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REASONING READINESS—THE VERY FIRST R: *Semiotic Skills Engender Basic Skills*

Abstract:
Embedded within the philosophy of Charles Sanders Peirce is a prescription for a semiotic skill development program to bring about *reasoning readiness* skills in students of all ages. The following article will explain how this semiotic skill development system connects with Peirce's phenomenology and normative science. Following this theoretical discussion will be a brief discussion of each of the three basic semiotic skill sets: qualifying, analyzing, and representing/ interpreting signs. Each of these will explained and provided with suggestions for ways of engaging students with these skill sets.

KEYWORDS: Semiotic, Educational philosophy, Linguistics, Reasoning skills, Peirce

Introduction

This paper will describe the specific processes underlying *reasoning readiness* and demonstrate that the semiotic of Charles Sanders Peirce holds the key to readying students of all ages to develop the cognitive skills necessary to engage in rational thought.

By following the Peircean method, we need not diminish the importance of affect or basic skill development to institute this proposed *reasoning readiness* program. For, just as Peirce's logic must be informed by affect (the admirable impulses of aesthetics) and ethics (right conduct), so too the program of semiotic skill development proposed here, first laid out by Albert Upton (1961) to improve thinking skills of college students, weaves together affect, effect, and reason. Thus, the semiotic skill development program for all grade levels is based upon a previously tested system (Upton 1961; Zenke 1985) that in one study raised IQ levels an average of ten points in college freshmen—and in one instance of that study, as many

as 30 points (Hechinger 1960). This embedded educational program can be easily smuggled into an existing curriculum by adding Peircean system and structure to subjects already being taught. Even very young children begin to develop *reasoning readiness* skills as they hone their affective and basic skill development.

Semiotic skill development provides access to the processes needed to develop *reasoning readiness* abilities, enabling students to read contexts, values, and purposes. It is nothing more than basic semiotics (very basic) grounded in Charles Peirce's phenomenology—his doctrine of the categories, which underlies his theory of signs.

This brief paper cannot begin to describe such a program in its fullest detail. Nor will I even attempt to provide specific methods or deal evenly with each of the skill sets. Mastery of the earlier ones, because they are fundamental, may be more important than later ones. The later ones are specific semiotic skills that foster lateral thinking and are valuable in that sense. Yet, aesthetics and ethics (admirable impulses directing right conduct) are such prime issues for Peirce's concept of right reasoning (and so often ignored as non-essential to critical thought) that the semiotic skills of qualifying and analysis may need to take precedence over the linguistic semiotic skills, which can be learned quite quickly once the others are mastered.

Although semiotic skill development is a pedagogical system and, as such belongs to the Practical Sciences, this system directly derives from Peirce's Phenomenology and affects the practical expression of the Normative Sciences. Thus, almost a third of this article details the relationship of semiotic skills to Peirce's Classification of the Sciences (*CP* 238-282). Although I have discussed elsewhere the connection between Peirce's work and the philosophy of education embedded within his work (Chiasson 1998, 2001, 2005b, 2008), the specific theoretical connections upon which I have based these statements appear for the first time in this article.

Semiotic Skills and the Development of *Reasoning Readiness*

School days, school days,
Good old-fashioned rule days
reading and 'riting and 'rithmetic
taught to the tune of the hickory stick
American folk song

For the duration of this article, let us set aside the traditional *Three R*s—*reading*, *'riting* and *'rithmetic*—of the old American folk song. Instead, let us concentrate on *reasoning readiness*, which is the fundamental capability for engaging intelligently with things, words, and ideas (Chiasson 1989). Perhaps *reasoning readiness* may seem to some people to have its roots embedded within that murky cognitive realm of natural talent and intelligence. However, unlike apparently inborn traits like intelligence and athletic ability, *reasoning readiness* can result from the mastery of *basic semiotic skills*.

Although Albert Upton (1960, 1961) seems to be the first to have delineated semiotic skills into a teachable form (albeit for college freshmen), they directly derive from C. S. Peirce's three categories and normative science, particularly from the semiotic focus of his logic. Upton, who based his work on Ogden and Richards' 1923 classic *The Meaning of Meaning* (reprinted 1989), appears to have been unaware of their (and his own) dependence upon Peirce's semiotic (Chiasson 2001, pp. 4-8). Thus, he constructed an elegant set of exercises for developing semiotic skill sets with apparently no awareness of their relationship to Peirce's semiotic. Although Upton's focus is a sophisticated linguistic one, most of these skills can be developed non-verbally as well—an important consideration when working with very young children or with those with learning disabilities.

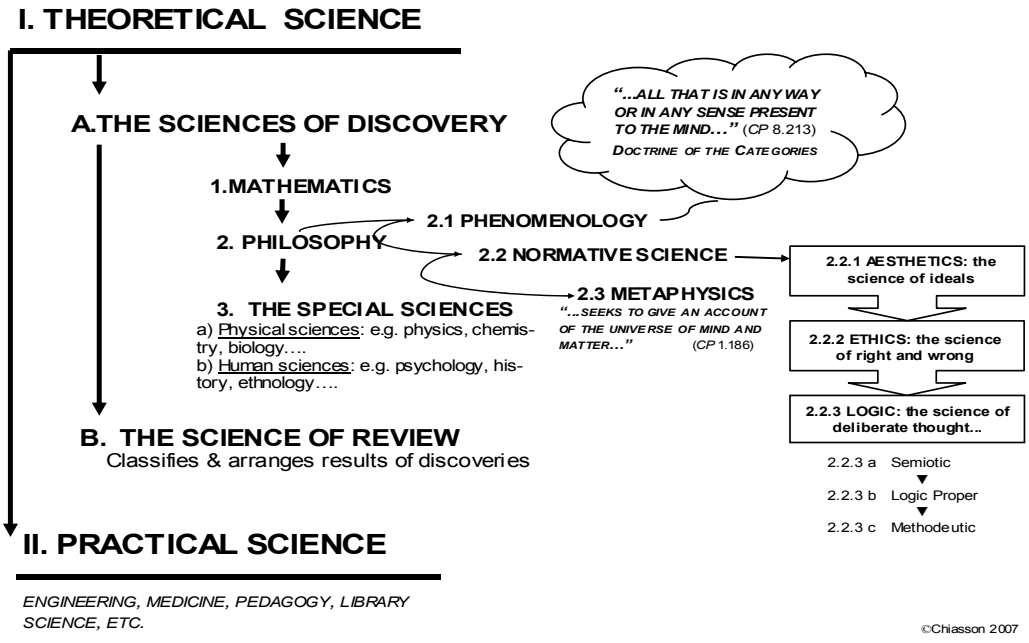
Semiotic Skills and Peirce's Classification of the Sciences

The best way to track the connection of these semiotic skills to Peirce's theoretical construct is to view his Classification of the Sciences (*CP* 1.238-282), which I have abbreviated into diagrammatic form in figure 1.

figure 1

PEIRCE'S OUTLINE CLASSIFICATION OF THE SCIENCES

(*CP* 1.180-202)



Peirce designed the order and direction of this classification to reflect his philosophical system as a whole. Direction is always downward to reflect the influence that the sciences above have upon the fundamental principles of the ones below. For example, mathematical foundations inform fundamentals in Philosophy, Metaphysics and everything else—but none of the other sciences contributes to foundations of mathematics; it is *the first science*. (There is not time within the constraints

of this article to discuss *how* mathematics might inform the other sciences, although its connection to logic proper is obvious.) In this same sense as mathematics informing everything else, fundamentals from all of the Theoretical Sciences (I) inform (or *should* inform) fundamentals in the Practical Sciences (II)—such as pedagogy, which is where this discourse about semiotic skills belongs.

The Theoretical Sciences are of two sorts: (A) The Sciences of Discovery, the theoretical sciences with which Peirce was most concerned, and (B) The Science of Review, which classifies and arranges discoveries (Peirce's Classification of the Sciences is an example of a Science of Review.)

Peirce focused his mental energy on the Sciences of Discovery, in particular Mathematics and Philosophy. He divides Philosophy into three categories: Phenomenology, Normative Science, and Metaphysics. The two areas with relevance to this discussion are 1) Phenomenology and 2) Normative Science—the latter includes a) Aesthetics, b) Ethics, and c) Logic.

We will not be discussing Metaphysics, the Special Sciences, or the Science of Review. However, the semiotic skill framework belongs in Practical Science since it is a pedagogical structure based upon Peirce's Theoretical Science.

The above description covers all there is to the basic structure of Peirce's Classification of the Sciences. If you have managed to follow this explanation, go on ahead—if not, return to the diagram. It is all there. This information really does matter when it comes to understanding the theoretical underpinnings of basic semiotic skills and for designing effective programs for semiotic skill development.

Phenomenology

Phenomenology, which Peirce defined as …*all that is in any way or in any sense present to the mind*…(*CP* 6.213), contains Peirce's Three Categories of Being: 1) qualities of feeling, 2) dyadic relations, (action/reaction) and, 3) representations

(*CP* 1.561). Although they are important and vital to understanding Peirce's thought, these categories are not about facts or logic. "Perhaps it is not right," wrote Peirce, "to call these categories conceptions; they are so intangible that they are rather tones or tints upon conceptions (*CP* 1.353)." Peirce explained:

> [Phenomenology] has nothing at all to do with the question of how far the [phenomena] it studies correspond to any realities. It religiously abstains from all speculation as to any relations between its categories and physiological facts, cerebral or other. It does not undertake, but sedulously avoids, hypothetical explanations of any sort. It simply scrutinizes the direct appearances, and endeavors to combine minute accuracy with the broadest possible generalization. The student's great effort is not to be influenced by any tradition, any authority, any reasons for supposing that such and such ought to be the facts, or any fancies of any kind, and to confine himself to honest, single-minded observation of the appearances. (*CP* 1.287)

Thus, Peirce is saying here that Phenomenology is purely observational, allowing for no speculation, no hypothetical explanations, no study of the correspondence of observed phenomena to any realities. As students of Phenomenology, we are not to be influenced by tradition, by authority, or *apriori* reasons for supposing one thing or another about whatever we observe. We are to confine ourselves *to honest single-minded observation of the appearances*.

Have you ever tried to do what Peirce suggests here? If so, you will know how difficult it is to do. Yet, this capability—the capability to observe closely and without judgment—is the most important skill in the *reasoning readiness* arsenal. Semiotic skill development relies upon this foundational skill. We cannot analyze what we do not notice. We cannot think about what we don't know that we don't know. Thus, sharpening observational skills is the first task of semiotic skill development.

Astute phenomenological observation requires—a) the capability to identify multiple layers of qualities in a single phenomenon—including those of affect, sense, and reason; b) the ability to notice subtle patterns of action and reaction; c) the capability of freeing oneself (however temporarily) from the shackles of judgment and preconception when apprehending and re-apprehending signs and their contexts. Developing the capability for astute phenomenological observation is the most fundamental aspect of semiotic skill development. Without this capability, nothing else works properly.

Phenomenological observation feeds the next branch of Philosophy, Normative Science, which Peirce labeled as such because this branch includes the three traditional divisions of Philosophy that he identified as providing specific norms (or standards) for their performance: Aesthetics (the science of ideals); Ethics (the science of right and wrong); and Logic (the science of deliberate thought).

Normative Science

A) Aesthetics

The fact that Peirce placed Aesthetics not only within the category of Normative Science but also as a source of fundamental principles for both ethics and logic, may seem puzzling until we consider the placement of Aesthetics as the first branch of philosophy following Phenomenology. Although Peirce identified Aesthetics variously as the science of the admirable and the science of ideals, we might also think of it as the first branch of Normative Science in which the observations of Phenomenology express in relationships of one kind or another. Aesthetics is the first place where we might begin to make connections among the kinds and qualities of the phenomena that we observe. In this sense then, Aesthetics—for which Peirce would have sentiment (feeling or affect) guide decisions—provides the most immediate norms from which to respond to observed phenomena.

However, the norms of aesthetics are not the norms of good and bad; right and wrong—they are the norms of admirable impulses, of affect, of feeling—of *pure play*, which *obey the very laws of liberty* (*CP* 6.458-461). Such apparently non-normative norms are very difficult to conceive unless we consider that their fundamentals are informed by the three categories of Phenomenology, which are themselves informed by mathematics. And, how might *pure play* and the *very laws of liberty* be mathematical? Too much to discuss here, but this writer's next book, currently in preparation, will provide algorithms for abduction, as the logic of play (Chiasson and Tristan *in preparation*).

If we allow Peirce's contention that feeling is the first, or immediate, state of being and that Aesthetics is mediated by feeling, we need not even think about specific Aesthetic norms to realize that they must have some importance to *reasoning readiness*. However, as delineated for semiotic skill development, Aesthetic norms are neither recipe-like nor artistic. Rather, they have to do with levels of competency for non-verbal expressions of the same sorts of skills that comprise good reasoning—especially abduction (Chiasson 2005a).

A well-designed *reasoning readiness* program is spiral in nature, always spiraling back to a beginning-like position and through a middle level again—whether at another level or for review. However to do that, one must know where a beginning is…and a middle. Which skills must one have to develop the next? Semiotic skill development is not linear; nor is it necessarily tied into reading and math skills, even seriously learning disabled children can benefit from semiotic skill development. This aesthetic core is essential to effective curriculum development and is as essential to learning as math drills.

Thus, semiotic skill development begins with phenomenological observation and introduces thinking about the categories through the Normative Science of Aes-

thetics—aiming toward a particular non-verbal aesthetic norm of abduction that parallels abductive reasoning (Chiasson 2005a).

B.) Ethics

Ethical self-control, which Peirce identified as the mirror for logical self-control, requires that one knows the right thing to do and then does it. Peirce did not equate Ethics with specific moral or religious norms and standards, but rather with having a basis and a method for making Ethical judgments and acting deliberately. *In all their features*, he wrote …logical *self-control is a perfect mirror of ethical self-control—unless it be rather a species under that genus* (*CP* 5.419). Elsewhere, Peirce said

> The machinery of logical self-control works on the same plan as does moral self-control…. The greatest difference, perhaps, is that the latter serves to inhibit mad puttings forth of energy, while the former most characteristically insures us against the quandary of [*a man of indecision*]…. In moral life we are chiefly solicitous about our conduct and its inner springs, and the approval of conscience, while in intellectual life there is a tendency to value existence as the vehicle of forms…. It appears to me that in the present state of our knowledge a sound methodeutic prescribes that, in adhesion to the appearances, the difference is only relative and the demarcation not precise (*CP* 5.440).

Peirce is very clear, therefore, that Logic as well as Ethics concerns deliberate conduct. The norms of Ethics delineate right and wrong conduct so that, just as Ethical norms determine how we should be judged for our conduct in society, so too Logical norms identify how we should be judged for our mental conduct—for our reasonings.

Peirce's Ethical norms do not reflect the specific criteria of a particular religion, society, or moral code (*CP* 8.138). Instead, like Aesthetic norms, Ethical norms rely upon method informed by sentiment that is driven by admirable impulses; im-

pulses gleaned from Aesthetics, informed by phenomenological observations, and measured against both potential and actual consequences. Ethical conduct is deliberate conduct—conduct that has been well considered and chosen after due diligence.

Children need not be preached at to learn how to make ethical decisions. Unlike immediate experiences of sentiment, decisions of right and wrong (as well as good, better, and best) are the first decisions children make that are evaluative. (Notice, the word here is *evaluative*—not relative. As his placement of Ethics into Normative Science should attest, Peirce is not a relativist.) In addition to the typical ethical problems (what to do with a found wallet, how to treat handicapped people, etc.), students of all ages can learn critical examination skills for the so-called soft-sciences.

Even very young children can use Peircean methods to explore ethical issues. For example, Dr. Seuss' book, *The Lorax*, provides a starting point from which to examine affective traits, such as greed, ugliness (following environmental degradation), hope, and possibility (in the form of a little boy holding a seed). Sensory qualities abound in this story, such as the truffula trees *color*, silky *texture*, and butterfly milk *smell*. Teachers may have to assist little ones as they discover rational qualities, such as cause/effect, space, location, magnitude, number, transformation, etc.

Following an exploration of qualities, even small children can begin to explore issues of character and context—they can begin to analyze, kindergarten style. If presented effectively, very young children can even come to understand the larger issue of matrix; the seemingly invisible elements as diverse as character and weather patterns that might affect (have affected, continue to affect) a situation—such as, "What do you think might have made the Once-ler so greedy?"

The question "What does it mean to be greedy?" bridges the lower impulses of affect, with higher ones and places these against difficult decisions of Ethics. If Aes-

thetics is to provide *admirable impulses* to direct Ethics and Logic, where do less than admirable impulses, like greed, take us? Ethics is the place from which students of all ages can begin to examine the laws of cause and effect.

C) Logic

Some scholars like to pluck Logic out of Peirce's architectonic in much the same way an old watchmaker wields a pair of tweezers to pluck out one set of gears from the complete workings of the watch. True, Peirce's watch does not run without this set of gears called Logic, but as we have discussed, this set does not work alone. The main gear, Mathematics, guides it; Phenomenology, its principles moved by Mathematics, then affects Normative Science—so that first, Aesthetics and then, Ethics inform Logic.

Peirce once wrote: *Logic, in its general sense, is, as I believe I have shown, only another name for semiotic* (CP 2. 227). Some might therefore argue that the entire branch of Logic should carry the name *semiotic*. However, Peirce himself did not name it as such, when, in his classification of the sciences he named Logic as the third of the Normative sciences and defined it as*…the science of the general laws of signs* (*CP* 1.191)*…*, separating it into three branches, which each depend upon the one before.

1. *Speculative Grammar, or the general theory of the nature and meanings of signs, whether they be icons, indices, or symbols;*
2. *Critic, which classifies arguments and determines the validity and degree of force of each kind;*
3. *[Speculative Rhetoric], which studies the methods that ought to be pursued in the investigation, in the exposition, and in the application of truth. Each division depends on that which precedes it.* (*CP* 1.191)

Speculative Grammar is more commonly referred to as Semiotic. While it may seem discordant with Peirce's statement that *logic is only another name for semiotic* to term this first branch Semiotic, keep in mind that each of these branches feed into the ones that follow. Merely by nature of its position as the first branch of logic, Speculative Grammar as Semiotic governs both of the other branches of logic, making all of logic Semiotic.

Critic is usually referred to as Logic Proper, or traditional logic; Speculative Rhetoric as Methodeutic.

Although these sets of semiotic skills to be laid forth here derive primarily from Peirce's phenomenology, aesthetics, and the first section of his logic, they are also a method for eventually demonstrating the viability of abductive reasoning and, thus, of his methodeutic. For, regardless of natural inferencing style (Chiasson and Tristan *in preparation*), an individual who receives sufficient training in semiotic skill development should be able develop the capability to deliberately operate retroductively, regardless of his or her natural inferencing pattern.

For example, retroduction begins with the recognition and observation (*qualifying*) of an interesting or surprising fact and the evolution of a hunch (by means of *relating*) that might explain that fact (as demonstrated by *representing* that hunch by means of signs). When combined with effective analysis and testing skills (developed during semiotic skill training) individuals develop a habit for thoughtful engagement with the world and ideas. Perhaps a society, for which semiotic skill development is ubiquitous, might one-day approach selections of facts, beliefs, and politicians in very different ways than occurs today.

Isn't semiotic skill development just critical thinking with another name?

No. Developing core semiotic skills are *precursors* to gaining the capability for engaging critical thinking skills. Much of the frustration educators feel over the inabil-

ity or seeming unwillingness of students to apply critical thought in their classes may well be that these students lack the core capabilities underlying such thought.

Moreover, anyone who has encountered a well-known scholar expounding carelessly outside his/her subject area might suggest that semiotic skill development is sometimes a remedial course that even some very well educated people may need.

Therefore, although semiotic skill development does not deal with Logic Proper or Methodeutic *per se*, it will affect an individual's ability to learn and apply critical thinking capabilities based on these skills—what Peirce termed *right reasoning*. Remember, the goal of semiotic skill development is *reasoning readiness*—preparing individuals to learn how to think critically, not teaching them how to do so. Thus, the focus for semiotic skill development in the division of Normative Science is semiotic, addressed in this article following the explanations of qualification and analysis skills.

Semiotic Skill Development[1]

Semiotic Skills

Before attempting to answer the question, *What are semiotic skills?* we might best turn to the caution that poets offer. One should never ask of poetry, *What does a poem mean?* but rather *How does a poem mean?* Semiotic skill development is much the same—it focuses upon *how* signs mean, rather than solely upon the meaning of those signs.

[1] **Note:** The organization and divisions for this section derive from the Peircean-derived work of Albert Upton—primarily from *Creative Analysis* (1961), which is the workbook he co-authored with Richard Samson. This section is neither a scholarly report nor a product of scientific research. Rather, it is a brief and very general discussion of each aspect of semiotic skill development program as it might apply in education. As this is a general essay with text limitations, there are no specific lesson plans/methods included.

Thus, although semiotic skill development at times concerns both *whats* and *hows*, the greater emphasis is upon *how*. Specific content and subject-matter skills are important, but semiotic skills are content-less. They are core level skills, which parents and preschool teachers can introduce to very young children and teachers at other levels (including college professors) can require as mastered skills of their variously able students. Language is a vital part of semiotic skill development. By means of this system, students develop a rich vocabulary for naming what they learn to observe, analyze, and interpret.

What are semiotic skills and why do they matter?

Semiotic skills relate to the deliberate deciphering and manipulation of each of Peirce's three phenomenological categories of being: quality, relation, and representation. In terms of skill sets, we are dealing with patterns of actions. Therefore, these categories are most correctly referred to in verb form: 1) qualifying, 2) relating, and 3) representing and interpreting signs. Below is a more thorough breakdown of these skills adapted from Upton and Samson's *Creative Analysis* (1961).

Basic Semiotic Skill Sets

There are three basic semiotic skill sets, which are practical expressions of Peirce's three phenomenological categories: quality, relation, and representation (*CP* 2.418-426). By mastering these skill sets along with a rich vocabulary of qualitative language that accompanies them, students should be able to operate confidently within a variety of subject areas.

1. **Qualifying**: identifying, sorting, and generating qualities of affect (feeling), sense, and reason.
2. **Analyzing**: performing descriptive and working analyses—including classifications, part-whole analyses (structures), and systems (operation) analyses.

3. Representing and Interpreting Signs

A) Signs: Identifying types of Signs—icons, indications (indices), and symbols; demonstrating their significance for interpreting/ communicating meaning

B) Context and Matrix: understanding how context shapes the meaning of given content (This skill can be demonstrated by interpreting and generating alternative interpretations of a given subject or situation.) Recognizing that the larger matrix surrounding subject and context can morph or shade meaning.

An important thing to keep in mind is that regardless of the early ages at which these skills can be introduced, none of them is a once-and-for-all skill, to be learned and safely tucked away until time for quick review. The nature of semiotic skill development is spiral—always circling back to an age-appropriate beginning-like expression of that skill and through a middle again—applying developmentally appropriate subjects and methods. Although they need not consume a curriculum, semiotic skills require ongoing reinforcement and refinement if they are to produce learners with the *reasoning readiness* levels necessary for an educable population.

Regardless of grade or ability level, it is always best to initially introduce these skills non-conceptually—that is, with concrete, experiential exercises. No harm to learning comes from letting students—especially secondary and college-level students—know the purpose of semiotic skill development. Older students might benefit from taking before and after aptitude tests as a way of measuring skill development.

1. Qualifying

Following the pattern of Peirce's organizational hierarchy (for which preceding classifications inform fundamentals of following ones), the qualifying portion of

semiotic skill development begins with affective qualities. The development of *Emotional Intelligence* (Goleman 1996) as well as Peirce's *admirable impulses* (the aesthetic norm that drives ethical conduct) hinges on this fundamental capability for identifying and naming affective qualities and the states they identify.

Affective Qualities

The table below identifies some words describing affective qualities; certain ones more or less appropriate depending upon grade levels. As you can see, some of these words, such as *happy* and *glad* • *angry* and *mad*, are nearly symmetrical synonyms. However, others provide opportunities to explore gradations of affective meaning.

figure 2

JOYFULNESS	happy pleasant glad contented	gratified delighted thankful open-hearted	ANGER	angry mad furious heated	indignant wrathful revengeful enraged
LOVE	loving affection warm tender	devotion liking compassion selfless	SORROW	sad sorrowful grieving regretful	mournful lamenting anguished woeful
DESIRE	wanting hoping aiming	yearning longing craving	HONOR	admire grateful favor	regard esteem respect
HAPPINESS	happy fulfilled content	gratified complete satisfied	FOCUS	concentrate center direct	dedicate apply intense
AWE / WONDER	amazing wondrous strange majestic sublime	profound sacred marvelous strange incredible	LOVELY / UGLY	beautiful attractive graceful impressive stunning	offensive disgusting ugly vile grotesque
BORED	tired vacant drained blank	void empty-minded weary jaded	GREEDY	selfish eager gobbling piggish	grasping self-seeking materialistic dissatisfied

For students to be affectively intelligent, they need an understanding and experience of the range between good and bad feelings; the range between beautiful and ugly surroundings. They should understand that there is a range between boredom and intense focus.

Admirable impulses, a reasonable consequence of affective intelligence, provide the cornerstone of Peirce's Normative Science. *Love*, Peirce once wrote, *recognizing germs of loveliness in the hateful, gradually warms it into life and makes it lovely* (*CP* 6.289). He proposed his overall philosophy, including logic was guided by evolutionary love (*CP* 6.287) and that his pragmatic test for science and for all conduct was nothing more than a rephrasing of the injunction *by their fruits ye shall know them* (*CP* 5.465).

Some of the affective words in the preceding table might afford discussion as to whether a term even belongs within its stated category. Does *contented*, for example, belong within the category of joyful? Might there be good reasons for keeping it there? For removing it? Might contentment be a joyful state for some people, but not others? Are *joy* and *happiness* so closely related that they belong as one category? Or, is there a kind of *joyful* happiness that is different from other kinds of happiness? Are there other affective categories and/or qualities that should be added to those listed in the table?

Sensory Qualities

Unlike qualities of affect, sensory qualities are semi-rational—*semi*, because even though their apprehension is empirical in the sense of being objective and observational, they are not mediated by judgment. *This pan is hot* is a realization determined by a brute encounter between someone's sense of touch and a hot pan. A response is forced upon that person; no act of reason need intervene. Below are a few examples of qualities that fall within of each of the sensory categories:

figure 3

VISION	Color red blue, etc.	Brightness light dim dull	SKIN SENSE	Touch tickle itch tingle	Temperature hot cold cozy
SMELL	fragrant fetid aromatic	stink sweet bouquet	BALANCE	leaning stable poised dizzy	
TASTE	sweet sour salty savory	delicious delectable bitter acid	MUSCLE SENSE	squeeze hug jam press push	heavy strain stretch twist pull
HEARING	Tone shrill deep brassy	Intensity loud soft piercing			

Sensory qualities are the qualities of engagement with the world: *chirping* crickets, *red* balls, *fuzzy* blankets. These are also the qualities of the practical arts and sciences: art, music, experimental science, medicine, architecture, engineering, etc. Helping students to develop the capability to read the signs of nature and of culture is arguably a vital task for the overall goal of helping them to develop semiotic awareness. However, the importance of developing sensory qualification skills pales in comparison to helping students hone their affective qualifying skills. Remember, according to Peirce, everything having to do with right reasoning depends upon a person's capability to produce admirable impulses. Only admirable impulses deliberately acted upon by right conduct, and tested both by imagination (plans) and by consequences (…*by their fruits*…) can be considered right reasoning. If Peirce is correct, students who develop the best affective skills—along with good analysis skills—should be able to, with proper training and encouragement, develop into good reasoners.

Sensory qualities are easier to deal with than affective ones for many students and teachers for several reasons:

- Sensory experiences are concrete. Sensation is the way that we physically react with our inner and outer worlds. Everyone experiences similar sensory experiences.
- Sensory qualities are empirically verifiable; they provide reliable feedback when we test them.
- Sensory qualities can be expressed in practical ways, enabling us to see (feel, smell, taste, hear, etc.) results of our enterprises.

While feelings are immediate and diffuse, sensations are reactive and clear. Although two people can see the same movie, yet not agree that it is funny, those same two can touch a hot pan and agree that it is hot; see a yellow balloon and agree it is yellow, etc.

Children who display natural aptitudes for art, music, science, or mechanics often have highly developed capabilities for reading the sensory systems that feed into that particular field. Because they notice sensory details that may slip by others, teachers may celebrate their seemingly prescient awareness as a mysterious factor in the make-up of talent or intelligence. Although true that sensory sensitivity is a factor in learning capabilities and creativity, sensory awareness is a teachable skill and one that should be emphasized at all grade levels. Just as semiotic skill training provides tools for learning how to *read* and label feelings, it also enables students to develop a rich vocabulary (both verbal and non-verbal) for *reading* and labeling sensations.

Logical Qualities

Logical (or rational) qualities highlight comparisons and judgments; they place things into relationships with one another. Just as affective qualities suggest the immediateness of feelings and opinions and just as sensory qualities indicate the clear, reactive responses that our senses provide, logical qualities are a step re-

moved from experience. These are qualities of clarification, mediation, and reflection. For example, if we say *red* house (*red* is a sensory quality we can quickly conjure up almost without thought), then add a logical quality of number—*A red* house… or *Three red* houses… we have greater clarity. *A small red* house located *in the center of the* block….provides even more clarity. Below is a table of common logical qualities:

figure 4

NUMBER	a, an, one, three, last, some, all, none, few hundred, first, many	TIME	duration, moment, interval, instant, second, minute, hour, day, year, now, hour, day, year,	now, past, present, between, future, then, when, long, short, during, after, before,	early, late, still, since, hour, day, year, now, past, present, between, future, then, when, long, old/ new*
SIZE	little, tiny, miniature, big, large, huge, mammoth,	long, short, high, tall, slim, wide, narrow	SPACE (*includes all prepositions*)	direction, orientation, position, location, among, in, up, down, on, between, of, off,	far, near, North, here, there, out, over, under, right, left, upside down
SHAPE	contour, form, figure, straight, angular, round,	organized, interrelated, spherical, square, bent, oval, spiral	CHANGE	modify, alter, transform, vary, affect, improve, cause, effect,	old/new*
MATTER* /ENERGY*	sand, steel, iron, metal, light, electricity,	water, liquid, paint, dirt, alcohol, glass, air,	COMPLEXITY	simple, easy, child-like, difficult, complicated, fractal-like, entropic,	intricate, incomprehensible, sophisticated

As for the other qualification categories, students might have valid arguments for or against particular words belonging within certain logical categories. For example, do the concepts of old and new belong within the category of time…or change? Might there be valid reasons for placing them within both categories? Might they belong somewhere else altogether? Additionally, the categories above are not the only ones that might be included for logical qualities; others might be elasticity, opposition, generality, etc.

You may notice that the matter and energy items appear to be physical things instead of qualities or attributes of things. However, when you think of them as modifiers, their qualitative nature pops right out; for example, think of a "steel beam" or a "glass jar."

2. Analyzing

Analyzing skills build upon qualifying skills since qualities are the factors used to sort things. For example, suppose I have a pile of laundry in front of me. I am going to sort that laundry in a particular way, depending upon the qualities of whatever is in my laundry bin. My first sort is always *dark – light*, which are sensory qualities. I have a special function on my washer that reads *whitest whites*. It washes clothes in very hot water and rinses them twice; I do not put light clothes that might shrink into the hot water load—thus, temperature, another sensory quality, is my next sorting factor. Then, I attend to the dark load and the process continues.

Now, while the above is a trivial example, understanding qualities and their use as sorting factors is very important for developing effective analyses. The teaching of analysis skills can begin at a very young age. Teachers might recommend to parents that children learn how to sort by helping with household chores: putting away the silverware, helping to sort laundry and put away clothes; helping dad sort tools. Children might learn to put away their own toys and re-organize them into new categories.

Sorting, classifying, and categorizing are the analysis skills that even very young children should be learning—and which educators and early childhood game makers have been doing a good job developing. However, since those programs lack qualitative skill development, which is a vital skill for generating independent analyses, children are not learning all they need to know from early childhood sorting programs. Thus, however much young children learn how to sort, without

learning qualifying skills, they will not gain the skills they need to set up sorts—the skills necessary for even the simplest acts of critical thinking.

Older students should learn how to create at least three distinct types of analysis: classifications, part/whole analyses, and systems analyses.

a) Classifications

There are two types of classifications: descriptive and working. Whether students learn the term for it or not, students correctly using either type of classification automatically become categorically consistent, something every English and logic teacher in the world will celebrate. *Descriptive analyses* begin by the student sorting items into categories defined by sorting factors (again, always qualities) that separate given items and eventually accommodate all of the items. This same process works for sorting collections of facts into consistent categories to produce topical outlines. *Working analyses* include categories for incomplete data. Learning to develop this latter kind of analysis teaches students to be aware of what they do not yet know, of obvious importance for critical thinking.

b) Part/whole analysis

Part/whole analyses are familiar to anyone who has ever worked with blueprints, directions for putting toys together, and diagrams of any sort. These kinds of analyses are concrete in nature: blueprints for a new building, a diagram of hand, a map…etc. Students who learn to read and create part/whole analyses will have advantages in several areas. Structure analysis can be introduced to grade school aged children to help them diagram a leaf for science class, create plans for a diorama, or to measure out the plot for a class garden and figure the planting design, etc. High school and college age students wrestle with structures in mathematics, biology, social studies (maps), and vocational classes. Training in structure analysis will make their experiences much more effective and memorable.

c) Systems analysis

System analyses involve structures moving through time and space. Although anyone can name simple examples, such as daily schedules and putting on a prom, systems analysis is the most complex of all three forms. It also incorporates the other two types of analysis into its chronology.

Even very young children can learn about systems analysis by studying the life cycle of the butterfly and other natural or seasonal events. Grade school aged children can be introduced to more complex scientific systems, such as weather patterns. Certain games teach systems analysis strategies—chess being one of the best games for teaching strategic thinking, a kind of systems analysis. The New York Times (20. 3, 08) reports an unusual pilot program in Idaho for which second and third graders are being taught how to play chess. In the fall of 2008, this program will be extended to all second and third graders in the state.

Of course, we want older students to be able to wrestle effectively with systems—including historical timelines, relationships among plot/sub-plots/and character development, chemical interactions, biological systems, and mathematical equations to name a few. Providing students with the powerful tools of system analysis will not guarantee their success in the *real* world as well as school, but it does increase their odds.

3. Representing and Interpreting Signs

For many, this set of semiotic skills may seem to finally deal with the *meat and potatoes* of semiotics—that is to say, these are the skills most people think of when semiotics is mentioned. However, the reason so much time was expended on explaining the connection of Peirce's Classification of the Sciences to semiotic skill development was to emphasize the point that the *underlying* skills of qualifying and analysis are essential to the development of right reasoning. It makes no sense for educators to teach *about* semiotics, which this last section does, and not en-

gage students in the practical expression of the semiotic skills that underlie and embody these. Doing so only graduates regurgitators with a new topic to regurgitate and does not contribute to the *reasoning readiness* level of the population.

a) Identifying types of signs:

Students at all levels can learn how to identify types of signs: *icons*, which represent the thing they stand for; *indices*, which are indications of something, such as smoke being a sign of fire or a cough being a symptom of a cold; and *symbols*, which must have an agreed on sense to have meaning.

Learning to read different types of signs correctly is, of course very important. Icons, or representations, are the least ambiguous because they look, sound, or smell like the thing for which they stand—the male/female icons on public toilets; a digital recording; the perfume scent from a scratch and sniff sample in a magazine.

Students can learn that misinterpretations begin to arise when *indices*, or *indications*, come into play. Once they understand that *indications* are the raw material of both superstition and science, most will begin to see the paradox. Strange weather might point to God's punishment for the non-rational person and possible climate change for the rational one. A family's yearlong bout with infections could point to any number of causes to the non-rational person (punishment from God, bad luck, bad karma, not enough wheat juice) and cause a rational medical investigator to look for pathogens, such as mold, that might keep infecting a whole family. Students who learn how to go about reading indicative signs correctly are less likely to jump to foolish conclusions and more likely to develop reasoned approaches to arguments.

Symbols are, of course, the raw materials of learning. Once students understand that symbols function in many ways, including as icons and indices, once they understand the origin and function of *live* and *dead* metaphors, of paradox, and the

use of language to communicate affect, sense, and reason, they will have a remarkable set of tools for writing and literary analysis. Upton (1961) used language and other symbols for developing each of the semiotic skills; students completing his graded exercises developed much greater abilities to use and interpret language.

One of the important lessons when learning about types of signs is the problem of *ambiguity*. Depending upon the make-up of the students with whom they are dealing, educators can begin to introduce the problem of ambiguity at a young age. Helping students to come to terms with ambiguity is a valuable gift that will open minds and enable them to engage critical thinking skills as these are introduced.

For students with linear reasoning patterns, of which there are many (Chiasson, Malle, Simmons 2003), the problem with misreading signs and the inability to recognize ambiguity increases as they become older. Much of what high school and college teachers complain about in terms of rigid thinking by their students may well be stemming from this inability to recognize ambiguity. Maybe those who master this concept of signs and ambiguity at a young age will be more likely to have developed the necessary flexibility to engage in critical, rather than literal, thought.

b) Understanding how context and matrix shape meaning

Just as a sentence provides the context for a word, affective, sensory, and logical settings provide contexts for events and experiences.

Young students might learn to explore contexts by thinking about the difference between a bee outside getting nectar from a flower and a bee buzzing frantically in their living room; meatloaf and mashed potatoes for breakfast or for lunch; reading lessons in the classroom or under a tree in the schoolyard. How might context change their feelings about the thing or event? Might context change the sensory experience or the logical effects—e.g. location: *Do you think you would learn as*

much from a story if we read it under the playground tree as you would if we read it in the classroom? *What might be the same*? *What might be different*? Answers here can be left open-ended or empirically tested.

Although we may express *meaning in words*, most experiences are non-verbal to begin with. We observe, create, respond, judge, determine, select, reject, prioritize, and solve problems non-verbally. Whether or not language and other symbols are used as tools of an experience depends upon the nature of the experience. Johanna, the artist, may use only brushes, canvas, and paints as the tools of her artistic experience; Ted, the dancer, may use only his body; Susan, the system's analyst, may use numbers and other symbols; Louis, the writer, may use only words. Any of them may or may not use a particular type of tool depending upon the purpose of an activity.

However, whether an activity is verbal or non-verbal, the meaning of the word or activity is created or comprehended using the same criteria. The purpose of helping students to become semiotically aware is to help them understand how we make and interpret meaning by making relationships among things in particular ways.

For the sake of clarity, Upton (1973) gave a new set of names to Peirce's categories based on their function: content, context, and matrix. Matrix, which corresponds to Peirce's concept of ground, refers to the overarching situation of an experience usually defined by its purpose. In the case of an experience, a matrix is everything else in the universe other than the content and its context. The context is the specific situation in which the experience occurs; the content of the situation is whatever sign we are seeking to create or understand.

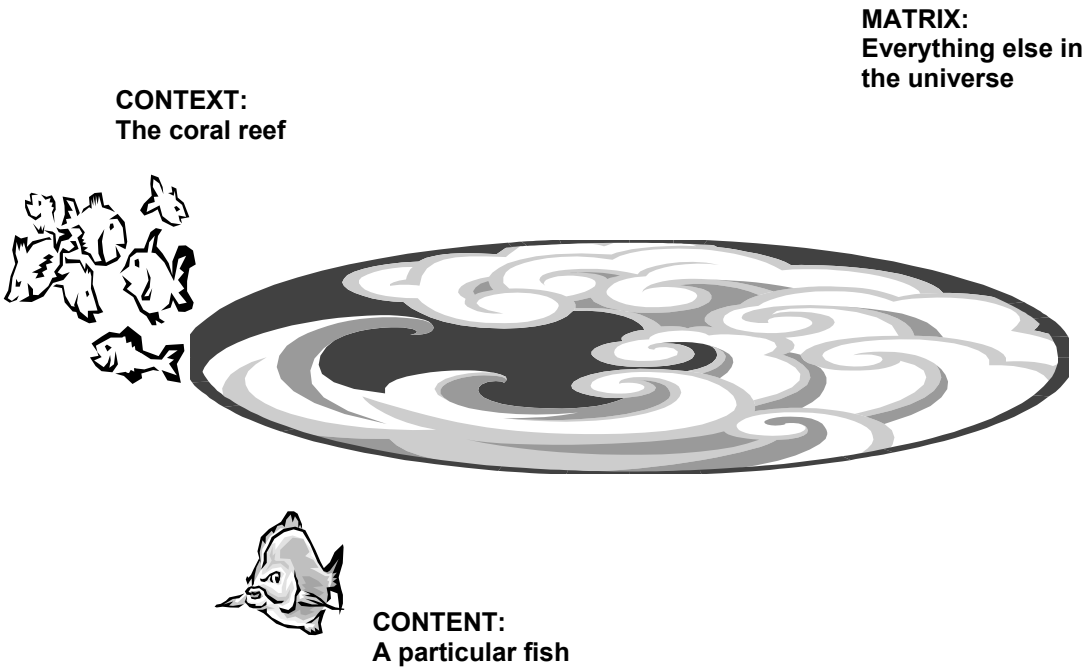
Peirce pointed to this division of content, context, and matrix in the following passage (Rosenthal 1994, pp. 5-6):

> I must first point out the distinction between a Fact and what in other connexions, is often called an…Occurrence. An Occurrence, which Thought analyzes into Things and Happenings, is necessarily Real; but it can never be known or even imagined in all its infinite detail. A Fact, on the other hand is so much of the real Universe as can be represented in a Proposition, and instead of being, like an Occurrence, a slice of the Universe, it is rather to be compared to a chemical principle extracted therefrom by the power of Thought; and though it is, or may be Real, yet, in its Real existence it is inseparably combined with an infinite swarm of circumstances, which make no part of the Fact itself. It is impossible to thread our way through the Logical intricacies of being unless we keep these two things, the Occurrence and the Real Fact, sharply separate in our Thoughts.

In this case, a fact is the content; an occurrence (or slice of the universe), the context; and the infinite swarm of circumstances, the matrix.

Students sometimes have an easier time understanding these concepts with a visual representation. Thus, one way of understanding the abstract ideas of matrix, context, and content is to think of a specific situation. Suppose the ocean is a *matrix* and a particular coral reef is a *context*. A particular fish in that coral reef might be the *content* (or symbol) that to be understood within that situation.

figure 5



The particular fish we have selected as the content of our situation has a relationship to things and events in and among its immediate context (the coral reef and the other creatures within that reef). However, it is easy to see that, although the fish is interacting with the elements in its context, it is also subject to influence by aspects of the larger ocean and universe that contains it. Temperature, nutrients, pollution, outside predators—many factors that exist outside this particular coral reef affect, and can change the situation inside that context. A student of marine biology might want to pull additional information from the matrix to study a particular fish, while a scuba diver might focus entirely on the affective and sensory enjoyment of the experience.

Thus, matrices, contexts, and contents can be viewed in many different ways. Every part of the ocean, coral reef, fish situation (*matrix, context, and content*) could be rearranged and viewed from a different perspective. For example, the coral reef could become the content, the ocean, earth, and all inhabitants the context and everything else in the actual universe, the matrix. An oceanographer might want to organize the situation in this second way to study the effects of pollution on coral reefs.

Traditional methods for ecological study (Ford 2000) provide an excellent format for applying this Peircean method for understanding signs in contexts In educational settings for older students, exploration of meaning and context can be embedded in nearly all subjects.

The Missing Skill Sets

Two other skill sets, analogizing and defining, have been left out of this discussion. These are more advanced skills than the other three and, while interesting and valuable, are not necessary for helping students to develop *reasoning readiness*.

Comments and Summary

If we agree that Peirce's semiotic delineates the best in formal reasoning, then this program, which trains minds to read and respond to each of Peirce's three categories (fundamental to his logic), should also bring students to the point of readiness for learning how to engage in formal reasoning. In other words, it brings them to the point of *reasoning readiness*. In particular, by approaching *reasoning readiness* by way of Peirce's three categories, students are led directly into Peirce's concept of *right reasoning*–reasoning informed by admirable impulses (aesthetics) and conducted deliberately (ethics) with affect, senses, and reason engaged.

The three basic semiotic skill sets of qualifying, analyzing, and representing/interpreting signs can be introduced at any grade level; they can be taught by

means of any variety of subject matter. Educators interested in activities that they might adapt for their classrooms should refer to Albert Upton's *Design for Thinking* (1960) and Anne Upton's *Teacher's Manual for Design for Thinking* (1961). Unfortunately, *Creative Analysis* (Upton and Samson 1961) is out of print.

As for any new program, developing lessons requires extra effort on the part of already overworked teachers. Fortunately, processes for teaching semiotic skills can be embedded into interactive computer programs, leaving teachers free to focus upon subject area skills. Perhaps enterprising program developers might recognize the promise of this system and begin to develop software for students at various grade levels. The exercises developed by the Uptons for teaching and mastering these skills are entertaining and might be adaptable for computer games.

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