Chapter 11 The Teacher-Learner Molecule

§ 1. Learning in Stages and Teacher-Learner Interaction

It is likely obvious to most parents and every public school teacher from kindergarten to high school that children's learning capacity exhibits qualitative changes with age. The phenomenon is likewise known to psychologists although here we find at least five different schools of learning theory. The phenomenon has not been adequately studied, using social-natural scientific methods, in either children or adults. Mental physics provides a unified basis for understanding the learning phenomenon in its teacher-learner aspects. It also provides a unified framework for evaluating currently popular but nonetheless scientifically ungrounded speculations that have come forth in roughly the last decade regarding that transitionary period called adolescence.

It has become widely accepted that learning capacity can be at least roughly characterized by different stages of cognitive and affective development. Although stagewise development of learning capacity obviously implies an open system of mental structuring, these developments do take place within a general and functionally invariant structure of mental *processes* that establish a basis for understanding how a learner learns, roughly when he becomes capable of particular learning feats, what sorts of effects experience has on his learning capacity, and what implications these have for effective teaching practices.

Teacher-learner interaction is a basic factor in instructional education and occurs in a social Molecule. I begin the discussion with some remarks on the nature of interpersonal transactions between the teacher and the learner that are fundamental to what the learner learns from the teacher and what the learner's expressed responses imply for the teacher. In every interpersonal communication transaction we have to deal with two separate meaning implication sets: meanings *intended* to be conveyed by the teacher; and meanings *interpreted* by the learner. The simplest transactional situation is depicted by figure 1, the two-person Weaver's model of interpersonal transactions [Wells (2011)].

The *soma* boxes in figure 1 denote the physical bodies of the two persons who are interacting with one another. Receptivity and motoregulatory expression belong to the division of *psyche* in

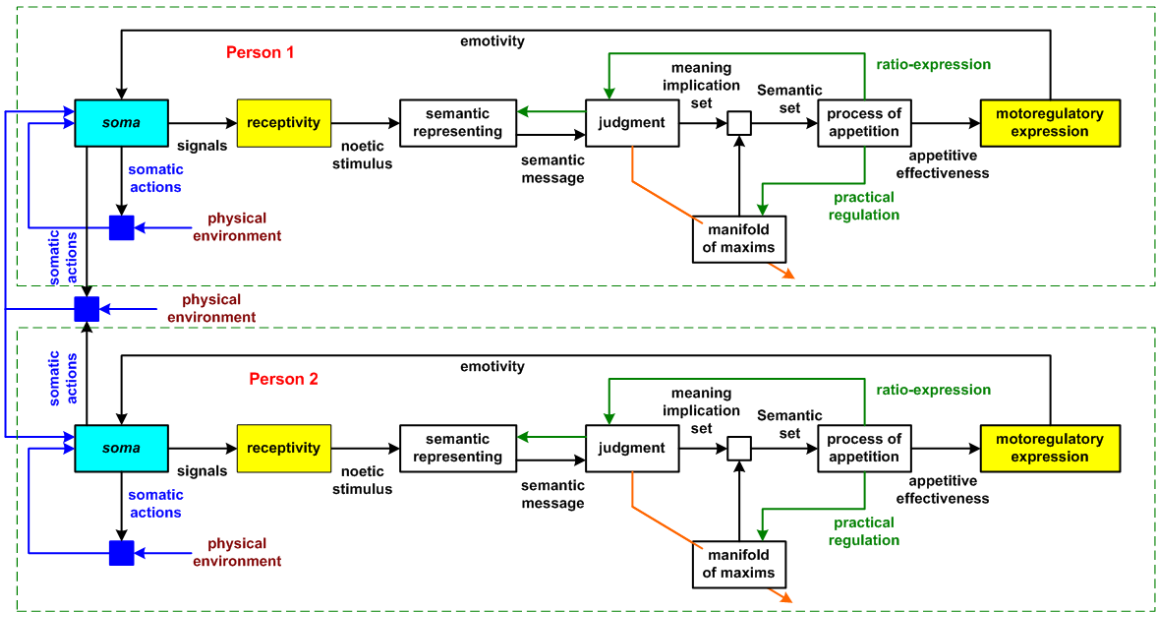

Figure 1: Two-person Weaver's model of interpersonal transactions and interactions.

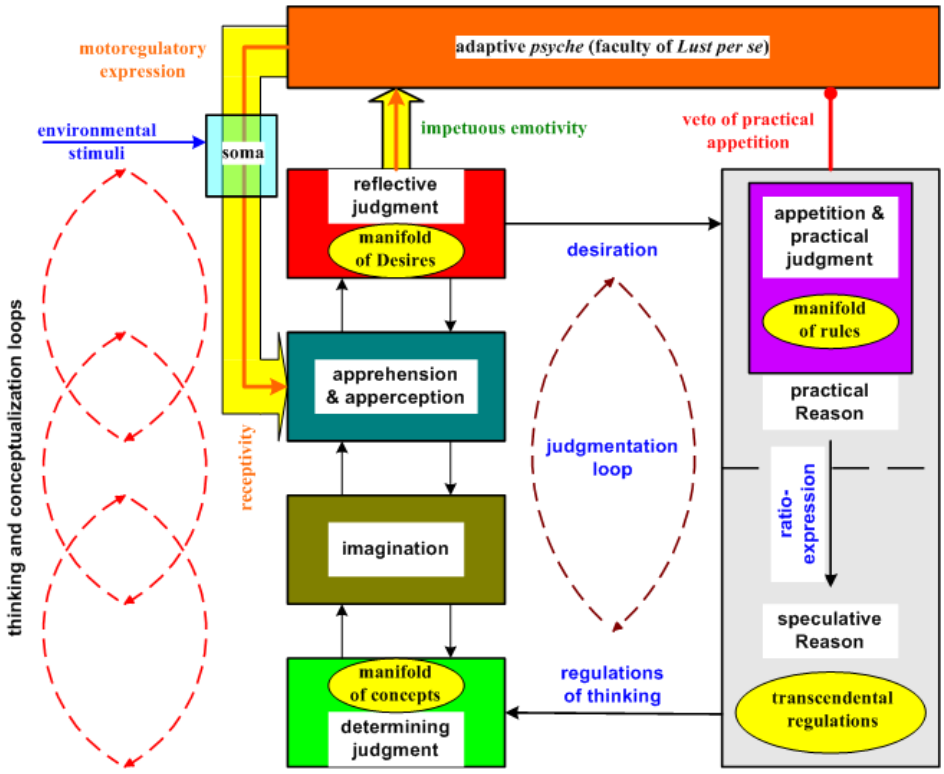

Figure 2: Mathematical structure ("anatomy") of the phenomenon of mind.

the mathematical organization of the phenomenon of mind. The remaining boxes depict processes in the logical division of *nous* in the phenomenon of mind [Wells (2009), chap. 1]. Mathematical operations depicted in figure 1 are derived from the mathematical structure of the phenomenon of mind depicted in figure 2. It is helpful to regard the boxes in figure 2 as a "mental anatomy" picture of the phenomenon of mind. In contrast, the boxes in figure 1 depict what the operations and interoperations of the processes in figure 2 mean in terms of the *semantics* of interpersonal communication transactions. The two figures illustrate *complementary aspects* of the same thing, namely the phenomenon of mind in action.

The process of semantic representing (figure 1) is carried out in the process of apprehension and apperception (figure 2) in interaction with the process of imagination and information flow from both the process of determining judgment and the process of reflective judgment. Processes of judgment are represented in figure 1 by the box labeled 'judgment' and the information flow is depicted by the double lines in figure 1 running between the semantic representing box and the judgment box. Semantic representing is the synthesis of an intuition that presents a semantic message. A semantic message is a concrete representation (a *parástase*, in technical terminology) of a message that can be associated with emotivity (in reflective judgment) and ratio-expression (in the process of appetition in practical Reason). A message is the persistent object of a succession of appearances (in intuitions) for which the objective *nexus* of its meaning depends upon the comprehension of these appearances all in one intuition (also represented in the process of apprehension and apperception). It is important to clearly understand that representations in apprehension include both objective representations (intuitions) and affective representations (affective perceptions). Moreover, sensibility (the specific representations of apprehension and comprehension) does not *judge* anything. What gets represented as an intuition and what is made an affective perception is adjudicated entirely by the process of reflective judgment, and this process is a process of *subjective*, not objective, judgment establishing the person's mental state.

The impetuous emotivity of reflective judgment (which is transformable into emoted action expressions via *psyche*) constitutes a set of possible meaning implications. These are regulated by practical Reason according to their congruence or lack of congruence with maxims in the practical manifold of rules (called the manifold of maxims in figure 1) to produce a subset of expressible meaning implications called the Semantic set. Frustration of equilibration by those motor actions that are expressed in *soma* provoke accommodations, adjudicated by the process of practical judgment, in this practical manifold. Acts of ratio-expression regulate employment of the process of determining judgment to produce accommodations in the manifold of concepts.

Communication transactions from one person (the transmitter) to the other (the receiver) are conveyed by the observable features of the transmitter's somatic expressions as these features are apprehended by the receiver. Somatic expressions by the transmitter are called **evoking messages** while the receiver's apprehensions of these are called **impact messages** [Kiesler *et al*. (1997)]. Evoking messages have semantic meanings for the transmitting person that are not necessarily the same as the semantic interpretations of impact messages by the receiver. When these semantics differ an ***information error*** is said to occur in the communication transaction.

This summarizes the main points of the mental physics of teacher-learner and learner-teacher communication transactions at the level of the 'social atoms.' However, there is one very pertinent consideration that is inherent in this communication model but which might not be immediately apparent from the way I have just described this process. It is this: *Affectivity and reflective judgment are the principal determiners of semantic representing*. Effective instruction is not achieved unless the teacher is fully aware these subjective factors play a key role in the learner's cognizance of what the teacher means to convey with his instruction. For the youngest learners affectivity is a dominating factor. It becomes less dominant as the learner ages and becomes more experienced, but even in adult learners affectivity is never a negligible factor in the learning phenomenon. This means that in addition to the cognitive-logical capacity of the learner, which is reflected in the types of operations he is capable of doing, there is a cognitive-affective capacity that interacts with the cognitive-logical capacity at every stage of the learner's intellectual development. Affectivity and subjective judgment entwine with cognition and logical reasoning so that, metaphorically, these two different capacities for perception must be said to be in a dance with one another. To ignore either one is as fatal to instruction *téchne* as it is to ignore the other.

It cannot be truthfully said that this phenomenon of mind has been adequately studied. Piaget recognized affectivity as an essential factor in the development of intelligence. Figure 3 illustrates

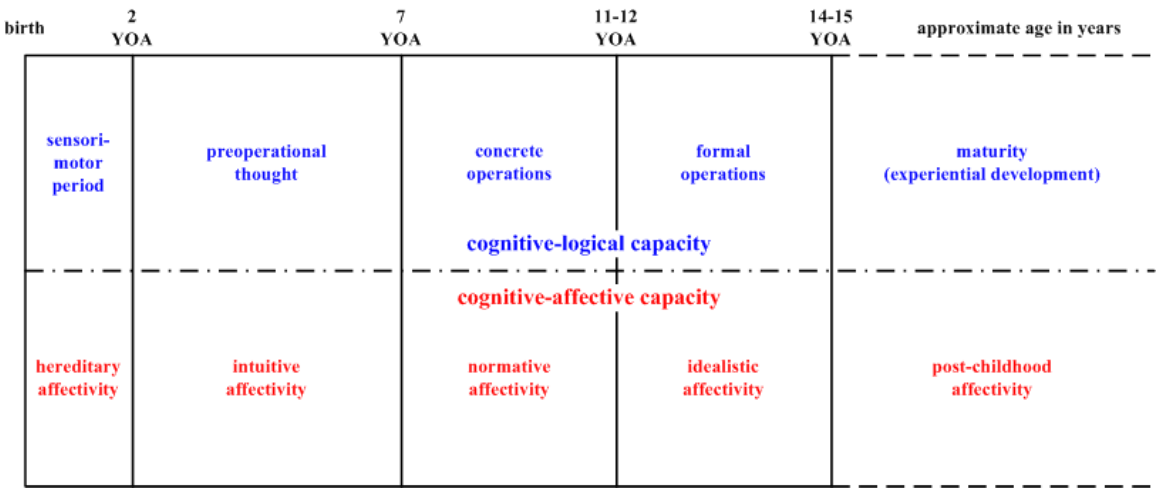

Figure 3: Piagetian stages in the development of cognitive-logical and cognitive-affective capacity. YOA = years of age. The empirical age boundaries depicted are approximate and real boundaries are "fuzzy."

Piaget's model of the stagewise relationships [Piaget (1953), pp. 8-22; Piaget (1953-54), pp. 12-15]. The alignments shown in the figure must be regarded as conjectural because Piaget never did carry out research studies that are still needed to make his model more precise. However, there is very little reasonable doubt that a stagewise model is a correct description of the intimate inter-relationship between affectivity and concept development. For example, Stanley Greenspan, who was noted for his work with autistic children, discerned six stages of affective development in the first four years of life [Greenspan (1997), pp. 44-94]. These stages overlap Piaget's sensorimotor period and roughly the first half of his period of preoperational thought (figure 3).

The essentially autistic nature of affectivity makes its scientific study a formidable challenge. "Emotion theories" go all the way back to Aristotle (*c*. 335-330 BC, Bk. II) and received attention and treatment by psychology beginning at the end of the 19th century [Wells (2006), chap. 15]. Unfortunately, all of these treatments have been predicated upon ontology-centered pseudo-metaphysical prejudices. The result is that the current state of emotion theory in psychology is best described as an aggregate of mini-theories, none of which have universal agreement among psychologists. The studies conducted are scientific, but the outcomes can only be called a pre-science. For centuries "emotions" were looked at as something that interfered with logical and rational thinking. Only in the past thirty or so years has evidence established beyond reasonable doubt that affectivity and logical thinking are inseparably bound [Wells (2007)]. Only since 2006 has affectivity received a Critical treatment grounding it on an epistemology-centered base and opening the way for its mental physics to receive Critically valid scientific treatment.

Piaget's affectivity theory, like most theories encountered in sociology and many areas of psychology, suffers from the shortcoming that it is merely descriptive and has no power of causative explanation. It brings attention to some quantifiable facts but is not itself a quantitative theory and it has no power of prediction. It is, in short, a qualitative theory more akin to a natural history than to a natural science. Its primary potential for fecundity lies with its connection with the much more comprehensive and systematic Piagetian theory of intelligence. To this degree it is systematic in the sense that it is part of that broad theory.

Figure 3 makes it look like the stages depicted have crisp boundaries but Piaget warns us it is a mistake to regard them as such. Mental physics doctrine teaches us these boundaries are "fuzzy" rather than crisp. "Fuzziness," at least, has gained some recognition by psychologists, *e.g.*, Russell (1997). Although a great deal of ***basic*** research is needed in order to develop objectively valid theories for instructional practice, Piaget's conjectures – as a *systematic* attempt to outline a proper relationship – can at least serve as an initial departure point for understanding the intimate linkages between affectivity, objective learning, and instructional practice. The overriding lesson to be taken from the stagewise character of mental development sketched out in figure 3 is this: Learner affectivity and its stages of development *must* be taken into account by instructional *téchne* if practice is to be effective. For this reason it is worthwhile to examine in more detail the later four stages of affectivity labeled in figure 3.

§ 2. The Piagetian Descriptions of Affectivity Stages

§ 2.1 Intuitive Affectivity

Pupils who are just beginning to attend public school for the first time are already well into the stage of preoperative thought–intuitive affectivity in figure 3. The first question to ask is: What does Piaget mean by "operations"? since this stage, as the name implies, is prior to a child's capacity for them. Piaget explained what he meant by this term in the following way:

> An operation is an internalized system of actions that is fully reversible. Reversibility is made possible by the fact that the actions in the system are arranged in inverse pairs. In

> other words, for every action in the system there is another action that reverses it, and the two actions performed in succession arrive back at the starting point. For systems of this sort to exist, it is necessary that the elements on which they act be invariant. Concepts, relations, etc. cannot change from one moment to the next; or, in the case of "cooperation," they must not vary from one person to another person. [Piaget (1953-54), pg. 59]

The actions to which Piaget refers can be physical action expressions or they can be purely mental actions. And, of course, most actions involve combined physical expression and mental scheme activities.

By "intuitive affects," Piaget tells us he means "elementary interpersonal feelings and the beginnings of moral feelings" [*ibid*., pg. 14]. Considered Critically, the phrase "interpersonal feelings" refers to acts of the process of aesthetical reflective judgment which present feelings of *Lust* and *Unlust* [1] [Wells (2009), chaps. 4, 8] that are associated (by reflective judgment) with objective perceptions of a child's interactions with other people which partially determine his state of satisfaction (*Wohlgefallen*) or dissatisfaction (*Mißfallen*). "Moral feelings," on the other hand, refer to feelings of *Lust* and *Unlust* associated with the congruence or incongruence of specific representations of impetuous emotivity (desirations) with high-level practical imperatives and tenets in the child's manifold of rules in practical Reason (figure 2).

The significance of the adjective "intuitive" in "intuitive affects" is this: Affective perceptions (desires, desirations, and their combinations as Desires) *do not form structures and are not conserved in the manifold of Desires*. Whereas the manifold of rules and the manifold of concepts are both structures, the manifold of Desires is not. "Feelings" are not remembered; they are *re-created* by the presentation of intuitions originating from concepts in the manifold of concepts that are reintroduced into sensibility by the synthesis of reproductive imagination (figure 2). The concepts carry with them pure notions of Modality that make the intuition a symbol signifying a meaning implication [Wells (2009), chap. 5]. The reintroduction of concepts into the synthesis of apprehension alters perception – and thus is an act of accommodation – and the accommodation of perception is Critical ***motivation***; motoregulatory expressions are *assimilations* of perceptions.

The second-stage child's *capacity* for intuitive affectivity is a major advance from what is found in the sensorimotor period, where "feelings" are primarily excited by perceptions arising immediately out of receptivity with either no or only a minor role being played by reproductive imagination. Piaget reserved the term "representation" to mean that which is represented by imaginative cognition of objects, and he therefore regarded children of under two years of age as being incapable of "representation." This is, of course, not true in the Kantian connotation of the word *Vorstellung* ("representation"). Critical theory therefore draws a distinction between "representation" and "Piagetian representation."

Greenspan, whose work with autistic children made it necessary for him to study affectivity in much more detail than Piaget did, found that childish affectivity in the sensorimotor period is much more complex than the picture of it Piaget presented. He was able to discern four distinct stages of affective development in the first 18 months of infancy and a fifth stage that overlapped the end of the sensorimotor period and the beginning of the preoperational period [Greenspan (1997), pp. 44-94; Wells (2006), chap. 11]. Critical appraisal of Greenspan's stages returns the verdict that there is some contribution to affectivity from reproductive imagination prior to age 2 years – and, therefore, a small degree of "intuitive affect" prior to age 2 – but that affectivity in the sensorimotor period is primarily stimulated and dominated by external stimuli of receptivity. Piaget was not 100% correct, therefore, when he said that

[1] *Lust* (pronounced 'loost') does not mean the same thing as the English word 'lust.' Refer to the glossary for technical explanations of the terms *Lust* and *Unlust*. See also Wells (2006), chap. 15.

> sensorimotor exchanges were not remembered in any way. Feelings disappeared just as sensations did. In contrast to this, after [Piagetian] representation becomes possible, feelings last in the sense that they can be recreated. [Piaget (1953-54), pg. 46]

Nonetheless, by the time children enter the public school system intuitive affectivity is a primary factor in childish psychology. In regard to hypotheses about the role of affectivity in the preoperational stage, Piaget wrote,

> An alternative hypothesis would be to assume that feelings are *reconstructed*. . . . In our view, it is not feeling that is conserved but a certain scheme of interaction with other people. Feeling, properly speaking, appears, disappears, and oscillates in intensity not because it sinks into or emerges from the unconscious[2] but because it is recreated. In other words, it is constructed or reconstructed on each occasion. [*ibid*., pp. 50-51]

The doctrine of mental physics teaches that Piaget's hypothesis is correct. It further explains that the imaginative recreation of intuitive affectivity is a necessary consequence of the operation of the cycle of judgmentation (figure 2).

This causative explanation also validates another of Piaget's hypotheses, namely his idea of what he called "interpersonal schemes" [*ibid*., pg. 51]. Critically, "interpersonal schemes" are presentative schemes and procedural schemata in the manifold of concepts that are evoked during a child's activities involving transactions and interactions with other people. Meaning implications link these concepts to procedural schemes in the manifold of rules. Piaget said,

> We have characterized schemes having to do with objects as modes of reaction that can be repeated and that, even more importantly, can be generalized. Even perceptual and sensorimotor schemes have these qualities. Not only are they patterns of reaction; they are also true instruments of generalization. . . . Our hypothesis is that interpersonal schemes make the subject react to people in more or less constant fashion in analogous situations even though the persons he is interacting with may vary. Schemes of this sort have their beginnings in the child's reaction to his parents, and the schematization of the individual's affective and cognitive reactions make up his character[3]. Naturally, the formation of interpersonal schemes would be susceptible to energetic effects analogous to those studied on the intellectual plane. [*ibid*., pg. 51]

Again this hypothesis is validated by mental physics providing one bears in mind that a child also classifies *people* into different categories and his interpersonal schemes *do* depend on which category he has placed the other person in. Parents and grown-ups are reacted to with different schemes than are evoked in interactions with the child's peers. Physically larger children (e.g. junior high school or middle school children) are placed in yet another category by a preoperational child – they are not quite the same as grown-ups but quite different from his peers.

The preoperational child has an extensive store of procedural schemes constructed in his mani-

[2] The idea of feelings sinking into or emerging from 'the unconscious' was Freud's hypothesis.

[3] More precisely, these reactions constitute what would have to be called the child's "social character" (at this stage of development) in the context of Wilson's model of interpersonal social styles [Wilson Learning Corporation (2011)]. As discussed previously [Wells (2012), chap. 8], interpersonal social style reflects structures of tenets and maxims in the manifold of rules. It is a fundamental error to presume that a person's "character" is some sort of innate trait or to assume that this "character" does not undergo experientially-driven changes as a person ages, especially during childhood. It is also a mistake to presume an individual has only one "character" that operates regardless of social circumstances. Indeed, a primary *social* mission of public instructional education is to *guide and shape* "character development" insofar as this relates to *citizenship* under the social contract.

fold of rules with a less extensive suite of presentative schemes constructed in his manifold of concepts. However, he has a relative paucity of constructed procedural schemata in his manifold of concepts (chapter 10, figure 7). This means the child has a very limited capacity to understand possibilities because he has established few imaginative options. Instead he acts on the basis of what Piaget called 'pseudo-necessities' and 'pseudo-impossibilities':

> Thus, each individual has at his disposal two main cognitive systems that are complementary to one another. The presentative system, which consists of stable schemes and structures, has the function essentially of understanding the world. The procedural system, which is in constant flux, has the function of assuring proper performance (success), of satisfying needs by inventing or transferring procedures. The first system constitutes the *epistemic* subject and the second refers to the *psychological* subject, since needs are always relative to individual subjects and the insufficiencies they may experience at certain times. . . . However, once a possibility gets actualized through the application of procedural schemes, a new presentative scheme is created, thence the complementarity of the two systems.
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> But these constructivist considerations are still insufficient for interpreting the process of how possibilities are generated. We must also specify the role of the limitations of which subjects need to liberate themselves. These limitations have to do with an initial lack of differentiation between reality, possibility, and necessity. In fact, any object or substance in a presentative scheme will first appear to subjects not only as what they are, but also as being that way of necessity, excluding the possibility of variation or change. These convictions, *pseudo-necessities* or *pseudo-impossibilities*, as we shall call them, are not only specific to children but can be found at all stages in the history of science. [Piaget (1981), pg. 5]

Because procedural schemata are constructed as generalizations of presentative schemes, before the child becomes capable of constructing them his repertoire of presentative schemes must be built up. This is, consequently, one of the primary tasks of instructional education at this stage of the child's development (kindergarten through the second or third grade). Preoperational children are *pupils* in the strictest technical sense of the word. Instruction at this stage of learning calls for no extensive theoretical explaining but, rather, concrete learning-by-doing (building procedural schemes), and gentle use of the non-frustrating failure function to stimulate the construction of conceptualized presentative schemes pertaining to both dead-matter topics (e.g., the alphabet, reading, writing, simple arithmetic, etc.) and live-matter (i.e. interpersonal/social) topics.

Children in this stage view teachers, by analogy to parents, as lesser authority figures. This natural predisposition of the child will be particularly reinforced if the child's parents emphasize to him rules such as "always listen to the teacher; always do what the teacher tells you to do." However, into this picture there enters the consideration that while the child has in his manifold of rules constructed maxims of obedience, he may frequently *also* have constructed maxims of *dis*obedience with which the teacher will have to cope. In this context there are two heavily entwined considerations that are very pertinent to instruction.

The first stems from the fact that practical maxims belong to the manifold of rules and these are entirely *unconscious* representations. The child's conceptual *understanding* of a rule and his actual *practice* of that rule are often two quite different things. A behavioral characteristic that Piaget documented in the case of childish games pertains with equal validity to a child's classroom behavior:

> With regard to the practical application of rules all these children . . . belong to the stage of egocentrism. The result is clearly paradoxical. Here are children playing more or less as they choose; they are influenced, it is true, by a few examples that have been set before them and observe roughly the general schema of the game; but they do so without troubling

> to obey in detail the rules they know or could know with a little attention, and without attributing the least importance to the most serious infringement of which they may be guilty. . . . And yet these same children harbor an almost mystical respect for rules . . . It is forbidden to change them, and even if the whole of general opinion supported such a change, general opinion would be in the wrong . . .
>
> In reality, however, this paradox is general in child behavior and constitutes . . . the most significant feature of the morality belonging to the egocentric stage. Childish egocentrism, far from being asocial, always goes hand in hand with adult constraint. . . . With regard to moral rules, the child submits more or less completely in intention to the rules laid down for him, but these, remaining, as it were, external to the subject's conscience, do not really transform his conduct. This is why the child looks upon rules as sacred though he does not really put them into practice. [Piaget (1932), pp. 60-62]

The child's *understanding* of a rule is his *concept* of it. This is something quite different from the practical maxim in his manifold of rules that governs his actions. Rules verbally explained to him will be understood by him through whatever references to meaning implications happen to be the ones he uses to comprehend what he is being told. Without some specific – and very recent – example of something *he has done* to provide this, the likelihood will be that he doesn't understand even remotely whatever it is the rule-giver intended he should. If he does understand it with a meaning implication directly referenced to something he himself has already experienced, understanding of the rule will be just that meaning implication connection to a procedural scheme that he might or might not have conceptualized as a presentative scheme at that time.

The teacher can be faced with quite a tricky task when the matter of instruction involves new "how to" types of learning because the child's *interest* connection, which goes hand in hand with procedural scheme learning in cases of new "how to" instruction, is most likely to be a remote interest connection to some maxim of moral implication in his manifold of rules. A child's moral maxim, however, is far from what an adult regards as a "real" moral maxim. Mathematically, it is merely a high-level tenet or a practically unconditioned imperative in his manifold of rules. All such maxims will have been formed as behavioral responses by which the child at some earlier time succeeded in establishing a reequilibration in response to some real disturbance to his equilibrium. Objectively, the maxim can be just about anything and no two children will have precisely the same ones. This leads us to a second consideration.

The second consideration is childish moral realism. When Piaget refers to 'moral rules' in the preceding quote, one must not understand by 'moral rule' what adults typically mean. Critically, every practically unconditioned imperative in the child's manifold of rules *is* a 'moral law' in the sense that it *defines* 'right' and 'wrong' to the child. This is the Critical origin of 'rule sacredness' as Piaget observed it in children's phenomenal behavior. It is incorrect to regard disobedience by the child at this stage of development as "willful disobedience" because the child, having very few tenets of reciprocal obligation constructed in his manifold of rules (he is not yet socialized), is in fact merely acting on 'moral' rules of obligation-to-Self. Disobedient behaviors cannot be altered by "reasoning with the child" because he has no concept of what you are talking about. His paucity of procedural schemata leaves him bound by his pseudo-necessities and pseudo-impossibilities[4]. Instead, the behavior can be altered by carefully provoking practical accommodations to the manifold of rules through introducing non-frustrating failure experiences.

[4] I have encountered an interesting adult version of this in international college students from east Asia. It seems to be that in these students' cultures it is regarded as very disrespectful to admit to your teacher that you do not understand something he has just told you. The maxims even seem to extend so far as to make asking questions impolite. I found it was entirely useless to ask one of these students if they understood what I had just tried to explain because they were going to tell me "yes" whether they understood it or not. I learned to read their eyes and faces instead to find out whether or not I was really getting through to them.

You can do this by scolding the child, but what will result from this is merely the construction of maxims of prudence by which the child neutralizes *you* as a disturbance and not the behavior you seek to cause him to change. Then, quite literally, when *you* are "out of sight" you are also "out of mind." The preoperational child is a naive but very practical realist. A child is not a small adult in any sense of that phrase and it is a thorough-going mistake to adultomorphize childish 'moral rules.' Instead, the teacher must, in a manner of speaking, turn the child's own maxim against him so that his subsequent accommodation of the manifold of rules accommodates the *base* behavior by conditioning it so it becomes subordinate to a new and higher practical rule.

Consider, for example, experiences you may have had when a child does something of which you disapprove and when asked "Why did you do that?" replies "I don't know." A preoperational child isn't being evasive. He really *doesn't* know. He acted on a procedural scheme but has no concept of a procedural schema to go with it. If he *has* a presentative scheme, that scheme is, to him, a pseudo-necessity. At the preoperational stage to cope with *apparently* disobedient behavior is, in a manner of speaking, to employ a kind of mental jujitsu: the child's maxim must be turned against him, and this is only done on the practical, never the reasonable, plane. The maxim is there; it is in his manifold of rules already. What corrective instruction must do is provoke a type-β accommodation of the rule because you cannot erase the rule itself. It was constructed to serve some quite practical purpose and the child has his basis for it in some experience he has had. The rule is merely too *general* and must be conditioned. The key to this sort of instruction is to understand that it is based on cultivating the child's *subjective judgment of taste* through manipulating intuitive affectivity. Examples useful for establishing starting points in developing instructional *téchne* can be found, for instance, by studying techniques Greenspan employed for treating autistic children [e.g., Greenspan (1997), pp. 13-29].

The principal idea I wish to highlight in this section is the dominating role intuitive affectivity plays in the preoperational child's educational Self-development. Lacking a robust concept base, dominated by childish egocentrism and moral realism, and not yet well-equipped with presentative schemes, affectivity is the teacher's portal to guiding the child's educational Self-development activities during this stage of learning. Intuitive affectivity prepares the child for the next stage in his development and constitutes, in this sense, what Piaget called semi-normative feelings:

> Feelings are not yet normative [in this stage], but they prepare the way for the establishment of moral norms defined by three characteristics parallel to the criteria for operations: (a) a moral norm is generalizable to all analogous situations, not just to identical ones; (b) a moral norm lasts beyond the situation and conditions that engender it; and (c) a moral norm is linked to a feeling of autonomy.
>
> From two to seven years, none of these conditions is met. To begin with, norms are not generalized but are valid only under particular conditions. . . . Second, instructions remain linked to certain represented situations analogous to perceptual configurations. An instruction, for example, will remain linked to the person who gave it . . . Finally, there is no autonomy during the preoperational period. "Good" and "bad" are defined [by the child] as that which conforms or fails to conform to the instructions one has received. [Piaget (1953-54), pp. 55-56]

Interpersonal affects, semi-normative feelings, and moral realism: these are the key ideas of the psychological condition of the child during the preoperational period that establish contexts for the development of instruction *téchne* applied to pupils in this stage of mental development.

§ 2.2 Normative Affects

An important part of the stage of concrete operations (approximately 7 or 8 to 11 or 12 years)

is the construction of what Piaget called a "logic of feelings" [Piaget 1953-54), pg. 60]. Piaget uses the word "logic" in this context in a way that might not be familiar to you. He had a *dictum* that I think nicely conveys the "flavor" of what he meant: "logic is the morality of thought, just as morality is the logic of action" [Piaget (1932), pg. 398].[5] In this *dictum*, you should understand 'morality' in the context of 'right vs. wrong'; similarly, you should understand 'logic' in the context of it being a system of rules of formal constructions[6]. He explained what he meant by a "logic of feelings" in the following way:

> As it happens, social life requires thought to acquire a certain permanence. For this to occur, mental activity can no longer be represented in terms of personal symbols such as playful fantasies but will have to be expressed in universal signifiers such as linguistic signs. The uniformity and consistency of expression enforced by social life plays a large part, therefore, in the development of intellectual structures with their conservations and invariants; and it will lead to analogous transformations in the domain of feelings. In effect, the permanence lacking from spontaneous feelings will appear with social and, especially, with moral feelings. [Piaget (1953-54), pg. 60]

Affective perceptions do not form structures (because they are not conserved in the manifold of Desires), but thinking links concepts to actions *through the symbolism of intuitions* (intuitions are the objects of concepts). This symbolism is made by the categories of Modality in understanding [Wells (2009), chap. 5]. Because the synthesis of an intuition recreates feelings, generalizations represented in concepts *produce* conservations of values as indirect byproducts of concept structuring and *values are forms of desires*. Piaget tells us,

> Values are initially linked to what is happening at a given moment. By the [concrete operations] stage, however, they have begun to be conserved. In [the concrete operations stage] and in the [formal operations] stage they will be progressively coordinated and will, as moral feelings or normative affects, come to constitute reversible systems parallel to operational systems of intelligence. [*ibid*., pg. 59]

The child in this stage is no longer bound and restricted by the pseudo-necessities and pseudo-impossibilities of the previous stage but, instead, has gained the capacity to conceive options and alternatives because his manifold of concepts has been enriched by the conception of procedural schemata. Put another way, moral realism loses its grip and, instead, he is able to reason and determine his actions out of his own value system. In popular language, he "develops a will of his own." This "will," however, must properly be called ***Piagetian will***, which practically means he has developed maxims in his practical manifold that perform the function of *regulating other regulations*. The stage of concrete operations-normative affects is a transitional stage between the child's limited capacity to learn only as a ***pupil*** and his extended potential capacity in the next stage for learning as a ***student***.[7] Helping the learner make this transition is one of the vital but too

[5] This agrees, in the first part, with an old Greek idea that "logic" is "right opinion" (what the Greeks called *ortho dóxa*, the root of our word 'orthodox'). In the second part, it agrees with the Aristotelian idea that moral character (*ήθος*, *ethos*) is acting out of principled habits.

[6] Piaget said, "there are many different logics and not just a single logic" [Piaget (1970), pg. 10]. This is true. What all the different logics distinguished by their adjectives (e.g., formal logic, symbolic logic, fuzzy logic, logic of meanings, etc.) have in common is that when they are *used* they are *exhibited* as rules being applied to the understanding of their topics. The name tags imply the sets of rules. This is why you find no one distinct and crisp definition of the term 'logic' in the Wells glossaries. All special logics are creations of human reasoning and reflection and thus can be viewed as products of Logic, which is the Critical science of the necessary laws of understanding and of reason in general in regard to the form of thinking in general. In Critical terminology, Logic and logic are not the same thing.

[7] Refer to the glossary for the distinction between a pupil and a student.

often unappreciated goals of public instructional education.

Piagetian will is, as Piaget put it, "an instrument for conserving values and is one of the affective characteristics of" the concrete operations-normative affects stage. The developmental advance made in this stage was described by Piaget in the following way:

> In problems of intelligence one encounters conflicts between perceptual experience and logical deduction. The subject [learner] must rise above the momentary perceptual configuration. He must free himself from it in order to bring out the relationships that were not given in perception at the start. This involves decentration, which permits mastery of the present situation by connecting it with former situations and, if need be, by anticipating future ones. That is how an operation works.
>
> Our thesis here is that it is exactly the same with acts of [Piagetian] will. Affective conditions are given which correspond to the perceptual configuration of intellectual operations. It is not a question of rejecting this affective configuration but of going beyond it by "changing perspective" in such a way that relationships appear that were not given at the start. . . . *The [Piagetian] will is simply the affective analogue of intellectual decentration*. [*ibid*., pp. 63-64]

The connecting link between perception and the practical manifold is made by representations of desiration in the process of reflective judgment (figure 2). When an inexpedience is detected by the process of practical judgment in pure practical Reason and this detection triggers off an act of reevaluation through ratio-expression conditioned by a practical maxim for regulating the application of other maxims, then speculative Reason's subsequent employment of the process of determining judgment produces (through the re-imagination of concepts) an accommodation in perception. Critically, this is how one must understand Piaget's notion of "changing perspective."

The idea of dominant importance in the concrete operations-normative affects stage is that of the emergence of what Piaget called "autonomous feelings." By this term he meant "new moral feelings that are superimposed on preceding ones" [Piaget (1953-54), pg. 65]. He tells us,

> After seven or eight years of age, the child becomes capable of making his own moral evaluations, performs freely decided acts of will, and exhibits moral feelings which, in certain cases, conflict with the feelings seen in the heteronomous morality of obedience. The feeling of justice is completely characteristic of this later sort of feeling. It indicates a new development in the area of moral feeling which will occasion significant conflicts with adults.
>
> Also in this stage, feelings become organized into a system of relatively fixed values to which the child feels obliged to adhere. A new attitude, moral reciprocity, appears. This is normative and entails a sense of "duty." It is expressed in the feelings of mutual respect that appear during this stage. [*ibid*., pg. 65]

Critically, this is the stage where the child begins to exhibit his establishment of practical schemes of mutual obligations. This is exhibitional evidence that the grip of childish egocentrism is loosening and giving way to decentration and socialization. This transitional phase is as important for teachers and for Society as it is for the child because it is in this stage where the child will determine if teachers are to become members of his personal society or whether he will come to exclude 'teachers' *as a corporate person* from his society and begin to set up maxims of outlaw relationships with them. If it comes to the latter, the tasks of *all* his future teachers will become much more difficult because these teachers will have to *individually* overcome anti-bonding biases to gain the trust and respect of the learner. If they are to be allowed to enter into the learner's society, his teachers must get him to mentally divorce them from the inimical corporate person he has come to habitually use as a stereotype for 'teachers.'

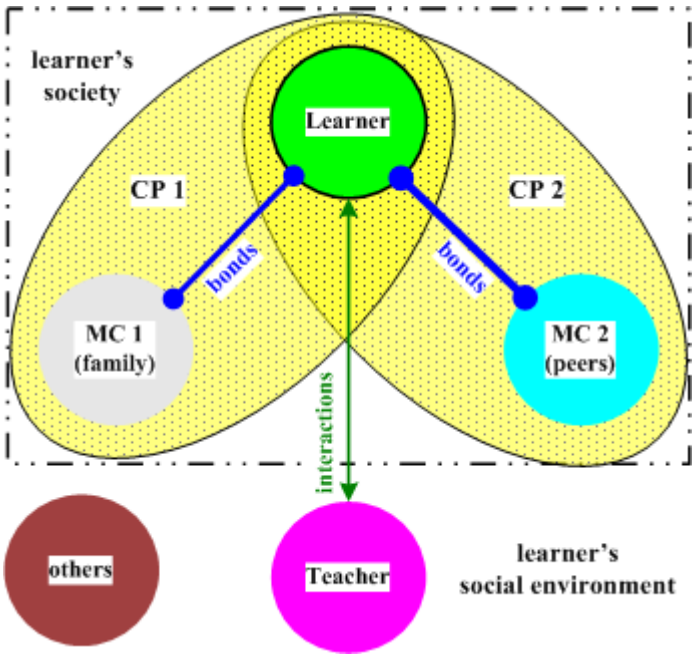

Figure 4: Simplified illustration of the learner's personal society in the concrete operations-normative affects stage of development.

Figure 4 illustrates in simplified form the social situation in play during this stage. In the majority of cases, it can usually be presumed that the child enters this stage with some few mini-Communities (MC) he has already admitted to his personal society and with whom he has bonded himself as part of a corporate person (CP). The most common ones are composed of: (1) his immediate family and close relatives; and (2) his friends from the playground, the neighborhood, or clubs and organizations he has participated in. There will generally be "others" who he perceives in his daily life but with whom he has little or no interaction. His relationship with them typically will be the outlaw relationship, which he self-governs through obligations-to-Self in his occasional *commercium* transactions with them. They exist in his social environment but *not* in his personal society. With some of these others – a playground bully, an unfriendly store clerk, a rude or threatening neighbor, etc. – he will have set up antibonding relationships.

His new teacher enters his life under conditions that differ from those his earlier teachers had enjoyed. The preoperational child often enters into relationship with his teacher coming out of an implicit situation of trust in adults and in a simple personal perspective (i.e., his teacher was 'Mrs. Jones' or 'Mrs. Weingarten' rather than an appendage of some impersonal corporate person – 'the teachers'). His teacher was "like a grandma" or "like a mommy" in that stage. This perspective changes during the concrete operations stage. His vague concept of "the teachers" as a corporate entity is beginning to form and "Mrs. Weingarten" is entering his world as a stranger now and is no longer "like a grandma." His world is undergoing changes that are at least mildly traumatic. Before it included wonderful magic characters – Santa Claus, the Easter Bunny, *etc*. Now he is coming to understand they don't really exist and never did. He may even feel some vague and incommunicable resentment toward trusted adults who told him about these characters in the first place (and who chastise *him* for telling lies). Against this background, his new teacher will be regarded with initial suspicion. His teacher's admission into his personal society is now being conditioned by what can be likened to a sort of peculiar "immigration" process.

He may be beginning to experience frustrations and conflicts at home. When he was younger, he was innocently inclined to accept the usual family oligarchy governance in which his parents were rulers by a kind of mystic "divine right." Now that he is undergoing decentration and

developing his own "sense of justice," this ruler-ruled relationship will become increasingly strained. He is not yet prepared for a social environment of Republican governance within his family, but he is going to begin to want his feelings and ideas to be listened to, respected, and represented in more and more family matters. "Because I said so" is not going to be a sufficient reason for him any more. Metaphorically, the little plant is outgrowing his pot and needs to be re-potted.

This will not happen all at once; but the child is changing and part of this change is going to be demand for his personal society conditions to change with him. As these new feelings – and new obligations-to-Self in his manifold of rules – develop, his teacher is going to be made an object of transference for these new feelings and attitudes. It is not incorrect to say a kind of trust-building seduction is going to be needed to gain and keep that important entry into the learner's personal society. Without it the teacher will be regarded as just another ruler among the other rulers in the learner's world. Maxims of prudence rather than maxims of mutual respect will dominate impact message semantics. It is a very challenging situation for the teacher and instructional *téchne* must be accommodated to fit this new and evolving situation.

§ 2.3 Idealistic Feelings

During the stage of concrete operations,

> We are still dealing with operations carried out on the objects themselves. These concrete operations belong to the logic of classes and relations, but do not take into account the totality of possible transformations of classes and relations (i.e. their combinatorial possibilities). [Piaget (1953), pg. 13]

In contrast,

> The new feature marking [the stage of formal operations] is the ability to reason by hypothesis. In verbal thinking such hypothetico-deductive reasoning is characterized, *inter alia*, by the possibility of accepting any sort of data as purely hypothetical and reasoning correctly from them. . . . But it is not only on the verbal plane that the subject reasons by hypothesis. This new capacity has a profound effect on his behavior in laboratory experiments. . . . The consequences of this new attitude are as follows. In the first place, thought no longer proceeds from the actual to the theoretical, but starts from theory so as to establish or verify actual relationships between things. Instead of just coordinating facts about the actual world, hypothetico-deductive reasoning draws out the implications of possible statements and thus gives rise to a unique synthesis of the possible and necessary. From this it follows that the subject's logic is now concerned with propositions as well as objects. [*ibid*., pp. 18-19]

Deduction means making judgments from general concepts that understand new particular concepts. In terms of mental physics, exhibition of this capacity demonstrates that the process of determining judgment has taken on a prominent role in the learner's thinking and that synthesis by episyllogism has come to rival thinking by prosyllogism as a dominant mode of thinking. All judgments are acts of subsuming particular representations under a general one. If the particulars are given and the general must be found, this is thinking by prosyllogism and the judicial act is an act of the process of reflective judgment (and so conclusions are subjectively adjudicated as judgments of taste). If the general is given and new particulars are to be subsumed under it, this is thinking by episyllogism and the judicial act is an act of determining judgment (figure 5).

In terms of mental physics dynamics, empiricism is a mode of thinking that is dominated by the prosyllogism; particular facts are gathered and an attempt is made to generalize from these. In rationalism, on the other hand, the mode of thinking is dominated by the episyllogism. A general

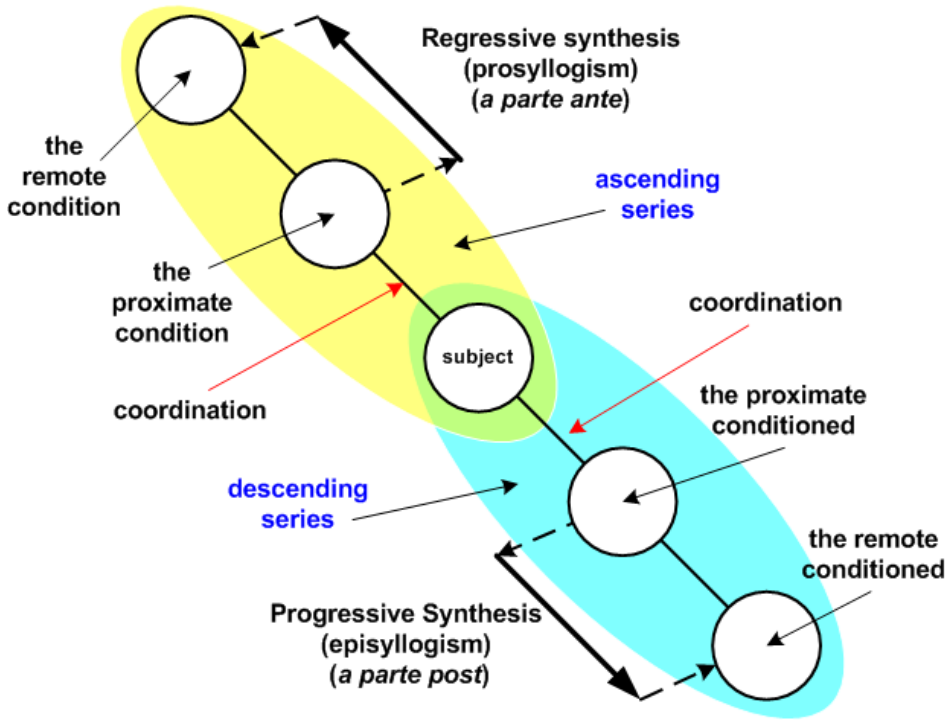

Figure 5: The logical structure of pro- and epi- syllogisms in the manifold of concepts. Both types of synthesis synthesize a series of higher-to-lower concepts (rather than synthesis of a simple coordination of higher concept to lower concepts). In a prosyllogism the synthesis proceeds from lower concepts to the higher concept *a parte ante*. In an episyllogism the synthesis proceeds from a higher concept to a lower concept *a parte post*. A prosyllogism generalizes, an episyllogism specializes and deduces.

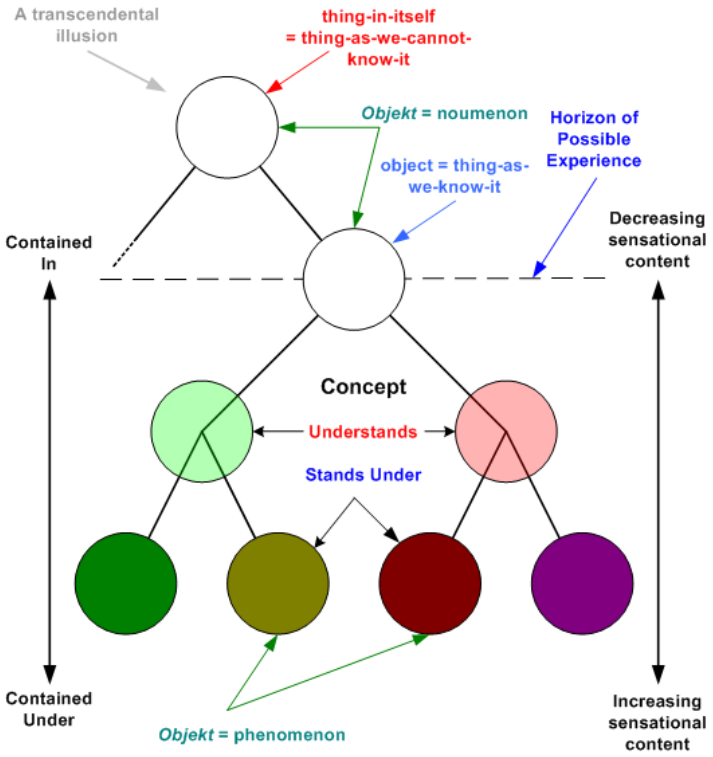

Figure 6: Structure of conceptual understanding and concept Objects in the manifold of concepts.

concept is taken as the starting point and particular consequences are deduced from it. In either case, the higher concept *understands* the lower and the lower concepts *stand under* the higher one (figure 6). Each ascending level in the manifold of concepts ascends by abstraction, i.e. by keeping what is common to all the subsumed lower concepts in the higher one and removing everything that differs among the lower concepts from the higher concept. This means the data of sensation is progressively removed as the series of concepts is ascended. Eventually a point is arrived at for which all sensational content has been abstracted from the concept and we are left with a concept of pure form without sensational matter. The Object of such a concept is called a *noumenon* and, because the concept contains no data of sensation, the object is said to be a super-sensible object (figure 6). Because data of sensation is necessary for human experience, when the point is reached in the manifold of concepts where a *noumenon* is represented, we are said to have reached *the horizon of possible experience* (figure 6). Further abstraction by prosyllogism beyond this point produces ideas incapable of being verified by experience; in the terminology of mental physics, such concepts are called ***secondary quantities of pure mathematics***. The Object of such a concept is called a *Ding an sich selbst* or "thing regarded as it is in itself." Its object is a thing-as-we-cannot-know-it. A concept right at the horizon of possible experience has for its Object a sort of 'placeholder' that serves as a hypothetical condition for Objects whose concepts stand under it. Its object is a thing-as-we-know-it. In the language of mental physics, this concept is called a ***principal quantity of mathematics*** because it can be set in immediate correspondence with objects of experience by means of its hypothetical connection (in the manifold of concepts) with objects of real phenomena [Slepian (1976); Wells (2009), chap. 1]. Concepts of principal quantities are the means by which it is possible for human beings to describe Nature by using mathematics [Wells (2006), chap. 23-24].

The learner in the stage of concrete operations can properly be called an empiricist. As he thinks about Nature, his thinking can be likened to that of the ancient Egyptians whose technical accomplishments in the practical arts and mathematical practices can be called "recipe-driven" in the sense that their scrolls (e.g. the scroll of Ahmes, entitled "Directions for knowing all dark things") were collections of problems in arithmetic and geometry that set out answers that had been discovered for particular problems but did not include anything regarding the processes by which these answers had been found [Ball (1908), pp. 3-8]. His determinations, being those of the syntheses of coordinations or prosyllogisms proceeding *a parte ante*, are adjudicated by acts of reflective judgment according to their expedience for practical Reason. These determinations are essentially judgments of taste. The learner does not tend to pursue *verifications* and thereby exhibit episyllogisms until he reaches the stage of development where he begins to exhibit he has become capable of performing his first formal operations.

The learner in the stage of formal operations, by contrast, can properly be said to be becoming a rationalist. The cause of this order of development is quite evident from the mental physics of understanding and concept structure (figure 6). Before the learner can perform an episyllogism, he must have a store of general concepts from which the synthesis can proceed. During the stage of concrete operations, this store of conceptual knowledge is being built up on a case by case basis. The onset of formal operations demonstrates that his manifold of concepts has become enriched enough by these higher level concepts that determining judgment can now use them in subsuming new particulars under them. He has, to put it simply, advanced to the state where he can make himself a logician in the conventional connotations of that word.

Piaget has documented [Piaget (1932), pp. 42-50, 65-84] how vividly a newfound delight in hypothetical reasoning-before-the-fact and abstract generalization for its own sake marks the change between concrete- and formal- modes of operational thinking. It is not incorrect to say that the child in the formal operations stage embarks on transforming himself into a Platonist in the sense that an interest in forms begins to supersede the empirical-pragmatic intellectualism of

the earlier period. He may still be an empirical realist, but a new fondness for idealism is nonetheless quite discernible in his thinking. Indeed, and like all human beings, it is with the onset of this stage that the child tends to push his reasoning well past the horizon of possible experience by conceptualizing supersensible *noumena* he may come to regard as more real than the factual evidences he has right before his eyes or at his fingertips. This inclination of human thinking is what Kant called the transcendental dialectic of pure Reason [Kant (1787), B249-732]. His concepts of *noumena* are, of course, the product of prosyllogisms and judgments of taste; there is here a re-staging of the previous habits of thinking formed during the concrete operations stage. But his thorough-going *application* of his *noumenal* ideas to his decisions, attitudes, prejudices, and reasoning in living his life is made by episyllogisms. These ideas in and of themselves are not harmful (no one can prove or disprove their objects since these are *Ding an sich selbst* objects); but his *use* of them *as conditions* for his actions can have consequences both futile and harmful to others. To the degree that these *noumena* are regarded as Baconian idols, the child's veneration for applying them can be called a kind of idol worship when he makes it his maxim to put more faith in his new powers of logico-mathematical reasoning than in factual evidences of experience.

This brings me to the affective part of this stage, which Piaget called idealistic feelings. He tells us,

> In this stage feelings for other people are overlaid by feelings for collective ideals. Parallel to this is the elaboration of the personality where the individual assigns himself a role and goals in social life. [Piaget (1953-54), pg. 14]

When Piaget says "personality" here, he means social style in the Wilson connotation of Driver, Analytic, Amiable, or Expression interpersonal style [Wilson (2011)]. Although all people are potentially capable of expressing any of these styles, it is usually the case that one of them will be made an *habitually* dominant style by the person. Piaget tells us,

> Formal thought is indispensible for the integration of the adolescent into adult society. We remark in this respect a clear distinction between adolescence and puberty. The age of puberty varies much less according to climates and civilizations than has been claimed. The age at which the child ceases to feel he is a child and is integrated into the social body varies much more.
>
> There are three characteristic aspects of this integration. First, the adolescent feels equal to adults. He tends either to imitate them in all respects or to contradict them. Second, the adolescent endeavors to integrate his work into social life. Up to this time, this had been a privilege only of adults. This integration will be professional if the adolescent devotes himself to effective work. If not, it will be a life-plan requiring a longer or shorter period for its realization. Finally, the adolescent will want to reform society in one way or another. . . .
>
> As early as 11 or 12 years, cognitive and affective transformations in the direction of formal operations are evident in the child's behavior. The first indications appear with the "juridical feelings" seen in play. Interest in rules and in the structure of the play group progressively increases. Children elaborate statutes and conventions before proceeding to action. Adolescence is, in general, characterized by the elaboration of theories, systems, or doctrines. These are used to assimilate, and, where needed, to reform the ambient ideology in every area, whether social, political, religious, metaphysical, or aesthetic. Concomitant changes occur in the affective domain. These can be labeled idealistic feelings. For us, these feelings define the personality. Up to 12 years of age, the child exhibits few feelings about ideas per se. His feelings are of a concrete sort directed toward objects or other people. Such values as he places on ideas are other people's values. These remain labile, since they are connected to the individual who represents them, and are quick to change or crumble. . . .
>
> Such is the intellectual and affective *ambiance* in which the personality is formed.

> Naturally, the term personality is taken here in its narrow sense. The personality is not identical with the self, and one could even say that it is oriented in the opposite direction. In effect, the self is activity that is centered on the self. The personality, on the other hand, develops at the time of entry into social life. Consequently, it presupposes decentration and subordination of the self to the collective ideal. [*ibid*., pp. 70-71]

What Piaget tells us here is largely true but is not entirely free of some important subtleties and issues that must be cleared up in regard to the notions of "social life" and "society." When Piaget says "society" the Object of which he speaks is what Critical theory calls Society. A child begins forming his own *personal* society from the time he is first able to understand the *Existenz* of other people as objects in his universe and is able to distinguish different individuals from one another. This occurs late in the sensorimotor period and it is from this point forward where the child can validly be said to have entered into a "social life" even if it is a life dominated by childish egocentrism and Obligations-to-Self. Piaget's "society" is the Object of phenomena with which the child integrates his personal society concept to make a *noumenal* concept of Society-in-general. His personal society is something particular, categorical, and supersensible. The Society *noumenon*, in contrast, is a stereotyped mathematical totality. None of us ever have an immediate experience with Society *per se*. What we experience are phenomena understood by concepts that are made to stand under a general *noumenon*. Society is the Object that organizes our particular and empirical exemplars.

The child constructs practical maxims for dealing with his social contexts long before he comes to theoretically conceptualize Society. Hence he "exhibits few feelings about Society *per se*" prior to the stage of formal operations-idealistic feelings. Understood in this way, what Piaget says about "social life," "society," and the child's "integration into it" is well grounded. One need only interpret what he says in terms of "Social life," "Society," and "Social integration." The child at this stage is ready to make his move from what Santayana called a "free society" to what he called an "ideal society" [Santayana (1905), pp. 137-159, 184-205]. In the latter, stereotyping, concepts of corporate persons, and moral theories are prominent. The moral theories are almost always ontology-centered and are mainly based on either consequentialist ethics (of one brand or another) or virtue ethics (of one brand or another). Theologies are also quite often developed.

The child in this stage of development is actively engaged in making practical maxims and concept structures – including those of Duty – that will, in most cases, dominate the rest of his life. The *culmination* of public instructional education, in terms of fulfilling the goals of Society which *justify* its investment of public wealth assets to the institution, either comes to fruition or fails on the *practical* plane during this stage. This is something that is vital for educators as well as for stakeholders and agents of government to fully comprehend and appreciate. The years when this formation of Social character takes root is during the 7th through 10th grade – junior high school or middle school to early high school – and is, unfortunately, the period where PEM reforms of the differentiated curriculum and tracking in the 20th century did the greatest amount of damage to the American institution of public instructional education and to America.

§ 2.4 Maturity-Post Childhood Affectivity

The label I use in this subsection is likely to be controversial among psychologists and others in American Society because the language can hardly avoid suggesting that after about age 15 years an individual is no longer a child. The issues this raises cannot be settled with objective validity unless we have common and objectively valid real explanations of what a "child" is and what an "adult" is. But no objectively valid and generally accepted real explanation of either exists. It is usual for people to use the term "adolescence" as a bridging term for a transitional period between childhood and adulthood. However, scholars don't agree on a common definition

for adolescence either. That the transition from "childhood" to "adulthood" is marked by a "fuzzy" boundary can hardly be disputed in the face of all this lack of practical or definitional agreement. I use the term "post childhood" because cognitive development research favors the hypothesis that development of formal operations ability is completed by about age 15. This completion marks *logical adulthood*. No similarly observable facts or adequate basic research is on record for affective development, leaving the affectivity issue scientifically unaddressed and open. There is a body of research on *emotional* development but, as Reber & Reber have noted,

> Historically, [emotion] has proven utterly refractory to definitional efforts; probably no other term in psychology shares its combination of nondefinability and frequency of use. [Reber & Reber (2001)]

Reber & Reber go on to say that the divers "definitions" different schools of psychology put forth "are really mini-theories about the underpinnings of emotions." Piaget, it should be noted, did not use the term "emotion" but, rather, the non-synonymous term "affectivity." There are, in addition to the numerous speculations of emotion mini-theories, a number of equally diverse mini-theories regarding the topic of "emotional development." About the only point of common ground one finds in these theories is that, whatever "emotional development" is, social environment appears to be one of its important factors. Interpersonal transaction *in* a social environment is one of the observably important variable classes in this dimension of the phenomena. A brief summation of the more prominent classes of theoretical speculation is provided by Saarni (2000). What I am saying here is that theories of "emotional development" can claim no better scientific standing than "emotion theories" can. More recent speculations based on neuroscience add *nothing* to either because all of these speculations require a *saltus* in reasoning – what can be regarded as nothing else than a leap of faith – dictating a causative connection between objects of biology and mental objects. Leaps of faith belong to religion, not science.

Kant held that the concept of "emotion" is an *empirical* concept and, as such, can be described but not defined. The Critical description of "emotion" is that it is an affective perception in which the feeling of pleasantness or unpleasantness is produced by means of a momentary inhibition of actions followed by stronger motoregulatory expression. A "momentary inhibition of actions" implies in mental physics a disturbance to equilibrium occurs, which is, of course, followed by an attempt to reestablish equilibrium. That this attempt is marked by "a stronger motoregulatory expression" implies nothing else than that ratio-expression has been evoked from practical appetition (figure 2). This brings the judgmentation loop into action, which in turn means that motivation (accommodation of perception) is active in the reequilibration effort.

Concepts reintroduced into sensibility via reproductive imagination alter affective perception. Affective perception is connected to behavior through the logical division of *psyche*, where the observable features are physically expressed somatic actions (motoregulatory expressions). One can speak of affective development beyond age 15 years in the same sense that one can speak of cognitive development through additional acquisition of experience after that age. In both cases, what phenomenal observables convey is nothing more and nothing less than continued structural developments in the manifold of rules and the manifold of concepts – changes in skill abilities and changes in cognitive capacity that are inseparably linked to re-creations of feelings and skills of motoregulatory expression. After the capacity for formal operations has been established, there are no *essentially new* developmental changes that have been discovered and reported; what the known empirical evidence indicates can be called a *maturation of experience* in the cognitive and affective dimensions of behavioral expression.

As can be easily confirmed by examining the definitions and explanations in Reber & Reber (2001), psychology can define neither child, childhood, or adolescence except by logical fiat. This, however, can never ground a natural science. My own observations of young people (some

as young as 16 years of age) who have worked as researchers in my laboratory, along with my own observations of high school students who come to the campus (both with and without being accompanied by their parents), lead me to conclude that I can find ***no*** *essential* difference between 16-year-olds and older people when they are observed in a socially common environment and are treated equally in terms of respect for their persons, expectations for their work and behavior, and allowance of equal liberties of action. I am not alone in disagreeing with the pop folklore about the "immaturity" of teenagers. Stone & Church (1957), Schlegel & Barry (1991), Dasen (2000), and Epstein (2007) all say this pop folklore is contrary to observable facts.

Inasmuch as the older people I have observed are called adults in American Society, I can find no scientific basis for calling the younger ones anything else. It is for this reason I *label* the affective dimension, accompanying experiential development in the cognitive stage of maturity, a *post childhood* stage of affective *experiential* development in figure 3.

What this implies for instructional *téchne* is this. Instructional methods and communication transactions between teacher and learners in the experiential development stage are not *essentially* different from those appropriate for college-age and other adult learners. The only difference that is notable is that younger learners have not yet had the opportunities for breadth of experience that older learners have had the opportunity to acquire. Thus, a greater degree of naivety and a lesser degree of prudent anticipation of possible adverse outcomes of actions is to be expected for younger learners, and a greater degree of challenge in overcoming resistances posed by naturally occurring pseudo-metaphysical Platonism must be expected (see previous subsection).

§ 3. The Social Chemistry Environment of the Teacher-Learner Molecule

The design goal for all instructional *téchne* comes down to developing instructional practices that most successfully facilitate the transactions taking the teacher's evoking message expressions to the learner's impact message semantics such that information error is minimized. The learner's developmental stage is one fundamental aspect *téchne* must deal with. This aspect, in a manner of speaking, goes to the learner's 'channel capacity' as a receiver of evoking messages. A second aspect of no less importance goes to the design of the evoking messages themselves insofar as these messages are transacted in a social-chemistry environment peculiar to a school setting.

Figure 7 is a simplified illustration of a teacher-learner social Molecule for a typical public school environment. The figure depicts interactions for one teacher-learner pair. Similar pair-wise

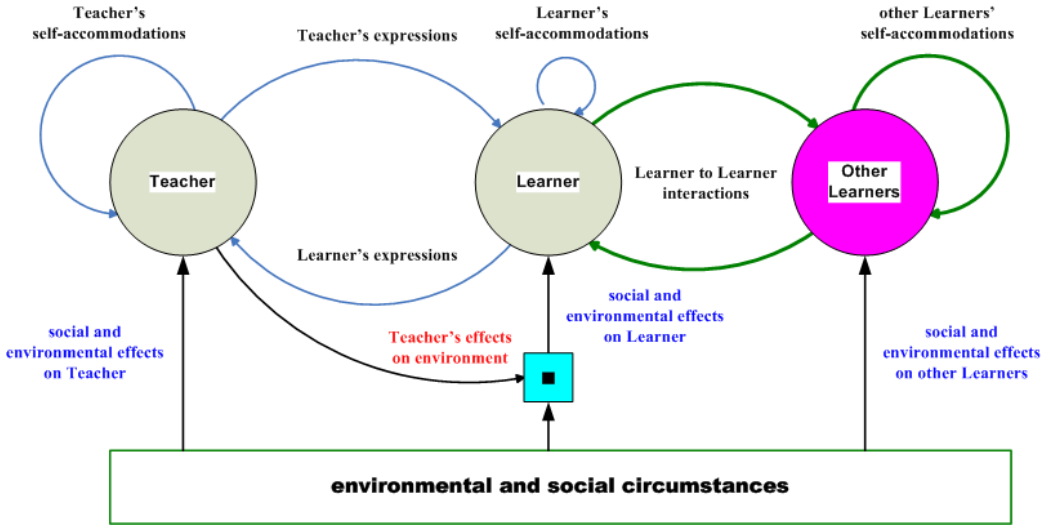

Figure 7: Social Molecule for a teacher-learner pair in a public school setting.

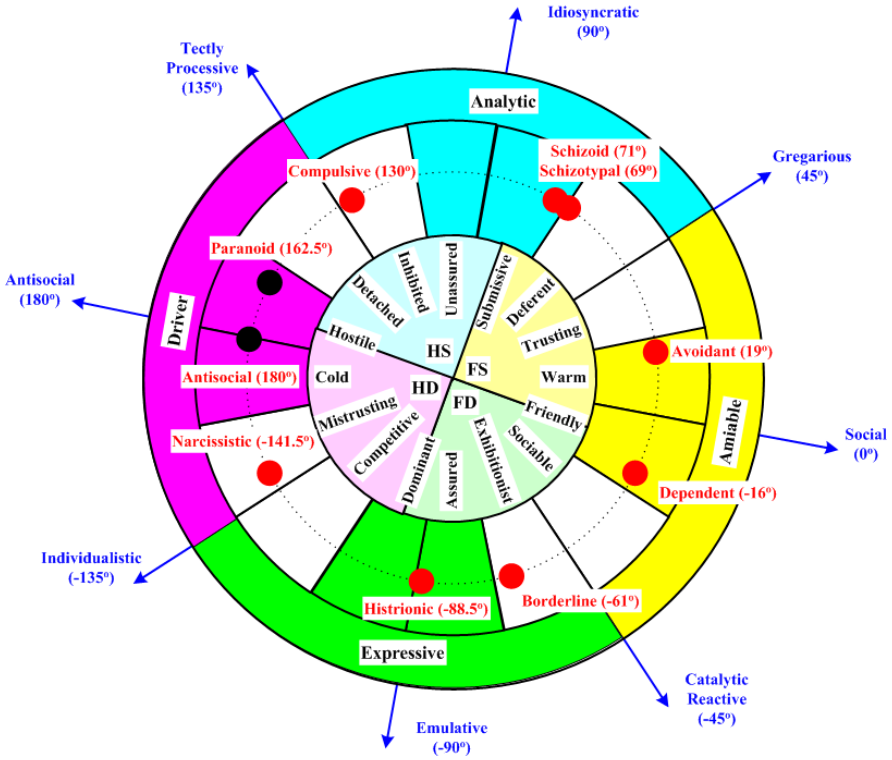

Figure 8: D-PIPOS circumplex model of personality style. The inner ring details the sixteen empirical Kiesler operationalizations in Kiesler's Interpersonal Circle model [Kiesler (1983)].

interaction expressions also exist between the teacher and each learner in the classroom setting. These interactions are not depicted in figure 7 in order to keep the illustration simple, but you should understand that these interactions exist between the teacher and each learner in the overall classroom Molecule nonetheless.

Teacher expressions and learner expressions in figure 7 include not only what the individual says or writes, but also includes body language expression operationalizations. The expression paths depicted in figure 7 represent evoking message functionals passing from one person to the other during communication transactions. Evoking message expressions are interpreted as verbal and non-verbal impact message contents by the receiver according to sixteen operationalizations proposed by Kiesler (1983). This is depicted in figure 8, the D-PIPOS circumplex model of personality style. Each of these sixteen operationalizations is further characterized by sub-operational interpretations explained in Kiesler (1985) and summarized in table 1.

The following points are fundamental to understanding interpersonal interactions in regard to the effect of operationalization expressions on semantic representing of impact messages. First, unless the transmitting person is conscious of and deliberately controlling his operationalization expressions, the operationalization he exhibits to the receiver will reflect his habitual inter-personal style (Driver, Analytic, Amiable, or Expressive in figure 8). Most people most of the time are not attentive to their interpersonal social style expressions. Indeed, some private sector companies find it important to send their new managers through a management training course so that these new managers can be more effective leaders. The training course offered by the Wilson Learning Corporation is one of the better examples of training courses of this kind [Wilson (2011)]. Kiesler likewise recommended, using arguments nearly identical to the Wilson people, that psychological therapists receive training in using their operationalization expressions to treat patients who exhibit extreme or overly rigid interpersonal styles [Kiesler (1983)].

Table 1

Kiesler Operationalization Levels and subclasses

Dominant (Controlling): a. Leading/influencing b. Active/self-assertive c. Strong/managing d. Taking charge	**Submissive (Docile):** a. Following/complying b. Passive/acquiescent c. Weak/yielding d. Obedient	**Hostile (Antagonistic/Harmful):** a. Antagonistic b. Quarrelsome c. Impolite d. Harmful	**Friendly (Cooperative/Helpful):** a. Cooperative b. Agreeable c. Courteous d. Helpful
Competitive (Critical/Ambitious): a. Energetic b. Enterprising c. Competitive d. Critical	**Deferent (Respectful/Content):** a. Insolent b. Unimaginative c. Content d. Approving	**Detached (Aloof):** a. Disinterested b. Distant c. Preoccupied	**Sociable (Outgoing):** a. Involved b. Sociable c. Extraverted
Mistrusting (Suspicious/Resentful): a. Vigilant b. Suspicious/jealous c. Cunning d. Resentful e. Covetous/stingy	**Trusting (Trusting/Forgiving):** a. Unguarded b. Trusting c. Innocent d. Forgiving e. Generous	**Inhibited (Taciturn):** a. Silent/private b. Undemonstrative c. Stiff/controlled d. Opinionated	**Exhibitionist (Spontaneous/Demonstrative):** a. Talkative/disclosing b. Demonstrative c. Casual/spontaneous d. Suggestible
Cold (Cold/Punitive): a. Cold b. Stern c. Strict/punitive	**Warm (Warm/Pardoning):** a. Warm b. Gentle c. Lenient/pardoning	**Unassured (Self-doubting/Dependent):** a. Self-doubting b. Dependent c. Unassured d. Awkward e. Glum	**Assured (Confident/Self-Reliant):** a. Confident b. Self-reliant c. Assured d. Self-composed e. Cheerful

Second, impact message interpretation (semantic representing) by the receiver constitutes a form of *model stereotyping* of the transmitting person by the receiving person. Even if you are the nicest, most kind person on the face of the earth, if the receiver's impact message interpretation tells him you are scoundrel and a villain then, to him, you are a scoundrel and a villain. It is a well documented finding of personality research going back to Leary's work in the 1950s that what a person thinks his personality style is and what others think it is are often two (or more) very different things [Leary (1957), chap. 6]. Although Leary's specific circumplex descriptors have been amended since 1957 as a result of further empirical research, these two principles of interpersonal communication are still generally accepted in present day personality theory.

So far as I have been able to tell by examining curricula and course descriptions reported by different colleges of education, present teacher education provides no or very little educational matter on the topics of interpersonal messaging, personality styles, or 'therapeutic' manipulation of interpersonal messaging dynamics. Yet these are key factors in how successfully a teacher can lead a learner's acquisitions of new knowledge, skills, and understandings. One important place where the social chemistry metaphor departs from dead-matter chemistry is this: In dead-matter chemistry all chemical reactions proceed on the basis of physical cause-and-effect phenomenon; an aggregate of atoms exerts no "self control" over their chemical interactions. In social-chemistry interactions, the social atoms are Self-determining beings who are each potentially capable of altering social interactions by means of their evoking message expressions. To put it less stiffly, a good teacher must be a good storyteller, a good actor, an effective leader, and an effective psychological therapist. So far as I have been able to discern from teacher college curricula and course descriptions, *none* of these skills are being taught to future teachers. This seems to me a wondrous perplexity given all the talk one hears frequently in the academic environment about 'shaping young minds' and 'changing people's lives for the better.'

Effecting a *desired* outcome of the learner's educational Self-development actions requires the teacher to take effective leader's actions that orient and bias the learner's actions in directions that are favorable to the desired lesson outcome. It is bankrupt folly to presume the learner has a moral Obligation to understand the teacher. The teacher, rather, has a Duty *to make himself understood*. To do so, it is a *sine qua non* that interpersonal communication transactions evoke favorable affective judgments by the receiver. Kiesler proposed a number of empirically-based

propositions for effecting dynamical control of the interpersonal interactions and the affective factors of semantic representing. These propositions are immediately relevant to effective instruction:

1. A person's interpersonal actions tend (with a probability significantly greater than chance) to initiate, invite, or evoke from an interactant complementary responses that lead to a repetition of the person's original actions; this is **the complementarity principle**;
2. For interpersonal behavior as operationalized by the two-dimensional interpersonal circle, complementarity occurs on the basis of (a) reciprocity in respect to the Control dimension or axis (dominance pulls submission, submission pulls dominance), and (b) correspondence in respect to the Affiliation dimension (hostility pulls hostility, friendliness pulls friendliness); control and affiliation are the two factor dimensions; I explain them below;
3. For interpersonal behavior as operationalized by the two-dimensional interpersonal circle: (a) *complementarity* exists among interactants when Respondent B reacts to Person A with interpersonal acts reciprocal in terms of Control and corresponding in terms of Affiliation; (b) *anticomplementarity* exists when Respondent B reacts to Person A with behavior both nonreciprocal in terms of Control and non-corresponding in terms of Affiliation; (c) *acomplementarity* exists among interactants when Respondent B reacts to Person A with actions either reciprocal on Control or corresponding on Affiliation, but not both; (d) *isomorphic complementarity* exists when Respondent B reacts from circle segments identical to those used by Person A; and (e) *semimorphic acomplementarity* exists when Respondent B reacts from circle segments directly opposite to those used by Person A;
4. Interpersonal complementarity and non-complementarity operate precisely only within the same level or intensity of behavior. That is, interpersonal actions at a particular level of intensity tend (with a probability significantly greater than chance) to initiate, invite, or evoke from interactants complementary responses at the equivalent level of intensity (mild-moderate actions pull mild-moderate complementary responses, extreme acts pull extreme complementary responses); this is the **interpersonal intensity principle**;
5. A given instance of the complementary response consists of a two-stage sequence occurring rapidly in an interactant: (a) a covert response, labeled the "impact message," and (b) the subsequent overt action, labeled the "complementary response";
6. The more extreme and rigid (maladjusted) the interpersonal style of Interactant B, the less likely he or she is to show the predicted complementary response to the interpersonal actions of Person A. An important exception occurs when the predicted complementary response to A falls at the exact segments that define B's extreme and rigid style;
7. Interpersonal complementarity applies primarily to naturally occurring, relatively unstructured interpersonal situations. The extent to which it applies in various structured situations or in other environmental contexts remains to be determined;
8. It is unclear how interpersonal complementarity applies over the temporal range of continuing transactions between interactants. [Kiesler (1983)]

The idea of 'complementarity' is a central one in the empirical theory. Operationalizations are characterized (empirically) by a two-factor model. The factors are called 'control' and "affiliation,' respectively. The control coordinate is defined in figure 8 by the dominant-submissive axis; the affiliation coordinate is defined by the hostile-friendly axis. Response complementarity is defined by the receiver responding to the transmitter's operationalization expression with a reaction that is reciprocal along the control axis and corresponding along the affiliation axis (proposition 2). Figure 9 illustrates the complementarity pairs of operationalizations. Although the language by which the operationalizations are labeled uses "soft" and "touchy-feely" words, the objects being described by this language are *mathematical* objects capable of being measured as principal quantities in a set-membership mathematical formulation. Indeed, the *usefulness* of all personality

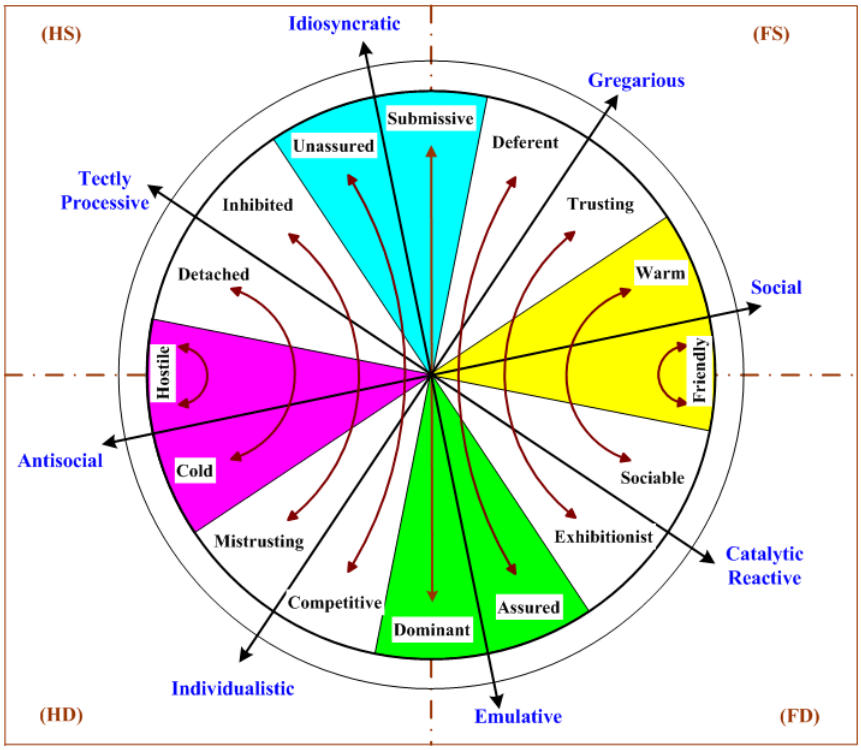

Figure 9: Kiesler's complementarity pairs. The horizontal axis shown here is the affiliation axis. The vertical axis is the control axis. These axes define four quadrants: FS (friendly-submissive); HS (hostile-submissive); HD (hostile-dominant); and FD (friendly-dominant).

theory utterly depends on these objects being measurable. Functionally applicable techniques for performing such measurements were, in fact, at the core of Leary's original formulation [Leary (1957), chaps. 3-5]. I mention this here in order to emphasize that, appearances notwithstanding, there is a great deal less arbitrariness in the mathematical structure presented by figure 8 than one untrained in psychology might be inclined to presume.

Third, the D-PIPOS circumplex depicts a projection onto a circle of three planes of impact message decoding and response. First, there is the Kiesler operationalization plane, which is depicted by the inner ring of the D-PIPOS circumplex. This is the control-affiliation plane of expression. Second, there is the Wilson interpersonal style plane, which is described by the four quadrants of Driver, Analytic, Amiable, and Expressive social style. This is the responsiveness-assertiveness plane of expression. Third, there is the personality plane studied by psychiatrists and described by empirical classifications of personality styles. These are described as discrete points around the circle (such as the 'antisocial' personality style located at 180°). Those depicted in figure 8 are classifications based on DSM-IV [American Psychiatric Association (2000)] as described in Sperry (2003). This third plane is not immediately pertinent to the discussion at hand and is the least well developed and most speculative plane of empirical personality theory.

Every human being is potentially capable of exhibiting behavioral expressions anywhere on the D-PIPOS circumplex because these expressions are governed by the person's manifold of rules in pure practical Reason (figure 2). The rules a person actually structures in his manifold lead to habits of expression and habits of judgmentation. Figure 10 depicts an illustration of how a person's manifold of rules might overlay the D-PIPOS circumplex. Note that this illustration shows practical maxims covering the entire angular dimension of the circumplex with variations in the intensities (radial dimension) with which these rules might be expressed. From figure 1 you can see that this manifold does affect semantic representing through feedback from judgment.

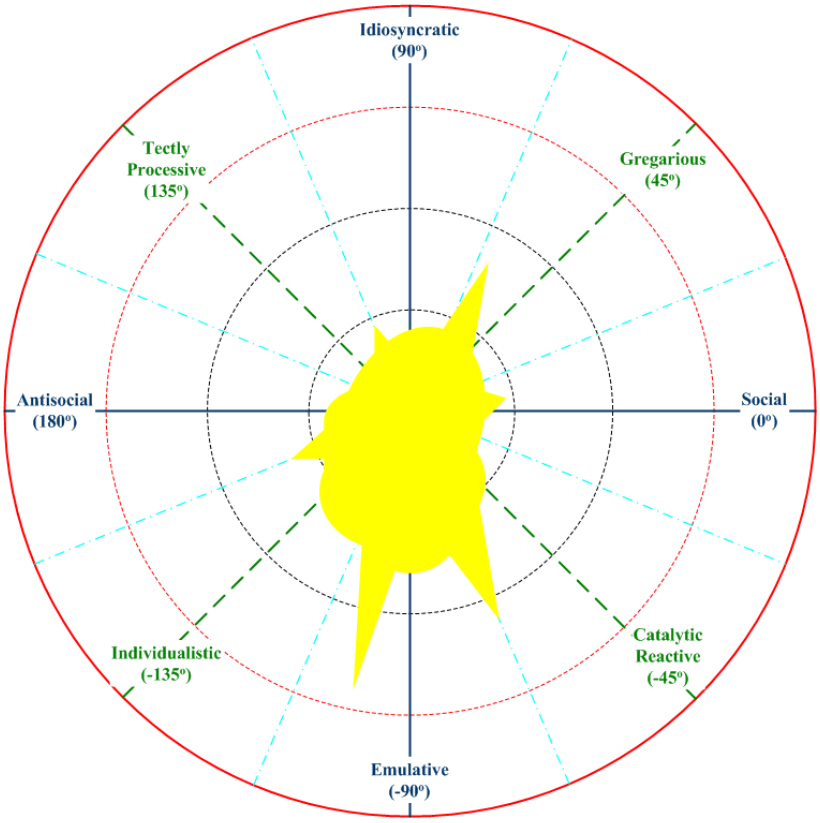

Figure 10: Hypothetical projection of a manifold of rules (yellow) onto the D-PIPOS circumplex. The hypothetical person illustrated by this manifold would be said to display an habitually dominant Expressive inter-personal style with secondary Analytic tendencies. However, he would be capable of exhibiting any of the interpersonal style behaviors and Kiesler operationalizations depicted by the D-PIPOS circumplex.

The third D-PIPOS dimension would be represented by an axis emerging vertically from the plane of the circle if it were depicted. It this vertical axis where the three aforementioned planes are defined. The Kiesler plane (Kiesler operationalizations) describes motoregulatory expressions externalized by an individual. The Wilson plane describes coordinated maxims of behavioral schemes that a person exhibits and most directly reflects the manifold structure of rule series (practical imperatives to practical tenets to practical maxims to specific expression rules). First I discuss interpersonal communication transactions on the Kiesler plane. Then I discuss social style expression on the Wilson plane. Coordination and integration of an observer's "reading" of an individual's expressions on these two planes is needed for estimation of the nature of that person's manifold of rule structures.

When a teacher's expressions pull a complementary expression in response from the learner, it can be provisionally assumed that a "normal" – that is, psychologically typical – communication has been effected and that the learner's reaction approximately characterizes the sorts of maxims in the learner's manifold of rules that the teacher's expressions have stimulated. Characterization in this context means the maxims are those consistent with specific operationalization exhibitions according to the D-PIPOS circumplex model. An adequately trained and observant teacher can use this to estimate how his actions are affecting the learner's judgment and his obligation rules.

In addition, if the learner's operationalization response lies in the HS or HD quadrants this is a likely indication that the impact message is being semantically represented by the learner (figure 1) as a situation appraisal provoking in the learner feelings of *Unlust* with tenets of obligation-to-Self, i.e., that he is appraising the situation *morally* and feeling ***relationship tension***. This will

affect the learner in subjective ways that very likely hinder what the teacher is trying to accomplish with the lesson. One likely implication of this is that the learner is having difficulty judging the teacher's evoking message and the likelihood of an information error occurring in the transaction is increased. It cannot be reliably presumed that a learner will adapt his own interpersonal style to cope with that being expressed by a teacher. It is rather the responsibility of the teacher to adapt *his* expressions in a way that moves them into the "comfort zone" of the learner's habitual interpersonal style. As Wilson *et al*. put it,

> Although we tend to think of all tension as a source of negative stress, that's not really the case. It's more helpful to think of tension as being productive or unproductive.
>
> There are two kinds of tension in every relationship – task tension and relationship tension. . . . Relationship tension is just as natural a part of any communication process as task tension, but it results much more from the personal connection – or lack of it – between you and others. . . .
>
> A certain amount of task tension is good. It increases productivity directed toward the goal you are accomplishing together with others in a relationship. Relationship tension prevents people from focusing on task tension. When relationship tension is high, people become uncomfortable and task-directed productivity drops. [Wilson (2011), pp. 36-39]

Instruction is intended to augment the learner's *Personfähigkeit* in regard to benefits accrued from the lesson object. This is the "task" part of the quote above. It requires that the learner make accommodations in his manifold of rules and/or his manifold of concepts. However, the learner will only make these accommodations in order to remove a disturbance to his equilibrium, and that disturbance is what is referred to as ***task tension***. To instruct, a teacher must provoke a productive but not excessive degree of task tension in the learner.

Relationship tension, on the other hand, hinders learning because the learner will focus more on it than on the beneficial task tension. Relationship tension tends to provoke maxims of prudence and tenets of obligation-to-Self. Because practical maxims of these classes tend to be higher-placed in the manifold of rules, with those related to task tension being conditioned by them, relationship tension will tend to dominate the learner's attention and equilibration efforts to the detriment of attention and effort being directed at the lesson object. For instruction to be effective, the teacher must provoke the needed task tension while minimizing *Unlust* and preventing excessive *Lust* in relationship tension. The interpersonal communication transaction factor is centrally important. Teachers routinely design objective lesson plans; however, for those plans to be effectively carried out, the instruction *téchne* employed *must* deal with the issue of relationship tension. Otherwise the task oriented part of the lesson has a significant likelihood of being dismissed or trivialized through type-α compensations by the learner.

The most effective teachers seem to know this at an intuitive level they would likely find difficult to express in words. It has long been presupposed that effective teaching is defined by the objects of the lessons. A naturally corollary to this presupposition is one that goes along lines holding that a learner who does not absorb a lesson clearly presented in its objective features is a learner who is (take your pick) lazy, careless, slothful, indifferent, or dumb. It is true that there are learners who have cultivated *habits* describable in such terms, but – and this is a key point – those sorts of habits express maxims that have proved to be expedient for that learner in past experience. *They can be changed by effective instruction that makes such behaviors produce outcomes that gainsay the anticipation of expedience*. It is very tempting for a teacher to give up on so-called "indifferent" learners – I can attest to this from personal experience – but to reach those learners most in need of the guidance of a teacher this temptation must be resisted. In some cases this might require Job-like patience, but kindly patience pays off more often than one might think. As a famous teacher from long ago advised,

> The husbandman waits for the precious fruit of the earth and has long patience for it until it receives the early and the late rain. You also be patient. [*Epistle of James: 5:11*]

Minimizing relationship tension by altering one's own social style to match those of particular learners is a learnable skill but does require a lot of practice. Learning it entails developing a set of heuristics for reading body language expressions in the learner's evoking messages. Limited space in this treatise precludes discussing this in depth, but Wilson (2011) is an excellent handbook one can use to guide educational Self-development for this skill. For a teacher in a classroom, probably the greatest challenges to be faced are having a deal with the diversity of social styles present and keeping track of those of the individual learners. It often takes many exposures to each individual's operationalizations to accurately estimate his approximate quadrant (in the classroom environment) on the D-PIPOS circumplex, especially since learners are all capable of any of the sixteen operationalizations and might not exhibit a dominant social style in the absence of relationship tension. Here is where reading body language is important.

Body language expresses low-level (amoral) practical rules. Social style identification is based on two factors: how 'responsive' is the person?; and how 'assertive' is the person? Wilson *et al*. provide the following guideline for clues to recognizing a person's social style quadrant:

low responsive:

- reserved, unresponsive
- poker faced
- actions cautious and careful
- wants facts and details
- eye contact infrequent while listening
- eyes harsh, severe, or serious
- limited use of hands; hands clenched tightly, folded or pointed
- limited expression of personal feelings, story telling, or small talk
- appears preoccupied or vigilant

high responsive:

- animated, uses facial expressions
- smiles, nods, frowns
- actions open or eager
- little effort to push for facts
- eye contact frequent while listening
- friendly gaze
- hands free, palms up, open
- friendly gestures
- shares personal feelings
- affirmative, responsive, appears to enjoy the relationship

low assertive:

- seldom uses voice to emphasize ideas
- expressions and posture are quiet and submissive
- deliberate, studied, or slow in speech
- indifferent handshake
- asks questions more than makes statements
- expressions are vague, unclear about what he/she wants
- tends to lean backwards

high assertive:

- emphasizes ideas by tone change
- expressions are aggressive or dominant
- quick, clear, or fast-paced

- firm handshake
- makes statements more often than asks questions
- lets one know what is wanted
- tends to lean forward to make a point [The Wilson Learning Corp., 1975]

Wilson *et al*. advise that recognition is more accurate if one observes one of these two dimensions at a time. Once the responsive factor and the assertive factor have been gauged, the person's social style classification is provisionally estimated as: (1) Driver = low responsive + high assertive; (2) Analytic = low responsive + low assertive; (3) Amiable = high responsive + low assertive; (4) Expressive = high responsive + high assertive.

Operationalization expressions (figure 8) are determined by practical maxims in the learner's manifold of rules that are evoked according to the situation, physical environment, and social circumstances in which the interaction is taking place. It is important to understand that the same person can and often will express different social styles under different circumstances. It is also important to understand, particularly in the case of children, that the individual's expressed social style will often change with age (because of structural development in the manifold of rules as well as structural development in the manifold of concepts). For example, when I was a little boy my primary social style expressions were Analytic. This remained my primary social style when I was with older family members and family members of my own generation. However, by the time I was a teenager my primary social style at school and at work had developed into the Driver style, where it remained until I was in my early thirties. My social style became versatile at that time as a result of management training I received, part of which was the Wilson training course. *Habitual* social style reflects the phenomenon of childish- or adult- egocentrism; *versatile* social style is the result of decentration and, usually, training and practice.

It is also important for a teacher to bear in mind that a teaching position is an authority figure position. This means the learner will tend to exhibit low assertive behavior, at least initially, in teacher-learner interactions regardless of whether or not this accurately reflects his habitual social style. Only after a degree of trust and rapport has been built up between teacher and learner will the learner typically begin to exhibit high assertive expressions *if* that is part of his social style. This reflects learned maxims of prudence the learner has built into the structure of his manifold of rules. Proper management of relationship tension by the teacher does require that the teacher put forth sometimes considerable effort to correctly identify which side of the assertive axis is the learner's habitually preferential social style.

As not only the conveyor but also the *manager* of instruction, it falls to the teacher to orient the social Molecule relationships between teacher and learner. To recapitulate what was said earlier, effective instruction requires a carefully administered degree of task tension *and* benign psychological manipulations aimed at minimizing relationship tension. Usually around three out of four learners in a classroom setting will have habitual social styles different from the preferred habitual style of the teacher. It is incumbent upon the teacher to develop versatility of social style expression in his evoking messages. Learners – especially young ones still in the stage of childish egocentrism – are almost always unaware that they even have an habitual social style and so should not be expected to self-adapt their operationalization expressions.

§ 4. The Teacher-Corporate Learner Macromolecule

A typical classroom has many learners to one teacher. Furthermore, and especially in the case of children, the learners know each other and belong to their own mini-Society outside the class-room setting. This means there is a second consideration facing the teacher in the classroom. In addition to managing and orienting individual teacher-learner Molecules, the learners as a class will present the teacher with having to manage and orient one or more *corporate* persons.

The presence of other learners does affect an individual learner. There is a leadership dynamic at work within the corporate body of a learner mini-Society, and the teacher must take leader's actions to guide this dynamic. This means understanding the peculiar mores and folkways that the learner-members have adopted among themselves in order to: (1) avoid producing relationship tensions among members of the learner corporate person; and (2) socially integrate, as much as possible, the teacher into that mini-Society. This is the social-natural significance of the "other learners" node in figure 7. Instruction is *personally individual* (teacher to specific learner), but can only be *practiced* within a mini-Society of learners. As a social-natural scientist, a teacher must be an applied sociologist and an applied anthropologist as well as an applied psychologist.

An additional important challenge is raised when the classroom population of learners is comprised of more than one learner mini-Society. This happens, for example, when outside the classroom the learners divide themselves into granulated cliques, or when the learners are drawn from divers specialty backgrounds. The latter is what is generally termed an *interdisciplinary* class. One often encounters this in higher education. For instance, I used to teach several different interdisciplinary courses. This meant the instruction environment was comprised of students from different majors, each of which generally had its own mini-Community, granulated with respect to the others, and the students within each of these had their own backgrounds, folkways, and specialists' perspectives on how and where the course topic "fit in the world" as they habitually viewed this world. Figure 7 is modified to reflect this sort of classroom Molecule by replacing "the learner" node by a "corporate learner" node and replacing the "other learners" node by an "other corporate learners" node. One of the tactics I employed in these settings was to encourage the students to organize themselves into 'study groups' that each contained members from the different corporate persons represented in the classroom. I also tried to guide the leadership dynamics of these groups so that when a particular sub-topic was being taught the group member who was a corporate specialist in that topic would step forward and act as a leader and student instructor for the others by helping them to learn material foreign to their own discipline. The most diversely populated course I taught was one where a typical class had engineers (usually themselves divided into two or three engineering majors), biologists, computer scientists, philosophy majors, and psychologists taking it. In a manner of speaking, I tried to produce a "melting pot" effect to somewhat anneal the "grain boundaries" separating the specialties.

All this likely sounds rather glib but that is not my intention. The interdisciplinary (or multi-corporate mini-Society) environment of instruction is one where almost no sound empirical research as been carried out and few heuristics of instructional *téchne* have been developed. It is one of the more glaring open research topics for social-natural education science.

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