

SIGNS AND DESIGNS

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Abstract: The concept of sign is ambiguous, even in the hands of its most persuasive advocate, the 19th Century semeioticist, Charles Sanders Peirce. Peirce's explication of "sign" is unclear both in the discrimination of its basic elements—signifier, interpretant, and object—and in its specification of the relations among these elements. Resolution of these ambiguities would seem to require invoking an intention to bring the interpretant to bear on the signifier and generate the object. But invocation of intentions as causes would seem to dilute Peirce famously anti-dualist stance. Such a dilution could be avoided, if one were able to provide a non-dualist account of intention. For many years, the Natural Design Perspective has been suggested to conceptualize intentional constructions as referring not to hidden inner causes but as higher order patterns of behavior, more widely spread across time and space than individual acts. Applying the Natural Design Perspective to the definition of "sign" offers the hope of reconciling Peirce's semeiotics with his monism.

Key words: Signs; Charles Peirce; natural design; semeiotics; molar behaviorism.

For 40 years, we¹ have been developing a form of biological behaviorism I call, the Natural Design Perspective. It is a quixotic sort of behaviorism because it attempts to repurpose the explanatory terms of non-behaviorists as descriptive terms. Such words as "feeling," "goal," "want," "belief," and "fear," which are ordinarily taken as referring to instantaneous causes arising from within an organism, are re-conceptualized as *natural designs*. Natural designs are higher order patterns of behavior, observable across time, space, and individuals, patterns that match organisms to their circumstances and give behavior an appearance of goal directedness. This natural design perspective bears some relation to the philosophical behaviorism of Ryle, in that it accuses psychologists of category errors, such as confusing wholes with their parts and explanatory terms with

¹ The collaborators have included Patrick Derr, Gillian Barker, Peter Lipton, Michael Bybee, and Eric Charles. To be fair, I should confess that none of these authors has agreed entirely with the goals of the project. However, they have all seen enough value in it to help me develop it and have labored mightily, if not successfully, to keep me from error. As for the present paper, Hossein Najafizadeh, Stephen van Luchene, Mike Bybee, Penny and Caleb Thompson, Chris Strauss, Eric Charles, Andrew Sinnes, Grant and Martha Franks and my colleagues in the FRIAM group all made contributions to its development.

descriptive ones. The natural design perspective has been developed in two dozen articles and commentaries, each reinterpreting one or more psychological or biological concepts as examples of natural design. These begin with the biological term adaptation, and are followed by papers on learning, motivation, development, communication, deception, and finally, intention.² Here, I would like to use it to straighten out some difficulties in my understanding of Charles Peirce's theory of signs.

That the natural design perspective should have something to say about Peirce's sign theory should surprise no one. The perspective itself was inspired by the early writing of the purposive behaviorist, E. C. Tolman, who argued that goal-directedness, was an objective, observable property of behavior. Over the years, I have traced these ideas back from Tolman through the "New Realists" including E. B. Holt (1914) through William James to the philosophical Pragmatism of Charles Sanders Peirce. Thus, the Natural Design Perspective is in some sense a descendent of Peirce's Pragmatism.

The Pragmatism of Charles Peirce

In ordinary language, pragmatism is an approach to life that is practical, opportunistic, and non-reflective. *Philosophical* Pragmatism, almost the opposite of its vernacular counterpart, has a strong connection to rigorous scientific method and careful logic. Charles Peirce was a chemist by training, a mathematician by birth, an expert in the measurement of gravity by employment, and a logician by avocation. He was not a man to neglect careful thought for short term gain.³ Thus, Charles Peirce's philosophy wasn't pragmatic in the vernacular sense, but Pragmatic, in the sense that its key terms were rooted in the *practices* of scientific inquiry. To assure that the distinction is not lost between these two "pragmatisms," the one based in practicality and the other based in the philosophy of scientific

² The papers in this series include, in chronological order, **Thompson, N S. (1981)**, Thompson, N.S. (1985), Thompson, N.S. (1986), Thompson, N.S. (1987a), Thompson, N.S. (1987b). Lipton, P. & Thompson, N.S. (1988), Thompson, N.S. (1988), Derr, P. & Thompson, N.S. (1992), Thompson, N.S. (1993a), Thompson, N.S. (1993b), Thompson, N.S. & Derr, P. (1993), Moody, K., Ledoux, K., & Thompson, N.S. (1994), Thompson, N.S. (1994), Thompson, N.S. & Derr, P.G. (1995), Thompson, N. S. (1997), **Thompson, N.S. & Derr, P. (2000)**, Strout, S. L., Sokol, R. I., Laird, J. D., & Thompson, N. S. (2004), Charles, E. P. & Thompson, N. S. (2011), Charles, E. P., Bybee, M. D., & Thompson, N. S. (2011). There is a lot of redundancy, so curious readers might save time by beginning with the bolded items, which, like most of the others, are available at https://www.researchgate.net/profile/Nicholas_Thompson/contributions, <http://home.earthlink.net/~nickthompson/naturaldesigns/id3.html>, or as .pdf files from the author.

³ In fact, he could barely put it aside to make a living [see, Brent, J. (1993). *Charles Sanders Peirce, A life*. Bloomington, IN: Indiana University Press].

practice, I will always capitalize “Pragmatism”⁴ when referring to the philosophical kind.

Peirce on Meaning and Truth

Two fundamental principles underlie Peirce’s philosophy, (1) the Pragmatic conception of meaning and (2) the Pragmatic conception of truth.

Peirce defines a conception’s *meaning* by the program of inquiry required to determine its truth. The Pragmatic definition of meaning can be quite hard for some psychologists to grasp because they think of psychological conceptions, such as feelings, thoughts, wants, etc., as inherently subjective, and perhaps beyond the reach of any program of inquiry. To a Pragmatist, such psychological conceptions would have no MEANING, because the meaning of a conception is just the ways in which a community of inquiry would go about exploring it. Remember that Peirce is an experimental scientist and he takes systematic inquiry to be the model of good thought.

A proposition’s *truth* is that upon which the community of [scientific] enquiry would eventually converge, if inquiry were carried on indefinitely. Peirce’s Pragmatism is an “experience-monism”; it works on the assumption that there is only one kind of stuff in our world, the stuff of experience, and that all conceptions point to enduring patterns of experience. To an experienced monist, “Truth” can only point to some real pattern in the way experience is arranged and talk of truth beyond all experience is *meaningless*. Thus, Peirce’s Pragmatism entails a repudiation of the belief that our minds, our senses, our powers of reasoning give us clues to a world outside the reach of human experience. For Peirce, such a dualist position is absurd. A world inaccessible to our experience plays no part in our experience as a matter of definition. Like the beetle in Wittgenstein’s box, it divides out. Thus, when we speak of it, as dualists are wont to do, we speak of nothing.

But Peirce is, paradoxically, also a realist. To be “real” or “true” on his account, something must be independent of what you, or I, or any particular person or group might think. The experience he is talking about is not merely your experience or mine, or that of any particular group of people. “Real” experiences, true conceptions, are those upon which the community of inquiry will tend to agree in the long run, if it does its job. Our best source of guesses about where the truth

⁴ OK, I am being a bit contentious, here. There are actually two threads in modern philosophical pragmatism, one more scientific than the other. William James, and some of his descendants, have tended to drag the term back toward its vernacular meaning. When Peirce, in his old age, found his control of the meaning of “pragmatism” slipping away, he offered a new term, “pragmaticism,” for his more science-based meaning. I think he made a mistake. I see no reason to cede the original word to popularists, relativists and obscurantists.

of any matter lies is in the historical convergences of opinion we see among contemporary scientists doing careful observation and experiment, sharing data, and vigorously debating their ideas – in the way that chemists developed the periodic table during Peirce’s lifetime. But such convergences often fail. Consequently, Truth, The Real, is always potentially beyond any *contemporary* consensus.

Notice that this conception of truth follows directly from the Pragmatic conception of meaning. “What is the effect on scientific practice of calling a proposition “true”? It is to send scientists in a collective search for evidence for and against the proposition. *If that is the effect of such an assertion, then, according to the pragmatic conception of meaning, that is its meaning.* Truth is just that upon which good scientists would converge if given sufficient time and resources.

As a substitute for the comforts of dualism, Peirce’s realism might seem a disappointment. The opinion upon which the community of inquiry would converge seems as far beyond our personal and immediate experience as that ephemeral world beyond the senses that dualists like to speak of. But Peirce has a way out of that dilemma via, of all things, probability and statistics. Let experience be as random as it could possibly be; indeed, Peirce thinks that experience is approximately that random. Considering all the events that are going on at any one moment -- the ticking of the clock, the whuffing of the wind in the eaves, the drip of the faucet, the ringing of the telephone, the call from the seven-year-old upstairs who cannot find his shoes, the clunking in the heating pipes as the heat comes on, the distant sound of the fire engine passing the end of the street, the entry of the cat through the pet door, the skitter of mouse-feet behind the wainscoting -- most will be likely unrelated to the fact that the egg timer just went off. Perhaps not all, however. Perhaps the cat anticipates cleaning up the egg dishes. Perhaps the same stove that is boiling the egg water has lit a fire in the chimney. But whatever relations we might discover amongst all these events, we can find an infinite number of other temporally contiguous events that are not related to them. Thus, as Peirce says, events are just about as random as anybody could care them to be.

But – and here is the main point – to the extent that events *are* related, these relations would be useful. They would, for instance allow the cat to predict that there would be food in a few moments, the mouse to predict that the cat has entered the house, and you to predict, among other things, that your eggs are ready. For this reason, on Peirce’s account, organisms are designed to ferret out these few regularities and take action based on them. But anybody who has spent more than a few moments thinking about probability and inference is aware that every random process is capable of producing strings of outcomes that seem anything but random. True, in ten throws of a fair die, it is extraordinarily unlikely that I will throw ten ones, or ten twos, etc. But equally unlikely is, 4318669890 (which I drew from a random number table). In fact, if we lay out in advance each and

every conceivable outcome, the likelihood that *any* one of them will occur is infinitesimally small. Yet one of them WILL occur. When the sequence that occurs corresponds to a notable pattern, the mind revolts against randomness. Who could possibly conceive that the World Trade Center attack, in which many hundreds of emergency service workers were killed or injured, would have occurred randomly on the date corresponding to the emergency service number in the United States!? Al Qaeda MUST have planned the attack as a humiliation of American first responders.⁵

Every organism has to discriminate between runs of positive events that have occurred by chance, and thus give no information about the future, and runs of positive events that have occurred because experience is sometimes patterned, and individual experiences actually provide useful information about future ones. On Peirce's account, the method that organisms use to make this discrimination is variously known as learning, habit-formation, induction, and statistical inference. Imagine that you are running a test lab and the Treasury wants you to test whether its newly-minted Trump three-dollar coin is fair. They suspect that the coin is biased toward heads. Knowing the coin is biased would, of course, be useful to gamblers and football teams. So, you put the coin in your coin-flipping machine and start. You get, "H, H, H, H, H, etc." do you report back to the government that the Trump \$3.00 piece is not fair? As the sequence of heads is extended, the probability that this coin's ultimate distribution of heads and tails is 50-50 declines, until at some point, all reasonable people will probably agree that the coin is biased toward heads.⁶ Of, course, this coin might be the only unfair coin in the minting. Imagine how even *more* convincing this demonstration would be if sample coins were sent out to dozens of different testing labs, with different personnel and different testing machines all with the same result. Such a multiplication of effort is what happens when a community of inquiry goes to work on a problem. Scientists from all over the world attempt to solve it and evidence sometimes converges on a solution. Of course, even that solution may be wrong, in the same way as a fair coin *can* produce a string of heads for as long as you care to flip. But the more such a convergence develops, the less likely the effect is random, and the more likely would be the wise organism or the wise person to make its next decision on the assumption that the effect is truly there. This sort of truth is not indubitable, but if, as Peirce insists, such patterns in experience are all we have, it is the only truth we are ever going to get. In Peirce's world, every

⁵ See, Chapter 9 of Mlodinov, L. (2008) *The drunkard's walk: How randomness rules our lives*. Pantheon: New York, N.Y.

⁶ I have done this demonstration in undergraduate classrooms with a "special coin" which "I always bring with me to class." Most members of the class have given up on the fairness of the coin by 4 ($p < .07$) or 5 ($p < .04$) flips, and rarely does anybody hang on after six ($p < .02$). These are roughly the values at which less cautious and more cautious scientists would make the same determination.

experience, every thought that we have, is nothing more than an educated guess concerning future experience: in short, a sign.

Peirce on Signs

Over his life time, Peirce articulated dozens of different definitions of the elements of a sign and of the relation amongst them, sometimes using starkly different and seemingly contradictory terms.

These can be found among the 76 definitions in the main text and the 12 additional definitions in the Appendix of *76 Definitions of The Sign by C. S. Peirce*⁷. Here are just a few of them:

#3 - 1868 - C.P. 5-283 - Consequences of four incapacities.

[...] Now a sign has, as such, three references: first, it is a sign to some thought which interprets it; second, it is a sign for some object to which in that thought it is equivalent, third, it is a sign, in some respect or quality, which brings it into connection with its object.

#12 - 1902 - C.P. 2.303 – Baldwin's Dictionary - Sign.

Anything which determines something else (its interpretant) to refer to an object to which itself refers (its object) in the same way, the interpretant becoming in turn a sign, and so on ad infinitum.

#18 - 1903 - C.P. 1-346 - Lowell Lectures: vol. I, 3d Draught.

[...] Now a sign is something, A, which denotes some fact or object, B, to some interpretant thought, C.

#28 - 1904 - C.P. 8-832 - Letter to Lady Welby dated 1904 Oct.12.

[...] In its genuine form, thirdness is the triadic relation existing between a sign, its object, and the interpreting thought, itself a sign, considered as constituting the mode of being of a sign. A sign mediates between the interpretant sign and its object. Taking sign in its broadest sense, its interpretant is not necessarily a sign. [...]

A sign therefore is an object which is in relation to its object on the one hand and to an interpretant on the other, in such a way as to bring the interpretant into a relation to the object, corresponding to its own relation to the object.

#29- 1905 - MS 939 - Notes on Portions of Hume's "Treatise of Human Nature."

[...] It is difficult to define a sign in general. It is something which is in such a relation to an object that it determines, or might determine, another sign of the same object. This is true but considered as a definition it would involve a vicious circle, since it does not say what is meant by the interpretant being a "sign" of the

⁷ Marty, R. & Lange, A. (2011). *76 definitions of the sign by C.S. Peirce*. This and many other extraordinary Peirce documents may be found at the Arisbe Website, <http://www.iupui.edu/~arisbe/>, an unparalleled resource for Peirce students, particularly for those amongst us who do not have ready access to research libraries. We are profoundly indebted and grateful to the creators and managers of this website.

same object. However, this much is clear; that a sign has essentially two correlates, its object and its possible Interpretant sign. Of these three, Sign, Object, Interpretant, the sign as being the very thing under consideration is Monadic, the object is Dyadic, and the Interpretant is Triadic.

#32 - v. 1905 - MS 283. p.125, 129, 131. The basis of Pragmaticism.

[...] A sign is plainly a species of medium of communication and medium of communication is a species of medium, and a medium is a species of third. [...]

A medium of communication is something, A, which being acted upon by something else, N, in its turn acts upon something, I, in a manner involving its determination by N, so that I shall thereby, through A and only through A, be acted upon by N. [...] A Sign, on the other hand, just in so far as it fulfill the function of a sign, and none other, perfectly conforms to the definition of a medium of communication. It is determined by the object, but in no other respect than goes to enable it to act upon the interpreting quasi mind; and the more perfectly it fulfill its function as a sign, the less effect it has upon that quasi-mind other than that of determining it as if the object itself had acted upon it. [...]

#36 - v. 1906 - MS 292. Prolegomena to an Apology for Pragmaticism.

A sign may be defined as something (not necessarily existent) which is so determined by a second something called its Object that it will tend in its turn to determine a third something called its Interpretant in such a way that in respect to the accomplishment of some end consisting in an effect made upon the interpretant the action of sign is (more or less) equivalent to what that of the object might have been had the circumstances been different.

Despite this variety of definitions, some features of Peirce's notion of sign remain stable across the range of definitions that he offered.

The Elements of a Sign. Most important, a sign always has three elements. Three is crucial because, for some other writers, a sign only requires two elements, the signifier and that to which it refers: the stop sign stands for a command to stop, "help!" is a sign of a need for assistance, etc. But for Peirce, a sign with only two elements is inadequately specified. A sign always requires something to connect the signifier to what it represents. The stop sign does its work only for drivers aware of federal highway sign conventions; "Help" is only effective as a sign of need if potential rescuers speak English, etc. For the purposes of this writing, we will refer to the three elements as the *signifier*, the *object*, and the *interpretant*. The interpretant is necessary, because only in the context of the interpretant does the signifier point to the object.

Most of the troubles with the elements of the sign relation arise from ambiguities in our understanding of the interpretant. An example may help to illustrate the problem. No Peircean would doubt that a weather vane pointing NW is a sign that the wind is from the NW. So, in laying out this particular sign relation, we are tempted to write something like, "To any observer (interpretant), a NW-pointing weather vane (signifier) implies that the wind (object) is blowing

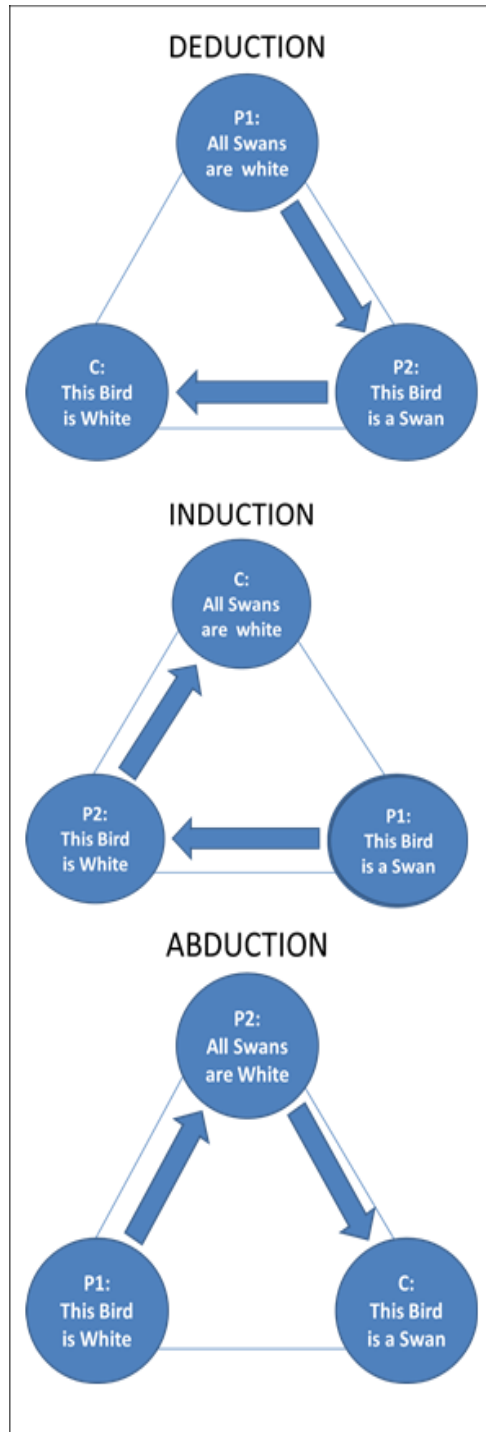
from the NW.” But reflection suggests that further specification of the interpretant is still necessary even if we know the person who is responding to the sign. What if the observing person knew that the particular weather vane had been broken since the Great New England Hurricane and had not moved for 80 years?! For that interpretant, that vane would not signify anything, except perhaps the direction of the wind gust that ended its life in September of 1938. So, it seems that if we were to identify the observing person as the interpretant, we still would have to specify the conception or concern or knowledge that the interpreting person brings to the situation that makes it possible for the sign to point to the object. So, a person can be the *interpreter*, but not the *interpretant*.

The Interpretant and Its Function. If the interpretant is not a person, what is it, and how does it bind the signifier to the object? My Peirce-mentor, Michael Bybee⁸, argues that for Peirce the proper relation amongst the elements of a sign, the movement that binds them together, is *inference*. Two ideas that would seem to support that conclusion are often reiterated by Peirce: (1) All thought is in signs; and (2) all thought consists of inferences. Thus, it’s entirely plausible that, for Peirce, the sign relation and inference are the same relation by different names or that signs are experiential manifestations of logical relations.

That inference forms the foundation for signs can be illustrated with a syllogism⁹. A syllogism, in its simplest form, contains three propositions, a general statement concerning one or more properties of a class (e.g., All Swans are White), a statement which picks out a member of that class (This Bird is a Swan), and a statement concerning one or more properties of that member (This Bird is White).

⁸ “I am deeply grateful for the lengthy email exchanges I have had about Peirce with Mike Bybee of St. Johns College, Santa Fe. I commend the reader’s attention to his “Abductive inferences and the structure of scientific knowledge” (Bybee, M. D., 1996). Despite my best efforts to enroll him as a co-author, in the end, he insisted that his understanding of CSP’s semeiotic and its relation to intention is too different from mine.

⁹Philosophers, particularly Peirce experts, may find naïve and tiresome my choice of the syllogism for illustration. Peirce was one of the most sophisticated logicians, American philosophy has ever produced, and described many forms of inference beyond those afforded by syllogisms. Also, biologists will demand that I limit my generalizations to adult British swans, because they know that young swans are grey and Australian swans are black.



On Peirce’s account, such a syllogism affords three kinds of inference, depending on which of the two propositions we take for granted and which one is up for grabs.

Let’s say we’re birdwatchers, interested in making inferences about birds. We can start with knowledge of the properties of the class (species, in this case) and knowledge of the class membership of the individual (*Cygnusolor*) and infer one or more properties of the individual. For instance, if we know for sure that all swans are white, and we know the bird before us is a swan, then we know for sure that the bird before us is white. Notice that no empirical observation is involved in this conclusion. Even a blind birdwatcher could know it with certainty. This is deduction.

Or, we can start with knowledge of the class membership of the individual and knowledge of one or more of its properties and infer one or more properties of the class. For instance, if we know that this bird is a swan and we know it’s white, we can infer (rightly or wrongly) that all swans are white. This is induction.

Finally, we can start with knowledge of one or more properties of the individual, and knowledge of a class that shares those properties, and infer (rightly or wrongly) that the individual in hand is a member of that class. This last sort of inference is abduction.

Now, aged psychologists amongst my readers are going to cry, “Murder!” We all remember that first lecture in

the Graduate Methods Course in which the professor took at least ten minutes to teach us philosophy of science. In those days, we were taught Falsificationism:

Popper's doctrine that the only valid logic is deduction, and that all scientific research was based on falsifying deductions that arose from "bold conjectures." Anybody actually doing science soon came to realize that the Doctrine of Falsification had no bearing on conducting a research program. Let's say you're out in the field studying birds. Without induction, how on earth could you ever have come to the notion that all swans are white? How without abduction could you ever come to the notion that the bird you just saw fly by was a swan? Yet both of these pieces of information are necessary before any deduction concerning swans' whiteness is possible.

Whatever your graduate professors may have thought, Peirce thought ludicrous the notion that only deductive inferences are valid. To Peirce, all three forms of inference, if properly deployed, were valid. The dimension on which they differed was strength. Valid inductive inferences start out weak but become stronger as more individuals with confirming *properties* are found, a process that requires abduction to identify relevant individuals. Valid abductive inferences start out weak but become stronger as more confirming *properties* are found, a process that requires induction to identify relevant properties. Valid deductive inferences are always strong, but they are wholly dependent on induction and abduction for their premises. Thus, in scientific practice, all forms of inference rely on one another and, given that abduction and induction are fallible, *all scientific conclusions are fallible*.

Thus, Peirce's answer to the falsificationism of our graduate mentors would have been *fallibilism*: there are no certainties to be had in science, no foundations on which we can build with absolute confidence. We start in the middle. But if we perform diligent inquiries and apply to their results a program of inductive, abductive, and deductive inferences, we will find some constancies in our collective experience, and if these remain stable long enough, they are truths, for all intents and purposes. They are, in any case, the best truths we will ever get.

Given that signs are inferences, the role of the interpretant is unambiguous: it is that set of propositions that, in conjunction with the signifier, entails the object.

So What If Signs Are Inferences?

Knowing that signs are inferences provides some additional specification of the elements of a sign and the relation among them. Because inferences are only possible amongst propositions, it makes plain that the elements of a sign consist of propositions. It also makes clear that the relation by which the sign is brought to bear on the object is entailment. Taken with the interpretant, the signifier entails the object.

The weather vane, as a sign, illustrates how inference generates and binds together the parts of a sign. We crave to know the wind direction. To know the wind direction, we must know (1) that weather vanes point toward the wind source

and that (2) the fish on the top of the church is a weather vane. The first premise can only be arrived at by induction. We see every day weather vanes in action, and we draw the general conclusion about their behavior from these experiences. The second premise can only be arrived at via abduction. This thing wiggling on the top of the church, even though it looks like a fish, must be a weather vane because it is doing what weather vanes do in a place where weather vanes are often seen. Only after inferences (1) and (2) can we draw the conclusion that the wind is NW.

SIGNIFIER: The fish points NW

INTERPRETANT:

- (1) Functioning weather vanes point in the direction of the wind; and,
- (2) The fish on the steeple of the church is a functioning weather vane.

OBJECT: The wind is from the NW

Unfortunately, for the complete specification of a sign, something is still missing. Notice that we started our hypothetical about the weathervane with an intention: "We crave to know the wind direction." If the intention had been different, the signifier might not have signified very much or something else entirely than the wind direction. Had we craved, instead, to know if the weather vane was functioning properly, then the weather vane would not have been a sign to us *unless we already knew the direction of the wind*. The sign relation in that case could be described as an inference as follows:

SIGNIFIER: The fish points NW

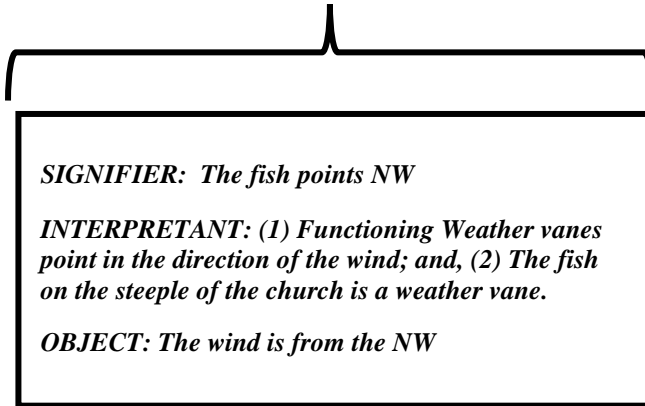
INTERPRETANT:

- (1) Functioning Weather vanes point in the direction of the wind; and,
- (2) The fish on the steeple of the church is a weather vane; and
- (3) The wind is from the NW.

OBJECT: The fish is a functioning weather vane.

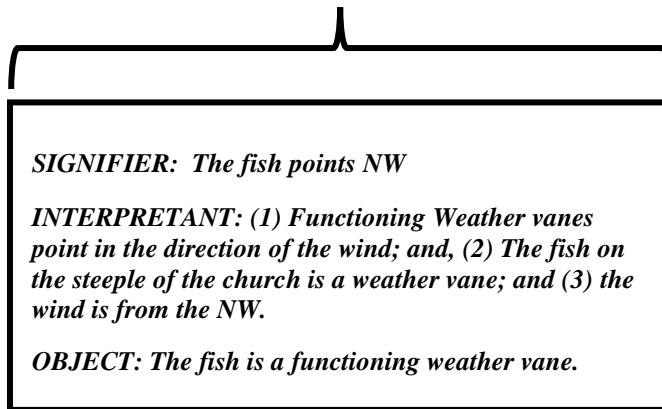
What this analysis suggests is that to completely specify any sign we must first place its inference within an intentional frame. To be an intentional frame, a proposition has to have a verb of mentation such as thinking, feeling, wanting, fearing, etc. that takes a proposition as its object. Set within their intentional frames, the two signs described above would be, for assessing the wind direction:

It is desired to know the direction of the wind



and for assessing the functionality of the weather vane:

It is desired to know if the weather vane is functioning



Where might that third part of the interpretant come from, given that functioning of the weathervane is itself in question? Perhaps from an abductive inference? Perhaps, on this breezy day, low clouds are out of the NW, smoke is arising from a nearby chimney, and a flag on the high school across the street is streaming out to the SE. The abductive inference would look like this:

SIGNIFIERS (a) The low clouds are moving out of the NW; (b) The smoke is moving toward the SE; (c) The flag is streaming toward the SE

INTERPRETANTS: Whenever a occurs, the wind is from the NW; whenever b occurs, the wind is from the NW; whenever c occurs, the wind is from the NW.

OBJECT: The wind is from the NW.

That signs require an intentional frame for their complete specification reveals additional essential properties of signs. It shows that they display referential and existential opacity. These two forms of intentional opacity arise because intentional utterances do not unambiguously determine the meaning of the terms within the frame. If you tell me that *you* crave to know the wind direction, my understanding of what you crave is dependent on *your* understanding of “wind direction.” Some people, for instance, quite reasonably assume that the wind direction is the direction toward which the wind is blowing! This opacity extends to all the terms within the frame. You might, for instance, imagine that a weather vane is a narcissistic meteorologist. Or a unicorn, for that matter. It could be that what you crave for has nothing to do with wind, as I understand it.

For at least one important contemporary of Peirce’s, Franz Brentano, the intentionality of psychological propositions has often been said to vitiate their scientific value:

Franz Brentano is often cited as the origin of the view that “intentionality is the mark of the mental,” that is that “all mental phenomena exhibit intentionality and no physical phenomena exhibit intentionality” ... [But this view] has the disadvantage that it irrevocably separates human psychology, and perhaps all human and animal behavior, from the causal laws and theories of the natural sciences. If intentional “causes” are immaterial, they can play no part in the causal system studied by the natural sciences. Nor can they be investigated by the natural scientific techniques which presume that system as their basis. (Thompson & Derr, 2000, p. 213-214)

Perhaps we have stumbled on the reason that Peirce’s relation to the concept of sign was so tortured. If intentions are required for the specification of signs, then an unambiguous definition of sign requires an unambiguous definition of intention. How are we to apply the Pragmatic Maxim to our conception of intention? Paraphrasing Peirce (1978a): “Consider what effects, that might conceivably have practical bearings, we conceive [an intention] to have. Then, our conception of these effects is the whole of our conception of [an intention]” (p. 132).

How can I determine the effect of your intention to discover the direction of the wind if, as Brentano and others have supposed, the meaning of “wind direction” is entirely dependent on your mental states, and mental states are inherently beyond the reach of science?

Natural Design Perspective to the Rescue!?

But what if Brentano was wrong? What if mental terms do in fact point to the forms of potentially shareable experience that science requires and that Peirce values? What if intentions and intentionality are objective patterns of experience across time, space, and individuals? Could we then arrive at an unambiguous concept of a sign as an inference framed by an intention?

Intentions are instances of what I have called, “natural designs,” – higher order patterns in behavior, organized across habitat, time, place, and individual, in which the organism (or its population¹⁰) meets variations in circumstances with variations in response which produce a constant result. Albert Hofstadter (1941) called the same phenomena, “purposes,” and called this approach to purposes, “objective teleology”:

Let us therefore turn to that context in which we do identify actions as teleological and ask what those traits are. All of us in fact make such identifications in the context of social action. The politician and the prizefighter, the military strategist and the chess-player, the business man and the teacher—you cannot name a social actor who does not, in the pursuit of his calling, find it necessary to estimate the objectively purposeful character of others' actions in order to adjust himself thereto. There is, then, no initial difficulty in locating objective teleological processes in the rough. The problem is, what common traits do these actions exhibit? In particular, where in these actions do we find objectively purposeful character? And the answer is, we never find an objective purpose by itself, but always in association with a certain "sensitivity to conditions" and a fund of "operative techniques" possessed by the actor. To seek for objective purpose alone, without reference to these two factors, is to embark upon an impossible quest. A purposeful action is directed to its end always in a concrete set of circumstances and along paths of connection between antecedents and consequences. Differences between purposive actions rest not only upon differences of ends, but also upon the range and depth of the circumstances or conditions which enter effectively as well as upon the scope of the connections of antecedents and consequences actually operative. (p. 32-33)

It will be helpful to map Hofstadter's abstract conception of intentions onto a familiar example. Let's say, it is your daily habit to take your dog for a walk in the woods, off-leash. The woods, where you walk, has a large oak tree and, as your dog comes down the path, he often spots a squirrel foraging on the ground. You have thus observed, dozens of times, versions of the following sequence of events. The dog stops, and then stalks slowly forward until the squirrel bolts. He then

¹⁰ An example of this pattern occurs in European Cuckoos whose different subpopulations produce eggs resembling the eggs of their different hosts in the service of the common function of parasitism (Wickler, 1968).

gives chase at a full gallop. As he closes on the squirrel, he follows its path more closely, matching each of the squirrel's evasive actions by a corrective action of his own. When the squirrel reaches a tree, the dog jumps up at the tree, trying to reach it. When the squirrel circles around the trunk away from the dog, the dog also circles, barking. From many occurrences of such behavior sequences, in your own dog, and others you say that your dog was "trying to catch a squirrel."

When you make the claim that the dog was "trying to catch a squirrel," you might think you base it only on facts immediately before your eyes. But in fact it is based on a much wider structure of experience consisting of the network of relations within a general context ("walking in the woods"), a set of particular circumstances (squirrel at distance on ground, squirrel running, squirrel running up tree, etc.) paired with specific responses (stalk, chase, leap up on trunk of tree, etc.) all of which have the effect of bringing the dog closer to catching the squirrel and which actually catching the squirrel would terminate. The structure, with its many pathways, is latent in the woods-dog-squirrel situation, a structure through which dogs and squirrels have navigated, ever since there were woods, squirrels, dogs. Notice that it is irrelevant that the squirrel is rarely caught or that the sequence is not always begun or terminated at the same point. The dog may enter the network at any point, may for instance leap up the trunk of a tree it is passing if suddenly teased by the resident squirrel, skipping all the preliminaries of stalking and chasing. The key, here, is that while we attribute the descriptor, "the dog is hunting for a squirrel" to individual behavior sequences on particular days, our knowledge of that fact arises inextricably from our knowledge of the structure of that relation, knowledge that has accumulated over myriad instances.

Your thorough familiarity with your dog and with the variations in its behavior under variable circumstances, all with a constant goal, has put you in the role of an ethologist. Classical ethology is the study of animals in their natural habitat combined, sometimes, with laboratory investigations designed to mimic the essentials of natural conditions. Ethologists characteristically spend long periods of time in the field with their subjects. Ideally, ethological work on a given species begins with the making of an ethogram, a catalogue of the behaviors produced by the animal, along with circumstances that elicit each behavior and its frequent consequences. The ethogram can be thought of as a structure which animals traverse as they conduct their daily lives. Familiarity with an animal's activities reveals the attractors upon which many behavioral pathways converge. Hofstadter would call convergences, purposes, and I would call, natural designs, or, narrowly, in this case, intentions.

Intentional opacity in ethograms is routinely demonstrated by substituting a simplified schematic model for an actual social partner and demonstrating that the responding animal's behavior is not substantially disturbed by the substitution. Often, the *goals* of the animal's behavior (= what it actually strives to accomplish) differ from its *functions* (= the good for which the behavior has been designed).

For instance, knowledge that the robin's behavior drives off competing territorial male robins, does not tell us what, in fact, the male robin is attacking. The experiments show, in fact, that the robin is responding to a much simpler and more schematic stimulus. Thompson and Derr (2000) write:

The distinction between the set goal and the function of behavior systems has remained as a foundational principle in the field of ethology, and has been called "The Law of Short-Sighted Striving" or "Lorenz's Law" (Thompson, 1986a). Konrad Lorenz (1935/1957) played an important role in further explicating the curious disjunction between the goals of an animal's behavior and the functions of that behavior. He attacked MacDougal's (1921) concept of instinct precisely because it seemed to imply that animals were aware of the good they did for themselves by pursuing their goals. Many of the phenomena so memorably described by Lorenz and the other classical ethologists--the English robin that would display to a bit of red fluff on a wire, the goslings that would follow Lorenz in his hip waders, the goose that would retrieve a giant egg, the stickleback that would display to a postal van--are clear evidence that animals will strive to achieve a particular set goal even when that set goal has been decoupled from the functional situation. (p. 232-233)

The similarity of ethologists' conceptions to Peirce's semeiotics can be emphasized by substituting the word "sign" for the word "cue" in our subsequent exposition.

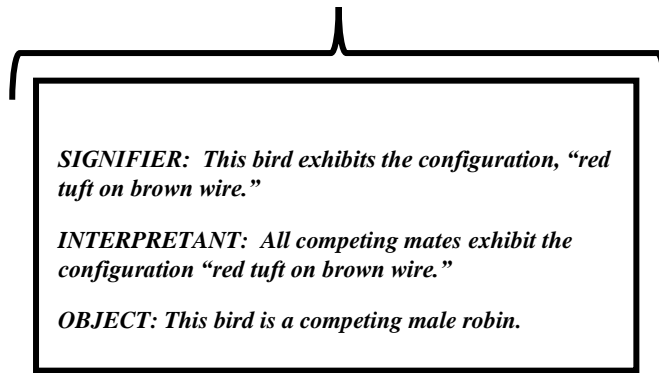
[Signs] play a similar role in the behavioral control systems that so fascinated classical ethologists. For instance, for male English robins, the configuration, "red-tuft-on-wire" is a [sign] that regulates territorial defense behaviors. The [sign] works because, in the natural evolutionary environment of a male robin, the only stimulus corresponding to the pattern "red tuft on stick" is another male robin. The reliance of the male robin territorial behavior on this [sign] can be demonstrated by inducing territorial behavior with a "red-tuft-on-wire" [sign] that is decoupled from its normal accompaniment, a male robin. For instance, by providing a tuft of died cotton mounted on a twist of straight brown wire, one can induce defense. (p. 233-234)

Because of the resemblance between this account and Peirce's semeiotic, we easily recast the robin's behavior in the same form as we cast the response to the weathervane above as an inference, in this case, an abduction:

SIGNIFIER: This bird exhibits the configuration, “red tuft on brown wire.”
INTERPRETANT: All competing male robins exhibit the configuration “red tuft on brown wire.”
OBJECT: This bird is a competing male robin.

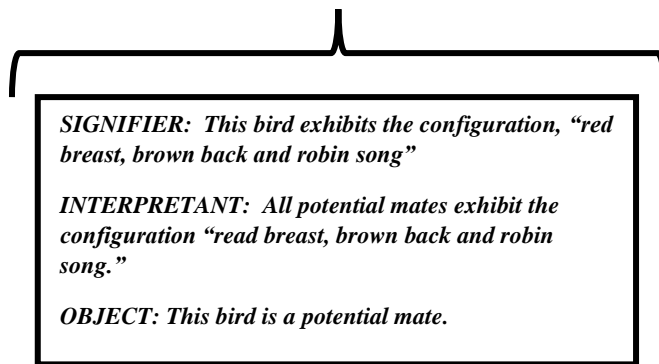
This inference relies for its veracity on an intentional frame provided by a territory-holding male robin, such as, “a desire to keep the territory free of competing male robins.” The framed sign in this case becomes:

It is desired to exclude all potentially competing male robins from the territory.



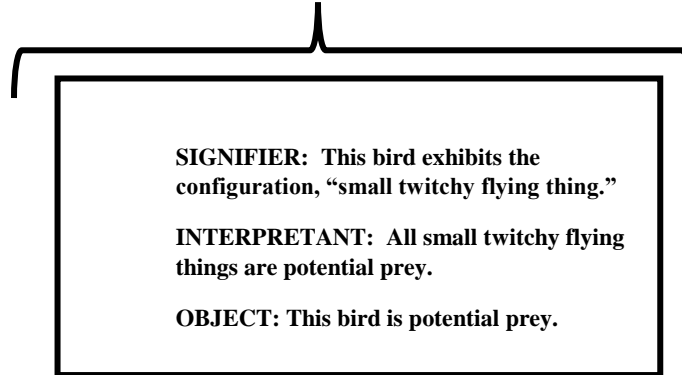
Notice that the intention provided by an adult female robin might frame the sign in quite a different way:

It is desired to find a potential mate.



And still another frame might be offered by quite a different sort of “partner,” a hungry cat:

It is desired to identify all potential prey items.



Thus, these ethological relations bear all the hallmarks of signs. They afford inferences and they display referential and existential opacity. And they are framed within intentions.¹¹

Yet none of these characteristics of ethological relations has prevented investigators from building a huge scientific literature of animal behavior over the

¹¹ Alert readers may be troubled by what seems an intractable rhetorical problem in any discussion of ethological signs: obviously the bird does not respond to “tufts” and “wires,” which are signs in the experimenter’s world, not in the robin’s. Every object has an infinite number of attributes and cognition plucks from that infinite array of possibilities those that serve the cognitor’s interests. My interest as a writer is to convey to you that whatever we see when we look at a male robin in breeding plumage is not what another male robin sees, nor is it what is seen by a breeding female robin or a hungry cat. This rhetorical problem is dramatized by Jacob Von Uexkull’s description of the perceptual system of the common wood tick. See Von Uexkull, J. (1934)

Like a gourmet who picks the raisins out of a cake, the tick has selected butyric acid alone from among the things in her environment. We are not interested in knowing what taste sensations the raisins give the gourmet. We are interested only in the fact that the raisins become sign stimuli in his world, because they have special biological meaning for him. Nor do we ask how butyric acid smells or taste to the tick; we merely register the fact that butyric acid, because it is biologically meaningful to the tick, becomes a receptor cue for her. (p. 13)

Because of the way in which Von Uexkull writes this passage, we are led to admit that a tick attaches to your body without knowing anything about you other than that you emanate butyric acid. But notice that he has played a rhetorical trick on you. *The tick knows nothing about “butyric acid,” either!* “Butyric acid” is a sign in a system of signs known to chemists and their students, which, of course, is totally lost on the tick. Unfortunately, I know of no way to illustrate the intentionality of signs without indulging in this sort of misdirection. I owe this insight to Eric Charles.

last 50 to a hundred years. Ethologists developed extensive catalogues of the free ranging behavior of their subjects. Through observations of sequences of free-ranging behavior and experiments with contrived social interactions among captive animals and between animals and models, they have identified the sign relations amongst these behaviors that govern these sequences. They have also worked out the motivations (i.e., intentions) that govern these sign relations.

This analysis implies that an unambiguous definition of a sign is possible if a provision is made for an intention that makes the object of thought salient amongst all other possible objects of thought, thus: *A sign consists of three linked propositions such that one, the signifier, implies a second, its object, as a consequence of a third, the interpretant. Necessary to the specification of every sign is an intention that brings the interpretant to bear on the signifier and generates the object.*

Conclusion

The philosophy of Charles S. Peirce is known for its Pragmatism and for its sign theory. To Peirce himself, these two elements of this philosophy were inextricable, but the rest of us have struggled to relate them. As evidenced by his 80-plus definitions of the sign and its elements, Peirce seems also to have struggled to explain the relation. We have proposed above that the difficulty may have resided in the intentionality of the sign relation. To completely identify a sign, and “precise” it (as Peirce might have said) from all other similar signs, we must specify the intention by which it is framed. Yet, that framing risks diluting Peirce’s scientific semeiotics. We have suggested that this difficulty is overcome by recognizing that intentions are objective organismic states, not covert mental ones, and that every sign is framed by an intention.

While Peirce didn’t make intentions a feature of his definitions of signs, he did use intentional concepts in his exposition, more generally. For instance, the concept of “interest” plays an important role in his writing on induction and the uniformity of nature. As we observed above, Peirce held the view that most pairings of events were random, an opinion that becomes non-controversial when you reflect that an infinity of events is always occurring at every instant of time. Given that every event is also followed by an infinity of successors, spurious patterns of succession will constantly be occurring. Our job, as organisms, is to smoke out those patterns of succession that meet two requirements; (1) they should be so statistically robust as to suggest that they could not have been drawn from a pool of random successions; and, most important, (2) *they should be of interest to us!*

Or as Peirce puts it,

We may, therefore, say that a world of chance is simply our actual world viewed from the standpoint of an animal at the very vanishing-point of intelligence. The actual world is almost a chance-medley to the mind of a polyp. The interest which the uniformities of Nature have for an animal measures his place in the scale of intelligence. (C.S. Peirce, 1883, p. 227)

Or even more succinctly:

If nature seems highly uniform to us, it is only because our powers are adapted to our desires. (C.S. Peirce, 1883)

Allow me to assume, for the moment, that I have shown you that a concept of intentionality is implicit in Peirce's concept of sign. Where does this leave us with Peirce's philosophy, full stop? Peirce, I am assured by my philosophical colleagues, was first and foremost a logician. Not being a logician, myself, I am at a loss to say what role intention should play in the semeiotic logic of Charles Peirce. Do we introduce it as a fourth feature in the sign relation? Do we insist on it as a necessary feature of the interpretant? Or should we treat intentions as extraneous to his logic, only helping us to describe how particular individuals might pick their way through the web of sign relations but giving us no insight into the nature of the sign relation itself. Peirce made a stark distinction between Philosophy, the study of how we ought to think, and Psychology, the study of how we actually do think, and he often expressed his contempt for the latter. Thus, Peirce might welcome the position that intention is extraneous to his philosophy. But despite such protestations, modern readers of Peirce will be struck by how much of what he writes is psychology and how much of his psychology is generations ahead of its time. Thus, my own view, as a behaviorist and an ethologist, is that reading Peirce primarily as a logician would deprive us of many rich insights that his philosophy holds for the behavioral sciences.

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