rules is produced that satisfies the formula of the categorical imperative and equilibrium is restored, or
    b. the cycle goes into rupture (via compensating acts of ignórance) and some new focus of attention and judgmentation is initiated.

This process is simultaneously carried out independently by each person during the course of their interaction. At the same time, each one's external action expressions affect the other and as a

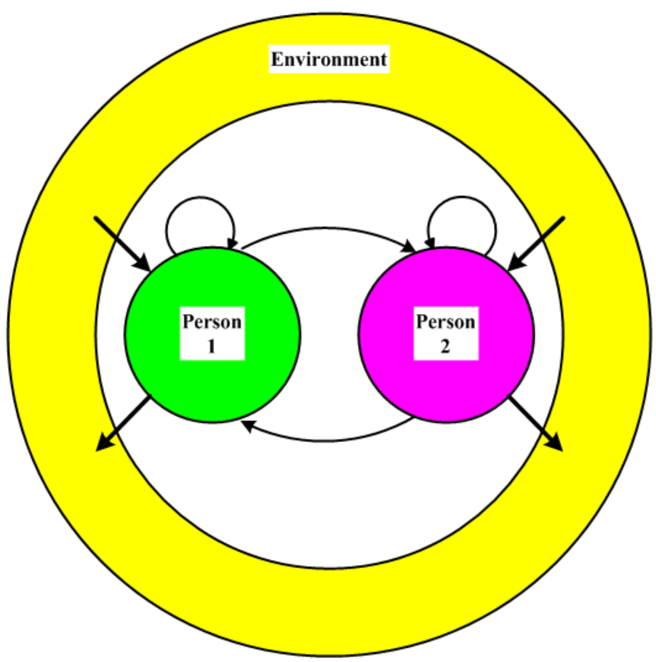

Figure 9.3: The fundamental social chemistry model of two-person interaction.

consequence of their perceptions of each other, each continues to receive somato-environmental aliments that contribute to the dynamics of the judgmentation process. Each is also influenced by the effect of the rest of their environment and by each one's knowledge of that environment. This interactive process of mutual causality and dependency effects can therefore be mathematically represented in terms of a social chemistry model. Figure 9.3 illustrates this for the two-person interaction case.

As soon as we consider that the factors depicted in figures 9.1 and 9.2 must be incorporated into the social-chemistry dynamics depicted by figure 9.3, it becomes rather obvious that the model presented by figure 9.3 represents an already extremely complicated system. Our task in this chapter is to examine what practical approaches to empirically modeling this complicated system are available to us. A good first step toward this objective is, perhaps non-obviously, to begin by factoring in an *additional* complication, namely, each individual's personality style factors as these factors are influenced by the social situation figure 9.3 illustrates.

§ 2. Personality Styles and the Manifold of Rules

Chapter 8 introduced the D-PIPOS circumplex model and traced its development from prior research work carried out in personality and interpersonal psychology and in sociology studies. Leary's remarks on variability according to structural, situational, and temporal factors were noted. Figure 9.4A repeats the chapter 8 presentation of a hypothetical circumplex for a specific individual based on that individual's manifold of rules as his rule structure exists at some hypothetically presumed period of behavior observation. Figure 9.4B depicts this same individual within one particular social environment. For specificity, let us suppose 9.4B represents him in his normal workplace environment. The darker-colored regions in 9.4B depict the submanifold within his manifold of rules that typically comes under stimulation in that social environment. The remainder of the manifold (colored in yellow) typically remains unstimulated during most of his time in the workplace and can be said to comprise a "background" of his personality upon which the "foreground" of his workplace social situation is placed. Using the Wilson system of interpersonal style classification, this person would be said to be an Expressive in the workplace.

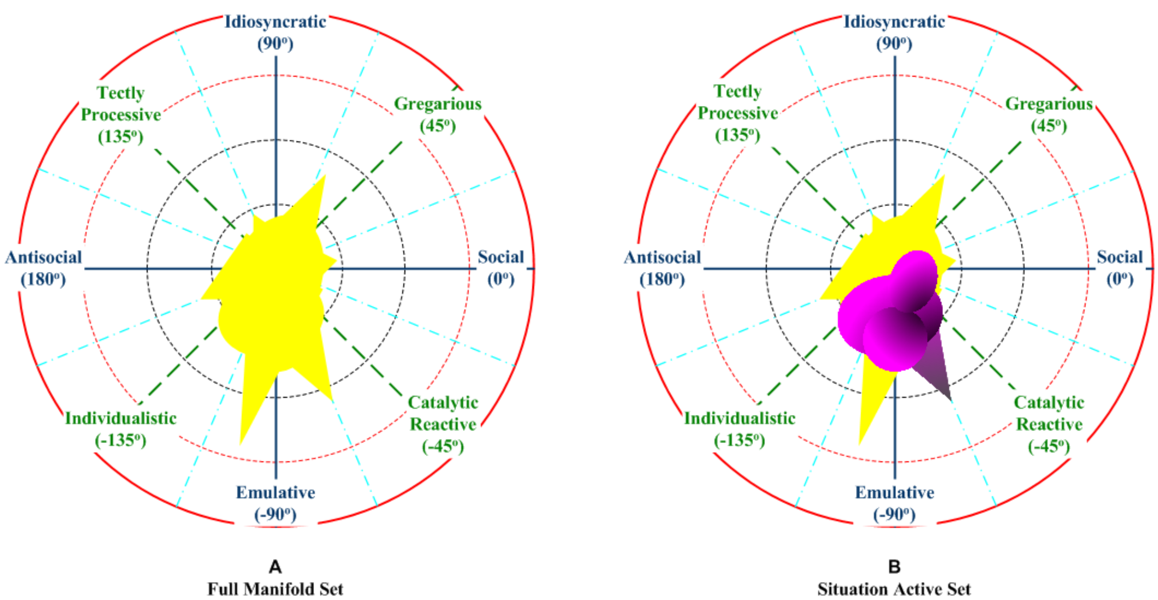

Figure 9.4: Personality style circumplexes according to the individual's manifold of practical rules. A: the full circumplex. B: Circumplex of active submanifold of rules invoked according to situation and time.

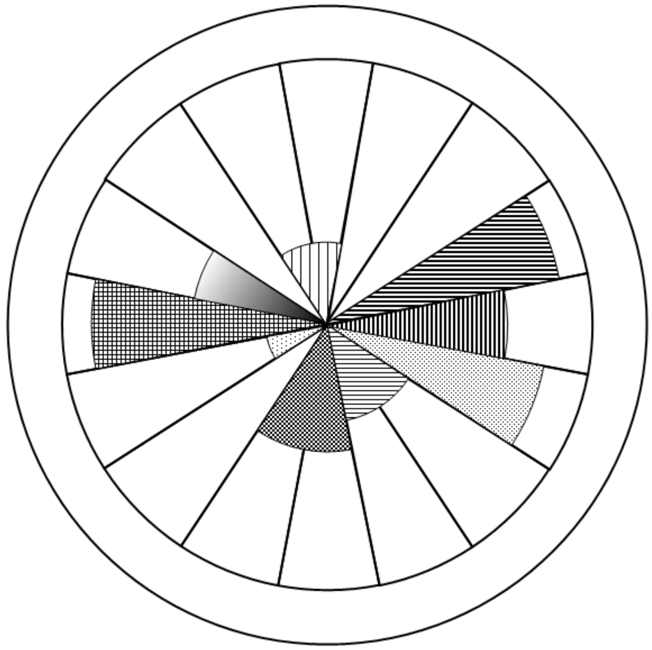

Figure 9.5: General form of the standard or "traditional" circumplex model in psychology.

There is a Critical difference between the circumplex model of figure 9.4A and the standard theory of circumplex modeling employed for the past fifty years by empirical psychology. Figure 9.5 provides a general illustration of the usual circumplex model one encounters in the psychological literature. Recall that the radial distance in a circumplex denotes the degree of intensity of a particular "trait," regardless whether we are considering emotion, personality, or etc. as the "trait" under study. The standard circumplex, which is properly regarded as a logico-mathematical model, depicts a widening of the angular coverage with increasing degree of intensity. This is nothing else than the logico-mathematical necessity that follows from a premise of an ontology-centered pseudo-metaphysic such as that underpinning the psychoevolutionary theory of emotion and personality. The individual segments *as traits* are seen under this premise as "primes" or "primitives" – fundamental "parts" out of which complex behavioral exhibitions are presumed to be built. Because of this "atomic-like" character of a "prime," it logically follows with logical necessity that the angular breadth of the "trait" must broaden as degree of intensity with which it is being exhibited is increased.

This, however, is fundamentally contradictory to a long-known empirical fact. When depicting personality-grounded behaviors, increasing intensity implies a progression from a *style* toward a *disorder*. It is, however, the empirically observed character of personality disorders that these are exhibited in a range that is both *narrow and rigid*. Quoting from *DSM-IV*:

> A Personality Disorder is an enduring pattern of inner experience and behavior that deviates markedly from the expectations of the individual's culture, is pervasive and inflexible, has an onset in adolescence or early adulthood, is stable over time, and leads to distress or impairment. [American Psychiatric Association (2000), pg. 685]

Mathematically, the broadening-out of the angular range of a circumplex segment is indicative of a *greater* range of expected behavioral appearances, not a range that is inflexible, stable, and pervasive. The traditional *mathematical* model is *contrary to actual case histories* of individuals who have been diagnosed as having a personality disorder. *Mathematical congruence with empirical facts* requires that the angular distribution in a circumplex be broader at *lower* degrees of intensity and narrower at the *higher* degrees of intensity. Figure 9.4A is consistent with this logico-mathematical requirement for theory; figure 9.5 is not.

Having said this, it is important to note that not all circumplex analysis methods make imputations of "primes" to be associated with discrete angular segments in a circumplex. Leary, for example, was not guilty of this metaphysical fallacy (although some later researchers have in fact inserted such ontological premises into Leary's circumplex and in a manner I think Leary would have repudiated). Leary did in fact use diagrams like figure 9.5 to present data summaries, but he did not impute any significance to "shading in" angular segments of his circumplex. The shadings he used in his exhibits were merely convenient visual ways to summarize large amounts of data [Leary (1957), pp. 62-71]. Leary's circumplex was a *mathematical structure* for quickly, conveniently, and systematically analyzing large amounts of data obtained in different functional contexts and according to a set of explicit *methodological* principles. Leary's research principles are summarized in Table 9.1 [Leary (1957), pp. 59-60].

Leary's first principle contains his technical definition of the object of study ("personality") and an empirical hypothesis of the relationship between this object and human Nature. The eight remaining principles all pertain to the construction of a mathematical system of analysis to be used to empirically describe the relationships between its mathematical constructs and empirical observations (what Slepian termed *principal quantities*). Leary could hardly have expressed in any clearer terms the *deontological* character of the Leary circumplex. This deontological character extends to the technical names he gave the segments of his circumplex (e.g., Dominant behavior). My criticisms above do not extend to approaches such as Leary's.

Table 9.1: Leary's Working Principles

1. Personality is the multilevel pattern of interpersonal responses (overt, conscious, or private) expressed by the individual. Interpersonal behavior is aimed at reducing anxiety. All the social, emotional, interpersonal activities of an individual can be understood as attempts to avoid anxiety or to establish and maintain self-esteem.
2. The variables of a personality system should be designed to measure – on the same continuum – the normal or "adjustive" aspects of behavior as well as abnormal or pathological extremes.
3. Measurement of interpersonal behavior requires a broad collection of simple, specific variables which are systematically related to each other and which are applicable to the study of adjustive or maladjustive responses.
4. For each variable or variable system by which we measure the subject's behavior (at all levels of personality) we must include an equivalent set for measuring the behavior of specified "others" with whom the subject interacts.
5. Any statement about personality must indicate the level of personality to which it refers.
6. The levels of personality employed in any theoretical system must be specifically listed and defined. The formal relationships which exist among the levels must be outlined. Once the logical system of levels and relationships is defined it cannot be changed without revising all previous references to levels.
7. The same variable system should be employed to measure interpersonal behavior at all levels of personality.
8. Our measurements of interpersonal behavior must be public and verifiable operations; the variables must be capable of operational definition. Our conclusions about human nature can not be presented as absolute facts but as probability statements.
9. The system of personality should be designed to measure behaviors in a functional context (e.g. the psychiatric clinic). Its language, variables, and diagnostic categories should relate directly to the behavior expressed or to the practical decisions to be made in this functional situation. The system, when used as a clinical instrument, should yield predictions about interpersonal behavior to be expected in the psychiatric clinic (e.g., in future psychotherapy).

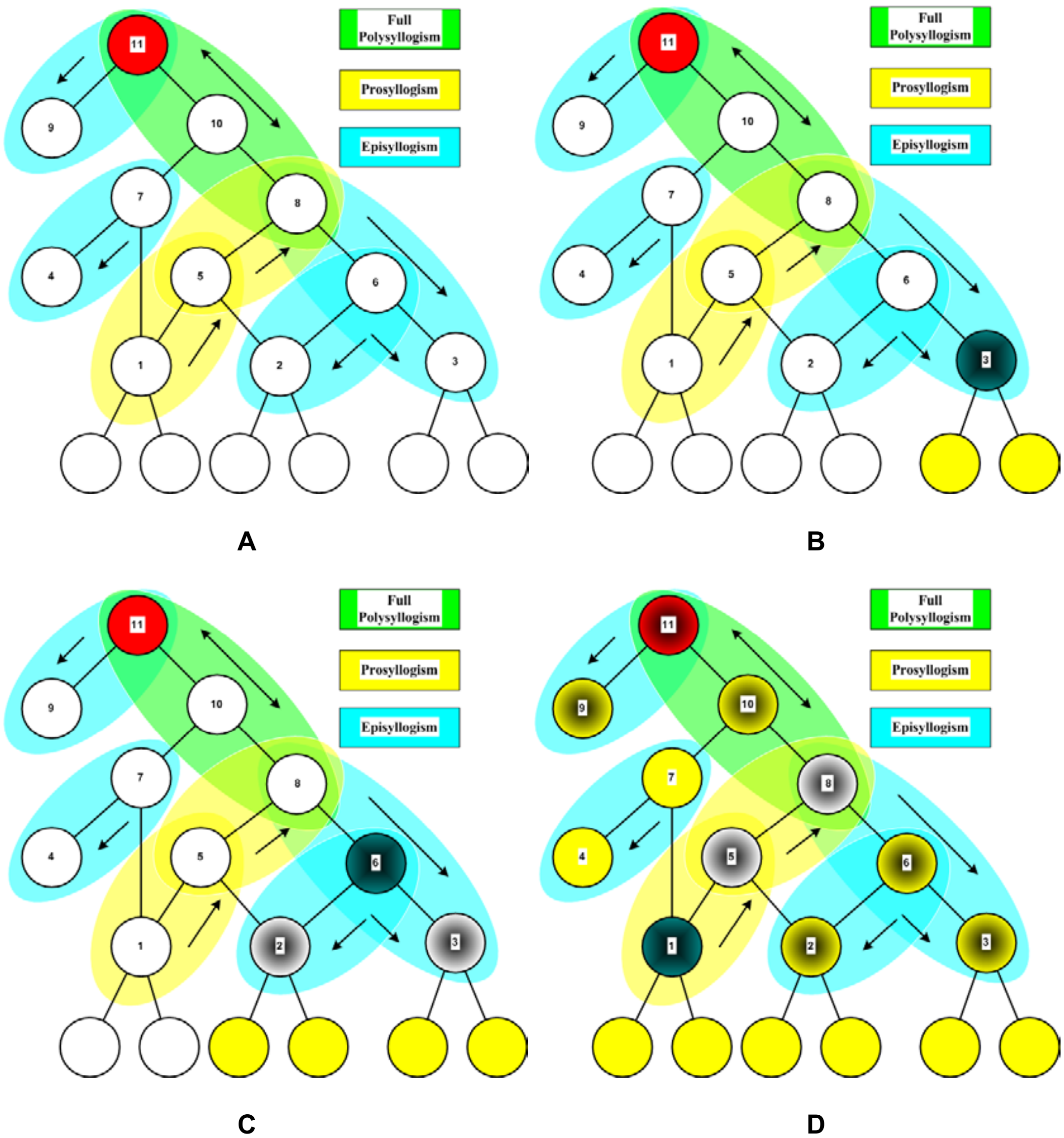

Figure 9.6: Simplified illustration of a subregion of the manifold of rules near a practical hypothetical imperative (denoted by the red circle). The numerical designations within the circles denote specific practical rules. A: structure of the manifold in an unstimulated condition; B: manifold activity when rule 3 is stimulated by a presentation of desiration from reflective judgment; C: manifold activity when rule 6 is stimulated by a presentation of desiration from reflective judgment; D: manifold activity when rule 1 is stimulated by a presentation of desiration from reflective judgment. See text for additional explanations.

Figure 9.4B illustrates an active subregion within an individual's overall manifold of rules. The activities in this submanifold reflect social situation/environment effects on the individual, which takes in two of the three sources of variability noted by Leary and quoted in chapter 8. The remaining source, which Leary called "levels of personality," is not directly relevant to the mental physics of behavior but *is* immediately pertinent to empirical studies of behavior. Leary's theory is an example of an *acausal* theory, by which I mean it is a descriptive theory that does not address underlying mechanisms and causes of behavior. That this is so is stated explicitly in his 8th working principle (table 9.1) because *probability statements implicate no causes*. They merely characterize the frequency of co-occurrence among measurable or mathematical factors. A statistic is a measurement and is pertinent to observables in facet A, the physical world, even though the statistic per se belongs to facet B, the mathematical world. A probability is a denizen of facet B that is always and *only* a mathematical secondary quantity. Probabilities are without any *ontological* significance whatsoever. Mental physics, on the other hand, is a theory addressing mechanisms and laws of the phenomenon of mind, i.e., it is a causal theory.

To understand what figure 9.4B is telling us we must examine the mental physics of the manifold of rules. Figures 9.6 present simplified illustrations of the Critical Logic governing this manifold. Figure 9.6A presents a hypothetical partial manifold substructure "near" a practical hypothetical imperative (a currently highest practical rule, i.e., a rule unconditioned by any other higher empirically-determined rules and conditioned solely by the categorical imperative). The other three panes of the figure depict three different cases of stimulation of this region of the manifold due to presentations of desiration from reflective judgment. I begin with an explanation of the notational conventions used in this figure.

The individual circles represent specific practical rules. Rules joined by solid lines are said to be ***coordinated*** in terms of a higher rule said to be contained *in* two or more lower rules combined with it by connections of coordination. The lower rules, in turn, are said to be contained *under* the higher rule. The higher rule is a representation common to all the lower rules with which it is coordinated and is synthesized in the free play between practical judgment and the process of appetition in practical Reason (figure 9.7 below).

In Critical Logic, combinations of rules are also rules and can be introduced into the synthesis of appetition *en masse*. There are in general two topological forms of complex rules of this sort, called ***polysyllogisms*** [Wells (2011b)] and ***disjunctive inferences of Reason*** [Kant (1800) 9: 120-134]. Figures 9.6 illustrate only the polysyllogism form. Polysyllogisms, in turn, are synthesized in three specific forms of connection: prosyllogisms, episyllogisms, and full polysyllogisms. Polysyllogisms are represented in figures 9.6 by the colored ovals.

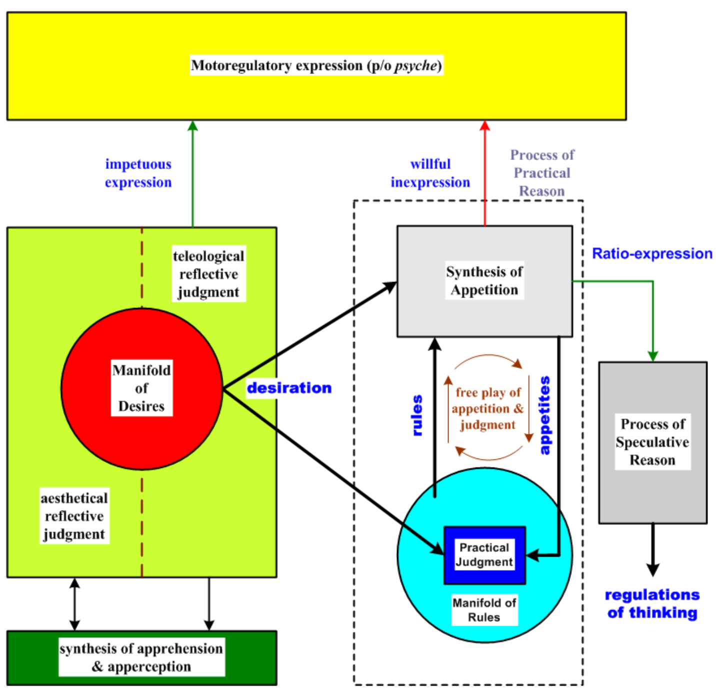

Figure 9.7: The interplay of reflective judgment, practical Reason, and the free play of appetition and practical judgment.

Prosyllogisms and episyllogisms are unidirectional in the graphical manifold network. In a prosyllogism, activity in a lower rule produces activity traveling "up the chain" in the higher rules contained in the prosyllogism. An episyllogism is the opposite of this, i.e., activity in a higher rule produces activities traveling "down the chain" in the lower rules contained under it. By "activity" I mean that the rule node in the manifold graph is participating in the synthesis of appetition. A full polysyllogism is bidirectional in the manifold, i.e. activity can "travel" in either direction through the manifold. This is illustrated in figures 9.6 by the arrows placed in the ovals representing the polysyllogisms. Note that two rules combined in coordination are not necessarily covered by a polysyllogism. In this case, activity in the higher rule might or might not produce activity in the lower rule depending on activities in other higher rules with which the lower rule may be combined. (These other higher rules are omitted from figures 9.6 for the sake of clarity in the graph and examples). There is no *a priori* limit to how long a polysyllogism chain can be other than, of course, the limit set by number of combined rules in the manifold.

A particular rule in the manifold can be stimulated (brought into activity) by the presentation of the representation of desiration with which it was previously associated when it was first synthesized. How the person will respond to this presentation depends on the structure of his manifold of rules (and, of course, on the other presentations of reflective judgment occurring concurrently with this presentation). Figures 9.6B-D illustrate three hypothetical examples.

In figure 9.6B rule 3 is stimulated. This is denoted in the figure by the coloring and fill of the rule 3 node. Because of its placement and connections in the manifold, rule 3 participates in the synthesis of appetition. Its lower coordinated rules may or may not be swept into the cycle of free play of appetition and practical judgment depending on other presentations of reflective judgment. This is because these lower rules are not covered by episyllogisms in the figure. All practical rules are action rules, and the effect of stimulating rule 3 in this example on the behavior of the individual will be relatively slight, depending on what lower rules combined with it also come into activity (and, of course, the still-lower rules coordinated under those that do become active). Rule 3 contributes to the activating potential of its lower rules because it is contained in those rules; the lower rules are said to be ***within the sphere*** of rule 3. The potentially activated rules are depicted in the figure by the solid yellow fill pattern in their nodes.

Figure 9.6C illustrates the effect of stimulating rule 6. The effect here is more pronounced. Rules 2 and 3 are both brought into activity by rule 6 because they stand under this rule covered by an episyllogism. In figure 9.6B, rule 6 is not stimulated by rule 3 because it is "upstream" in the episyllogism combination. This is the directional effect of polysyllogisms. In figure 9.6C the activities of rules 2 and 3 are depicted by the dark fill color pattern shown in these nodes. These two rules might or might not bring their coordinate lower rules into activity, which is again depicted by the unshaded yellow fill color in those nodes.

Finally, figure 9.6D illustrates the effect of stimulating rule 1, a rule you will note is at the same level in the manifold as rule 3. The effect this time is dramatically different because of the forms of connection of rule 3 in the manifold. Rules 5 and 8 are immediately brought into activity because they are connected to rule 1 through a prosyllogism. Rule 8, in turn, brings rules 6 and 3 into activity *mediately* because of the combining episyllogism, and rule 6 brings rule 2 into activity because these two are also covered by an episyllogism. Rule 8 *also* mediately brings rules 10 and 11 into activity because these three rules are covered by a full polysyllogism (that is, the combination is both an epi- and a prosyllogism). Rule 11 brings rule 9 into activity because of the episyllogism between them, while rule 10 potentially activates rule 7 (which in turn potentially activates rule 4 by episyllogism). These activity relationships are depicted by the fill colors and shading patterns shown in the figure.

The activation of rule 11 in figure 9.6D carries a significance that must be emphasized. This rule is an imperative, which means that its sphere of effect is the largest of all the combined rules in this submanifold. Generally, the higher in the manifold an activated rule is placed, the greater is its effect on behavior. Unless it is a "weak imperative" – by which I mean a relatively recent construct not yet covered by episyllogisms connecting it with its coordinated lower rules – it will activate or potentially activate a large number of lower rules in its submanifold, with an overall effect on behavior that, coming from a "mature" imperative well endowed with long chain episyllogism constructs, is unrivaled in terms of resulting behavior. A practical hypothetical imperative is the "highest law" in its region of the manifold, cannot be gainsaid by any other rules in the manifold. Consequently, its activity will typically bring about an intensity and focus in expressed actions well beyond that of other, lower rules. The behavioral profile of an imperative in the manifold of rules is stubborn and relatively inflexible because an imperative *commands* actions. In terms of figure 9.4B, the practical hypothetical imperative is found at the "tips" of the narrow, protruding regions of the manifold.

This aspect of the topology of the manifold of rules is what underlies the phenomenon of re-staging of rules discussed earlier in chapter 5. As the most general rules in the manifold of rules, the imperatives are, in a manner of speaking, the practical "rules of last resort," the exhibition of which is most pronounced when the lower levels of the manifold are still in a developing state and lack a broad lattice of interconnectivity moving "horizontally" across the manifold. Figure 9.8 illustrates what I mean here by "breadth in interconnectivity." Generally speaking, the earliest and lowest constructed levels in the manifold will have the greatest amount of breadth across the manifold, which implies that the circumplex of figure 9.4 will exhibit its greatest angular extension at these lower, simpler levels and, therefore, greater versatility in the person's behavior.

§ 3. The Complexity Issue

As soon as one compares the theoretical discussion of the previous section with the model of figure 9.3, it does not require a great deal of imagination to foresee the staggering complexity that attends a direct application of mental physics' first principles governing mathematical processes of *nous* to even the simple social chemistry of the two-person model. One can justly ask, "Doesn't this complexity render the whole idea of 'social-natural science' moot?"

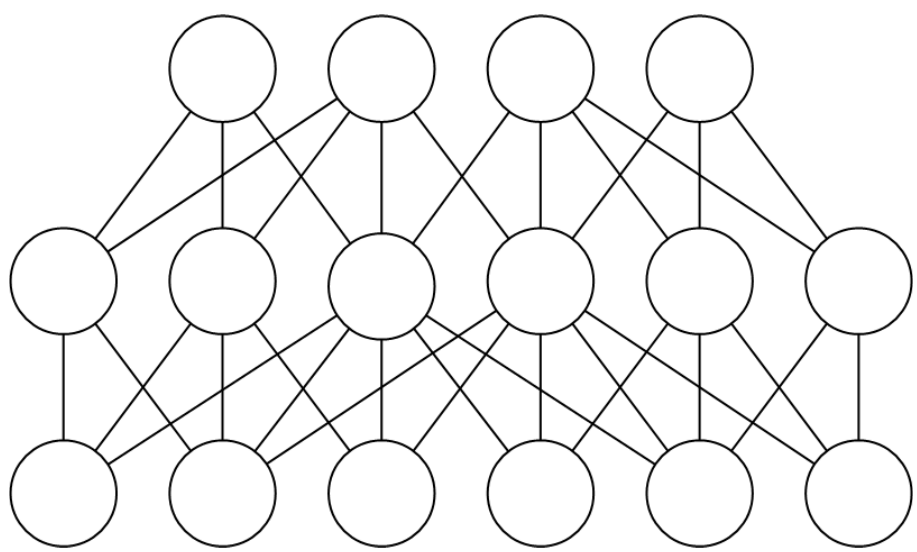

Figure 9.8: Illustration of breadth of interconnectivity in a manifold. The greater the number of coordinated rules a higher rule has under it, the larger is its sphere and the broader is its effect.

It does not, but why it does not and what methods the scientist has to employ are topics that call for at least a brief discussion here. Some scientists take up an extremist's attitude that their particular field of study is the one-and-only "true" example of "real science." A few members of the physics community are particularly prone to doing this. A famous physicist of the early 20th century once commented dismissively that, "there is physics and there is stamp collecting." Students majoring in physics are particularly vulnerable to this odd bit of professional narcissism, and, by and large, the physics culture tends to promote the attitude. There is a great allure to the fantasy. But this attitude is nothing more than childish *chutzpah*.

At issue here is the philosophical question of whether science is an explanative undertaking, a descriptive undertaking, or if sometimes it is the one and at other times the other. Physicist and avocational philosopher Henry Margenau wrote,

> To settle the problem [of whether science is descriptive or explanatory] one must first of all expose *what* is to be described or explained. . . . [The] distinction between explanation and description is a genuine one in scientific discourse; some theories are *de facto* said to describe, others to explain. The former are often called *phenomenological*, the latter *causal* theories[3]. . . . In contrast to Mendel's descriptive laws, the modern theory [of genetics] which locates the genes within material carriers (the chromosomes) is usually looked upon as an explanation. The reason most likely to be given is that it answers the question *why* hereditary traits are transmitted in certain ways, whereas Mendel's laws merely show *how*. It seems unnecessary to argue at length the superficiality of this distinction, for it is perfectly clear that the why is nothing more than a disguised how. If the problem of heredity were simpler and we had observed all along how particles with specific properties had been handed down from generation to generation, we should certainly want to know *why* this happened. What now goes as explanation would then be mere description.
>
> Although few would admit it, there is an admixture of anthropomorphism in most judgments regarding what constitutes an explanation. Heredity is an example which presents this feature clearly enough. . . . Such anthropomorphism tends to prefer mechanical artifacts and to look upon a mechanistic explanation as an ideal type. . . . If we consider the two explanatory phases of heredity without preconceptions, we find nothing more than this: One is a prior stage of the other. Historically, Mendel was prior to Morgan, the discoverer of the gene, but Morgan's theory is logically prior to Mendel's laws. It is the logical, not the chronological, relation which interests us here. We regard the theory of genes as an explanation because Mendel's laws can be deduced from it.
>
> Thus it turns out that the distinction between the how and the why is primarily a logical one. As such it has an interesting corollary in the theory of knowledge, which permits the problem of "description vs. explanation" to be dealt with in another way. We have previously drawn attention to the variation in "distance" of constructs from the plane of perception; concepts can be related to Nature by very obvious rules, and in the other extreme they can be quite abstract. We mean by a *descriptive* theory one which involves constructs of the former sort; an *explanation* involves a further progression into the constructional domain. . . . If regression from the immediate is the character of explanation – and this is the view we have now formulated – then explanation can never be final. Nor is the distinction between description and explanation an absolute one [Margenau (1977), pp. 167-169].

One man's explanation is another man's description. There is no crisp division between science that is explanative and science that is descriptive. This is why the "ladder structure" of levels of scientific reduction and its complement, model order reduction, that was introduced in chapter 2 is a pragmatic and fecund division of labor in science. It would be a fool's errand indeed to

[3] Under this distinction, quantum mechanics must be called a phenomenological theory.

embark upon trying to make up a complete model of the social-chemistry "molecule" of figure 9.3 by direct application of the primitive categories of Critical metaphysics proper. A structured and multi-level approach to the problem is a practical necessity for us, and for just the same reason as model order reduction was something Newton found himself necessitated to practice in deducing his famous theory of gravitation. General system theorist Gerald Weinberg wrote,

> Consider first the equations needed to describe the most general system of only two objects. We must first describe how each object behaves by itself – the "isolated" behavior. We must also consider how the behavior of each body affects that of the other – the "interaction." Finally, we must consider how things will behave if neither of the bodies is present – the "field" equation. Altogether, the most general two-body system requires four equations: two "isolated" equations, one "interaction" equation, and one "field" equation.
>
> As the number of bodies increases, there remains but a single "field" equation, and only one "isolated" equation per body. The number of "interaction" equations, however, grows magnificently, with the result that for *n* bodies we would need 2^n relationships! . . . To be more concrete, for 10 bodies [the sun plus the number of known "planets" in the solar system in 1975] we would need $2^{10} = 1024$ equations and for 100,000 bodies [the rough number of solar bodies accounting for the asteroids, moons and comets], about $10^{30,000}$. By "ignoring small masses," then, the number of equations is reduced from perhaps $10^{30,000}$ to approximately 1000. At least it would now be possible to write down the equations, even if we still could not afford to solve them.
>
> In practice, then, there is an upper limit to the size of the system of equations that can be solved. Clearly, $10^{30,000}$ equations are far beyond that limit. And in Newton's day, without computers at all, the practical limit of computations was well below 1000 second-order differential equations, especially since Newton had just invented differential equations. Newton needed all the simplifying assumptions, explicit or implicit, he could get away with, just as physiologists and psychologists do today. We may note, in this regard, that old-time physicists now say that the "youngsters" no longer do "real physics." These young upstarts use the computer to solve large sets of equations, rather than applying physical "intuition" to reduce the equations so they can be solved with a pencil on the back of the proverbial envelope. . . .
>
> And yet, even having reduced the number of equations to 1000 – by applying some deeply buried assumptions – we still may not be able to say we have solved this mechanical problem. The equations may still prove intractable, even for a large computer. We need further simplifications. Newton supplied an important one in his Law of Universal Gravitation, which has been called "the greatest generalization achieved by the human mind." The law states that the force of attraction (F) between two (point) masses was given by the equation $F = GMm/r^2$ . . . From the viewpoint of simplification, this equation says more implicitly than explicitly: for it states *no other equation is needed*. It says, for instance, that the force of attraction between two bodies is in no way dependent on the presence of a third body, so that only pairs of bodies need be considered in turn, and then all of their effects may be added up. A psychologist, for one, would be tickled pink if he could consider only summed pair interactions. . . .
>
> But Newton went even further than this, for he observed that the dominant mass of the sun enabled him to consider each planet together with the sun as a separate system from each of the others. Such a separation of a system into noninteracting subsystems is an extremely important technique known to all developed sciences . . . At this point, Newton stopped simplifying and solved the equations analytically. He had actually made numerous other simplifications, such as his consideration of each of the solar bodies as point masses. In each of these cases, he and his contemporaries were generally more aware of – and more concerned about – the simplifying assumptions than are many present day physics professors who lecture about Newton's calculations. Students, consequently, find it hard to understand why Newton's calculation of planetary orbits is ranked as one of the highest

> achievements of the human mind. . . . Newton was a genius, but not because of the superior computational power of his brain. Newton's genius was, on the contrary, his ability to simplify, idealize, and streamline the world so that it became, in some measure, tractable to the brains of perfectly ordinary men. [Weinberg (1975), pp. 6-12]

The present day system of education in America, from kindergarten through post-graduate school, is profoundly ignorant of this firmament of the human-Nature of science (and, as well, of mathematics) and has been for *at least* the past forty years. There is no strong evidence that the situation is otherwise in other countries. For at least the past forty years we have been churning out generations of scientists *and teachers* whose ignorance of the human-Nature of science and mathematics rivals the ignorance of the ancient Romans in scope and arrogance. Unless this is corrected, we will continue on the course of churning out generation after generation of scientists, mathematicians and teachers who are heir to an intellectual darkness not seen in the West since the end of the Dark Age that followed the fall of the Roman Empire. Our education system, aided and abetted by *both* political parties, is building the foundations for the next Dark Age right now.

The pragmatist's question this brings up is, "Is it always necessary to find a Newton to 'streamline the world so that it becomes, in some measure, tractable to the brains of perfectly ordinary men'?" The answer is "no." It is true enough that model order reduction is not recognized as a science by more than a very few people. This does not change the fact that it is the complement to the (presently overspecialized) division of labor known as "the disciplines" that each practices science at its own peculiar, and increasingly isolated, levels of scientific reduction. Model order reduction practice has its techniques, its methods, its theories, and its paradigms. Metaphorically, it is the science of constructing the rails that integrate the different rungs on the scientific ladder and holds science-as-a-whole together. We do not have very many scientists who work primarily in this area, true, but that does not mean that the knowledge and practice of this science cannot be taught and mastered. Indeed, achieving this state of affairs is the vital core of what has become widely called "the interdisciplinary movement" in science. A well-trained ***and well-educated*** corps of scientists *and teachers* who practice in this field is a perfect-enough substitute for the occasional and accidental Newton.

Let us turn now to more specific discussion of the problem of our social-molecule (figure 9.3). The root scientific problem is easy enough to state: Between the underlying low-level primitives and basic functions of mental physics and the observables of high-level social phenomena there is an unfilled scientific gap as wide as or wider than any encountered anywhere in science. The task is to fill this gap, and the quest is to find a good method for filling it.

Here we are fortunate because this problem belongs to the very same intellectual class as the basic problem long faced by theoretical neuroscientists – and, in particular, by those who work in the subfield popularly called neural network theory and more properly called computational neuroscience. The gap between biology/physiology and psychology/behavior is as wide as any found in present day science[4]. What is called for is an organized and disciplined problem-solving approach by means of which we can take on the "gap problem" characteristic of this class of scientific research.

This approach exists already. It was discovered, within the context of neural network theory, and published in 1972 by Stephen Grossberg of Boston University. Much more recently it was shown that Grossberg's method is applicable to the general problem we face here and can be expressed in a specifically broader mathematical context [Wells (2011c, d)]. Grossberg wrote,

> This article derives neural networks from psychological postulates concerning

[4] For a more detailed discussion of this see Wells (2010), chapters 1 and 7.

punishment and avoidance. Relevant experiments and theories will be analyzed in terms of network mechanisms. These networks form part of a theory of pattern discrimination and learning which is called the theory of ***embedding fields***. The equations of this theory can be derived from psychological postulates and, once derived, can be given an anatomical and physiological interpretation.

The theory introduces a particular method to approach the several levels of description that are relevant to understanding behavior. This is the method of ***minimal anatomies***. At any given time, we will be confronted by particular laws for individual neural components, which have been derived from psychological postulates. The neural units will be interconnected in specific anatomies. They will be subjected to inputs that have a psychological interpretation which create outputs that also have a psychological interpretation. At no given time could we hope that all of the more than 10^{12} nerves in a human brain would be described in this way. Even if a precise knowledge of the laws of each nerve were known, the task of writing down all the interactions and analyzing them would be bewilderingly complex and time consuming[5]. Instead, a suitable method of successive approximations is needed. Given specific psychological postulates, we derive the *minimal* network of embedding field type that realizes these postulates. Then we analyze the psychological and neural capabilities of this network. An important part of the analysis is to understand what the network cannot do. This knowledge often suggests what new psychological postulate is needed to derive the next more complex network. In this way, a hierarchy of networks is derived, corresponding to ever more realistic anatomies, and provides us with a catalog of mechanisms to use in various situations. The procedure is not unlike the study of one-body, then two-body, then three-body, and so on, problems in physics, leading ever closer to realistic interactions; or the study of symmetries in physics as a precursor to understanding the mechanisms of symmetry breaking.

At each stage of theory construction, formal analogs of nontrivial psychological and neural phenomena emerge. We will denote these formal properties by their familiar experimental names. This procedure emphasizes at which point in theory construction, and ascribed to which mechanisms, these various phenomena first seem to appear. No deductive process can justify this process of name calling; some aspects of each named phenomenon might not be visible in a given minimal anatomy; and incorrect naming of formal network properties in no way compromises the formal correctness of the theory as a mathematical consequence of the psychological postulates. Nonetheless, if ever psychological and neural processes are to be unified into a coherent theoretical picture, such name calling, with all its risks and fascinations, seems inevitable, both as a guide to further theory construction and as a tool for more deeply understanding relevant data. Without it, each theory must remain a disembodied abstraction. [Grossberg (1972a)]

Grossberg's work frames the topic in the language of the neural network theorist, psychologist, and the physiologist. However, embedding field theory and the method of minimal anatomies are mathematical methodologies, belong to facet B (the mathematical world), and like all good mathematical methods are applicable to problems outside of the original peculiar scientific niche where they are first developed. In this particular case, embedding field theory has been shown to expressible in general graph-theoretic terms and the minimal anatomies it expresses have been shown to have a topological interpretation [Wells (2011d)]. This is merely an enlarged *context* for the methodological theory Grossberg discovered and developed. Assuming we successfully deter the growing threat of a new Dark Age, Grossberg's discovery will merit being hailed as one of the most important scientific discoveries of the twentieth century.

This, then, is our solution approach to dealing with the complexity problem in social-natural science. This book is not the appropriate venue for teaching the mathematical rudiments of embedding field theory and minimal anatomies. That must be left to another endeavor. What we

[5] Grossberg, who was trained as a mathematician, is an optimist here. The task is a *practical impossibility*.

will do in this treatise is presume the method and explore what we can from our present level of understanding of mental physics and social-chemistry. (Yes, I *am* asking you to trust me on this). This is because the primary objective of this book is to understand the human-Nature of social contracting.

§ 4. The Social Chemistry of Bonding, Anti-bonding and Non-bonding

Psychologists use the term *bonding* in general to mean "the forming of a relationship" or as a synonym for *attachment*. The term typically carries an emotional connotation. The term *bond* has five technical definitions, two of which refer to the chemical and biological usages of the word. The most general definition is "a connection or link between things" [Reber (2001)]. It is evident that these terms are not strongly technical in psychology because they lack criteria by which one can tell whether or not a "relationship," "attachment" or "link" of any kind has been formed.

As this treatise uses chemistry as an analogy for the nature of social relationships, let us look at chemistry's definitions of the analogical terms. A chemical *bond* is *the linkage between atoms in molecules and between molecules and ions in crystals* [Sharp (2003)]. Bonding, the present participle of the verb "to bond," is the act of forming a bond.

In order to understand how to properly employ the analogy and to understand how the social-chemical bond differs from the chemical bond, it is helpful to briefly review the qualitative model of bonding used in chemistry and quantum mechanics on a non-mathematical level. Figure 9.9 is a cartoon-level illustration of the three principal types of commonly encountered chemical bonds. The bonding mechanism is provided by outer shell electrons that become disassociated from their "home atom" and are "shared" by, between or among different atoms. The atoms are said to become "ions" because after "giving up" an electron to the chemical bond the atom itself is left with a surplus positive electric charge.

In a covalent bond, each atom contributes one or more electrons to what is called the *molecular orbital*. The bonding electrons are no longer said to "belong" to any particular atom in the molecule but, instead, are said to be "shared equally" by the bonded atoms. Covalent bonds are typically a strong form of bonding and tend to form "hard" or "rigid" molecules. An ionic bond, in contrast, occurs when one atom "takes" an electron from the other, acquiring a net negative charge and leaving a positively charged ion behind. The two atoms are now bound together by electrostatic force as the positive and negative ions are "attracted" to each other. Ionic bonding tends to be a weak form of bonding in the connotation that the bond is more easily broken than is typically the case in covalent bonding.

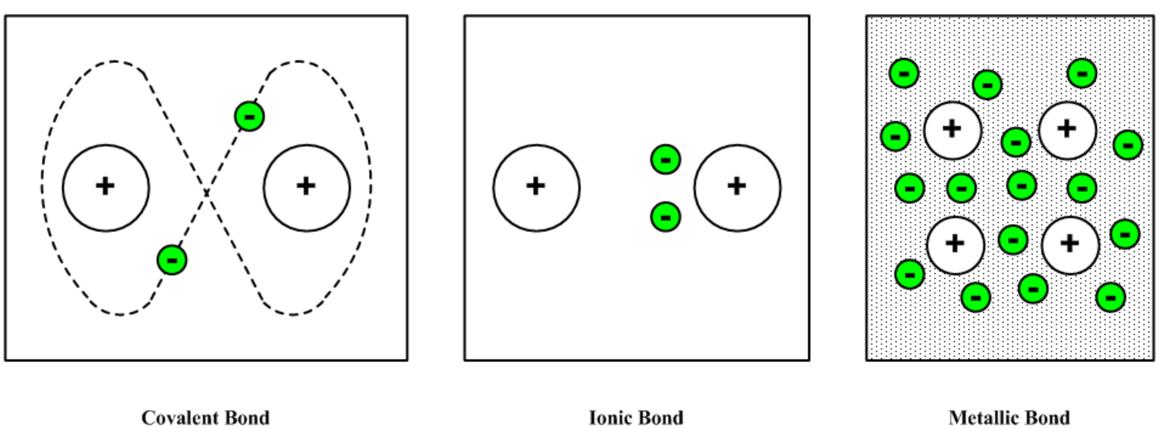

Figure 9.9: Cartoon-level illustration of the three principal types of chemical bonds.

The metallic bond is a kind of combination of the first two. Every atom in the material "gives up" one or more electrons, which are then "shared" by all the ions in the material. These electrons are said to form an "electron gas" and hold the positively charged ions together by virtue of the negative charges they carry (an ionic-bond-like feature). Metallic bonds are typically ductile (i.e., the material is flexible and bendable without breakage) rather than brittle (i.e., not flexible or easily bendable without breakage, as is the case in most covalent bonds). Unlike the electrons in a covalent bond, the electrons in a metallic bond are not associated with *any* specific ions, whereas those in a covalent bond are strongly associated with the two particular ions they bond together and those in an ionic bond are strongly associated with just *one* of the ions they bond. Thus, the bonding electrons in a metallic bond are said to be "itinerant" or "traveling" electrons.

The bonding electrons in a molecule are said to occupy *molecular orbitals*, whereas those electrons that remain "with" the original ion and do not participate in the chemical bond are said to occupy *atomic orbitals*. (This terminology gets a bit vague in the case of ionic bonding). There is said to be three general types of molecular orbitals: bonding, anti-bonding and non-bonding. In a bonding orbital the presence of an electron tends to hold the molecule together. In an anti-bonding orbital the presence of an electron tends to cause disruption of the molecule. In a non-bonding orbital the presence of an electron has no bonding effect on the molecule [Sharp (2003)].

There are some important and more or less obvious differences between bonding in physical chemistry and social-chemical bonding. We must be cognizant of these differences or risk misuse of the analogy. The first and most obvious difference is that there is nothing analogous to an electron in a social-chemical bond, no physical entity traveling back and forth between or among the social atoms. We can still speak of social-chemical bonding, anti-bonding and non-bonding, but we must clearly understand that bonding is in this case the product of Self-determinations made by each person involved in the social situation. The bonding is psychological rather than physical. Psychological objects are non-physical (supersensible). They belong, one and all, to facet B of the mathematical world[6]. We will call psychological objects *bonding factors*, *anti-bonding factors*, or *non-bonding factors* according to whether these objects are significant for describing a tendency to hold a social molecule together, to disrupt it, or to have no effect on it.

It is wise, I think, to mention something at this point because I have little doubt that at least some readers are feeling highly skeptical about where this analogy is going. Even though many people speak sometimes of "the chemistry" between two people, I think it is likely that some of you reading this treatise might harbor unpleasant memories of chemistry from high school or college. The plain fact is that chemistry as it is typically presented in, e.g., most college undergraduate chemistry courses involves a lot of memorization and supplies few or no mathematical laws a person can bring to bear on understanding a chemistry problem. If, for example, your chemistry course tells you that under such-and-such a set of conditions salicylic acid mixed with acetic anhydride produces acetylsalicylic acid (aspirin) and acetic acid, you have pretty much no choice except to memorize this (along with the chemical formulas for the jaw-

[6] As an interesting side note, the same is true for physical electrons in molecular orbitals. Although we tend to speak of "the electrons in a molecule," in point of fact it is a *law* of quantum physics that electrons *must* be regarded as physically indistinguishable (no individual "identity" can be given to any specific electron) and the electrons cannot be said to "exist" at any particular "place" in space other than "in such-and-such an orbital or state." There are important consequences resulting from this empirical law of indistinguishability, and these lead to testable physical predictions. We have a high level of certainty that electrons as physical entities exist (because there are physical effects that can be measured in isolation pointing to the *Dasein* of electrons), but on the whole we do not really know just exactly "what" an electron "is" outside of the context of specific and measurable manifestations of physical phenomena. The electron has been called "a riddle wrapped in an enigma inside a mystery." All useful and fecund ideas about electrons belong to facet B of the world of mathematical theory exclusively.

breaker molecule names). One of my college friends, a zoology major, once called his organic chemistry course "a fancy history course." Such a course does not actually teach most people how to solve a chemistry problem.

If a mathematical relationship that looks-like-a-law *is* presented (e.g., the "law of valency" as typically first presented in high school or to college freshmen), one soon discovers that this "law" only applies in particular special cases, and that the instructor neglected to mention the fact that it *only* applies to particular special cases. No explicit table of organization is presented to help you keep track of what applies where and when. (Also in the typical case, the special limitation is first brought to the student's attention when he or she gets a homework assignment back with all the answers marked wrong because the "law" didn't apply to the chemical reactions in the homework assignment). The impression, no doubt unintended, this bizarre pedagogy leaves with many students is that chemistry is *at best* as Kant once described it: "a systematic art rather than a science" [Kant (1786), 4: 468].

Most physicists won't hesitate to tell us, with an awe-inspiring air of self-confidence, that the quantum theory explains all of chemistry. In other words, there are general, specific and quantitative laws that apply to every chemical reaction and phenomenon. I remember feeling much more friendly toward the subject of chemistry after taking a year of quantum mechanics as an undergraduate than I did after completing my freshman chemistry course. The day I received my Ph.D. in electrical engineering, I joked that, "now I have the prerequisites for taking freshman chemistry." Why, then, do chemistry professors not tell their undergraduate students, especially the freshmen, that: (1) there are laws that govern chemistry; but (2) there is a lot of mathematics and physics one has to learn first to really understand these laws; and (3) eventually the student will learn these laws if he/she takes more advanced physics or physical chemistry courses?

I don't really know the answer to this (other than that I am fairly sure a lot of it is mere teaching habit) but I have long suspected that chemists harbor a deep-down skepticism about how *practical* the claims of the physicists actually are. "In principle," quantum mechanics yields very specific and quantitative answers for chemistry problems. In practice, the vast majority of actual chemistry problems are complicated enough that nothing but computer solutions to them can be achieved – and many of them are so complicated that the relevant quantum mechanics equations cannot even be concisely written down. The simple fact is that the "in principle" solution is often not even attempted (not even by physicists) in the majority of actual cases of chemical practice. As it happens, the old-timers in physics at the birth of the quantum theory shared this skepticism about the proud boasts of youngsters like Werner Heisenberg. Heisenberg once made a remark on a radio program that amounted to saying that now physicists could solve any chemistry problem. Wolfgang Pauli, in a letter to physicist George Gamow, sardonically wrote, "Comment on Heisenberg's radio advertisement: 'This is to show the world that I can paint like Titian'." Below this line was a blank box followed by the words, 'Only technical details are missing' [Gamow (1966), pg. 162].

In point of fact, the *qualitative* properties illuminated by the quantum principles are of great and practical use to practicing chemists. So are a number of relatively new computer-aided design and analysis programs that relieve the drudgery of doing lengthy mathematical calculations. It is tempting (though basically erroneous) to think these kinds of tools can substitute for training in quantum physics, but the simple fact is that many chemists can and do make important chemical discoveries without so much as lifting a pencil to write out a quantum mechanical wave function. I have many times listened in admiration as my colleagues in the chemistry department have spoken in detail of designing new molecules with specific properties aimed at specific results. They speak with the self-assured confidence of a master carpenter explaining how to saw a board in two. Then I have seen them go on to *do* what they *said* they could do. There is a quantitative element in the practice of chemistry, just as there is a significant art to the practice as well. It is worth remembering that *all* the physical sciences – physics included – were once known as "the technical arts." Social-chemistry is a nascent technical art at present, but it can be expected to develop and mature. No one doubts the scientific fecundity of chemistry; social-chemistry has not had time to achieve this yet or to attract the corps of pioneering practitioners who will develop its methodology and prove its fecundity. Its history-to-come is the history of every science, whose scenic journeys are painted in the words of Robert Frost:

> I shall be telling this with a sigh
> Somewhere ages and ages hence:
> Two roads diverged in a wood, and I –
> I took the one less traveled by,
> And that has made all the difference. [Frost (1916), *The Road Not Taken*, st. 4]

Hierarchical construction in a scientific ladder of levels of abstraction is even more urgent for social-chemistry than it is in the physical sciences because Weinberg's complexity issue presses upon it all the harder. For the model of figure 9.3 there is not just one "isolated" equation per person because of the factors of situational and temporal variation. The pairwise "interaction" equations will generally differ between the Person 1 to Person 2 direction and the Person 2 to Person 1 direction because each person makes his own semantic determination of somato-environmental events. There is even probably more than one "field" equation because the social environment that gives rise to field effects is itself the product of many different individuals. We must, as a minimum, presume more than one "social field" is or can be present in a particular situation, or that the "social field" will differ in kind from one situation to the next. Weinberg's separation issue looms much larger for social-chemistry than for physics. All of these considerations make the hierarchical method of minimal anatomies necessary for success in the practice of this new science.

One variability factor present in social-chemistry that differs from physical chemistry is a state dependency that can be called a *social-isomerism effect*. Dead-matter atoms of physics are relatively simple objects inasmuch as, e.g., an oxygen atom right now is no different from what it was a moment ago or what it will be a moment from now. This is not true of our social atoms because *experience changes the individual*. In chemistry, compounds possessing the same composition and the same relative molecular weight but differing in their chemical structure are said to be *isomeric*. Isomers have differing chemical, physical, and physiological properties [Sharp (2003)]. In social-chemistry, experience alters the individual's semantic interpretations of somato-environmental events so that, in effect, when you deal with the same person the next time the possibility must be taken into consideration that you are having social intercourse with a different "isomer" of the same person. This is the principal significance of the self-feedback loops representing the "isolated behavior" shown in figure 9.3.

In dead-matter chemistry, isomerism effects are easily modeled by a network methodology that is mathematically contained in the generalized theory of embedding fields. The methodology was introduced in Wells (2010), chapters 4 §2.3-4 and 5 §5-7. It is called a ***Linvill model***. Linvill models are mathematically isomorphic to the mathematical forms presented in Grossberg (1972a, b) but provide a simpler and more direct way to represent mathematical secondary quantities and deduce modeling equations for psychological postulates. Psychological tension, for example, has a natural representation as a state variable in a Linvill model. The *modeler's art* involved in constructing Linvill models subsists in the judicious choice of the level of abstraction represented by the model. This selection is always key to every successful scientific model. Leary's principles 3-6, 8 and 9 apply to the selection. Construction of an adequate model is an act of *design* and here the engineer's art is pertinent to methodology. William K. Linvill (brother of the Linvill for whom the model mentioned above is named) wrote,

> The approach which is meaningful in a specific system problem is usually indicated by the problem itself. It is very dangerous in a system problem to start the analysis by bending the problem to a typical analysis technique. Rather, one should adapt the technique to the problem in a useful way.
>
> System design problems generally are not well specified at the outset. Usually the objectives for the system are not clear initially in the mind of the person who gives the specification. Partly this is due to the fact that in most practical cases the objectives will be modified on the basis of better knowledge of what is available and what the cost structure is. In view of this situation the process of setting up a system problem requires a broad background of alternatives to be presented initially with crude evaluation of costs and payoffs. The consideration of detailed payoffs and tradeoffs usually requires a fairly extensive set of assumptions which could be justified only after considerable study of the problem. Any detailed set of tradeoffs may well be radically changed in time as the problem situation develops. It seems to me just as bad to rush into a detailed computer simulation at the beginning of a problem as it is to apply a detailed analysis. The initial look at the problem should yield perspective. The necessary approach to a system design problem is very similar to the one made by the usual servo designer or by the designer of an electronic instrument. Usually the designer does not do a sharp focusing of his parameter values at the outset, but first puts together a simplified rough model which he tries primarily to get "to work." Detailed optimization is done, if ever, nearer the end of the design process when most factors have been well specified by experience. . . . Accordingly, if the professor doesn't warn the student to get "ball park" figures first, experience soon will. In system design of large systems the cost of such education by experience is high. . . .
>
> Having described the problems of the modelmaking area in a general way, we now see what sort of capability they imply as necessary for the system engineer. At the outset it is clear that he needs to have a broad background . . . Narrow scientific training will almost certainly be inadequate . . . Another more important aspect of system engineering has so far received too little attention it seems to me. It is the design aspect. *Engineering design and invention depends much more on concept than quantity*. Really significant concepts can be shorn of their special restrictions and should be presented in as clear and uncluttered fashion as possible. *Portable concepts* are necessary because of the wide technical range of system problems. At the detailed and sophisticated level no two problems are sufficiently alike so that the same specific methods of solution apply. The system engineer brings his system into focus by applying concepts to it. After such focusing, the finer resolution of the problem may require detailed analysis but the rarer and more valuable element required for design is the portable concept. [Linvill (1962)]

The method of minimal anatomies is precisely such a portable concept as Linvill described.

The engineer's art is woefully under-taught in science education; some science disciplines have even reach that point of old-age where it is scorned by the practitioners (who are most often professors). But this marks the onset of senility in that science and augers a decline of new discoveries and breakthroughs in it. The literature of the field becomes a trash heap (called 'the archival literature') of generally uninteresting and soon forgotten papers. As Bacon warned us long ago,

> The idols of the theater are not innate, nor do they introduce themselves secretly into the understanding, but they are manifestly instilled and cherished by the fictions of theories and depraved rules of demonstration. . . . The lame (as they say) in the path outstrip the swift who wander from it, and it is clear that the very skill and swiftness of him who runs not in the right direction must increase his aberrations.
>
> Our method of discovering the sciences is such as to leave little to the acuteness and strength of wit, and indeed rather to level wit and intellect. For as in the drawing of a straight line, or accurate circle by hand, much depends on its steadiness and practice, but if

> a ruler or compass be employed there is little occasion for either; so it is with our method. . . .
>
> In general, men take for the groundwork of their philosophy either too much from a few topics, or too little from many; in either case their philosophy is founded on too narrow a basis in experiment and natural history, and decides on too scanty grounds. For the theoretic philosopher seizes various common circumstances by experiment, without reducing them to certainty or examining and frequently considering them, and relies for the rest upon meditation and the activity of his wit. [Bacon (1620), Bk I, LXI-LXII, pp. 33-35]

It is an alarming development in the United States that the teaching of the engineer's art *to engineers* is in a threadbare state of poverty today, the invariant end effect of a fossilized and unreflective Platonism that so often in history precedes a collapse and disintegration. The pedagogy has been impoverished by copying the Platonic habits of pompous prejudice long displayed in other fields. The landscape in technical and scientific education is far different from and much more dangerously impoverished than that which was envisioned and called for in the days of revolutionary technical advancement that existed in 1962. If we are to succeed in the future, we have no choice but to resuscitate the teaching and learning of the engineer's art.

Social-chemistry, at least, has the advantage that it is not crippled by rigorous and hidebound habits of practice. We will be inventing the field as we go. At the outset of every new science, it has always proved best to begin with Aristotle's dictum and start with that which is closest to observation and study, working step by step down the ladder of *ordered and integrated* scientific reduction, and with due consideration of and reflection upon the model order reduction that links each successive rung to the one above and the one below it. There is a mass of psychological data already gathered from which to begin. The models of operationalizations, social styles, and interpersonal interactions reviewed in these pages provide a potentially fecund starting point for developing models of social-natural interactions such as figure 9.3 depicts. One begins, as Grossberg did, with psychological postulates, for which care has been taken to avoid the extremes of, as Bacon put it, taking too much from too little or too little from too much. At this step, the qualitative reflection is far more important than the quantitative one, as Linvill pointed out.

Wilson *et al*. provide a semi-concrete example of this sort of outset consideration:

> When there is increasing relationship tension, most people tend to retreat deeper and deeper into their comfort zones. They begin to exhibit inflexible, less versatile versions of the behaviors normally associated with their Social Styles. [Note: this is called "back-up behavior."] As you might expect, people with the same Social Style tend to continue to behave in similar, predictable patterns when tension gets too high for comfort. People's Social Styles provide useful clues about what Back-Up Behaviors to expect, but fight or flight behaviors are not always revealed in obvious ways.
>
> For example, the first sign of discomfort for people on the ask-directed end of the assertiveness scale – Analytics and Amiables – is a tendency for flight. Because of the complexity of Back-Up Behavior, however, flight may not be nearly as obvious as some-one literally walking away from you. Ask-directed people who have had enough of a relationship with you may show it in more subtle ways – avoiding you, not returning calls or e-mails, not having time to meet with you, etc. Despite any anger or deep frustration they might feel, you won't hear any shouting or see any table pounding as they separate from you. They will probably be much more subdued, and quietly withdraw.
>
> An Amiable tends to acquiesce, giving in rather than fighting on principle ("Sure, do whatever you want.") An Analytic will withdraw through avoidance, not returning messages, putting a low priority on the task or relationship you share ("Sorry, haven't had time to figure out the details. Can we talk about this later?"). Both are fleeing, either from the task or relationship, but doing so quite differently. [Wilson *et al*. (2011), pp. 60-61]

This is obviously a different manner of qualitative description than the more semi-mechanized habitual ones often promoted by training in psychology. (The difference is not surprising; *The Social Styles Handbook* is not written for the trained psychologist). Look, however, at what this description implies for an embedding field graph model of a Weaver's model depiction of an individual. First, it directly implicates *tension* as an important state variable. It does not matter that "tension per se" is not immediately observable from behavior *because tension is the concept of a secondary quantity in mathematics*. The description says that increasing degree of tension results in more inflexible, less versatile behaviors. *This is consistent with 'movement' outward in the personality circumplex within a narrowing cone of motor rule structure*. If Person 2 in the Weaver's model of figure 9.2 is, for example, the Amiable or Analytic used in the above example and Person 1 is "you," the types of avoidance behavior Wilson *et al*. describe is reflective of the characteristics of the semantic representing process in play. The behavior of Person 2 when he is "out of immediate contact" with Person 1 is nothing else than a non-robust equilibrium cycle by which he reduces his immediate unbalance in his feelings of *Unlust* by actions that permit him to carry out type-α compensation – in other words, by ignoring you and your *Existenz*, which in mental physics is called ***ignórance***. The very enactment of this sort of compensation behavior *implies not reduction in the tension state variable but, rather, opposition by another state variable we might term a 'self-comforting' variable*. Your next interaction with him will rupture this delicate compensatory cycle and put him back into a state of non-equilibrium. This "excited state" of our Person 2 social atom implies either a reduction in the level of the self-comforting variable, an increase in the tension variable, or both.

Habitual "routines" are oftentimes compensation mechanisms of this sort. That which we call routines and rituals, through which we "forget our cares and woes" for the moment, belong to the class of behavioral *schemes* we are talking about here. Invocation of such schemes, putatively, are functionally dependent on our hypothesized self-comfort and tension state variables. In the terminology of that subdiscipline of neural network theory called "the actor-critic model" by some and the "reinforcement learning model" by others, these schemes constitute what are called the "policies of the actor." Figure 9.10 illustrates in block diagram form the generic actor-critic model employed by neural network theorists. Theorist Andrew Barto describes the mathematical methodology employed in the following way:

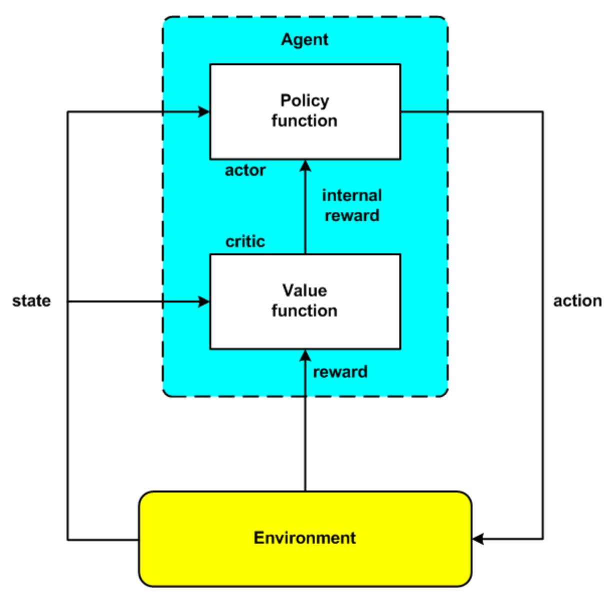

Figure 9.10: The generic actor-critic model of neural network/embedding field theory.

> Think of an agent interacting with its environment over a potentially infinite sequence of discrete-time steps $t = 1, 2, 3, \ldots$. At each time step t, the reinforcement learning agent receives some representation of the environment's current *state*, $s_t \in S$, where S is the set of possible states, and on that basis executes an *action*, $a_t \in A(s_t)$, where $A(s_t)$ is the set of actions that can be executed in state s_t. One time step later, the agent receives a *reward*, r_{t+1} . . . and finds itself in a new state $s_{t+1} \in S$. The reward and the new state are influenced not only by the agent's action, they are also influenced by the state, s_t, in which the action was taken . . .
>
> The rule the agent uses to select actions is called its *policy*. It is a function, often denoted π . . . While interacting with its environment, a reinforcement learning agent adjusts its policy based on its accumulating experience to try to improve the amount of reward it receives over time[7]. More specifically, it tries to maximize the *return* it receives after each time step. . . .
>
> This model of the reinforcement learning problem is based on the theory of Markov decision processes (MDPs), which has been extensively developed in decision theory and stochastic control. . . . Reinforcement learning has much in common with this traditional study of MDPs, but it emphasizes approximating optional behavior during on-line behavior[8] instead of computing optimal policies off-line on the basis of known probabilistic models. In particular, the objective in reinforcement learning is actually not to compute an optimal policy; it is instead to allow the agent to receive as much reward as possible during its behavior. . . .
>
> The most commonly studied reinforcement learning algorithms are based on estimating *value functions*, which are scalar functions of states, or of state-action pairs, that tell how good it is for the agent to be in a state, or to take an action in a state. The notion of "how good" is the return expected to accumulate over the future[9] . . . If the agent uses policy π, then the state value function V^π gives the value, $V^\pi(s)$ of each $s \in S$, which is the return expected to accumulate over the time period after visiting s, assuming that the actions are chosen according to π. . . . Similarly, the *action value* of taking action a in state s under a policy π . . . is the expected return starting from s, taking the action a, and thereafter following policy π . . .
>
> Value functions are used in several different ways in reinforcement learning. One approach is the *actor-critic architecture*, which maintains a representation of both a value function and a policy [figure 9.10]. To select actions, an agent using this architecture consults its current policy, represented by the actor component. . . . To evaluate the action just taken, the critic component is consulted, which maintains an estimate of the value function of the current policy. The action is considered to be "good" ("bad") to the extent that it [is expected to lead] to a next state with a value higher (lower) than that of s, both state values being estimated by the critic. Upon receiving this evaluation, the actor updates its policy by making a good action more likely to be selected on revisiting s, or a bad action less likely, thus implementing a version of Edward Thorndike's famous Law of Effect (Thorndike, 1911). The critic component then updates its value function estimate [Barto (2003)].

Under mental physics, a ***value*** is the form of an affective perception of a desire presented in an aesthetic Relation of sense-of-interest (and understood from the judicial Standpoint of Critical metaphysics). A value is referenced to the somatic *Kraft* of *psyche* through the synthesis of objectivity in judicial continuity. It is referenced to appetitive power mediately through the

[7] A "negative reward" is usually called a *punishment* in the terminology of this field. Decreasing the amount of punishment is therefore regarded as increasing the amount of reward. It is a more or less Epicurean theory of behavior.
[8] This means "while the agent is acting"; more often this is called its "real time behavior."
[9] i.e., expected *by the agent* to accumulate.

synthesis of desiration in an act of teleological reflective judgment. Although current actor-critic theory is ontology-centered, this value-driven aspect of the theory is, with appropriate adjustment of the metaphysics employed, applicable with objective validity to human Nature. What we see by combining Barto's description of engineering's actor-critic systems with mental physics is that the critic function of figure 9.10 is primarily associated with the process of reflective judgment and the synthesis of apprehension in sensibility.

What Barto calls a *policy* is called a ***scheme*** in mental physics. A scheme is that which can be repeated and generalized in an act or an action. What he calls "adjusting" the value-function or the policy function, mental physics calls accommodation. Motivation is the accommodation of perception, and motoregulatory expression is its assimilation. Accommodation and assimilation in equilibrium is called adaptation.

Although one never reads these words in any engineering journal, the fundamental postulate of the actor-critic model Barto describes is that *the agent acts foundationally from moral judgments*. *All* judgments of "good" or "bad" actions are foundationally moral judgments. That the morality involved is local and private to the agent itself is unimportant because, as we have seen earlier, *every* person constructs his or her own private system of morality. Piaget called morality "the logic of actions." The simple "me-centered" and rather Epicurean decision process Barto describes above is more or less equivalent to presuming the agent is unaffected by any notions of "duties to others." In a word, the engineer's artificial agent as Barto describes it is non-socialized and "lives" in a state-of-nature – an observation that, on those occasions where I explain this model to them, sometimes elicits humorous witticisms from my colleagues in the humanities to the effect of "Well, what else would you expect from an engineer?"

The points I wish to emphasize here are these: (1) that the actor-critic model is capable of being mathematically represented and capable of actually being constructed in practice; (2) that it presents an explicit "existence proof" example of the practicality of mathematically describing the interaction functions represented in the social-chemistry molecular model; (3) that the majority of actor-critic model systems are implemented using mathematical neural networks – which means they are embedding field representations; and (4) that the isomerization functions depicted in the social-chemistry model are implicit in the mathematical notions of "state" and adaptation employed in actor-critic theory. The standard theory as it is put into practice is missing only the social environment interactions, and this is corrected by adding to the baseline actor-critic model of figure 9.10 an additional capability that Woods called a "reasoning loop" and described as an "external world modeler" [Woods (1986)]. This function, of course, is the function of the process of determining judgment in mental physics. Viewed from the theoretical perspective of the engineer's art, the Organized Being model of figure 3.2 is an actor-critic model. Hierarchical development of social-chemistry is a matter of applying the method of minimal anatomies in carrying out social chemistry research to understand the nature of interactions and isomerizations depicted in figure 9.3.

§ 5. Social Chemical Bondings and Isomerizations

To further explain and delimit the chemistry analogy used for the social-chemistry model we must examine in some greater detail some more specific concepts going into the ideas of the interaction and isomerization relationships. Figure 9.11 presents an annotated version of the earlier figure of two-person social-chemistry. Let us start with the interactions between the person and the environment. In a Weaver's model framework, the environment includes all factors and persons known to the interacting participant but not immediately involved in the social interaction taking place. These are denoted by functionals F_{ij} in figure 9.11. Physical factors (e.g. weather) do exert a direct effect on the person's *soma*, and these effects are explicitly modeled functionally.

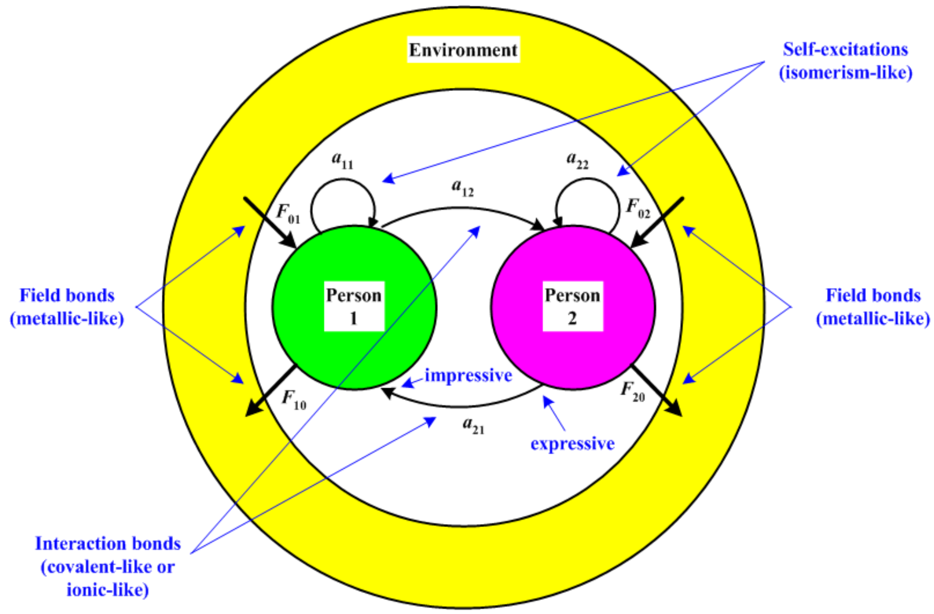

Figure 9.11: Annotated version of the two-person social-chemistry molecular model.

Social factors, on the other hand, are supersensible factors and call for their functional representations to be different in kind from those representing physical interactions. Specifically, these functionals represent the effect that the person's *understanding* of his environment has on his motivational dynamic. They include the effect of his anticipations of how his actions will impact his relationship with others not immediately involved in the present social situation. Functionals in this class of relationships can represent either socialization effects or anticipations concerning state-of-nature consequences of the person's actions. Because these effects are generally not tied to direct and specific individuals in the environmental background, the character of F_{ij} relationships is analogous to the metallic bond phenomenon in chemistry – the "carriers" of the bonding factors are not associated with specific other-individuals. They make up semantic representing functions within a Weaver's model. The effect of these functionals can be bonding or anti-bonding. In general, if an environmental factor plays no role in the social or motivational dynamics taking place, it is a non-bonding factor with a null functional.

The direct interactions, a_{ij} with $i \neq j$, are analogous to the typical covalent or ionic bonds in chemistry, the distinction in embedding field theory depending only on the amount of effect the interaction produces. This is termed ***associational strength*** in embedding field theory [Grossberg (1971)]. *Ceteris paribus*, high associational strengths have the character of covalent-like bonding (or anti-bonding) while low associational strengths are more like ionic bonding (or anti-bonding). However, this is a distinction in the analogy that is mathematically impertinent to the model.

There are, however, some important differences between the chemistry model and the social-chemistry model that must be clearly recognized. First, in a chemical model the bonding interaction between two atoms is directionally symmetric (Newton's third law). This is not necessarily the case in the social chemistry molecule and, in point of fact, there will usually be important differences between a_{12} and a_{21}. In embedding field terms, the graph connectivity is *directional*. Embedding field graphs are directed graphs. Next, the relationship is conveyed by *appearances* rather than by physical forces. Person 1 does not "know what's going on inside Person 2's head" or vice versa. This means that there are two co-involved yet separate aspects to bonding and anti-bonding interactions. The first is the *expressive factor* – the exhibited motoregulatory expression by the person taking an action (originator). Kiesler's concept of the operationalization factor is associated with this factor. It has long been known to psychology that facial expressions, tone of voice, eye contact, and other "body language" factors subconsciously attend a human being's explicitly conscious action expressions. Russell terms this a *script* [Russell (1997), Russell and Lemay (2000)]. There are some ontology-centered issues attending Russell's concept of a script, but the main point I wish to make is that habitual and often unintentional motoregulatory expressions always or almost always attend a person's volitional actions. Facial expressions in particular have gotten a great deal of study from emotion theorists, e.g. Keltner and Ekman (2000).

The second aspect is the *impressive factor*. Regardless of the originator's intentions, the receiver (that is, the person who observes the originator's actions) forms his own semantic interpretation of the appearance based upon his own affective condition, manifold of concepts, and manifold of rules. The concept of impact messages is a concept associated with this factor. In embedding field terminology, the expressive and impressive factors pertain to the source and sink of embedding field connections between the embedding field models of the interacting originator and receiver[10].

Isomerization functionals a_{ii} symbolically represent what is taking place in the motivational dynamic during judgmentation (figure 9.1). This dynamic includes the acquisition of new experience during the course of the interaction as expectations and semantic interpretations run up against appearances. This acquisition involves changes in the manifold of Desires as well as accommodations in the manifold of concepts and, possibly, the manifold of rules in both individuals. The latter accommodations are both forms of policy adaptation in actor-critic terms.

In mathematically representing the interaction functionals, there are three types of basic behaviors, termed compensation behaviors [Piaget (1975), pp. 64-77], to be considered. These compensation behaviors operate in both motoregulatory expression and ratio-expression, and so are factors in isomerization functionals as well as in interaction functionals. They are called types α, β, and γ compensations. Piaget describes these compensations:

> If there is a small disturbance close to the balancing point, the compensation will be obtained by a modification introduced by the subject in a direction opposite to the disturbance in question. [For example, if he sees something new in his peripheral vision, he will turn his head and look directly at it.] . . . On the other hand, a second kind of reaction, of type α, will intervene if the disturbance is stronger or judged as such by the subject; in this case, he will cancel the disturbance by neglecting it, or by simply avoiding it. . . . When a new characteristic is incompatible with a previous discernment, the subject, though perceiving it, will neglect it or pretend to consider it, but distort it in order to adjust it to the scheme retained for the discernment. . . . It is evident that these type α reactions are only partially compensating, and consequently the resulting equilibriums remain very unstable.
>
> β. Another behavior will consist of integrating into the system the disturbing element arising from without. The compensation then no longer consists in canceling the disturbance or rejecting the new element, so that it will not intervene within the whole set already organized, but in modifying the system by "equilibrium displacement" so that the unexpected fact is made assimilable. The description will be thus improved; the classification will be recast to coordinate the new category with the others; the seriation will be extended or distributed in two dimensions, etc. Or a causal explanation contradicted by an unexpected fact will be completed or replaced by another explanation which takes the new factor into consideration. In short, what was disturbing became a variation within a reorganized structure, thanks to the new relations which make incorporating the element possible. . . . In short, by integrating or internalizing the disturbances at play in the

[10] Figure 9.11 displays only one node for each person, but in embedding field theory this is symbolic of a network of interconnected interior nodes that collectively model each of these "macro" nodes.

cognitive system, these type β behaviors transform them into internal variations which are capable of being compensated, still partially but nevertheless in a manner quite superior to that of type α behaviors. . . .

γ. Superior behavior . . . will then consist in anticipating the possible variations which, as foreseeable and deducible, lose their disturbance characteristic and establish themselves in the potential transformations of the system. . . . The only major difference between these transformations and that of two actions occurring in opposite directions, each tending to cancel the other and reach a compromise (like a balance of two forces), is that, being part of the same system, all the transformations are sufficiently bound together so that the operation T implies the existence of T^{-1} and the product $T \cdot T^{-1} = 1$. Our understanding of the compensation is consequently that there is a symmetry inherent in the system's organization and no longer an elimination of disturbances. . . . Finally, the third type of behavior generalizes these anticipations and retroactions in the form of direct and inverse operational compositions. In this case, the compensations approached from the preceding level reach a form with complete symmetry and what were initially disturbances are entirely assimilated as internal transformations of the system.

Added to this development of behavior, as illustrated in types α through γ, (as shown by the uses of retroactions and anticipations), is the development of differentiations (through gradual accommodation with disturbances) and the internal integration of systems (through assimilation which enriches the cycle which constitutes them). [Piaget (1975), pp. 66-71]

These compensation behaviors are *schemes of ratio-expression* in the motivational dynamic. Type α compensation leads to no changes in the manifold of rules but only to accommodation of perception such that the disturbing factor is ignored (ignórance behavior) or avoided (flight behavior). Type β compensation produces an accommodation in the manifold of rules and may or may not produce a special accommodation in the manifold of concepts (i.e., one over and above changes to that manifold occurring through cognition of a new object in the free play of imagination and understanding). Type γ compensation involves accommodation of both the manifold of rules and the manifold of concepts. The root of all three compensation behaviors lies in teleological reflective judgment and, more specifically, in the Quality of teleological reflective judgments as: (1) the *momentum* of real tendency (type β); (2) the *momentum* of real repugnancy (type α); and (3) the *momentum* of real significance (type γ) [Wells (2009), chap. 8, pp. 336-339]. In the case of type γ compensation, we may say that the subject *reasons about* Nature – a logico-mathematical *ratiocination scheme*. It is because of this that type γ compensation behavior appears later in development than the other two compensations; it requires a sufficient support within the manifold of concepts before it can be successfully carried out (brought to equilibrium).

Piaget goes on to observe that the compensation behaviors appear to follow *a minimization principle*. In some ways this principle is not unlike the minimum principle physics employs in advanced mechanics (Lagrangian mechanics) and in the quantum theory. He tells us,

Behaviors of the first type, α, consist of restricted and weak structures, hence involve little cost, yet allow for no gain from new integrations or compensation. Consequently, the reaction consists only in scattering again what is at once both slightly costly and slightly profitable.

On the other hand, with behaviors of the second type, β, the strategy consists in incorporating the disturbances by a process both retroactive and partially anticipatory, to the extent of making internal variations in the system. In these situations, the cost is a displacement of equilibrium with modifications of the earlier form, but the gain is an extension of the system and, in comprehension, a re-handling of relations with the double benefit of increased coherence and greater safety in handling new disturbances.

With type γ behaviors, the cost is limited to the construction of rules of composition by

> reflective abstractions, whereas the gain is the whole set of combinations thus rendered possible and protection against any distortion. If we express the combinations in terms of expenses, the strategy will be to minimize the costs . . . Thus it is clear that a stable system of composition reduces to the *maximum* the disturbance risks by using a precorrection procedure whose cost is *minimum*. [Piaget (1975), pp. 74-75]

Mathematically well-trained system theorists will be able to see in Piaget's words the shadow of what is known in the trade as optimization theory (e.g. Hamilton-Jacobi-Bellman optimization[11]). Economists, likewise, will be able to discern here ideas usually associated with decision theory.

Type α behavior accomplishes reduction in tension by removing a perception in sensibility from the realm of the affective. The way this is done is by incorporating the tension-effecting perception *into* an intuition of another object, thus rendering the tension-effecting representation *obscure* and, at the same time, removing it from *affective* perception. Freud would probably call this "repression." Recall that perceptions only come in two types: objective and affective. What is not *made* an objective perception is *defaulted to being made* an affective one. Remember that reflective judgment judges affectivity, not objectivity, and yet is the *generating source of all* new objective representations (cognitions). Reflective judgment judges the synthesis of apprehension.

Merely hiding a tension-effecting perception within another perception (an intuition) does not produce robust equilibrium. Recall of the concept (from the manifold of concepts) that has that intuition as its object presents the possibility of re-introducing the tension-effecting perception into the synthesis of apprehension – where it again becomes a disturbing factor. Much of what we call "stress in the workplace," for example, is probably a manifestation of this[12]. It is a factor in the readily-observable interpersonal tensions that sometimes arise between low-versatility Amiables and their more assertive colleagues (Drivers and Expressives). Wilson *et al*. write,

> The initial Back-Up Behavior of Amiables is called Acquiescing. They manage stress and tension in their relationships by limiting their exposure to the cause of their woes. They opt to surrender or give up, which is their way of taking flight from the situation.
>
> In negotiating a tough decision . . . that means an unhappy Amiable may still meet with you to discuss the options you're debating, but your chances of winning agreement are slim. Amiables in this stage of Back-Up may respond positively to you during these discussions, even if they have already decided not to agree with your recommendations.
>
> They might even go so far as to concur with you in a meeting to avoid creating a new tension, and then retract the agreement later. Their ask-assertive and people-directed nature creates two important points about Amiables in Back-Up. First, because of their ask-assertive tendencies, you might not notice they have entered Back-Up. All of a sudden they start agreeing with you, not showing tension in their actions or body language. But, because of their people-directed responsiveness, they take conflict personally. If you keep Amiables in Back-Up too long (and when you don't sense they are in Back-Up, that is quite possible), you may never regain their trust.
>
> Because Drivers and Expressives tend to fight in Back-Up, you might feel that the worst you can do is to upset an Expressive or a Driver. But the truth is, an Amiable in Back-Up presents a tougher relationship to repair. An Expressive may explode in front of you, but will be more likely to forgive and forget. Amiables will tend not to forget, and if pushed far enough, will not forgive, ever!
>
> The message you'll get from an Amiable who is Acquiescing is, "I give up. We will do it your way . . . until I get a chance to do it my way." That way begins the first moment you are out of sight. [Wilson *et al*. (2011), pp. 140-141]

[11] see Lewis (1986), pp. 311-318.
[12] This is an empirical hypothesis that has not yet been adequately tested.

Type β compensations are more durable than type α because there is an actual adaptation that is effected during the motivational dynamic. A disturbance factor is converted into a variation factor. However, the adaptation is not yet very versatile. Versatility comes from type γ compensations, where there is a re-structuring of the manifold of rules *and* the manifold of concepts. Modeling and understanding isomerization functions requires us to take into account these three basic forms of compensation in the motivational dynamic (figure 9.1).

§ 6. Segue Remarks

In the past few chapters we have had to depart from the immediate subject of this treatise, the Social Contract, in order to understand the human factors that underlie the possibility of that social phenomenon. No social-natural science can be grounded, with objective validity, in anything other than our social atom – the individual human being – and so it has been necessary to take this long route through mental physics and empirical personality psychology. There is clearly a great deal more that can be explored within the topics presented in this and the previous two chapters, but that exploration belongs more properly to another treatise. We have, I think, reached far enough into the subject-matter now that we may return to the main topic this treatise is intended to address. And thus we now pass on to chapter 10 and examine the phenomenon of social compacting.

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