

Surviving in the Bermuda Triangle of Semeiosis

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Abstract

What we think is part of reality and at least partly determined by reality at the same time. The advent of knowledge engineering asks for a shift from lifeless representational and blind reductionist models towards a relational and teleological interpretation of cognition in order to embed the cognitive events in processes of meaning production or semeiosis. Such embedding is determined by the properties of perception (the senses) and the types of distinctions that can be made by semeiosis. The selection of elements in such processes that are formalizable asks for a model in which the phases that make up the process, the decision moments and their degrees of freedom are clearly indicated. In this paper we will outline such a model for two levels: the level of sign recognition and the level of response to a sign. The decision moments will only be indicated. The practical importance of this structure lies in its potential to be interpreted as a methodology for (formal) specification.

Keywords C.S. Peirce, semeiosis, cognition, process, semiotics.

1 Introduction

The choice between a rationalist, propositional account of knowledge as exemplified by Fodor and Pylyshyn and a naturalist, reductionist account as proposed by Patricia and Paul Churchland is not very attractive since either we are left with mental symbols or with brain states as the privileged type of fact. As a consequence of which either the world's contribution to knowledge becomes highly problematic or knowledge theory is reduced to science of the brain and meaning to brain states¹. Similarly, human behavior tends to be understood as either governed by natural law (sciences approach) or by subjective impulses that are grounded in individual histories (hermeneutic approach) [1].

Mixtures of internalism and externalism will not offer a solution:

“They miss the mark by tending to absolutize the contribution of either the subject-as such or the object-as such. Considering the fact that knowledge is first off all a relation between subject and object, it is clear that no such approach will ever be completely successful.” [7](p.253)

¹For a detailed analysis of both positions and a discussion of their (dis)advantages see [7].

So, what is needed is a radical new approach that respects both the epistemic and the natural aspects of knowledge. Sleutels proposes to this end the development of a theory that is relational and teleological in character. It must be relational because

“... , we must study internal activity (which is real and, according to our best theories, computational in character) in terms of the subjects external relations to reality (which are logical or epistemic). Hence, we must take an externalist view of mental representations.” [7](p.204)

without, however, falling prey to the mistake of regarding internal representations redundant.

“Rather, the conclusion should be that ‘having knowledge’ is primarily a matter of relating to the world, not of being related to symbols. . . . Still, knowledge is realized by means of internal representations: for a subject to be cognitively related to the world is for him to be tokening mental representations that go proxy for external states.” [7](p.205-206)

There is no space to go into the arguments that occasioned Sleutels to the conclusion that the relational theory must also be teleological, so a short characteristic must suffice for now². A teleological theory tries to take into account that since

“the content of internal representations is constrained by the organisms use of these representations in organizing its interaction with the environment” [7](p.213)

it is wise policy

“to analyze the notion of mental content specifically from the point of view of this purposiveness.” (idem)

We gladly accept this harvest of half a century of philosophy of mind, i.e. that a knowledge theory must be relational and teleological in character³. In this paper we will focus on the semeiotics of Charles Sander Peirce (1839–1914), an early proponent of such a theory. After a short indication of Peirce’s relational and teleological position, a semeiotic account of a sign sequence will be presented, next we will pay attention to the formation of a perceptual judgment and finally we will draw some conclusions, the most important of which probably is that both processes show a remarkable similarity.

2 Peircean Semeiotics: Setting the Scene

Peircean philosophy is too complex to deal with in some paragraphs. So, we only will indicate that it is justified to call his philosophy relational and teleological. We will conclude this scant introduction with some words about the categories, since they are very important for the way in which Peirce tackles his problems.

²For an excellent treatment of teleology see [3].

³It is tempting to ponder the question what relations might be constructed between the downfall of strictly representationist approaches to knowledge and the advent of knowledge engineering.

Peirce makes clear that he rejects reductionist and mentalist positions alike since he states explicitly that a synechist – or adherent of the doctrine that all what exists is continuous – holds that “all phenomena are of one character, though some are more mental and spontaneous others more material and regular” [5](7.570)

With regard to teleology an undated letter to F.C.S. Schiller gives a clear statement⁴. In it Peirce states that although every physical event is directly determined by dynamical non-telic conditions and laws alone, this does not prevent mental representations and physical events to determine each other in respectively a telic and a causal way. In the paragraph Percepts and the perceptual judgement we will look at this interconnectedness in more detail. Here we only want to stress that this supposed mutual influence of different types of phenomena with different types of causality is not informed by a wish to argue for human freedom or any kind of fundamental unpredictability of behavior. On the contrary, he explicitly states that man is as free as a machine with automatic controls for five or six grades at least:

“I, for my part, am very dubious as to man’s having more freedom than that, nor do I see what pragmatic meaning there is in saying that he has more. The power of self-control is certainly not a power over what one is doing at the very instant the operation of self-control is commenced.” [5](8.320)

So, the power of self control is not exercised at the moment one acts, it is exercised when making up the resolve to act in a certain way if certain circumstances occur, it consists in short in a habit that determines a response.

The Peircean categories give the fundamental modes of being. They are operative at every level of reality. At a very general level they are determined as Firstness or that what is without any relation, Secondness or ‘brute’ reaction and Thirdness or mediation. Signs are characterized as predominantly thirds that involve seconds and firsts. Much more can be said, here we only want state that in the Peircean approach towards semiotics the categorial distinctions are applied repeatedly in order to sort out the different aspects that need to be taken into account if one wants to understand semeiosis.

3 Sign Processes: The Case of the Lost Baseball Game

Before we look at the way in which the physical and the telic causes play their role in the relational semeiotic of Peirce a remark must be made. The triadic nature of Peircean semeiotic allows that starting from a basic definition of the sign detail is added in such a way that the theory becomes a more specific representation of semeiosis. Peirce refined his semeiotic throughout his career. We base our present work on the way he formulated his thinking between 1902 and 1904. This remark is made because Peirce changed his terminology quite often, in his unceasing search

⁴See [5](8.320) letter to F.C.S. Schiller.

for the right words⁵.

We will introduce the model with a simplified example. A baseball game is going on. The game reached its climax; if the hitman of team A misses this ball, team A loses, if he hits and reaches at least first base the game goes on. The perspective is that of the supporters of the teams. The event that triggers a sign response is the watching of the miss by the supporters. For briefness sake we abstract from the role of the umpire in deciding whether it is out or a miss, neither will we make an issue of the difference between learning about the miss from looking at the field and looking at the scoreboard. In the next paragraph we will deal in more detail with perception.

Given the Peircean sign definition we get a first approximation of the miss event.

A Sign, or **Representamen**, is a First which stands in such a genuine triadic relation to a Second, called its **Object**, as to be capable of determining a Third, called its **Interpretant**, to assume the same triadic relation to its object in which it stands itself to the same Object [CP 2.274]⁶.

The object is 'the ball being missed'. The sign is 'perceiving the miss of the ball' or 'the score on the scoreboard'. The interpretant is 'the subsequent recognition of the miss of the ball'. It is through the perceiving of the miss that the recognition of the miss connects to the event. This calls for a distinction between different types of objects. On the one hand we have the object as recognized by the interpretant through the sign. This is the immediate object of the sign, which is defined as the object as presented by the sign. On the other hand we have the event that determines the sign, that determines our perceiving the miss. This event is the dynamical object. See figure 1 the bottom triangle.

This triadic structure can be expanded in two ways. Firstly at the nodes and, secondly, in the relations between the nodes. The second approach will have to wait for the next paragraph. The rules for node expansion are simple. A First, like the sign regarded in itself, is monadic and cannot be expanded. A Second, like the object, is dyadic. Here a node can be replaced by two nodes that are regarded as related to each other. A third, like the interpretant, is triadic. This node can be replaced by a new triad. In case of replacement, probably the First of the implanted triad occupies as a rule the position of the replaced node. It is important to note that this structure is recursive. See the boxed concepts in figure 1 for an instance of two steps of expansion of Thirds.

- representamen = either the score on the score board or watching the miss event
- immediate object (a) = object as presented by the sign
- dynamical object (b) = the actual event that took place

⁵One example will do. The sign-aspect legisign (legi from legis, law) is used to indicate the aspect of generality of signs, sinsign (sin as in single meaning 'only once') is used to indicate the actuality, the here and now existence of a sign. This same distinction is also indicated with the terms Type, Token and with Famisign, Actisign. For a detailed account see [4].

⁶Reference to the Collected Papers of Ch. S. Peirce is according to the format: Abbreviated title volume.paragraph. So in this case volume 2 paragraph 274.

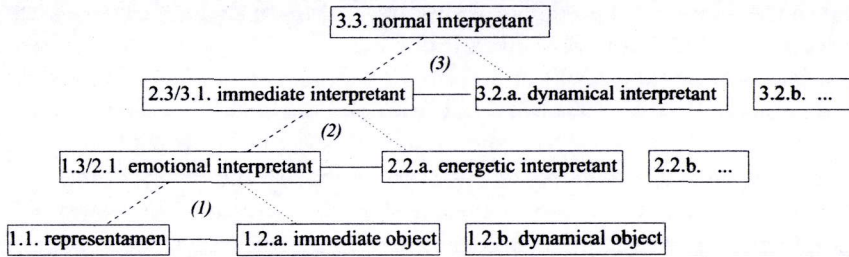


Fig. 1: Peirce's sign-object-interpretant scheme in which the object node of the bottom triangle is exploded and the interpretant node is exploded twice.

- emotional interpretant = the knock on the door of consciousness, something attracts attention.
- energetic mental interpretant (a) = the mental rehearsal of the sign without generality, as a here and now event.
- energetic physical interpretant (b) = the physical effect of the sign in the nervous system, as a one time event.
- immediate interpretant = the sign is rehearsed in the interpretant mind, including the original potential for affecting life it had.
- dynamical interpretant (a) = the sign as functioning in the thought process
- dynamical interpretant (b) = the sign that is produced in response after processing
- Normal interpretant = the rule(s), habits that direct the processing and the response to the sign at the moment of response. Experience with previous sign processes is stored here, together with the relevant goals one pursues.

The intermediary triad is dispensable if we have no interest at all in how a sign is entering thought⁷. In the next paragraph we will look at 'the taking in of the sign', the 2nd triad. Here we will concentrate on the response to the score, the uppermost triad.

The miss (representamen) has entered the mind/brain and did arouse an immediate interpretant. At this point the interpretant mind has a specific interest, a goal orientation, either as a consequence of the sign itself in combination with past experiences or as a consequence of encompassing processes going on, like watching a game with an interest in the outcome. This type of information is part of the normal interpretant or, in Peirce's words, part of the "... effect that would be produced on the mind by the sign after sufficient development of thought."⁸ Before the miss has occurred normal interpretants already are doing their work in anticipation of what is going to happen, the normal interpretant involves the habits that determine the

⁷Compare mathematical proof with testifying in a legal case.

⁸See [5]8.343.

response to the sign anticipated. For a supporter of team A the normal interpretant can be represented by something like: If our hitman misses this ball, the team will be out of competition and I will be fighting tears of sadness. At the moment of the miss, the immediate interpretant enters the stream of thought (as the recognition of a fact), which is indicated by it becoming a dynamical interpretant of type (a), the normal interpretant and the dynamical interpretant of type (a) together determine the response, which is in case of a miss a showing of sadness or, tag-wise, a dynamical interpretant of type (b). So, the transition from immediate interpretant to dynamical interpretant of type (a) comes down to a process of embedding the sign in the range of meaning possibilities of the normal interpretant at the time of embedding⁹. Notice that on account of this analysis a response to a sign always involves past experience and operative goals besides the sign that occasions the response.

4 Percepts and the Perceptual Judgment

As a preparation of a treatment of percepts we have to look at the second way to expand the triadic structure. It consists in adding characteristics to the relations between the terms of the triad, one of its goals is to assist in making a typology of the different kind of signs. Peirce sets off this type of branching with three triads.¹⁰ See figure 2 below. Each triad specifies the sign in the aspect of the corresponding node:

1. The sign in itself yields Qualisign, Sinsign and Legisign. Informally one could say that qualities (qualisigns) make up the sign as an existing here and now entity (sinsign) which can only do its proper job as a sign if it is recognized as being an instance of a general type (legisign).
2. The relation between sign and object yields Icon, Index and Symbol. The icon doing its job due to a similarity between sign and object, the index due to a real connection between sign and object (symptom and illness for instance) and the symbol depends on a convention for the establishment of the relation between sign and object.
3. The relation between sign and interpretant yields Rheme or Term, Dicot or Proposition and Argument. The perspective here is the way in which the interpreting thought is addressed; suggestive, as a term without context; assertive, as a statement with which to agree or disagree; law like, as an attempt to convince with an argument.

For any sign Peirce demands a score on each of the triads¹¹ and repeatedly he indicates that the higher sign aspects involve the lower; no legisign without

⁹Here we have a recognition of the role of perspectives.

¹⁰We do not follow the sequence in which Peirce developed his thought. But that is of no consequence since the aim is expository.

¹¹See [8] for a more detailed exposition of the sign system and for further refinement.

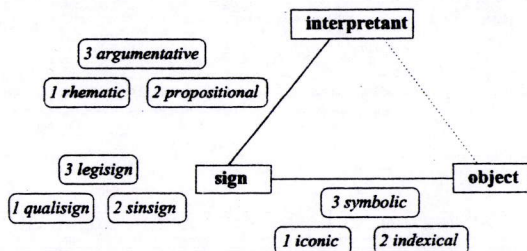


Fig. 2: The aspects that determine the different sign types

sinsign, no symbol without index or icon as the foundation upon which the symbol could be developed in the first place or communicated in the second place and no propositions without terms. From these two rules it follows that an argument will involve immediately or mediately all sign aspects. We will make use of this insight in the following analysis of the formation of a perceptual judgment. Now we are not concerned with something like a response to a miss. But only with the recognition of such events, i.e. the process that leads to the perceptual judgement: *This is a miss.*

A percept, according to Peirce, is that what stares us in the face, in that sense it has a compulsory character. For, whatever eventful situation we put our sense organs in, some percept will be unavoidable. At the same time a percept is not general, since it is the here and now affection of our senses. So, how do sensory caused percepts enter purposive thought? It is by means of a kind of abduction or abductive process

“Consequently, whatever feature of the percept is brought into relief by some association and thus attains a logical position like that of the observational premiss of an explaining Abduction, the attribution of Existence to it in the Perceptual Judgment is virtually and in an extended sense, a logical Abductive Inference . . .” [CP 4.541]

So, with regard to the feature of the percept that is singled out and also with respect to the existence of that feature abductive reasoning is needed. But it is not a full fledged abduction since a percept is a kind of term, certainly not a proposition. It is probably best to write about the percept in terms of proto-signs[6] that are in a process of becoming signs. In order to do so we present the models of figure 3. They illustrate the various steps of cognition, their logical interpretation, and their correspondence with Peirce’s sign types. Out of this model the three relata required for an authentic sign are removed. The relational sign aspects are organized according to their categorial value, the lowest value at the bottom, the highest at the top in order to indicate that the lower values are involved in the higher.

Cognition, as a process, can be modeled as follows. According to cognitive theory, physical stimuli are represented by the senses by qualia, which are processed by the brain in percepts. In a single observation, the brain compares the current

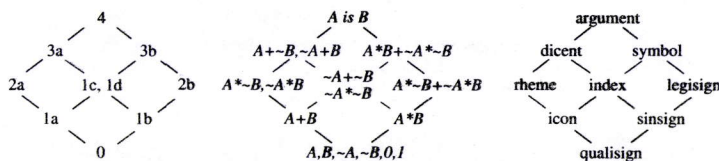


Fig. 3: Computational, logical and semiotic interpretation of the process model of cognition

percept with the previous one, and this enables it to distinguish between two sorts of input qualia (in short *input*): one, which was there and remained there, which we call a 'state'; and another, which, though it was not there, is there now, which we call an 'effect'. The input triggers the memory, which in turn generates a response, consisting of information about the properties of the input qualia. In a nested process, which is omitted due to lack of space, the input and memory information are linked, yielding the signs of the input state and effect completed with (i) information about their *actual* properties, and (ii) *complementary* information about the rules of combinations. Such rules, which are subject to learning, specify the possible co-occurrences of qualia. This completes the initial operation (step 0) of cognitive processing.

In step 1, the input qualia, which are signs, are identified separately, as constituents (1a), and collectively, as a simultaneous appearance, including the relation of correspondence (1b). Also the combinatory rules contained in the input meaning, are represented analogously (1c, 1d). In the subsequent step 2, the 1a and 1b signs are used for the representation of the meaning of the constituents, independent from the meaning of their correspondence (2a), and, the other way round, the meaning of their correspondence relation, independent from the meaning of those constituents.

By complementing the abstract meaning of the constituents (2a) with background information about the rules of combination (1d), the actual meaning of the constituents, representing the *subject* of the observation (3a) can be obtained. Analogous complementation of the abstract correspondence meaning of 2b may yield the characteristic property, or the *predicate* of the input (3b). Finally, by merging 3a with 3b, cognitive processing may 'generate' the meaning of the entire input, as a proposition which is a hypothesis (4).

The different steps of cognitive processing can also be interpreted as logical operations. The logical meaning of the state and effect qualia of (i), in step 0, can be represented by logical variables, respectively, by A and B ; and those of (ii), by $\neg A$ and $\neg B$ (0 and 1 can be defined as the sign of a 'not-valid' and 'valid' input, respectively). Additionally, 1b can be interpreted as a logical 'and' operation, 2a as an 'inhibition', and 3b as an 'equivalence' (which is a logical definition of a property). An analysis has revealed that all 16 Boolean relations on two variables appear in sign recognition, indicating the completeness of cognitive processing, in the (naive)

logical sense.¹²

Equally important is the fact that each step of such process, a semiotic aspect (of meaning) can be assigned to. For example, the aspect of an 'actual event' to 1b, the aspect of 'abstraction' to 2a, and the one of a 'consensus' to 3b. We have proved in [2] that an isomorphic relation between the 9 types of cognitive representations, and the sign aspects introduced by Peirce can be defined. This relatedness between the cognitive and semiotic concepts of meaning is the key to the possibility of a definition of the combinatory properties of qualia, for instance in language.

Finally, we may ask how both models are related. It is too early for stout statements, but some remarks are in order.

A major difference between the Peircean sign model and the process model of cognition consists in their starting points; respectively, a sign as given and a sign in the making. In the later model the relations between sign, object and interpretant is part of the process of sign formation out of the original contrast between qualia. This means that those relations are already present at the very beginning as a *potential*, in the comparison of the percepts (sign), in their characterization as state and effect (sign-object relation), and in the state being subject to the effect (sign-interpretant relation).

The proto-sign model fits in the sign response model. With the emotional interpretant, the catching of attention, the processing of signs starts. It ends with the immediate interpretant, the internalized sign in its full potential of meaning, at the brink of its entering the stream of thought as a recognized fact. The energetic interpretant specifies only some aspects of that process, i.e. the non-general mental and physical rehearsal of the sign in our mind/brain. The proto-sign model gives a much more detailed model of this stage, this enables the treatment of questions met in the sign response model. Questions that involve low level habits like seeing something as a sign, as a unity, but also as a composition (see [9]).

The sign response model in its turn may clarify some of the steps of the proto-sign model. We concentrate on the last step in which the symbol, that is, the generalized percept, is turned into a perceptual judgment, which is a proposition. The percept itself is a fact, but this does not imply that the percept states a fact, it *may* be a figment. In its development from the first arousal of the receptors until its term like state as a symbol, there was no assignment to an object other than the percept probably being caused by one. But the 'probably being caused by an object' was no part of the process. Here, as with the response to a full fledged sign, the symbol is presented to an argumentative habit that takes the symbol and either discards it as a figment or recognizes it as a fact by assigning an index and tuning it into a proposition. All according to habits and goals present.

¹²See [2].

5 Conclusions

A pragmatic definition of man does not start with ideas about central nervous systems or rationality, it starts with the idea that man is a sign capable of growth.

If meaning is pragmatically interpreted as 'a certain habit to act if certain conditions are fulfilled', then an expansion of our knowledge of the world is an expansion of our selves. But then the real question is not *How do we make a model of ourselves?* The real issue is what kind of being we want to be, which comes down to the question *How do we want to model ourselves?* Or, in other words, the models we make of ourselves do model our selves.

Why is the sign-object-interpretant triad of semeiosis called a 'Bermuda-triangle'? Because interpretation, the phenomenon of the sign's mediation between the sign's object and interpretant, is something that 'happens to us', instantaneously. By revealing the structure underlying interpretation, as a process, we uncover the steps of 'natural' representation of phenomena as meaning. If problems are phenomena, then a meaningful specification of a problem can always be generated by means of adopting those steps of natural representation, which is also how we think the Bermuda-triangle of semeiosis can be sailed.

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