Chapter 5
The Semiotic Paradigm View of Theoretical Semiotics

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5.1 Abduction and Explanation

Peirce used the term "abduction" ambiguously for at least four different concepts throughout his working life. He only became aware of the full significance of this in his later years, for which he apologized profusely. One of his later uses of "abduction" was for the invention of abstract theory to explain the generals of nature and life. Peirce called this "reasoning to the best[1] explanation of the phenomena." This is the meaning of "abduction" that the semiotic paradigm focuses on.

Theory is arrived at by abduction from a set of known laws or other generals to a set of abstract principles that explain troth the known laws, the generals, and many new laws. Abduction carries us from signs with iconic structure to signs with full symbolic structure.[2] This allows for the development of abstract concepts, principles, theories, and their relations. A theory has the status of a tentatively best working hypothesis that explains the known laws.

5.2 The USST

The universal sign structure theory (USST) is the main explanatory tool of the semiotic paradigm. The standard version was adopted by the Semiotic Society of America's (SSA) Special Interest Group for Empirical Semiotics (SIG/ES) in 2000 and is therefore known as the USST-2000.[3] It replaces and slightly modifies an ear-

[1] In this context, "best" should be interpreted as "best available at this time," or "tentatively best."

[2] See Pearson (1991).

[3] See Pearson (2002b).

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lier version, called "USST-89." The USST is the static theory of sign structure for the semiotic paradigm, explaining the static structure of all signs. The dynamics of sign processes (often called "semiosis") depends on the USST for determining its boundary conditions and is explained by the theory of operational semiotics (TOS), discussed in Sect. 5.3.5.

Peirce is known for his three categories: firstness, secondness, and thirdness. It is not as well known, but he derived his set of three categories four times, in four different ways, with four different sets of meanings. The first set was derived phenomenologically (see Hausman 2008); the second set was derived metaphysically (see Colapietro 2008); the third set was derived logically, consisting of monadic relations, dyadic relations, and triadic relations; and finally, the fourth set stemmed from his experimental work, as noted in his laboratory books, while running his psychological experiments.

Peirce did not spend as much time and effort in explaining his empirical categories as he did for the other three category systems, but the empirical categories are essential for the development of a rigorous science of semiotics, including semiotic theory.

The terminology adopted in this chapter stems from the empirical categories. While the terminology remains the same, "firstness," "secondness," and "thirdness" lose their phenomenological and metaphysical meanings and take on meanings that are determined by semiotic experiments. For instance, whereas in the first three categorizations, firstness, secondness, and thirdness in semantic structure take on the same order: icon, index, and symbol; in the empirical categorization scheme they take on the different order of index, icon, and symbol. Other changes in meaning will be obvious as we proceed.

In Sect. 5.2.1, I present the details of the USST-2000, explaining the USSD and deriving some very elementary but important theorems on sign structure and sign classification that shows the intimate relation between the Peircean theory of empirical sign categories and the USST theory of sign structure. Then, in Sect. 5.2.2, I summarize a very few of the results of the USST, going far beyond the taxonomic science of semeiotic,[4] as Peirce regarded it. Finally, Sect. 5.2.3 presents some conclusions and recommendations for future research.

5.2.1 The USST-2000

5.2.1.1 Background

This theory came to be called the universal sign structure theory, or USST, for short, since it claimed that it could explain the meaning structure, the information structure, and all other forms of semiotic structure of any kind of message, text, or com-

[4] Peirce's favorite spelling.

munication. These original goals gradually expanded over the years as the USST met with ever increasing success.

The USST is an abstract theory whose purpose is to explain the nature of semiotic laws and to aid the understanding of all semiotic reality. It can be described logically as a result of Peirce's abduction process. A sign is an abstraction and hence cannot really exist in the positivistic sense, but if it did exist, that would explain…(insert here whatever semiotic law, effect, or phenomena you are trying to explain)…, and then apply the USST to derive that law, effect, or phenomena. The derivation is the semiotic explanation of the law, effect, or phenomena.

The USST may be considered a development, an outgrowth, or an expansion of Charles Peirce's taxonomic theory of semiotics (called "Semeiotic Theory"). The reason for this is that throughout our investigations, we have had occasion to use several different taxonomies, or classification schemes, for signs. Of these, only the classifications by Peirce (1866–1892, 1866–1910) have proved to be satisfactory in every empirical setting for which a classification was wanted. We therefore ascribe the Peircean scheme an empirical reality, and would like our theory of sign structure to explain the applicability and usefulness of the Peircean classification scheme in terms of the structure of the sign. This is accomplished by the first nine theorems of the theory.

However, the USST goes beyond the Peircean science in that it provides not only a taxonomy but also a systematic method of explanation. For instance, in Sect. 5.2.1.3.1, we show how the USST motivates and explains Shannon's communication model. Most textbooks present this as an unmotivated, unexplained starting point. The USST thus brings Shannon's information theory firmly into the fold of semiotics.

5.2.1.2 Development of the USST

The guts of the USST are embodied in the USSD. The standard version, called the "USSD-2000," is shown in Fig. 5.1. The theory is universal in the sense that it displays the structure of all categories of signs. To show how this diagram explains the Peircean taxonomy, we must first state the following three principles of the theory:

The Representation Principle *A sign must consist of a triadic relation, and it must signify*. A sign, therefore, consists of three relational dimensions: a syntactic structure, a pragmatic structure, and a semantic structure.[5]

The Principle of Internal/External Balance *The internal and external structure of a sign must be balanced, consisting in the syntactic and semantic dimensions of exactly one external component for each internal component and vice versa, and in the pragmatic dimension of exactly two external components for each internal component*. The external components are called "information generators"[6] and the

[5] These dimensional names were given by Charles Morris, although his concept of *dimension* was off-base.

[6] A later development proved that every information generator is also an abstraction generator.

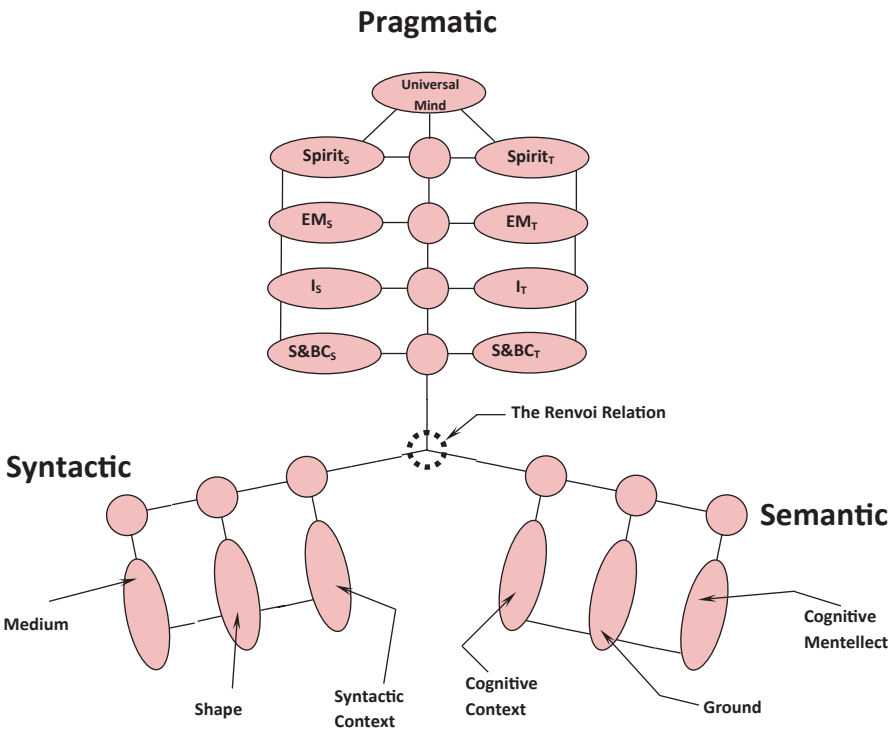

Fig. 5.1 The USSD-2000

internal components are called "components of meaning." The two external components in the pragmatic structure are required because of its dual mediating role between the syntactic and the semantic structures and also between the source and target interpreters. The two components belong to the source and target structures, respectively.

The Principle of Additional Structure *Whenever a sign has more than the minimum structure, the additional structure is built up from the center out (as per Fig. 5.1), and for each dimension independently*. This is consistent with Peirce's observation that there can be no thirdness without secondness and no secondness without firstness.

Using the USSD of Fig. 5.1 and these three principles, we can now explain the Peircean taxonomy of signs by means of nine representation[7] theorems. Certain rules of interpretation or translation between the theoretical vocabulary and the observational (or less theoretical) vocabulary will become apparent as we proceed with the proofs of these theorems.[8] The rules of interpretation are obvious, and they

[7] Representation is used here in its mathematical rather than its semiotic sense.

[8] Now called the "subduction" rules. See Pearson (1991).

form an integral part of the theory. We first define the Peircean taxonomy.[9] We then give the nine representation theorems, and finally an example proof.

Definition 1 *A sign, whose being consists of an abstract quality both in itself and in its relation to other signs, is called a* "TONE".[10]

Definition 2 *A sign, whose being consists of a general kind, both in itself and distinguishable from other signs, is called a* "TYPE."

Definition 3 *A sign, whose being consists of an actual, single, physically existing individual, is called a* "TOKEN."

Definition 4 *A sign, whose interpretant represents it to its interpreter, as a sign of possible reference is called a* "RHEME."

Definition 5 *A sign, whose interpretant represents it to its interpreter, as a sign of fact or actual reference is called a* "PHEME."

Definition 6 *A sign, whose interpretant represents it to its interpreter as a sign of reason, is called a* "DOLEME".[11]

Definition 7 *A sign, whose object is related to its representamen by an actual, single, existential, cause, and effect relation, is called an* "INDEX."

Definition 8 *A sign, whose object is related to its representamen by a similarity in shape, is called an* "ICON."

Definition 9 *A sign, whose object is related to its representamen by an arbitrary convention, agreement, or general law, is called a* "SYMBOL."

We may now state theorems 1–9.

Theorem 1 *A sign is a tone iff it has exactly one level of syntactic structure.* It therefore has one component of syntactic meaning (tagmension) and one syntactic information generator (the syntactic context).

Theorem 2 *A sign is a type iff it has exactly two levels of syntactic structure.* It therefore has two components of syntactic meaning (tagmension and eidension) and two syntactic information generators (the syntactic context and the shape of the sign).

Theorem 3 *A sign is a token iff it has all three levels of syntactic structure.* It therefore has three components of syntactic meaning (tagmension, eidension, and onto-

[9] Strictly speaking, this will not be exactly the Peircean taxonomy, but an explication of it (in the sense of Quine (1960)) since the three classification schemes used by Peirce to define his sign categories are significantly changed, despite bearing the same names, due to a change in the concept of semiotic dimensionality (Pearson 1977a).

[10] It must be remembered that Peirce employed a great number of different and differing nomenclatures. The one adopted here was used in Pearson (1977a).

[11] Peirce's actual term was "deloam" from the Greek δελωμ.

sion) and three syntactic information generators (the syntactic context, the shape of the sign, and the medium in which it is embodied).

Theorem 4 *A sign is a rheme iff it has exactly one level of pragmatic structure.* It therefore has one component of pragmatic meaning (contension) and two pragmatic information generators (the source social/behavioral context of the sign and the target social/behavioral context of the sign).

Theorem 5 *A sign is a pheme iff it has exactly two levels of pragmatic structure.* It therefore has two components of pragmatic meaning (contension and purporsion) and four pragmatic information generators (the source social/behavioral context, the target social/behavioral context, the source interpretation, and the target interpretation).

Theorem 6 *A sign is a doleme iff it has exactly three levels of pragmatic structure.* It therefore has three components of pragmatic meaning (contension, purporsion, and emosion), and six pragmatic information generators (the source social/behavioral context, the target social/behavioral context, the source interpretation, the target interpretation, the source emotive mentellect, and the target emotive mentellect of the sign).

Theorem 7 *A sign is an index iff it has exactly one level of semantic structure.* It therefore has one component of semantic meaning (denotation) and one semantic information generator (the dynamic object of the sign).

Theorem 8 *A sign is an icon iff it has exactly two levels of semantic structure.* It therefore has two components of semantic meaning (denotation, and connotation) and two semantic information generators (the dynamic object and the dynamic ground of the sign).

Theorem 9 *A sign is a symbol iff it has all three levels of semantic structure.* It therefore has three components of semantic meaning (denotation, connotation, and pronotation) and three semantic information generators (the dynamic object, the dynamic ground, and the cognitive mentellect of the sign).

Proof of Theorem 1 By the representation principle and the principle of additional structure, any sign must have at least one level of syntactic structure and this must be the innermost or tagmatic level. According to the USSD-2000 (Fig. 5.1), the outermost syntactic level consists of the embodiment of a sign in a physical medium. But if a sign had an embodiment in a physical medium, it would exist as an actual, single, physically existing individual and could not exist merely as an abstract quality. It would be a token, not a tone; therefore, a tone cannot have an ontotic level of syntactic structure.

Also from Fig. 5.1, the second (or middle) syntactic level consists of the distinguishability of a sign by a shape. But, if a sign had a distinctive, distinguishable shape, it would exist as a concrete general, serving as an archetype for all tokens of the same type and could not exist, etc. It would be a type, not a tone. Therefore, a tone cannot have an eidontic level of syntactic structure.

Thus, a tone has exactly one level of syntactic structure, i.e., the tagmatic structure. By the principle of internal/external balance, this structure will consist of both one internal component and one external component. From Fig. 5.1, we see that the internal component is tagmension, the meaning component abstracted from the syntactic context, and the external component is the syntactic context, the syntactic information generator abstracted from the tagmatic level of syntactic structure—*QED*.

The other proofs are all similar and equally simple, but all nine proofs may be found in (Pearson and Slamecka 1977a, b;).

Some other theorems may easily be added to the above.

Theorem 10 *The sum of the number of syntactic and semantic levels must not be less than 4*.

Letting L_X stand for the number of syntactic levels and L_S stand for the number of semantic levels, this may be easily expressed as

$$L_X + L_S \geq 4.$$

Theorem 11 *The number of semantic levels must not be less than the number of pragmatic levels*.

If we let L_P stand for the number of pragmatic levels, then this can be expressed as

$$L_S \geq L_P.$$

This can be interpreted as saying that a term can be an index, icon, or symbol, but a proposition can only be an icon or symbol, while an argument must only be a symbol, an observation first made by Peirce.

The following four theorems assure that every sign must always be able to determine an interpretant.

Theorem 12 *Three-level syntactic structure generates syntactic recursion*.

Theorem 13 *The first three levels of pragmatic structure generate pragmatic recursion.*

Theorem 14 *Three-level semantic structure generates semantic recursion.*

Theorem 15 *The simultaneous and joint action of syntactic recursion, pragmatic recursion, and semantic recursion guarantee that any sign has the possibility of being interpreted at any time in the future*.

Many other theorems of semiotic structure may easily be derived from the above theory. These few were chosen as examples for their simplicity, clarity, and importance.

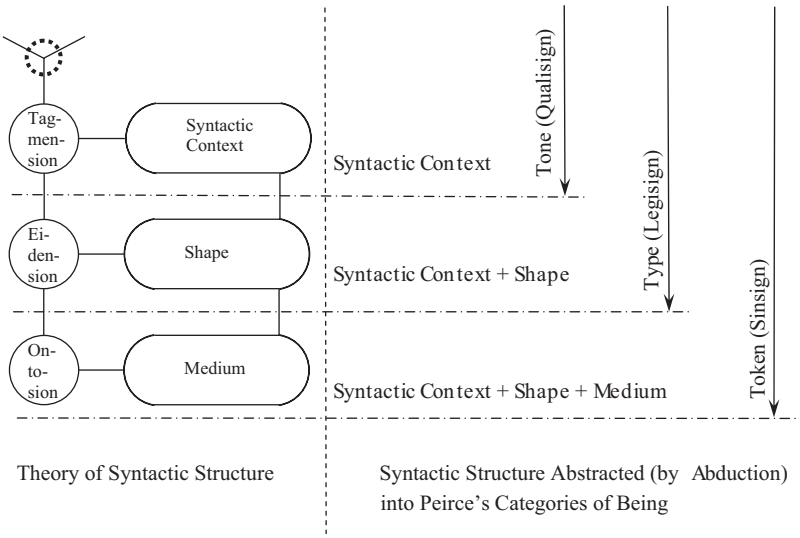

Fig. 5.2 The syntactic translation diagram

5.2.1.3 Syntactic Considerations

Many investigations into the structure of signs and information processes have been carried out using the language, concepts, and theory outlined above. Each investigation was selected for its ability to test and demonstrate the utility of the language and theory across as broad a range of basic information and semiotic processes as possible. We begin with examples involving only the syntactic structure. The translation between syntactic structure and Peirce's categories of being is shown in Fig. 5.2.

The USST predicts three levels of syntactic structure: ontotic, eidontic, and tagmatic. In the syntactics of natural language words, these levels may be identified with phonetics, morphophonemics, and tagmatics, respectively, although the details of this identification have not been explicated as yet. Instead, early efforts were concentrated on using this prediction to ground the statistical theory of syntactical communication within semiotics. The USST appears to offer the most natural explanation for this theory.

The Statistical Theory of Syntactic Communication Processes

In communication, we use actually existing, embodied signs (tokens) to carry out actual instances of communication. Communication thus requires the use of sign tokens; the syntactic structure of sign tokens is therefore our only concern in syntactic communication theory. Therefore, according to Theorem 3, the syntactic structure of a sign used in communication is represented by the diagram of Fig. 5.3. This is

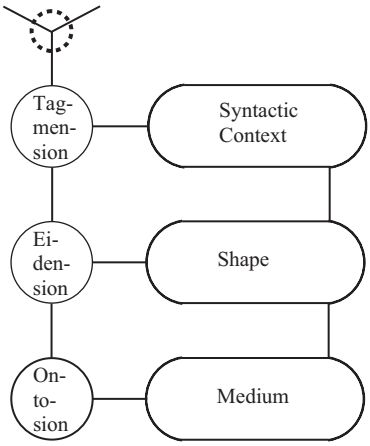

Fig. 5.3 The structure of communication

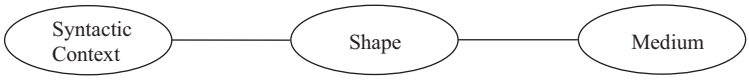

Fig. 5.4 Rotated external syntactic structure

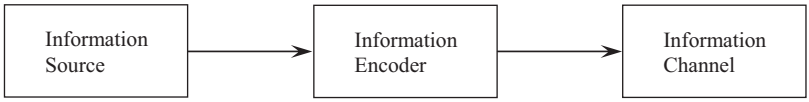

Fig. 5.5 The communication interpretation

what Peirce called "the representamen." In the standard theory of syntactic communication as introduced by Shannon (1948), however, we are not interested in the meaning of the message, not even the syntactic meaning; hence, ignoring the internal portion of the above diagram and rotating the external portion, we obtain Fig. 5.4.

Figure 5.4 already looks a lot like Shannon's communication model; however, we must now interpret this model in the communication setting. In generating, or initiating, communication, we start with the syntactic context, since this is the first, or innermost, level (as determined by the principle of additional structure). Therefore, we first generate the syntactic context of a sign for communication; next, we add a shape to the sign and its context; and finally, we embody the sign in some physical medium so that the communication can actually be carried out. From these steps, we derive Fig. 5.5. The communication component that generates the context of a sign has been called an "information source" (Ash 1965); the component which adds a shape to a sign and its context is called an "encoder"; and the physical medium embodying the sign is called the "communication channel." Taking into account the fact that communication includes both a sender and a receiver, we arrive at

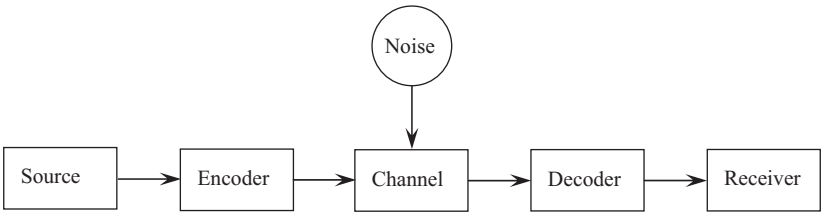

Fig. 5.6 The communication model

the traditional communication model, shown in Fig. 5.6. As usually presented, this diagram includes noise, a physical property of every real physical medium.

In most textbooks, the "communication model" is usually presented unmotivated. We were able to motivate the communication model directly from a simple semiotic theory of sign structure. It was derived rationally from the fact that the theory of syntactic communication is interested only in the external syntactic structure of tokens.

From our viewpoint, current theories of communication are theories of communication physics, not general semiotic theories of communication. We suspect that further advances in communication science will require further development of more general semiotic theories. For example, the fact that communication engineering and communication physics is impacted by semiotics has a flip side in that semiotic theory must also be influenced by communication engineering and physics. Such concepts as, for instance, bandwidth and the Nyquist criteria must be brought inside semiotic theory and receive a thoroughly semiotic interpretation. I suspect these make up part of the four linkages shown in Fig. 5.7.

Figure 5.7 illustrates a new discipline, known as communication physics, and its associated engineering discipline, known as communication engineering. We can thus see how communication physics can form a bridge between physics and semiotics.

The semiotic properties associated with tone, type, and token phenomena may be used to understand the communication processes associated with each component. Pranas Zunde and I incorporated this approach into a set of class notes for a senior level course on communication processes, at Georgia Institute of Technology, which makes these processes quite easy to explain (Pearson and Zunde 1976).

Eidontic Level Studies

Much interest in information theory has concentrated on the semiotic concept of *shape*. This section reports on a major study to learn more about the quantitative theory of semiotic shape.

The deviation in the shape of a natural language sign from its hypothetical norm, or expected shape of a typical sign in a given natural language is of considerable interest to information science, psychology, physiology, and pedagogy for both

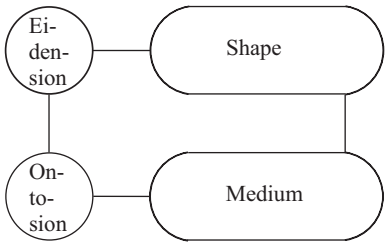

Fig. 5.7 The communication physics domain

Fig. 5.8 Law of redundancy for natural language

theoretical and applied reasons. In an early work, Shannon attempted to study these phenomena (Shannon 1951) by developing a pseudo-relation (nonempirical and nonmeasurable).

To measure such a deviation, an instrument called the "eidontic deviometer" or "eidometer" for short, was invented (Pearson 1981). The accuracy, precision, and reliability of the eidometer were assessed (Pearson 1987c)[12] and it was found that all three were sufficient to allow the conversion of Shannon's pseudo relation into a true law of semiotics (Pearson 1981). My law of redundancy for natural language (Pearson 1977b; Pearson and Slamecka 1977a; Shannon 1951) is shown in Fig. 5.8.

The differences between this law and Shannon's pseudo-relation are discussed in Pearson (1977a).

Also in previous work, Miller et al. (1954) had shown that the interpretation of signs is affected by their shape. The eidometer enabled a precise measurement of this phenomena, and hence leads to a better understanding of the role of shape in the interpretation process. Interpreting these two previous results using the USST led to a direct measurement of the redundancy curve for natural language as shown in Fig. 5.8. This measurement was not possible before the invention of the eidometer (although Shannon (1951) determined upper and lower bounds for this curve mathematically).

[12] Many of these concepts of measurement quality are discussed in Pearson (2012a).

The eidometer permits the redesign of many other classical experiments involving the measurement of sign shape, as well as the design of new experiments investigating various other aspects of the theory of semiotic shape. Nearly, 100 preliminary experimental paradigms employing the eidometer are now on file.

Algorithmic Information

This next example shows how the USST theory of shape can be applied to the shape of phemes.

In many kinds of signs, shape is primarily concerned with length and pattern, especially signs associated with data and/or computer codes. In 1965, Kolmogorov proposed a measure of shape which is mainly a measure of the pattern (Kolmogorov 1965) called "algorithmic information" or "complexity." It pertains to the length of the shortest algorithm that will produce a given sign as its output.

Patterns, however, can be described verbally, whether for the purpose of internal coding or of long-term memory and reproduction. In 1963, Glanzer and Clark, using signs composed of linear arrays of black and white elements, showed that accuracy of reproduction of patterns was correlated with the length of the description of these patterns (Glanzer and Clark 1963).

In this case, the correlations were based on average rather than minimum lengths, and length was measured as the number of words in a natural language (American) description rather than the number of steps in an algorithm. Using various outline shapes, Glanzer and Clark further showed that the length of the description was correlated with judged complexity of the shapes; in general, longer descriptions go with greater difficulty of learning and with greater judged complexity.

Conceptually, the Kolmogorov and the Glanzer–Clark measures are the same and show a relation between the eidontic structure of phemes and their ease of interpretation. Kolmogorov's measure is a formal, or mathematical, model of Glanzer–Clark's empirical measure.

Other Measures Associated with the Theory of Shape

Many more concepts of information abound in the literature, all having something to do with the shape of the sign. Among these are:

1. Popper's inductive information
2. Shannon's selective information
3. Kullback's statistical information
4. Osgood, Suci, and Tannenbaum's pragmatic information
5. Fisher's metrical information
6. Gabor's structural information
7. Loveland's algorithmic information
8. Mackay's scientific information
9. Carnap and Bar-Hillel's (so-called) semantic information
10. Hartley's information capacity
11. Mandelbrodt's information temperature

12. Ackoff's (so-called) pragmatic information
13. Hintikka's (so-called) semantic information
14. Shannon's negentropy
15. Harrah's surprise information
16. Quastler's uncertainty information
17. Zipf's relative frequency information
18. Kemeny's syntactic strength
19. Rashevsky's topological information
20. Büchel's structural information (Büchel 1967; Ryan 1972)
21. Wilson's bound information (Wilson 1968; Ryan 1972)
22. Ryan's functional information (Ryan 1972)

Büchel also referred to his structural information as "structural negentropy" and defined it as the information required to construct a system from its parts (Büchel 1967; Ryan 1972). Thus, this can be seen to be a variation on Kolmogorov's algorithmic information measure. Wilson's bound information is defined as the information required to specify the precise microstate of any resonant system (Wilson 1968; Ryan 1972); while Ryan (1972) defines functional information as the entropy change corresponding to the order put in, or maintained in, the environment of action.

5.2.1.4 Pragmatic Considerations

Why do we take up pragmatic considerations next when everyone knows by heart that the proper sequence should be: syntactic, semantic, and then pragmatic? The answer comes from the dynamic theory component of the semiotic paradigm, the TOS. What this makes clear is that the theoretical sequence has empirical consequences and the order must be syntactic, pragmatic, and semantic; and that the sequence used universally by Peirce, Morris, Bloomfield, Chomsky, etc., is wrong (Pearson 1998). This will become clearer in the next discussion. Figure 5.9 shows how to translate between Peirce's pragmatic categories and my pragmatic structure.

Bosanquet's Law and the Factorization of Mood

Bernard Bosanquet, British idealist philosopher (1848–1923), claimed that every proposition could be factored into a predicate about the ideal world. Despite Bosanquet's use of obsolete terminology, what is important is that his analysis does not require an ideal world. It holds for any world or genre whatever. And although it does not hold for every sentence of any kind, it does hold for every indicative sentence type in any language. Thus, we may call this Bosanquet's law (Pearson 1998).

Using Bosanquet's law to improve our understanding of the USST leads to a pragmatic definition of mood. *MOOD is a syntactic coding expressing the attitude that the source interpreter, I_S, of the sign bears towards the whole proposition contained within the sign itself*. This definition relates to the link between the source

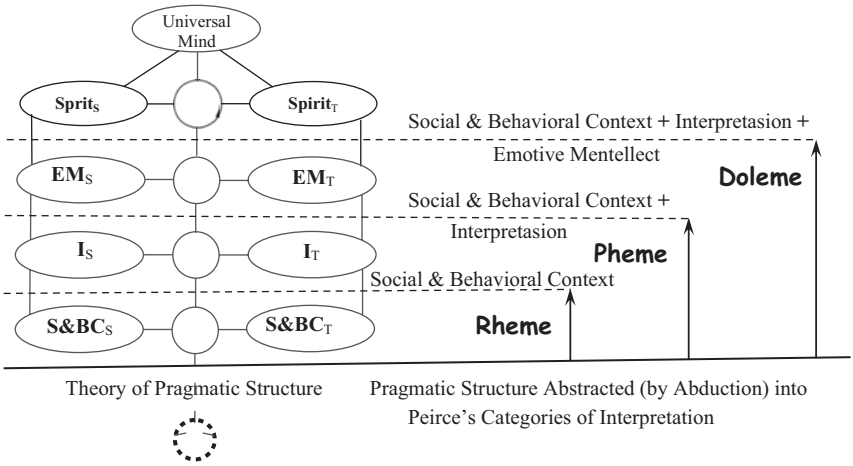

Fig. 5.9 The pragmatic translation diagram

interpretation of the sign and the purporsion of the sign, and leads to a natural generalization of Bosanquet's law that was first stated by myself in Pearson (1998). *Every natural language sentence type can be factored into a mood operator followed by a semantic operator containing a proposition. Further, each of the moods can be represented by an invariant operator independently of the semantic proposition, and each semantic proposition can be represented by an invariant operator independently of the mood of the sentence*.

This can be represented very neatly by the operator expression

$$\Pi_{ph} = \Pi_M : \Pi_S$$

where Π_{ph} is a pheme operator, Π_M is a mood operator, and Π_S is a semantic operator.

The General Factorization Law

As I was carrying out this study, I also became aware of the work of the American semiotician, John Searle, and the critical relevance it has for the project of factoring semiotic operators in general. Searle's work relates to the factorization of what I loosely called the mood operator, but concerned not so much mood itself as the pragmatic structure of the sign in its relation to the *illocutionary force,* a concept developed by the British philosopher, John Austin (see Searle 1969).

I later learned that an important part of this relation between the pragmatic operator and the illocutionary force concerned the operation of converting a type into a token, so I thus began to look at the structure of the type-token conversion opera-

tor as part of the structure of the pragmatic operator and gradually the concept of semiotic factorization started to become clearer. To finish this brief thought: *All complete utterances have both a mood and an illocutionary force and these are always present and distinct in every pheme token, even when they appear identical in the surface structure of the utterance. The mood is part of the type while the illocutionary force is part of the token*.

After figuring this out, it became obvious that *all sentential utterances can be represented by a pheme operator as shown by the next equation:*

$$\Pi_{ph} = \Pi_X : \Pi_P : \Pi_S$$

where Π_{ph} is a general pheme-token operator, Π_X is the syntactic operator, a general operator governing the syntactic dimension, Π_P is the pragmatic operator, a general operator governing the pragmatic dimension, and Π_S is the semantic operator, a general operator governing the semantic dimension. We have now arrived at the sequence: syntactic, pragmatic, semantic that is necessary here to make phematic analysis work. Similarly, in the case of phematic synthesis, we have the following equation containing the sequence: semantic, pragmatic, syntactic, just as predicted. There is no way we can force the sequence: syntactic, semantic, pragmatic to work.

$$\Pi_S{}^{-1} : \Pi_P{}^{-1} : \Pi_X{}^{-1} = \Pi_{ph}{}^{-1}$$

Let us take a minute to review what has happened here. We started with a link at the purporsion level of pragmatic structure and have arrived at a set of relations which constitute a semiotic law, or constellation of laws. This essentially repeats what happened in our syntactic investigations of semiotic structure. This leads one to suspect that every link between sign components in the USSD represents a constellation of laws relating those two components. In all of our investigation to date, this suggestion has proven true, leading us to a major interpretation of the USSD. *Every link between two sign components in the USSD represents a constellation of semiotic laws; and it is the USST that explains these laws*. This is a powerful tool for research economics because it shows us how to use the USST to predict where to look for interesting empirical questions for semiotic research.

5.2.1.5 Semantic Considerations

Peirce himself adumbrated the three levels of semantic structure present in the USSD. Without developing any systematic structure or formal theory, he attempted to discriminate the three semantic levels. In MS 645, devoted to an explication of the concept of *defining*, Peirce points out that there are stages one must pass through in order to arrive at a mutually acceptable definition of any name, term, or complex general idea, all of which he calls “rhemes.” There are three stages in the definition of any rheme and he names them from the top to bottom as: (1) precision, (2) dissociation, and (3) discrimination.

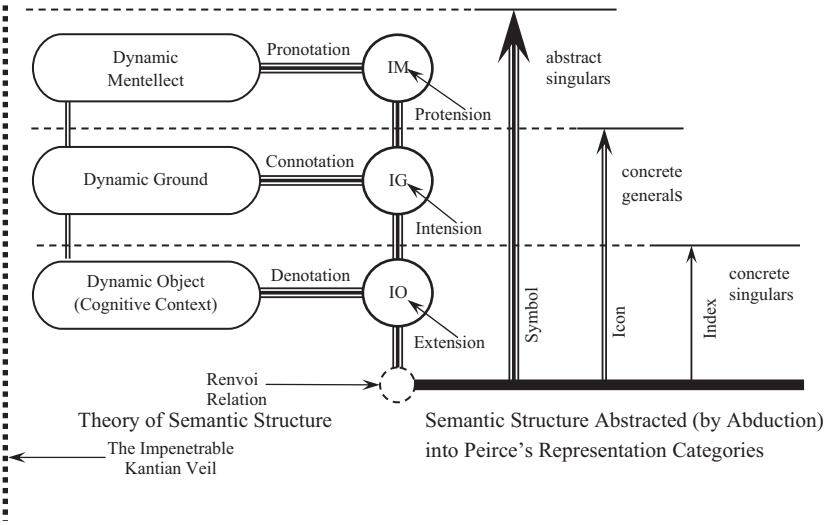

Fig. 5.10 The semantic translation diagram

Precision is analogous to the lifting out of the accepted ground some quality, property, or aspect to be focused on isolated from its customary cognitive context. This corresponds to précising in abstraction and abductive reasoning in logical analysis.

Dissociation requires the separation of those qualities, properties, or aspects that are necessary to the definition of the concept from all those others which are merely accidental or else totally unrelated. This results in a knowledge of the ground of the sign.

Discrimination points out the object of the sign as this, and this, but not that, thus creating the extension of the sign. Thus, Peirce was generalizing and correcting the modern (1500–1900 C.E.) concept of *clear* and *distinct* levels of semantic structure.

Many different studies investigate the semantic structure of the USST empirically, (Fig. 5.10), and either help improve our understanding of semantic theory or enable us to use the USST's theory of semantic structure to increase the state of the art of doing semiotic research in general. Two examples have been chosen for illustration.

Moore's Paradox of Analysis

G. E. Moore, an early-twentieth-century British philosopher, was concerned about a paradox discovered earlier by Alexius Meinong, but which has since come to be called Moore's paradox of analysis, and may be stated as follows: if the analysis of the meaning of a philosophical concept has the same meaning, it is trivial; but if it has a different meaning, then it is wrong. Meinong and Moore both knew well that

philosophers very often make correct and nontrivial analyses, but they were never able to develop a theory of analysis which solved the paradox.

While other philosophers have tried with varying amounts of success, the problem has never been solved completely. The most popular approach is to say that the problem lies in the formulation of the paradox, which assumes that meaning is either a single or a holistic kind of thing that is either completely the same or else totally different. Frege (1892) and Carnap (1958) both assumed that the meaning of signs has two semantic components, but their assumptions were for entirely different purposes. Carnap was able to delineate the character of scientific analysis very well with his concepts of *extension* and *intension*, but he was never able to handle the kind of philosophic analysis that Meinong and Moore were interested in. Moore himself said that he thought philosophic analysis required something like determining the same objects by the same properties but understanding or cognizing this determination in a different way.

From the USSD, we note that protension uniquely determines intension, which in turn uniquely determines extension; while a difference in extension ensures that two terms will have a difference in intension, which in turn ensures a difference in cognesion. We may therefore state the solution of Moore's paradox as follows: *Scientific analysis requires an identical extension with a difference in intension, while philosophic analysis requires an identical intension with a difference in protension*.

It turns out that three levels of semantic structure are just the right amount and kind of structure to solve every known semantic paradox. Of course, this gives us increased confidence in the semantic structure hypothesized in the USSD.

Memory Coding

Another area involving semantic structure includes all the psychological processes of cognitive representation. We call this memory coding. If this can be related to the USST, the principle of paradigm inversion[13] suggests that it would increase the accuracy, precision, and reliability of all future semiotic research. The principle of paradigm inversion is the keystone for integrating experimental and observational semiotics into theoretical semiotics.

Kintsch has reported three aspects of cognitive memory which he calls "sensory," "short term," and "long term" (Kintsch 1970). Bruner has reported several modes of representation, or coding, including "enactive," "ikonic," and "symbolic" (Bruner 1966). He studied the sequence in which these capabilities develop in children and the rate at which signs can be processed using the various modes of representation. It would appear as if there was only one form of coding associated with each aspect of cognitive memory; however, this is not clear because of confounding effects on the experiments.

An experimental program was designed to critically isolate each memory aspect and the mode of representation that is associated with it. The first experiment, to

[13] See Pearson (2012b).

isolate and determine the characteristics of iconic coding, uses an interference effect suggested by Siegmann (1975); in experimental trials the interference effect is well marked and can be detected easily (Pearson et al. 1976). Another experiment used children to verify Bernbach's results (Bernbach 1967).

The advantage of achieving an answer to this question is to allow the principle of semiotic reinterpretation[14] to reinterpret quantitative psychological measurements as accurate, precise, and reliable semiotics measurements so that they can be used for future development of semiotic theory. For instance, memory span times, processing rates, and age of development are all quantitative measurements, and all run in the same sequence as the levels of semantic structure of the USSD: index, icon, and symbol.

5.2.1.6 Summary

In this section, we have described the USST, a theory of sign structure that explains the syntactic, pragmatic, and semantic taxonomy of signs due to C. S. Peirce, and goes beyond Peirce to begin the development of an abductive/subductive theory. Fifteen theorems were given in order to show the kind of formal power this theory makes available to the study of semiotics. Early experiments were described in order to exhibit the kind of empirical foundation that supports this theory. It is time to move on now to discuss later and more powerful results that exhibit the true advantages and power of this theory.

The 1989 split session of IASS-4 in Barcelona, Spain and Perpignan, France seemed to mark a watershed in direction and emphasis for research in semiotic theory. The symposium on empirical semiotics that was held in the Barcelona section of that Congress marked the general acceptance of the semiotic paradigm, with all of its subparadigms, and especially the USST (then called "USST-89"), and seemed in unanimous agreement that it was time to apply these techniques to solving some of the major problems in semiotics. Most of the research reported on in this section was carried out before the 1989 Congress while most of the research reported on in the following sections was carried out after that Congress.

5.2.2 Results and Advantages

5.2.2.1 Syntactic Results

Again, space allows the inclusion of only two examples.

[14] See Pearson (2011).

The PZ Notation

One of the most significant results in the study of syntactic structure over the past few years is Shea Zellweger's invention of the PZ notation for propositional material logic. Zellweger (1982, 1997) developed a notation for each of the 16 binary connectives, whose shape encodes the logical properties of the connector and thus helps to reflect the structure of propositional logic. He then goes on to develop an algebra for the connectives that illuminates that structure and makes it obvious.

Keeping the USSD in mind is the easiest way of understanding the strategic moves made in this development. Whereas Aristotle found a way to code the extensional level of semantic structure onto the tagmatic level of syntactic structure with syllogistic logic, Zellweger found a way to code the tagmatic level of syntactic structure onto the eidontic level with his PZ notation. This should motivate a search for a way of double coding that will code at least part of the extensional semantic structure onto the eidontic structure. While this would not result in the complete universal language of logic that Leibniz and the Scholastics sought, it would represent an achievable part of it.

The Type-Token Relation for Natural Language Text

For about 15 years, I used the syntactic structure of the USST by applying the definition of types and tokens to various observations on natural language text. This enabled me to derive six boundary conditions (BCs) on a function known in the literature as the type-token relation. Finally, in Pearson (1987b), I was able to apply a simple statistical urn model to the syntactic dimension of the USSD and thereby derive, from a few obvious and simple semiotic assumptions, a function that satisfied all the known BCs (the first ever to do so). A counting experiment was then carried out and the result was that the theoretical function matched the observed measurements in every case (again, the first ever to do so).

Thus, by the application of mathematical semiotics to the USST, and making a few simple semiotic assumptions, the exact expression for the type-token relation for natural language text was derived for the first time. The derived expression satisfied all known BCs and was an exact match to observation within instrument tolerance. Pearson (1987a) contains a more detailed history, derivation, statistical tests, data, and bibliography.

Assuming $T(K)$ represents the cardinal number of word types at a point in the text where the ordinal number of word tokens is K, then the BCs are:

1. $T(0)=0$
2. $T(1)=1$
3. $T(m)\leq T(m+n)\leq T(m)+n$, for all nonnegative integers m, n.
4. $\underset{K\to\infty}{\text{Lim}}\, T(K)=V_\infty$ (where V_∞ is a finite integer)
5. $\Delta T(K)$ is monotonically decreasing for all values of K; and
6. $\underset{K\to\infty}{\text{Lim}}\, \Delta T(K)=0$

The derived type-token relation for natural language text is then:

$$T(K) = V_\infty \left[1 - \left(\frac{V_\infty - 1}{V_\infty} \right)^K \right]$$

5.2.2.2 Pragmatic Results

The pragmatic dimension[15] is one of the most difficult areas of semiotics. Therefore, it is easy to understand that this is where the USST has made some of its most notable achievements. These include discoveries ranging all the way from the need for a revision to the USSD, thus showing its power of self-correction, to a new, and totally unanticipated, law of mystical union, thus showing its predictive power.

Discovery of the Need for a New Level of Pragmatic Structure

Advocates of the semiotic paradigm claimed that it explained all forms of communication and sign structure (Pearson 1977a, b, 1982a, b). However, these early claims neglected the evidence of religious communication. Various religious phenomena can be interpreted as forms of communication. For instance, prayer can be interpreted as communication from man to God, and revelation as communication from God to man. Other religious experience can also be interpreted in this fashion, such as the interpretation of union as the development of close communication between man and God and mystical experience as an unexpected experiencing of God. In this vein, communication between man and the Holy Spirit is also interpreted as a form of communication between man and God (Teresa of Avila 1565(c)).

The USST could not explain the semiotics of such communication as it stood in 1999. Could the USST be modified to incorporate the new forms of communication, or would it have to be abandoned to a radically new and more powerful theory? It turned out that the only change required was the addition of one new level of pragmatic structure.

Revisions to the Pragmatic Dimension of the USSD

A single, very simple, extension of the USST allows for the explanation of religious communication without sacrificing any of its previous explanatory power. This extension involves the addition of a fourth level of pragmatic structure to the USSD. Essentially, it says that the universal mind is part of every sign. Pearson (2000) describes the requirements on any modification to theory, the search for, and development of the new theory, and an interpretation of the new epistemology resulting from the new theory.

[15] Morris named this dimension in honor of Peirce (personal communication).

This change yields all the desired improvements, but it also produces some unanticipated predictions. To date, all of these predictions that have been tested have been verified. This is powerful evidence in favor of the USST and this new refinement.

The unanticipated predictions include an explanation of the fallibility of revelation, and an explanation of revelation as a source of knowledge, thus requiring a modification to most theories of epistemology. It also raises some questions. Such as, how do we test the accuracy of revelation, how do we detect and correct the errors of revelation, and how do we increase the efficiency and efficaciousness of prayer? The logic of abduction is helpful in answering these questions about revelation.

But revelation also answers some perplexing questions in the study of abduction, such as where do the very fine guesses that are required to make abduction work, come from. Peirce credited them to the evolution of human instinct, whereas this new theory credits them to revelation from the universal mind. This suggests a very close relation between the semantics of abduction and the pragmatics of mystical communion. This is the first adumbration of such a relationship.

Unanticipated Advantages of the Revised USSD

The addition of a fourth level of pragmatic structure not only solved the problem of religious communication, which motivated the change, but it also resulted in many unforeseen predictions; and every prediction that has been tested empirically has been verified. This is powerful evidence in favor of the proposed changes to theory. These predictions are listed and discussed in Pearson (1999).

Explanation of a Classical Theological Ambiguity

The modifications to the USST mentioned above revealed the existence of a deep seated and pervasive ambiguity in the concepts of *love* and *union*. These ambiguities were adumbrated in the theologies of Peirce (Evolutionary Love), Teilhard de Chardin (1955), Bonhöffer, Tillich, and Wilber, etc., but never clearly recognized before.

The universe itself was created out of love by the universal mind that perpetually flows in and through the spirit (the Holy Ghost of Christian theology), the ceaseless novelty that has the strange habit of adopting habits so that over time and with the help of continuity, love becomes law. Whereas community is founded on human love, the Christian concept of *love of man for man,* or *αγαπέ*. These two concepts of *love* have different semiotic structures that allow them to play their distinct roles.

Teresa of Avila always professed a *union with Christ* in her mystical trances, while Christ himself always stressed that his mystical experiences were with God (the creator), a union in God. These two concepts of *union* also have distinct semiotic structure. And this difference also causes them to play different roles in all the-

ologies examined. Interestingly, these differences in the concept of *union* involve the same differences in semiotic structure as the differences in the concept of *love* discussed above.

Now that semiotic theory has the ability to untangle these confusions of ambiguity, it is easy to discover their pervasive existence throughout modern theology and explain many of the startling contrasts between modern and postmodern theology.

This investigation concentrated on the modifications to the USST that allow this powerful advance in semiotic explanation, concentrating on the parts of sign structure that these two ambiguities share in common. It thereby explained the semiotic structure of both halves of the two ambiguities in terms of the modifications to the USST. And finally, it found examples of the treatment of these ambiguous concepts in modern theology, and the different treatment of both ambiguities in postmodern theology that adumbrated their discovery and leading to their explanation in terms of semiotic structure.[16]

The Law of Mystical Union

Pearson (2003b) concentrated on a semiotic analysis of mystical union and other closely related states of consciousness, using the USST-2000 as the primary tool of theoretical analysis. Their religious and empirical properties were explored using data from cognitive psychology and Christian mysticism, and examples were used from Christianity, Shamanism, Islam, and other religions.

Various instruments, such as music, dance, drumming, hypnosis, and prayer, were examined for their possibilities as probes to explore the structure of these states, as well as their possibilities for several new types of semiotic experiments.

St. Teresa (1565c) examined the structure of prayer, which is like the structure of hypnosis and Scott Goble examined the structure of rapture, which is similar. Baer (2001) analyzed various aspects of the holy as given by Levinas, and Corrington (1993) analyzed the semiotics of the divine from the standpoint of ecstatic naturalism. Pearson has developed the communicative analysis capabilities of the USST-2000. All of these helped to throw light on the structure of mystical union and its semiotic analysis.

This investigation discovered many interesting semiotic properties associated with mystical union phenomena, but by far the most important was the law of mystical union, which states that *the logics of meditation, hypnotism, artistic rapture, prayer, and mystical experience are identical*. A single logic can be developed that will apply to all. Not that meditation, artistic rapture, hypnotism, prayer, and mystical experience are the same, but just that their logics are. This can best be summarized by Fig. 5.11, which displays the progressive opening and closing of various levels of the selfhood sign structure (S^3) as rapture, mystical experience, etc., progress deeper and deeper into the selfhood.

[16] Discussed in more detail in Pearson (2001).

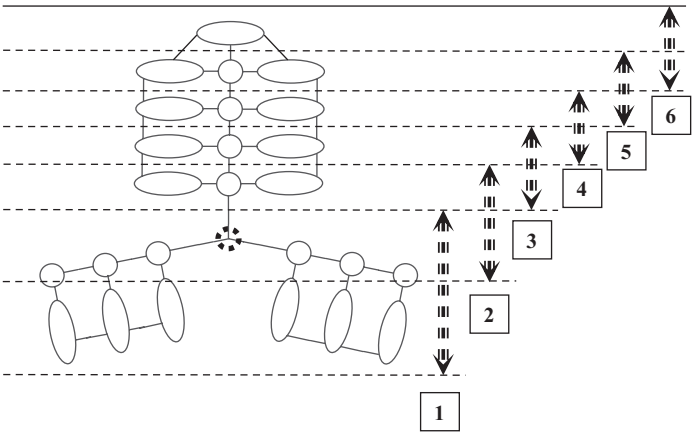

Fig. 5.11 Theoretical hypotheses regarding the selfhood processes of mystical union

5.2.2.3 Semantic Results

Perhaps it is only because of my own personal interests or abilities, but most of the results and advantages of applying the USST to semiotic analysis have come in the semantic dimension.

Empirical Convergence and Ampliative Reasoning

Peirce asked how a concept, proposition, or argument could achieve empirical reality and suggested that the Cartesian single-chain mode of deductive reasoning, used by modern logic, be replaced by the multifilament cable mode of ampliative reasoning, for his postmodern logic. This was all the hint that Wendell Garner, a mid-twentieth-century experimental psychologist, needed in order to develop a concept of *operational convergence* (Garner 1974). However, this still leaves unanswered the status of such important scientific signs as facts, laws, and theories. The USST allowed Garner's approach to be completely generalized by Pearson (2003a) giving a satisfactory answer to Peirce's question for the empirical reality of all scientific signs.

Wendell Garner was one of the earliest psychologists to apply Shannon's concept of variation measures in modal statistics ("information"—so called) to problems of perception and other areas of experimental psychology (Garner 1954, 1962; Garner et al. 1956; Pearson 1978). Although he came to use Shannon's quantitative measure of "information" less and less in later years, the basic idea of information structure led him to develop several interesting concepts, such as the concept of *dimensional integrality,* and the concept of *energic versus informational properties*

(Pearson 1978). In applying his basic methodology of "Critical Realism,"[17] he had to ask himself how his concepts could achieve empirical reality, and in doing so, he explicated his concept of *operational convergence* (Garner 1954, 1974; Garner et al. 1956; Pearson 1978).

> The basic idea [of converging operations] is that we come to know things, usually described as concepts, by carrying out two or more experimental operations that converge on the single concept. A concept that is synonymous with a single operation is nothing more than a restatement of an experimental result. But a concept that arises as a consequence of converging operations has a reality that is independent of any single experimental observation. …However, we must have a variety of inputs and outputs, differing in their nature, to allow convergence to meaningful concepts that are in fact independent of any single observation or experimental result. (Garner 1974, p. 186 f.)

Garner gave as an example several of his own concepts. But one that will be more easily understood by most readers is that of the many experiments involving, and the many different ways of observing and measuring, the observational temperature, all of which converge to essentially the same result and play the same role in the laws of thermodynamics, thus giving to the concept of *temperature* an empirical reality.

Garner's concept of *operational convergence* applies to inductive reasoning to a general concept. One can see here the influence of troth Bacon, Mill, and Peirce. Converging operations hold when many different kinds of observations, measurements, experiments, etc., converge to a single general concept, which subsumes them all. This is the process that Peirce described as a multifilament cable. The general concept arrived at always has a concrete general connotation.

Instead of asking for the source of empirical reality for a general concept, we might have asked how a general proposition, such as a scientific law, achieves reality. Likewise, we could have asked about a theoretical proposition or an individual argument. Thus, we have a two-dimensional, nine-way classification of empirical convergence as shown in Table 5.1.

Using the USST, the explication for each of the nine kinds of scientific signs is a simple generalization of Garner's explication. An example for eductive phematic convergence follows for illustration.

A proposed fact that is justified by a single observation is nothing but an ad hoc eduction from a concrete singular to a specific individual—nothing but a convenient shorthand for recording the data from that one observation. But a single fact that records and summarizes the data from many different observations, each

Table 5.1 Forms of empirical convergence

Convergence	Rhematic	Phematic	Dolemic
Eductive	Eductive rhematic	Eductive phematic	Eductive dolemic
Inductive	Inductive rhematic	Inductive phematic	Inductive dolemic
Abductive	Abductive rhematic	Abductive phematic	Abductive dolemic

[17] Ironically, this is the same name that Peirce gave to his philosophy.

made objectively and fairly on different individuals chosen by random sampling[18] from the entire population using experimental design theory,[19] gains more empirical reality with each new observation that justifies it. This gain in empirical reality is called "eductive phematic convergence**.**" We say that the collection of observations converges to the empirical reality of the fact. Thus, eductive phematic convergence means that one fact converges to the recording and summarization of the data from many different observations. The resulting fact is a proposition with a concrete singular denotation.

Since it is convergence, rather than the precision of a single technique, that provides the empirical meaning of a concept, we should be free to use techniques that are not as precise and reliable as we might otherwise prefer if these techniques did not converge to a common result. As Garner says, "The ultimate validity of a concept does not depend on any single procedure, but on a convergent result, so the importance of any one procedure is greatly diminished" (Garner 1974, p. 188).[20]

I would like to give one more example of empirical convergence because of its impact on our understanding of semiotic theory.

Garner introduced the notion of *converging operations* as an empirical justification for going from the concrete individual to the concrete general. The natural analog of Garner's concept is my concept of *converging explanations* as an empirical justification for the step from concrete generals to an abstract singular—from law to theory.

Converging operations hold when many different kinds of observations, measurements, experiments, etc., converge to a single concept with one general description. Converging explanations allow us to go to the next level of scientific thinking. It is justified when we have many different laws with many different general concepts and their attendant many different general descriptions that can all be explained by the assumption of a single abstract theory.

A proposed theory that is justified by a single law is nothing but an ad hoc abduction from a concrete general to a hypothetical abstraction—nothing but a convenient shorthand for remembering that one law. But a single theory that explains many different laws gains more empirical reality with each new law that enters into its network of explanation. This gain in empirical reality is called "abductive dolemic convergence." We say that the collection of laws converges to the empirical reality of the theory. Thus, abductive dolemic convergence means that one theory converges to an explanation of many different laws. The resulting theory is an argument with an abstract singular pronotation.

We can say that abstract theories, and other abstract dolemic symbols, obtain their empirical reality by means of abductive dolemic convergence. Abductive dolemic convergence holds when many different laws, general invariant descriptions, etc., converge by abduction to a single abstract theory that explains them all.

[18] A concept developed by Peirce and his students.

[19] A theory developed by Peirce and his students.

[20] Cf. Peirce's multifilament cable.

Thus, applying this to our present discussion, with each new law subsumed, the USST converges to the most powerful explanation available in all of semiotics.

The Semantics of Perception

Many interesting theories, explanations, and solutions to important problems had to be left out of our discussions for lack of space. I have arrived at the conclusion that every semantic problem of interest can be solved using the USST. One theory that I deliberately left out was Peirce's philosophical theory of perception. That is because it is so important and its results so dramatic that it deserves a discussion of its own. I attempt to do that in this section.

Any adequate theory of perception must find a way to combine the syntactic, pragmatic, and semantic dimensions of semiosis. I have not even attempted this yet. The work mentioned here was reported in Pearson (2003c) and discusses some comments by C.F. Delaney (1993) on the scattered writings of Peirce on the philosophy of perception as seen through the lens of the USST, and concentrates only on the semantic dimension. It attempted to make some progress in the development of a generally accepted philosophical theory of perception by combining the little-known theory of perception by Peirce with both the semiotic methodology of the semiotic paradigm and the theoretical power of the USST.

In developing his philosophy of perception, Peirce presents an even balance of phenomenology, idealism, semiotics, realism, logical analysis, and scientific analysis in a more natural way than any of the classical phenomenologists, philosophers, or scientists themselves.

Peirce's notion of perception is a holistic notion that requires a detailed analysis into its logical components if we are going to get any satisfactory answers to the epistemological questions with which we are concerned. It is theoretically decomposable into simpler elements, but Delaney reminds us that, "the analysis should not blind us to the holistic character of the experience itself" (1993, p. 120).

Although it is not inappropriate to talk of *this* particular perceptual process and these *components* of perception, our actual process of perception is not a series of discrete units made up of isolated parts but rather a continuous whole. The actual process, no matter how direct or how short, involves dimensions of confrontation and meaning as well as elements of memory and anticipation. However, this having been said, Peirce acknowledges the legitimacy of analysis and the significance of abstractly characterizing the various structural elements of the perceptual process.

The easiest way of understanding Peirce's analysis of this holistic process of perception is to start with Fig. 5.12. It is an adaptation of the semantic dimension of Fig. 5.1 with the components relabeled in order to follow more easily Peirce's discussion of his theory.

To follow Fig. 5.12 better, we will use Peirce's own method, which he calls "precision." It is an act of mental abstraction which "arises from *attention* to one element and *neglect* of the other" (1.549). Delaney says that, "When this analytic intention is focused on the flow of perceptual experience, Peirce is able to distin-

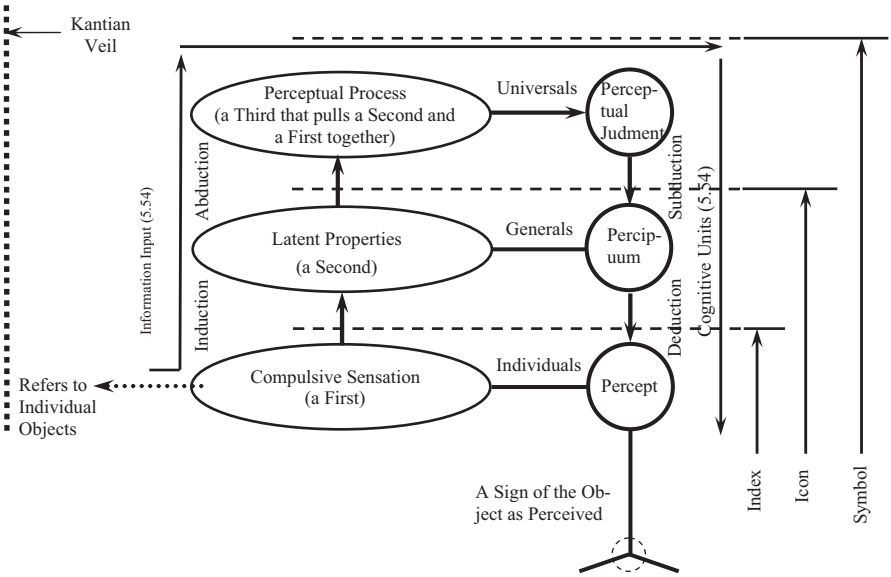

Fig. 5.12 Peirce's philosophy of perception

guish as elements the percept, the percipuum, and the individual perceptual judgment" (1993, p. 120). These three components are shown in Fig. 5.12 as the three internal components of perception.

Delaney says that, "As one prescinds the elements from the concrete flow of perceptual experience, the order is from the *perceptual judgment,* through the *percipuum,* to the *percept* as one moves away from the complex phenomenon of meaningful perceptual experience toward what simply confronts one in perception" (1993, p. 121). This follows the sequence shown in Fig. 5.12 from the perceptual judgment, a universal, down to the percept, a concrete singular.

In interpreting the cognitive side of Peirce's theory of perception, Delaney says, "We come to know facts about our world by means of the perceptual judgment which, through the percipuum, indicates the percept which indicates the physical object" (1993, p. 123).

Delaney does not mention three other semantic components of the perceptual sign that Peirce refers to as external aspects, and which he also lumps together, in the same paragraph (5.54), as information inputs (or II). They are the *compulsive sensation*, the *latent properties*, and the *perceptual processes*. These also occur naturally in the USST as shown by Fig. 5.12.

Peirce claims that a perceptual judgment is initially defined as "a judgment asserting in propositional form what a character of a percept directly presents to the mind is" (5.54). It is the act of forming a mental proposition about some characteristic of the perceptually given, together with an assent to that proposition. The perceptually given stems from the *compulsive sensation,* an external first, an information generator, or an II; the selected characteristic stems from the *latent proper-*

ties, an external second, another information generator, or II; while the proposition stems from the *perceptual process,* an external third, and also an II. The assent to the proposition is the assertive force of the proposition, the illocutionary force of assertion,[21] and is inserted into the perceptual sign by a link between the perceptual process and the pragmatic structure, which does not show in Fig. 5.12.[22]

However, Peirce is quite specific about the precise logical form of perceptual judgments, namely, they are to be regarded as limit cases of abductions: "The perceptive judgment is the result of a process … [and] if we were to subject this subconscious process to logical analysis, we should find that it terminated in what that analysis would represent as an abductive inference" (5.181).

In the more precise language of the semiotic paradigm, this would read something like, "a perceptual judgment can be represented as a combination of inductive inference from a first (a compulsive sensation) to a second (the latent properties), followed by an abductive inference to a third that pulls the second and first together (the perceptual process), all of which are external information inputs to the perception, followed by the perceptual judgment (a process—one which carries the information inputs to the cognition), yielding finally, a perceptual judgment (the result) which is an internal component of the sign and thus available to the cognition.[23]

Peirce's perceptual judgment is the internal half of the pronotative level of a symbol. The perceptual judgment (an internal third) is then translated by the percipuum (an internal second) into the percept (an internal first).

Delaney says that, "Perceptual judgments are to be thought of on the model of the ascription of a general predicate to individuals, which would reduce them to some kind of unity and thereby render them intelligible. They have the form of hypothetical interpretations of given elements and are general in nature" (1993, p. 125). Figure 5.12 shows us that the "general predicate" stems from the latent properties while the "individuals" stem from the compulsive sensations, both of which are information inputs and external components of the perceptual sign structure. The "hypothetical interpretations" are due to the abduction from the latent properties to the perceptual process (process—an external third), and the "general nature" of Peirce's perceptual judgment (result—an internal third) is due to the secondness of the latent properties which forms the external connotative structure of an icon.

Delaney continues, "It is important to note, however, that when we are speaking of perceptual judgments as abductions we are speaking analogously, because these instances of abductions are both subconscious and uncontrolled, characteristics contrary to standard abductions. Strictly speaking, perceptual judgments are not really judgments that we make but rather ones that are forced upon us" (1993, p. 125).

These are not real abductions because they do not proceed from one sign to another but only mimic abductions (pseudo inferences, if you please) by availing

[21] See perceptual process in Fig. 5.12.

[22] See TOS for description of the process that inserts the illocutionary force into the proposition.

[23] See Fig. 5.12.

themselves of the abductive machinery in connecting two external components of the analysis of perception together.[24]

Perceptual judgments are not available to our control. Delaney says, "In the appropriate concrete circumstances these perceptual judgments are things that happen to us, not things we do" (1993, p. 126).

Peirce says:

> You may adopt any theory that seems to you acceptable as to the psychological operations by which perceptual judgments are formed. …All that I insist upon is that these operations, whatever they may be, are utterly beyond our control and will go on whether we are pleased with them or not. (5.55)

The USST shows that since perceptual judgments are the result of pseudo inferences, we do not have initial signs (called "premises") available to control, while the final signs (called "conclusions") are completely determined for us subconsciously by the perceptual process, they are part of the semiosis of perception.

Other Insights into Semantic Theory

But the machinery we have set up to explain the semantic structure of Peirce's philosophy of perception also serves a dual purpose.

An object is nothing but the simultaneous presence of an infinite and complete collection (I deliberately do not use the technical word "set") of generals, i.e., properties and aspects, with possibly a little bit of hecceity thrown in for good measure to serve as a kind of glue. Perhaps this is logical positivism's concept of *infinite porosität*. Most generals do not even have names, unless they are important for human purposes.

And in turn, a general is nothing but an infinite collection ("association" might be a better word?, but certainly not "set") of universals, i.e., abstractions or concepts with maybe some second kind of glue to hold them together. Again, an explication of *porosität?* As conceptualists, members of the Vienna Circle did not distinguish between generals and universals. Only the universals mankind has found useful have either names or general (i.e., semantic) markers, so we are never fully aware of their presence until they make themselves known in some way.

Thus the USST gives us a semiotic foundation for developing not only a theory of perception but the same foundation also simultaneously explains the philosophy of individuals, generals, and universals, a wonderful integration and consolidation of theory. These suggestions are summarized in Table 5.2, which shows the relations between four domains: (1) the ontology of perception; (2) the epistemology of perception; (3) the ontology of universals;[25] and (4) the epistemology of universals.

This study also resulted in another important insight. One that has important bearing on how we must go about doing semiotics, and perhaps even all of science.

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[24] See latent properties and perceptual process in Fig. 5.12.

[25] The so-called problem of universals includes the problem of individuals, the problem of generals, as well as the problem of universals.

Table 5.2 Implications of a USST theory of perception

Semiotic Structure of the Semantic Dimension	Semantic Function	External Structure	Internal Structure	Mathematical Model	Mode of Discrimination	Perceiving	Ontological Status
Symbol	Pronotation	Dynamic Cognitive Mentellect	Immediate Cognitive Mentellect	Protension	Process	Arrangement	Subjective
Icon	Connotation	Dynamic Ground	Immediate Ground	Intension	Similarity	Likeness	Interjective
Index	Denotation	Dynamic Object	Immediate Object	Extension	Physical Stimulus	Object	Objective

Semiotic Structure of the Semantic Dimension	Semantic Function	Cognitive-Function	Meaning Produced	Ontological Result	Concepts	Epistemological Result	Ontology*
Symbol	Pronotation	Conceptualize	Abstract Singulars	Abstraction	Abstract Concepts	Universals	World of Abstracts
Icon	Connotation	Categorize	Concrete Generals	Generality	General Concepts	Generals	World of Generals
Index	Denotation	Individualize	Concrete Singulars	Actuality	Singular Concepts	Individuals	World of Individuals

Relations between signs or sign components are internal in the USST sense and hence involve only phenomena. But phenomena involve the first person point of view. Therefore, semiotics as a science must involve both the first and third person points of view. Hence, semiotics is broader than either traditional science or traditional phenomenology. Semiotics is the science of triadic relations, but the distinction between classical science and classical phenomenology disappears in the requirements of the new theory of semiotics. There is a uniform continuity between the first person point of view and the third person point of view.

It is like drawing a rectangular coordinate system on a two-dimensional plane. Before drawing the *x*-*y* coordinates, one could only conceive of traveling back and forth in one direction along the *x*-axis (thinking scientifically), or traveling back and forth in the other direction along the *y*-axis (thinking phenomenologically). Classical science was like the *x*-axis and classical phenomenology was like the *y*-axis, but they were distinct domains. After drawing the *x*-*y* axes as a two dimensional coordinate system, we can wander around in the whole plane and view the problem from any angle that is most convenient for solving it (see Fig. 5.13 for an illustration).

The *Ding an Sich* may or may not have something that looks like individuality, generality, and/or universality. It does not make any difference because we could never know it, or even talk about it, if it did. We could never prove or disprove it, so we might as well simplify our analysis by using the simplest language possible, our ordinary language of intuition.

In the process of perception, our perceptual apparatus causes a sign to be created in the observer and this sign has denotative, connotative, and pronotative structure, causing the perception to have individual, general, and universal characteristics. But these characteristics are in the representation, not in some hypothetical neumenal object. They may or may not also be in the *ding an sich* itself, but this we can never know (see Fig. 5.14 for an illustration).

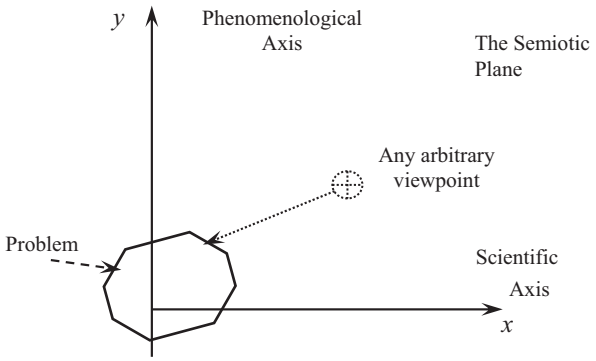

Fig. 5.13 The semiotic plane allows arbitrary viewpoints, from any balance of science-phenomenology to suit the problem needs

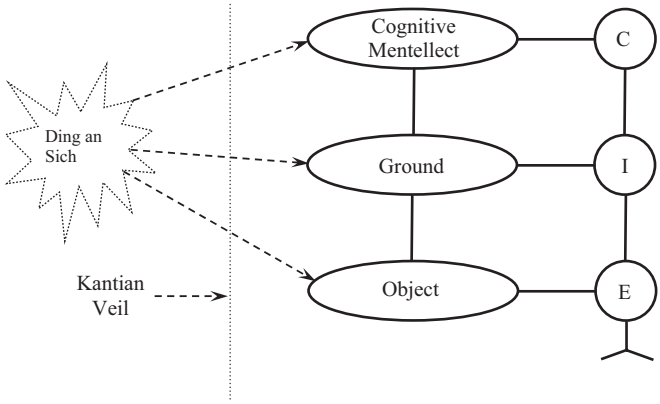

Fig. 5.14 Perception and the semantic structure of the perceptual sign

5.2.2.4 Summary

We thus come to summarize the results and advantages of using the USST as a semiotic theory along with its full context, the semiotic paradigm. And truly, there are so many, as this section has shown, that the only concise summary can be the conclusion that the USST has the power to solve any properly stated problem of static semiotic structure to which it is directed.

The examples given here are only a small selection of those that I and the people known to me have addressed. And what we have addressed must be but a minute fraction of the most interesting problems.

5.2.3 Conclusions and Recommendations

This short survey attempted to present a brief and superficial overview of the USST. It omitted all details and derivations (except for a few theorems in Sect. 5.2.1.2).

The USST is part of the semiotic paradigm and must be understood in the full context of that paradigm, but I believe that the material presented in this chapter was sufficient to provide overwhelming proof of the power of the USST to solve and explain problems and questions regarding the semiotic structure of static signs.

Young and capable scholars, who may be interested in the improvement of intellectual understanding, and perhaps even making an immortal name for themselves in the process, would be well advised to adopt the semiotic paradigm in their efforts to advance the science of semiotics. And those with a theoretical bent could find no better tools than the USST and its TOS companion to which we turn next.

5.3 The TOS[26]

The USST, was introduced more than 30 years ago (Pearson 1982a, b; Pearson and Slamecka 1977; Slamecka and Pearson 1977), as the theoretical part of the semiotic paradigm (Pearson 1982a, b; Pearson 1983), in order to provide a scientific theory that could explain all the semiotic phenomena associated with the static structure of signs. Although the USST was successful for its intended purposes, it could never explain phenomena associated with dynamic semiotic processes (semiosis).

Now the semiotic paradigm has been expanded to include a second theory that can handle dynamic sign processes. This section will formally present the TOS, provide examples of its use, and make the claim that *the semiotic paradigm is now able to explain all semiotic phenomena*.

Parsing trees and linguistic transformations are too limited to handle all of the processes of semiotics, but trees and transformations are just narrowly restricted forms of mathematical operators. The TOS uses the more general concept of a functor, or operator function, to explain what happens when sign processes take place, thus introducing a theory of semiotic dynamics to accompany the USST which is a theory of semiotic statics.

5.3.1 Background

Bernard Bosanquet, British idealist philosopher (1848–1923), claimed that every proposition can be factored into a predicate about the ideal world. Thus, example (1), which appears to predicate blue of sky as in analysis (2), or even a two place relation predicating blue and sky of the copula as in analysis (3), actually is, according to Bosanquet, predicating a proposition (4), of the ideal world, as in analysis (5). This thesis was picked up by Francis Bradley, another British idealist philosopher of the same period (1846–1924) and made a key point of his theory of logic.

[26] A preliminary version of this section appeared as “The Theory of Operational Semiotics” in Pearson (1998).

1. The sky is blue.
2. Blue(sky).
3. Is(blue, sky).
4. the sky being blue
5. The ideal world is such that it can be described by: the sky being blue.
6. The actual world is such that it can be described by: the sky being blue.

Actually, their terminology was already obsolete at the turn of the century (1885–1915) when they were working this out, and we now use "sentence" and "proposition" for far different concepts than what Bosanquet and Bradley meant, but this has little relevance for us here and now (Pearson 1994, 1995).

What is important is that Bosanquet's analysis does not require an ideal world; it holds for any world or genré whatever (thus analysis (6)), and that it does not hold for every sentence but it does hold for every utterance of an indicative sentence in any language. Thus we may call this Bosanquet's factorization law.

5.3.2 Factoring the Sentence

A similar strategy works for any mood, but I would like to use a different example for a very simple reason. One can say both (1) and (7), but it is hard, at least in American, to say (8). This is merely an accident of linguistic history. Therefore, I choose proposition (9) for an example, which, at least in American, is fairly easy to utter in each of the more common moods: indicative, imperative, interrogative, etc.

7. Is the sky blue?
8. * Blue the sky!
9. the door being open
10. The door is open.
11. Open the door!
12. Is the door open?

The factorizations are as follows:

13. The real world is such that it can be described by: the door being open.
14. Endeavor to make the real world such that it can be described by: the door being open!
15. Is the real world such that it can be described by: the door being open?

By all accounts examples (10), (11), and (12) contain the same proposition. Analyses (13), (14), and (15) make it obvious that this is so, a decided advantage for any system of notation. I am not certain, but evidently I am the first to carry out this complete analysis and so I make the universal claim: *Every natural language sentence type can be factored into a mood operator followed by a semantic operator containing a proposition*.

Propositions have been represented variously throughout history, depending on which of their properties it was desired to emphasize. I use the gerundial form to

emphasize that the proposition is an abstract semantic operator rather than a concrete sentence, etc. (Pearson 1994, 1995). Thus, we have the logical form given by expression (16):

16. $\Pi_M : \Pi_S$

where Π_M is a mood operator and Π_S is a semantic operator.

We have not got to the end of our analysis but already it is yielding very surprising results. When we have finished it will motivate an entirely new approach to semiotic theory. For now, we merely need to notice that according to the conventional sequence: syntactic, semantic, pragmatic, we would expect either a syntactic or a pragmatic operator to appear in the final factored position, not a semantic operator. But instead, this is just what we do get. This is indeed unusual. Could we have our categories in the wrong sequence? Should it be syntactic, pragmatic, semantic, or semantic, pragmatic, syntactic? Actually both occur depending on whether we are synthesizing the sign, or analyzing it. What will become clear is that the sequence: syntactic, semantic, pragmatic used by Peirce, Morris, Bloomfield, Chomsky, etc., is wrong (Pearson 1994).

5.3.3 Factoring the Mood

The next step is to break down what I have loosely called the mood operator into its component factors. It turns out to be difficult because so much of the structure of the sign is contained in it. One such attempted analysis of the indicative operator showed that two distinct interpreters were required for every sign along with a truth warrant, an epistemic operator, a convention binding operator, etc., such as for instance in analysis (17), with similar analyses for each of the other moods. It seems that all of the meaning contained in analysis (17) is imbedded in the sentential period of examples (1) and (10).

17. I_S(I) WARRANT to I_T(YOU) that I_S am placing myself under all the conventions of LANGUAGE COMMUNITY(L_C) including all punishments for not adhering strictly to all such conventions and that I_S KNOW sufficiently a restricted part of the WORLD(W) as it relates to L_C and that this part of W may be DESCRIBED(D) by:

This showed that *each of the moods can be represented by an invariant operator independently of the semantic proposition, and that each semantic proposition can be represented by an invariant operator independently of the mood of the sentence*.

At this point, I started to look at an inventory of moods for all of the world's natural languages, and although it appears that there are only a very few moods, or at least combinations of mood factor components, I became sidetracked by another more pressing problem before I could finish this one.

The interference was caused by my becoming aware of the work of the American semiotician, John Searle, and the critical relevance it has for the project of factor-

ing semiotic operators in general. Searle's work relates to the factorization of what I loosely called the mood operator, but concerned not so much mood itself as the pragmatic structure of the sign in its relation to the illocutionary force, a concept developed by the British philosopher, John Austin.

I later learned that an important part of this relation between the pragmatic operator and the illocutionary force concerned the operation of converting a type into a token, so I thus began to look at the structure of the type-token conversion operator as part of the structure of the pragmatic operator and gradually the concept of semiotic factorization started to become clearer. Most importantly, it became clear that unlike the USST, semiosis was involved in every factorization. Thus dynamics suddenly became an important part of theory development.

To finish this brief thought, *all complete utterances have both a mood and an illocutionary force and these are always present and distinct in every rheme token, even when they appear identical in the surface structure of the utterance. The mood is part of the type while the illocutionary force is part of the token*.

After figuring this out, it became obvious that *all sentential utterances can be represented by a pheme operator as in equation (18)*.

18. $\Pi_{ph} = \Pi_X : \Pi_P : \Pi_S$

where Π_{ph} is a general pheme operator governing pheme tokens, Π_X is a syntactic operator, Π_P is a pragmatic operator, and Π_S is the semantic operator as before. Note, we have arrived at the sequence: syntactic, pragmatic, semantic which is necessary here to make phematic analysis work. Similarly in the case of phematic synthesis, we have equation (19), containing the sequence: semantic, pragmatic, syntactic, just as predicted. There is no way we can force the sequence: syntactic, semantic, pragmatic to work.

19. $(\Pi_S)^{-1} : (\Pi_P)^{-1} : (\Pi_X)^{-1} = (\Pi_{ph})^{-1}$

5.3.4 General Semiotic Factorization

We now take a short diversion to look at rheme and doleme operators. All complete communications are dolemes and all dolemes are composed of rhemes, phemes, and other dolemes, so we might expect:

20. $\Pi_C = \Pi_{D1} : \Pi_{D2} :\ldots: \Pi_{D(n-1)} : \Pi_{Dn}$ *with* :

21. $\Pi_D = \Pi_{ph1} : \Pi_{ph2} :\ldots: \Pi_{ph(m-1)} : \Pi_{phm}$ *and*

22. $\Pi_{ph} = \Pi_{rh1} : \Pi_{rh2} :\ldots: \Pi_{rh(l-1)} : \Pi_{rhl}$

but we have already seen that the Π_{ph} do not have the structure of (22); they factor as in (18). Then, from (18) various of the components factor into rhemes. *The pheme is the central component of dynamic semiotic theory*.

Also, the first doleme of the communication, and several other dolemes as required, have a peculiar structure. I call this the "once-upon-a-time" doleme. All

American fairy-tales begin with the phrase "once upon a time."[27] What does it mean? This peculiar phrase has a very special meaning and a very important function to serve in the overall communication. First of all, it says, "Welcome to the world of the fairy-tale" and so it communicates the genré. Now the interesting thing is that the I_T never needs to be reminded of the genré again, at least until it changes. And so the communication processor must have some way of remembering the genré. We say that it does this in the genré register. The genré register is part of the sign processor, not part of the sign, or sign process. However, we know that the genré can change and actually imbed itself by recursion—the play within a play concept. And so, the genré register must be a LIFO stack. I call this LIFO stack genré register the "Doleme Stack," since all evidence suggests there is only one Doleme Stack per interpreter. Now, if this were all the doleme stack had to do, it would be a rather ad hoc kind of concept with no empirical reality. But the fact is that the doleme stack has much more to do than simply store the genré, or universe of discourse as it is often called in some contexts. The doleme stack also stores the general time and place of interpretation and the name of all special roles and scripts needed to process all S&BC information. Each of these has a special place in the doleme stack. The set of all doleme variables on a particular recursion level is called a doleme vector, and so the doleme stack is technically structured as a LIFO vector stack.

Now the remarkable observation is that every communication has a similar doleme for its first, and so I call all of these "once-upon-a-time" dolemes. They all have a similar function of loading the doleme stack with the genré, time, location, roles, scripts, etc., and so we see that the *doleme stack* is a very general concept required for all forms of semiosis.

As an example, all Sousa marches begin with a four- (or eight-) bar intro that is so characteristic that anyone familiar with Sousa marches, but hearing a new one for the first time can say instantly, "This is a Sousa march. It will start in exactly four (or eight) measures. It will be in the same key as the intro. It will have the same time signature as the intro." And so the first doleme of every Sousa march says, "Welcome to the world of Sousa marches. The composer (I_T), is John Philip Sousa. Here is the tempo, the key, and the time signature. The march itself will start in just four (or eight) bars."

Similarly, the last doleme of every communication has a special structure, although this structure is simpler than that of the "once-upon-a-time" doleme. The only function of what I call the "and-they-lived-happily-ever-after" doleme is to pop the current doleme vector off of the doleme stack, thus returning the communication to the previous recursion level. Every communication contains an "and-they-lived-happily-ever-after" doleme as its last doleme. In a Sousa march this would be the Coda. The coda is a short section, usually eight to sixteen bars that sets up a fully resolved cadence to say this is the end of this march—"The End."

Transformational linguists have worked out much of the structure of the $\prod_X$ for those signs having the structure of a linear text, such as natural language and music. It is easy to see that a linguistic transformation is just an especially simple kind

[27] All Chinese fairy-tales begin with the phrase "long, long ago" with the same meaning.

of semiotic operation. Where the grammarians ran into trouble is when they went beyond syntactics and attempted to analyze semantics before they understood the pragmatics.

The pragmatic operator factors as equation (23), much like equation (22).

23. $\Pi_P = \Pi_{rh1} : \Pi_{rh2} :\ldots: \Pi_{rh(l-1)} : \Pi_{rhl}$

Some of the individual operators in equation (23) include the tense and aspect operator, *Æ*; the voice operator, ∧; the type-token conversion operator, *ð*; the illocutionary force operator, *I*; and the focus operator, *f*. However, mapping the specific location of each of these operators is very much like mapping out the location of each of the genes in the Human Genome project.

One function of *ð* is to read the real world and the doleme stack and drop the specific conversion time, t_c, place, manner of interpretation and the value of I_S into the pheme stack, another LIFO vector stack similar to the doleme stack. *Æ* must appear to the left of *ð* because one of its functions is to read the value of t_c from the pheme stack and compare it to a set of times in the proposition (those times when the proposition is true). In simple tensed languages without aspect, like American, the set of time values may be represented by a single closed interval, $[t_i, t_f]$. In such languages, *Æ* also has a simple form. It makes the following simple determination:

24. $t_c < t_i$: $\text{Verb}_{\prod S} \rightarrow \text{Verb}_{\prod S} + FUTURE$
25. $t_c > t_f$: $\text{Verb}_{\prod S} \rightarrow \text{Verb}_{\prod S} + PAST$
26. ELSE: $\text{Verb}_{\prod S} \rightarrow \text{Verb}_{\prod S} + PRESENT$

The markers *FUTURE*, *PAST*, and *PRESENT* are later interpreted by the appropriate syntactic transformations to yield a tensed surface structure. These markers were introduced into transformational grammar in an ad hoc fashion with no theoretical explanation or even any motivation other than the need to explain some grammatical relations. Now we see that they arise from semiotic functors in a natural way out of the semiotics of pragmatic structure.

5.3.5 *Theory of Operational Semiotics*

We have now developed enough background to motivate our study of the TOS. The theory of operational semiotics is abbreviated as TOS. The TOS is intended to explain sign dynamics, or semiosis. It fits within the semiotic paradigm (Pearson 1982a, b; Pearson 1983), as a second theory that complements the USST rather than competing with it. The TOS starts by assuming one basic principle in addition to the three principles of the USST (Pearson and Slamecka 1977; Slamecka and Pearson 1977). All sign processes, all transformations, all changes in sign structure whatever can be represented by an operator which transforms an initial sign into a final sign. Equation (27) is called the "Dynamic Principle."

27. $\Psi_f = \Pi_{f,in} : \Psi_{in}$

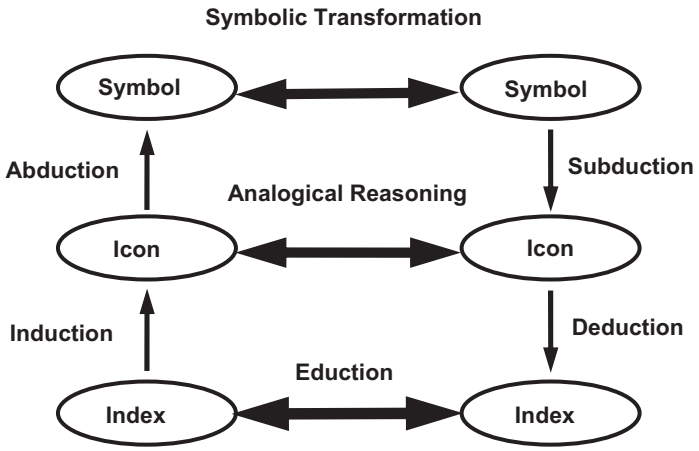

Fig. 5.15 The ladder diagram of semantic reasoning. (After Pearson (1993c, p. 309))

where Ψ_{f} represents the final sign, Ψ_{in} the initial sign, the structure of Ψ_{f} and Ψ_{in} are given by the USST, and $\prod_{\text{f, in}}$ represents the operation of changing Ψ_{in} into Ψ_{f}. This implies that USST explains the static structure of sign systems, the TOS explains their dynamic properties, and the USST acts as a set of boundary conditions on the TOS.

In many analyses, the structure of the Ψ are assumed given and fixed. In such cases, the entire process is characterized by the $\prod_{\text{f, in}}$ and all attention is devoted to the study of $\prod_{\text{f, in}}$. Such for example is the case with the study of induction:

28. $\Psi_{KS} = \Pi_{ind} : \Psi_{IS}$

where Ψ_{KS} is an iconic symbol and Ψ_{IS} is an indexical symbol. The problem is to completely characterize the induction operator, $\prod_{\text{ind}}$.

There are similar ways of studying abduction, subduction, deduction, analogical reasoning, and symbolic transformation (Pearson 1993). When this is done, the following amazing diagram is uncovered, which I call the "ladder diagram of semantic reasoning," see Fig. 5.15.

Equation (18) implies that pheme processes are represented by equation (29):

29. $\Psi_f = \Pi_X : \Pi_P : \Pi_S : \Psi_{in}$

This may, in fact, be trying to tell us that conversion from a tone to a token takes place in exactly the same sequence, with the same structure as equation (30):

30. (30a) $\Psi_{ph,K} = \Pi_X : \Psi_{ph,T}$
31. (30b) $= \Pi_X : \Pi_P : \Psi_{ph,N}$
32. (30c) $= \Pi_X : \Pi_P : \Pi_S : \Psi_{in}$

which implies that we could separate phematic analysis into three distinct stages:

33. $\Psi_{\text{ph,K}} = \Pi_{\text{X}} : \Psi_{\text{ph,T}}$
34. $\Psi_{\text{ph,T}} = \Pi_{\text{P}} : \Psi_{\text{ph,N}}$
35. $\Psi_{\text{ph,N}} = \Pi_{\text{S}} : \Psi_{\text{in}}$

in which case, one is sorely tempted to identify equation (33) with Chomsky's program of transformational syntax and to predict two other associated programs: operational pragmatics associated with equation (34); and operational semantics associated with equation (35). This theory very strongly suggests that linguists and other semioticists should deliberately tackle the development of a science of pragmatics after the development of syntactics (as in transformational grammar) and before attempting systematic development of a science of semantics.

5.3.6 Words to World Flag

Each pheme contains an operator whose job is to signal whether the intention of I_{S} is for the pheme to match the world, or to force the world to match the pheme. For instance, an indicative sentence uttered in its normal use is normally intended to match the world. If it does not, it is a mistake at best and a lie at worst. But an imperative sentence uttered in its normal use is intended to get the world matched to it. If the world does not come to match the imperative utterance, it may have been ineffective, but never a lie.

This operator has either two or three values: "words to world"; "world to words"; and possibly "don't care, or not applicable." Searle has pointed out the importance of this operator for the study of illocutionary force in natural language (Searle 1979). James also pointed out its role for mood in his study of the English subjunctive (James 1986). It is just as important in nontextual, nonlinear sign systems, such as painting.

The words to world operator contains within its expansion a truth/falsity operator. Whenever the words to world flag points in the words to world direction, the truth/falsity operator is inserted into the operator expansion string and its job is to test whether the words do indeed match the world and if so it issues the value true and otherwise it issues the value false.

This means that the flag operator must contain a pointer to the value of the world/genré variable on the doleme stack, so that the truth operator knows how to find the current value of the world variable so later it can tell what world to test (real world, world of fairy tales, world of Sherlock Holmes, world of ghost stories, etc.). The words to world operator is probably contained in the expansion of the mood operator and in turn it contains an operator that establishes a linkage between the proposition in the semantic operator and another operator that tests for a match between the two, as well as the truth/falsity operator and the pointer to the doleme stack discussed above.

5.3.7 Theory of Intention, Intentionality, and FEMs

In Sect. 5.3.4, I likened the complexity of mapping the various detailed operators in any practical sign process to unraveling the human genome. Many investigators have already started to do this. I already referred in Sect. 5.3.4 to the work of transformational linguistics as working out the details of $\prod_X$ for sign systems having the structure of linear text. Other groups working on this problem include the speech act theorists, especially its founder, Searle (1969), and the logical semanticists, especially Grice (1975). Tools that are available for the semiotic analysis of the operator string include philosophical analysis, logical analysis, speech act theory (SAT), discourse theory, transformational grammar, linguistic semantics, linguistic pragmatics, cognitive science, and artificial intelligence. Among these, Grice's conversational postulates and Searle's felicity conditions, rules, dimensions, etc., are especially useful with a very important caveat. Grice's conversational postulates contain a mixture of tone concepts, type concepts, and token concepts all intermingled. I expect that the conversational postulates will factor into at least three subsets referring to tone operators, type operators, and token operators. Similarly, Searle's analysis contains a mixture of tone, type, and token concepts. If these are distinguished, Searle's tools become much more powerful.

One area of semiotic operator string theory that has been developed extensively is SAT. A speech act contains an illocutionary point, followed by an intentional attitude, followed by illocutionary force indicating devices, followed by the propositional content. Illocutionary points are such things as asserting, reporting, promising, warning, etc., i.e., the purpose for which the source interpreter creates the sign. Intentional attitudes express a psychological state, such as believing, intending, wishing, etc. Illocutionary force indicating devices are conditions that require the propositional content to suitably match the illocutionary act and the intentional attitude. And the propositional content contains the abstract proposition along with modal operators, generalization operators, abstraction operators, such as Church's λ, along with other propositional operators.

If we let F stand for the illocutionary force of the speech act; I stand for the illocutionary point; S stand for the psychological state; C, for the illocutionary force indicating devices; ~, for the propositional operators (such as negation); m, for the modal operators; P, for the predicate operators; and s, for the subject operators, then we can represent the speech act, or at least its illocutionary force, by:

36. $F = I(S(C(\sim(m(P(s))))))$,

as long as we insist that the notation does not imply simple functionality in the strict mathematical sense, although, it must be admitted that there is a strong feeling of some kind of functional dependence hinted at by this representation. For this reason, it is better to use an operator notation, so we write:

37. $\prod_F = \prod_I : \prod_S : \prod_C : \prod_\sim : \prod_m \prod_p : \prod_s$

for the structure of a general speech act. In this representation, $\prod_{\sim}:\prod_{m}:\prod_{P}:\prod_{s}$ corresponds roughly to $\prod_{S}$ in the notation of equation (18), and $\prod_{I}:\prod_{S}:\prod_{C}$ to part of $\prod_{P}$ in the same notation, along with *Æ*, *Λ*, *ð*, *I*, *f*, and others. The words to world flag, discussed above, is contained in the state operator, $\prod_{S}$, of equation (37).

Now, a very important sign system is intentionality, including all intentions and FEMs (feelings, emotions, and psychological moods). Semioticians have not always recognized that these all fit together in one system. In fact, one of the saddest legacies of the modern age is the separation of intentionality from emotionality along with the separation of mind from body, and science from religion. Semioticians have wrestled with the theory of intention and intentionality for years, but without any good notation for representing intentions, the job has been slow and difficult. The operator string notation employed by the TOS gives us the desired representation. In fact, all we have to do is drop the illocutionary point operator from the front of the right hand string of equation (39) and we have the TOS representation of intentions, intentionality, and FEMs as in equation (38), where $\prod_{N}$ is the operator expression for intentionality.

38. $\prod_{N}=\prod_{S}:\prod_{C}:\prod_{\sim}:\prod_{m}:\prod_{p}:\prod_{s}$

Suppose the operator **P** is the value of ***S*** that stands for the psychological state of surprise (not the word "surprise"), likewise the operator **U** the value of ***C*** that stands for the conditions that relate surprise to unexpected events, **H** the value of ***P*** that stands for the condition (not the assertion of a condition) of being in my home, and **B** the value of *s* that stands for a burglar (again, not the word "burglar"), then equation (39) represents the feeling of surprise at encountering the unexpected event of a burglar being in my home. This feeling need never be asserted, nor even expressed silently to oneself. It may remain just a raw, unexpressed, feeling of surprise. And yet equation (39) shows that the TOS has the ability to handle even this ephemeral kind of sign.

39. F=P:U:H:B

Now, intentions have often been defined as internal psychological states that relate to objects, events, or conditions in the external world, while emotions have been defined in some instances as simply "a rush of hormones." So, it may be surprising to find that equation (38) will handle FEMs as well by the simple expedient of defining various operators in expression (38) as either null or identity operators. For instance, if **D** is the value of ***S*** that stands for the psychological state of being depressed, equation (40) represents the feeling, or emotion, of being depressed.

40. E=D:1:0

Not all feelings and emotions have trivial values for $\prod_{C}$, $\prod_{P}$, and $\prod_{s}$, however. The language for discussing intentions, intentionality, and FEMs is notoriously imprecise. Many feelings behave more like propositional attitudes, while many others behave more like emotions, while some even behave like internal perceptions. One advantage of the more precise language and more powerful theory of the TOS is that

it should help to sort out and systematize much of our observation and understanding of FEMs.

Another advantage of the TOS, not shared by any of its competitors, is the additional insight that the TOS gives into the semiotic interpretation of the sign and its relation to the source interpreter, I_S. For instance, SAT represents the utterance (41) as an assertion of the proposition (42). This explains the linguistic and grammatical properties of (41) very well, but also represents I_S as a disinterested party with no more personal involvement with (42) than if he had uttered (43) as an assertion of (44). What is needed here is an acknowledgment of the very special first person, subjective, relation existing between I_S and his feeling of sadness that cannot be experienced or shared when he asserts someone else's sadness. Now, this is just what the TOS does when it lets **S** be the value of ***S*** that stands for the psychological state of sadness (not the word "sad," nor even the proposition 'being sad'), and explains (41) by (45), and the assertion of (41) by (46), the assertion of **G**.

41. I'm sad.
42. my being sad
43. Tom is sad.
44. Tom's being sad
45. G=S:1:0
46. ⊥:G

We thus see that by bringing each of the components of the USST diagram into the representation as an operator, the TOS gains in both power and flexibility in ways that no other semiotic theory can do, especially a theory like SAT which is limited to such a narrow semiotic domain as natural language.

5.3.8 Boundary Conditions

The weakest part of the TOS at this time concerns the lack of knowledge about the boundary conditions on operator string representations of semiotic processes. The boundary conditions are determined by the requirement that the operators have to operate on sign structures and that the sign structures are represented by USST diagrams, however, much study needs to be given to the detailed relations between the TOS and the USST. As one very hypothetical example, the USST explains semantic structure as having three distinct levels, the extensional, the intensional, and the protensional. These determine the behavior of indexes, icons, and symbols (in corresponding order), and also individuation, generalization, and abstraction (in the same order; Pearson 1999). We might expect the semantic operator $\prod_S$ to factor into three separate operators, in the same order. To date, the details of how to do this have not become clear. However, as suggested above, it may be best to postpone semantic investigations of this type until much more is known about the structure of the pragmatic operator, $\prod_P$. In the meantime, there is much to do to investigate the boundary conditions relating $\prod_P$ to the pragmatic dimension of USST diagrams.

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