# AN OVERVIEW OF PEIRCEAN SEMIOTICS, WITH APPLICATIONS TO MODERN LINGUISTICS

Daniel L. Everett
Bentley University
deverett@bentley.edu

*"[Cognitive Science] focused upon the symbolic activities that human beings employed in constructing and in making sense not only of the world, but of themselves."*[i]

In discussing the modern origins of semiotics, it will be useful to take a later scholar first, since his work is ironically better known (another example of the Beta vs. VHS problem). Ferdinand de Saussure (1857-1913) was born eighteen years after Peirce (1839-1914) and died one year earlier, at the age of fifty-six. The reason for taking up Saussure before Peirce is the result of their own personal histories. Whereas Peirce left no students able or willing to take up the work of systematizing and presenting his ideas (perhaps an impossible task in any case, given the disorder of his papers when he died), Saussure had students who turned his lecture notes into a book, the influential, Course in Linguistics, which brought his "semiology" to general intellectual society. This led to a much greater association with the name "Saussure" with semiotics/semiology than the name "Peirce," at least for many.

Saussure was a linguist, not a philosopher, logician, natural scientist, nor mathematician, as Peirce was. His concerns were therefore in the main focused on linguistic issues, e.g. historical reconstruction of languages, language description, and so on. His semiology focused on his linguistic concerns. Yet, like Peirce, Saussure defined a language as a system of signs: "A language is a system of signals: what makes the language is the relationship the mind establishes among these symbols." (Saussure 1996, 23) Before going into Saussure's understanding of signs in detail, let's first unpack this passage. First, what did Saussure mean by "language (langage)?" Second what did he mean by a "system?" What did he mean by "mind?" And by "relationship?"

By "langage" Saussure means a "... socially shared, psychologically real system of signs, each consisting of the arbitrary conjunction of an abstract concept and acoustic image." (Joseph 2012). This is a fascinating view of language and, as we will see, resonant with Peirce's own views. Obviously this definition of the sign overlooks other types of physical manifestations of signs, including sign languages, drum communication, Morse code, and so on. Contra Saussure, Peirce showed that signs need not have an acoustic image at all, only a physical manifestation (which could be neuronal firings as we think).

Acoustic "image" is an interesting phrase. It suggests that each person knows, and each society enforces, a target for the signifier of the sign. Saussure's view of social control of speech is that it was enforced - get the wrong acoustic image, allow your pronunciation to vary too dramatically and you will not be understood. By mind Saussure meant more or less what a relatively educated layman today might mean. Knowledge in the head.[ii]

Signs for Saussure were composed of a signifier and signifiant. The former is the physical manifestation of the concept of the signifiant, the meaning of the sign. The two together

form a sign. Thus for Saussure signs were dyadic. There are roles for both minds and society in Saussure's concept of meaning from signs, but he had no well worked out theory of these ideas.

Saussure also divided language dyadically into two principle components, for which he is famous, *la langue* and *la parole*. Langue is the system known at some level by an entire linguistic community. Parole is the manifestation of the langue in the speech of the individual. In Peircean terms one might say that the langue is the type and parole is the token of language. Therefore the haecceities of language (which makes each idiolect and dialect distinct, for example) are found in parole. From a semiotic perspective, parole is where the interesting theoretical action is, not langue.

> *"Now, de Saussure does not hold that every linguistic fact fits into a system. He holds that, as we narrow our attention from language as a whole (langage) to that part of it which is a socially acquired and passive repository in the minds of native speakers (langue), we find that langue, thus defined, is a system. What de Saussure calls parole embraces the non-systematic elements of language."* (Wells 1947, 10)

That is, la langue is a set of social practices. It is not in the mind alone but in the communicative practices-feedback loop of people in a society, as well as their minds. For Saussure, the mind is less important to langue than the social. But as I argue in Everett (2017), there can be no practice without cognition and if it is cognition then it is in the mind, even when it is, as langue would be, dark matter of the mind. Saussure's theory in fact follows as a special case of dark matter of the mind, with his semiology contributing what little in his theory of signs that is novel. As I study him more closely, I can see some of the appeal to audiences of the time in a renewal of the old interest in signs and communication, but seems to be an anemic and inadequate theory. There is still a lot of good in it. But huge inconsistencies and holes in my reading. This is unsurprising since he never really worked hard at developing a theory of signs so much as bringing some extremely elementary ideas about signs that had been around since Aristotle at least to the attention of linguists and philologists, building them into his diachronic and synchronic theories.

If the langue is never seen, can we be sure it exists? Yes, just as we can say that, say, everyone who uses Polish logical notation (Warsaw notation, etc.) shares a knowledge of its uses. This social conception of language distinguishes Saussure's semiology from Chomsky's mentalistic, non-social view of language. However, Saussure does not thereby reject the mental - social knowledge must after all abide somewhere (see Everett (2016)).

But what did Saussure mean by a "system of signs?" He meant that language has structure before any signs exist and that the signs come into being constrained by oppositions and associations in functional units, e.g. syntagmemes, paradigms, and so on. The main price of admission for a sign into a system is that "...every sign rests purely on a negative co-status (Joseph 2012, p60). A language is thus a system of contrasts between signs in a grammatical system.

Take the sign "male," for example. It is opposed by the sign "female." Or consider my name, "Daniel." It is opposed at one level to my informal name, "Dan." "Opposition" here does not mean that opposed signs are "opposites" but that each occupies a position in the system of a given language that no other sign can occupy, not syntactically per se but *qua* signs.

Consider in this regard the following English sentences:

John saw Mary in the supermarket.

John saw Susan in the garage.

Bill hit Susan with his car in the street.

These sentences allow for substitutions where the signs share certain grammatical characteristics. Using the Peircean terms, type and token, which would have been acceptable to Saussure I believe, there is one abstract sign in these examples, the icon of the sentence (and index of where to place different signs), NP V NP PP (noun phrase, verb, noun phrase, prepositional phrase). By Saussurean contrasts we produce the three tokens of this type observed. The purpose of these subsitutions is to create tokens of the idealized sentence icon with different meanings based on their constituent signs. Each sentence type is a sign. The sentence tokens manifest the sign of the token, the signs of the token's constituents, and the inference from these signs to the meaning (that is, jumping ahead a bit to a Peircean analysis).

For Saussure, then, beyond the connection inherent in the sign, between a meaning (not precisely defined, other than a "concept") and an "acoustic image," there is no clear notion of an "object" of each sign, as there is for Peirce, in Saussure's theory. The concept in Saussure's sign confuses the distinct ideas of "object" and "interpretant" in Peirce's theory and is overall disappointing in leaving the linguist or philosophy unsure as to what to make of it.

As emerges in ensuing discussion, Peirce develops the details of the sign in much greater intension and extension. Thus (in Peirce's formula extension x intension = information) greatly increasing the information of each sign.

To introduce Peirce's signs, let's consider a couple of amusing but important linguistic examples. I think that the first question asked in my first linguistics class was about a word the professor wrote on the board, "squeat." He asked what it meant. No one knew. Then he asked us to say "Let us go eat" faster and faster. Eventually everyone realized it is how their dialects pronounced "Let's go eat."  Kenneth Pike used this in my first linguistics class in order to highlight the independence of phonology from syntax (separate "hierarchies").

A Peircean way to address phenomena of this nature is to say that *squeat* is an icon of the symbol "Let us go eat." You use this icon in fast speech and symbols in slower speech or a different social register. This supports Saussure's and Peirce's theories via a sociolinguistic component to the semiotics of speech.

For Saussure, symbols were not a significant concept of semiology. As Wells puts it, in Saussure's system, "Linguistic signs are not aptly called symbols, since 'symbol' ordinarily connotes a more or less natural non-arbitrary sign." (in Wells, p10)

To see another example from practice, consider the American English exchange below:
Jeet? (speaker A)
Not yet. (speaker B)
Squeat then! (A)
Sounds good. (B)

In the standard analysis of these forms, [jeet] is the fast speech form of the full sentence [did you eat] and squeat is the fast form of [let us go eat/let's go eat]. From Saussure's perspective, in order for the signs of the fast forms to work, they both have to be associated with the signs of the slow forms in the langue. Either form can then be used in a speech situation, fitting the speed of the utterance or the sociolinguistic register, parole as per Saussure. Thus in Saussurean semiology (as in Peircean semiotics), these alternations can be seen as part of langue, as independent signs of, say, social register. On the other hand, if the fast speech forms were produced simply as a result of more rapid speech, they could be considered examples of parole that are but manifestations of the slow speech representations/signs in the langue. However, I would classify them as part of langue for the most part because the forms seem stable across speakers. The point, though, is not to offer a definitive semiological analysis but to merely

indicate that such an analysis would not be difficult. And that indication is important because anytime we bring to bear semiological or semiotic principles on empirical questions, we show that these theories are not simply museum pieces but could have current relevance, depending on coverage and depth of understanding.

What is the sign in Peirce's theory to interpret langue? There is none. Peirce would not have drawn such a hard and fast distinction between the social and the personal or between knowledge and practice. These distinctions are antithetical to Pragmaticism. But if it is not found in the mind langue cannot be knowledge. Is it a habit? This is how Peirce would characterize it. When describing Saussure's use of langue, it sounds like any number of other social practices. And this extends to individual components of la langue, such as Pirahã phonemic structure.

For this very reason I believe that Saussure's model has a problem. There are no practices that exist only in the interstices between individuals. Individuals are cognitive agents. One might say that Saussure has a behavioristic view of language. A social practice is a behavior. But can we characterize any practice without implicating knowledge or cognition? Is the individual speaker nothing more than a parrot imitating practice? To a limited degree yes. Two great forces in human culture and language are imitation and innovation.

We wear sports jerseys with famous athletes' names out of imitation. And we come up with new design ideas partially from imitation (using old signs), occasionally together with innovation (producing new signs). But these, while not necessarily conscious, are the principal cognitive forces that shape society (Richerson and Boyd (2004); Boyd and Richerson (2005)). Any talk of "social knowledge" can only be, therefore, a façon de parler. There is no such thing as social knowledge except as knowledge spread across individuals in a community. There is no "society's brain." As I argue in Everett (2016) the shared knowledge of a society is stored in the brains of its members.[iii]

Thus Saussure's langue is part of the dark matter of the mind of an individual that overlaps ("shared" is a sloppy way of putting that unfortunately) with the dark matter of other speakers. It was an important step forward for linguistics when included with Saussure's other ideas, especially the break between "synchronic" vs. "diachronic" linguistics. But it seems inadequate in its original form as a theory of language.

Therefore, let's move on to Peirce's theory of signs. In T.L. Short's excellent introduction to Peirce's Semiotics he claims that the two problems semiotics was invented to address were (i) "to construct a naturalistic but nonreductive account of the human mind" and (ii) "to explain and defend the claim that the sciences are objective in their mode of inquiry and in fact yield knowledge of an independently existing reality." Moreover, "... the mature semiotic was developed in an attempt to explain, on a naturalistic basis what we (not Peirce) call the 'intentionality of mind." (TL Short 2007 Peirce's Theory of Signs)

I have lived among fishers in the Amazon and in Brazil for many years of my life. I have always been fascinated with their ability to interpret the movements in water, the behavior of fish, the season of the year, watching them infer from these signs what is going on below the surface of a river. As a recent report describes one case: *The fishers wade through waist-deep seawater near the beaches of Laguna, Brazil, patiently watching for bottlenose dolphins to appear and send cues, which indicate where the mullets are. Those cues involve the dolphins making arch-shaped flips, quickly jumping out and back into the water. Upon the cues, the fishers cast their nets.*" (Jeong January 31, 2023, Washington Post)[iv] Here the fishers interpret the movements of the dolphins as *indexes* of the presence of mullets. To me the dolphins would have

been a mere curiosity. I would have inferred either nothing or the wrong thing from their movements. But to the experienced fishers, their cultural and personal knowledge enables them to see the behavior of the dolphins as a physical manifestation (jumping dolphins) that is linked to an object (the mullets) and accompanied by an interpretant (the link between the physical sign - jumping dolphins - and the object - mullets - supplied by the culture and knowledge of the fishers). Signs are fundamental to life. In fact, without them there is no life. Therefore, one might claim that not having a theory of signs is a moral shortcoming for a scientist. And even theories of signs that *are* used tend to be ad hoc when they fail to follow Peirce's theory or at least show working knowledge of it.

Thus we need such a semiotic theory. And this theory should provide a typology of signs, a grammar of signs, a rhetoric of signs, and a logic of signs. Where possible, it is also always informative to explore the relationship between signs and Peirce's understanding (influenced, again, by Aristotle) of "final cause" and how final causes - natural selection, cultural values, knowledge structures, social roles, cognitive limitations, personal goals, and the like - shape local inventories and uses of signs.

Imagine that you and I are walking down a jungle path and I point to a spider, the deadly Phoneutria, or "Wandering Spider." "Look out," I say, pointing at the spider. You stop and look in the direction I am pointing, though you only can make out something brown on the jungle floor. You don't know what it is. But your stopping and looking interpreted my words and my pointing, my verbal and manual indexical legisigns, as we will understand directly. As to the object, you watch for a while and see more of its shape. You recognize it as a spider. When you leave the Amazon you google that spider, whose name I gave you. You might read an article about it. Maybe even a book about it or a book about spiders of the Amazon. In this way, the object and its signs grow for you.

So how did our semiotic interaction work? And how did your subsequent bug-learning affect your semiotic interpretation of the spider? Step one was when I pointed and uttered the (pseudo-) command via the verbal indexical "Look out." Step two was when you looked. You interpreted my indexicals by stopping and looking where I was looking and pointing (with my finger, though in fact my whole body was oriented towards the spider and therefore it served as yet a third indexical legisign). Step three was when you identified the object as a spider. Step four was when you looked the spider up and learned more about it. You expanded in this sense your understanding of the object, transforming it into a somewhat different object (Peircean semiotics thus anticipates the semantic externalism of Hilary Putnam). We immediately experienced three components of the semiotic encounter together and you experienced the fourth, expanding the object, in your own subsequent reading.

My body, my index finger (great semiotic name by the way), and my words gave form to the signs I emitted. Peirce labeled the form of a sign its representamen (plural representamens). The spider was the object. Your reaction was the interpretant. The spider that you did not recognize as anything more than a brown bug or a generic spider (a large one, though, Phoneutria grow to a leg span of about seven inches) was the "immediate" object of the sign. As your knowledge grew you in effect expanded the object and affected your interpretant. This new object that your learning created is the "dynamic" object of the sign, at least you are moving in that direction. We arguably never in our lifetime know an object fully. The dynamic is the *true* object, but truth only comes, again, at the end of inquiry.

This simple illustration not only reveals part of the nature of signs, more importantly it shows what signs *do*. "The importance of Peirce's theory of signs ... lies in the project it defines:

the critical illumination of proposed principles and the painstaking application of them to particular cases." (Short 2007, p2)

Peirce began work on his theory of semiotics in 1865, when he was twenty-six years old, continuing until his death at age seventy-four in 1914.  Forty-nine years of thinking, revision, and development of this theory still under-appreciated by linguistics science as a whole as well as logic and analytic philosophy more generally, two of its primary audiences.  Peirce's semiotics is a theoretical exploration and exposition of cognition, its purpose for Peirce being to provide "... a naturalistic but nonreductive account of the human mind." (Short 2007, ix) As noted briefly above, Peirce's semiotics are guided cognitively and culturally by Aristotelian final cause, i.e. signs are shaped teleologically, either by means of our interpretation of the signs, or altering the interpretant or the understanding of the signs themselves.  Social communication and interaction are the ends which shape the means of semiosis in animal communication, human and nonhuman animals.

Getting back to the crucial important of a theory of signs for understanding ourselves, our world, our culture, and the rest, Peirce states that "... it has never been in my power to study anything, - mathematics, ethics, metaphysics, gravitation, thermodynamics, optics, chemistry, comparative anatomy, astronomy, psychology, phonetics, economics, the history of science, whist, men and women, wine, metrology, except as a study of semiotic." (SS 1977, 85-86)

According to Atkin (2022, p1) Peirce's semiotics went through three phases: "a concise Early Account from the 1860s; a complete and relatively neat Interim Account developed through the 1880s and 1890s and presented in 1903; and his speculative, rambling, and incomplete Final Account developed between 1906 and 1910."

Although this chapter does not examine semiotic history in detail, it does point out a few milestones, as well as issueing a warning against taking Peirce's earlier work, even his work up until 1903, as definitive. Rather, we need to see the theory of semiotics as a diachronic process, never quite terminated, with some fundamental findings being constantly rethought. The same is true of course of any theory. Chomsky's theories have undergone many changes over the decades and it would be misleading to take an analysis he proposed in the 50s-90s as definitive of his current thought. Particle physics is yet another of many, many examples of the truism that science always evolves (see Monk 2012 for an insightful and engaging account).

Part of the cognitive implications of Peirce's semiotics is the idea that all people have a language of thought - it is semiotic and it is a real language: "We think in the words of the language we have learned." This is not quite the same therefore as Fodor's Language of Thought (LOT) hypothesis. It is true that to the degree that all animals think in signs, all animals have a LOT constrained by a Universal Grammar. But for Peirce the latter is learned within strict logical parameters.

Peirce began to work on his theory of signs about 1865, while Saussure's theory emerged from papers he wrote in the last few years of the century, beginning around 1895. Saussure was influenced initially to work on signs by reading William Dwight Whitney's book *Life and Growth of Language* (Joseph 2012, 89). Later he "encountered Peirce's sign theory," (Joseph 2012, 393). Saussure even encountered references to sign theory in his colllege classes, as show in this quote from one of his professors, Antoine Verchere, uttered when Saussure was a student (course notes of a person named Claparede) (Joseph, 2012, p143):

> *"One of the great resources of the human species is the ability to communicate*
> *intellectually. These communications are carried out by different means which generally*
> *take the name of language [langage]. The material processes are called signs. But if one*

*gives a sign to an absent person it no longer has any value. Every time a collection of conventional or natural signs is made, this is called a language [langage]. There are several system of signs: thus the sounds of the voice or speech [parole], which is language par excellence [la langue]..."*

Saussure was from the beginning of his intellectual career therefore exposed to old as well as Peircean ideas about signs. A striking contrast between Saussure's theory of signs and Peirce's, moreover, is brought out in this quote:

*"[Although] Peirce, in fact, wrote a good deal on grammars of particular languages which did have implications for his sign theory... there is a sense in which it can be said that Peirce's theory of signs has little to do with linguistics. This can be traced to the fact that much of contemporary linguistic theories have developed generally from the Saussurean and neo-Saussurean methodological assumptions that are not congenial with those underlying Peirce's general theory of signs."* Chandrashekar (1994, p58)

Nevertheless, Peirce's semiotic theory, not Saussure's, is foundational for any "true" theory of linguistics, i.e. a theory of linguistics looking for truth. One cannot discover underlying principles of human language and languages without semiotics. Non-semiotic linguistics is an oxymoron. This will not resonate initially with most linguists, I realize, because it doesn't fit the founding myths of a large swath of the linguistic enterprise about a new field of theoretical linguistics emerging Minerva-like from the mind of a linguistic Zeus based on an "autonomous syntax." (Nothing could be more at variance with the Peircean concept of synechism than an autonomous anything in fact.) And it will also challenge many linguists conceptualization of the preeminence of linguistics proper to the study of language.

On the other hand, if Peirce is correct, linguistics classifies structures and languages according to principles of semiotics and not according to normative theories (pick any current theory, from Role and Reference Grammar to Minimalism or Construction Grammar) from linguistics proper. Linguistics, as a non-normative science in Peirce's terms (see below for a diagram of Peirce's classification of the sciences), applies semiotic theory to the classification of structures (signs) encountered in natural languages. This is part of the metaphorical channel-switching mentioned in the Preface.

So let's get first to the typology of signs, one of the sharpest distinctions between Peirce's theory and Saussure's, for example (Saussure defined the sign in such a way that a theoretically-motivated typology made little sense). As we saw above, a sign is anything interpretable as saying something about something. That is, anything is a sign. All things can serve as signs.

The object of a sign is anything discussable or thinkable - any thing, event, relationship, quality, law, argument, fictional entity. The fuller object is the universe of discourse to which the partial or special object belongs. For example, a planetary oscillation is a sign about a planet or gravity, but ultimately not only about a specific planet. That is, the dynamic object is free of haecceities, a general term.

The interpretant of a sign is a more or less clarified meaning or ramification, a kind of form or idea of the difference which the sign's being true or undeceptive would make. (Meaning for Peirce is not merely lexical) An interpretant is a sign of the object and a sign of the sign of the same object. Thus interpretants are recursive.

We saw that Peirce's phenomenology affected his thinking and constrained theorizing about all other categories. So with regard to signs, the basic typology is constrained by his phenomenology.

Basic Semiotic Typology

|  | Sign in itself | Sign relative to object | Sign relative to interpretant |
|---|---|---|---|
| Firstness<br>*Tone* | Quality (qualisign); *icon* | Characteristic in itself | Possibility (rheme/term) |
| Secondness<br>*Token* | Actual Existent (sinsign); *index* | Existential relation to object | Fact (dicisign/sentence) |
| Thirdness<br>*Type* | General law (legisign); *symbol* | Relation to interpretant | Reason (argument) |

In this chart the columns represent phenomenological distinctions and the rows distinctions among signs. The symbol is quite different from the other signs. Thus Short (p85)states that "A symbol ... is a sign that is a law determining what may count as its instances and also determining what they are to be interpreted as signifying." New signs arise in part through invention by a society (Everett (2017); Barham and Everett (2020) and Short (2007, p93) and part via Peirce's conception of final cause and its combination of tychism with selection, *producing novel forms.*[v]

In this chart all of the basics of a sign typology are presented. In the left column we see the words "tone," "token," and "type." All three terms were, again, introduced by Peirce. As we read the boxes to the right of tone, we get a better idea of what these mean. It is a sign of something we feel, see, think, etc. that has not yet been defined by resistance to or comparison with another sign. We might sense a flash of red out of the corner of an eye. That flash is a qualisign. We have not yet seen its edges, shape, how it compares to other examples of the quality of red. Or we see some resemblance between a picture and a real-world object (which can be extremely undefined, as we discuss relative to the Pirahãs in chapter nine below). What we feel to be correspond in some way to another object is an icon. You are trying to solve a problem. You get a hunch. That hunch has not been tested or even well-defined. It is a possibility and thus a tone. It is a predicate without its pieces plugged in. A term without subjects. Type and token follow the same phenomenological trajectory, but are familiar enough.

Summing up, a sign that represents a quality is a qualisign, or a firstness. And a third sign of firstness is a theme (such as _run or _ give __ __, where there is a property of running or giving but it is not yet connected to any runner, giver, receiver, or gift). For secondness we find signs that are made by resistance to some other object, such the sinsign, i.e. a sign exemplifying another sign (i.e. a "replica" or token of that sign). An allophone is a signsign of a phoneme.

Many questions arise almost immediately about this chart. For example, how does this typology relate to what counts as a sign and the relationship between our thoughts and signs? Consider this example: my dog lying on her mattress by the fireplace is not herself a sign of a dog. She is not "about" a dog. She *is* a dog. But when I intend to think about a dog, my thoughts *are* about dogs. As Short (2007, p7ff) discusses, the intentionality of non-existent objects like my thought of a dog, contrasted with the non-intentionality of an actually existing dog, is the sign of the mental.

Every unit of the triadic (object, representamen, interpretant) sign is constrained by the *Final Cause* of culture recognition (see chapter two). So each representamen, object, and interpretant will have relevant and irrelevant or secondary components, i.e. those not formed in my mind by a final cause). If I see bear scat I can take this as a sign of a bear and I will interpret it perhaps by placing my hand on my bear spray, as I walk in the woods close to my

Massachusetts home. But I am not concerned about the color of the scat, nor its height, but only the general features that indicate "bear," e.g. whether it is full of berries or other plants, its size, and whether there are hairs or bones in the scat.

As for the bear as object, I will not be thinking of the bear as being scarred, being exactly a certain height, being currently up a tree, and so on. I will simply form a general impression of "bear" as object. The haecceities of the bear and the scat are ignored, unconsciously and automatically. And my interpretation of reaching for my bear spray is not defined by reaching for a particular brand of bear spray, nor how far my hand reaches until it comes into contact with the aerosol can.

Or consider a representamen of the English written word, "bear." To serve as a sign of a bear, any of the following forms will do: BEAR, bear, BEar, beAr, *bear*, **bear**, bear, and so on. We are able to extract from our culturally-molded sign and interpretant inventory, the relevant portions of the object, interpretant, and representamen in each semiotic act/exchange.

Peirce expanded this typology. We have seen the distinction he drew between "immediate object" and "dynamic object." He also expanded the interpretant. When you drew back from a possible spider, a brown object in the leaves, your immediate object ("brown thing") produces your immediate interpretant, "might be a spider; might be dangerous." A better, safer interpretant would be to simply back up.

As you learn more about the object, your interpretant will change. Peirce identifies three different interpretants, the immediate interpretant (this corresponds to the immediate object and is seen by contrast with the dynamic interpretant when you interpret a sign as one thing, but later discover that it is a sign of something else, like thinking you're bleeding, when you have ketsup on your arm); dynamic interpretant, and the final interpretant, which is the actual interpretant - e.g. the ketsup you thought was blood. And then, finally, the final interpretant -the interpretant after learning and experience, the true interpretant (corresponding to the dynamic object).

In 2+2 = 5 an interpretant of 2+2 is offered. But this could only be the immediate interpretant of someone bad at math. A teacher can help them reach a different, or dynamic, interpretant. But whatever this person decides, the final interpretant will always be 4.  Other examples include an animal track that is not fully identified (immediate interpretant) vs. species identification (dynamic intepretant), and so on.

There are other types of interpretant, however, just as with any sign. One prominent interpretant is an emotional interpretant, an emotion in seeing a sign, e.g. a bouquet of flowers, or hearing a sentimental song. Another type would be the energetic interpretant, i.e. when you jump back from a snake, interpreting a sign via and action. The logical interpretant is the most important for conceptual understanding. It is a thought or other general sign or habit formed and modified as an interpretant of a sign.

Short (2007, p192) talks about "triangulating the object" based on the interpreter's "collateral experience." This means that as we move from an immediate object to a dynamic object, we draw on what I have referred to as "dark matter" and what Peirce has referred to as "the commens," or what John Searle (1980) has called the "background," what Michael Polyani ([1966] 2009) terms "tacit knowledge," and so on. When we encounter an object, what is before us is a tokens of the object, the immediate object, and we must eventually settle on the *type* of the object. One way of thinking of this growth of understanding of objects is that tokens asymptotically approach their types. In our collateral experience, indexicals are crucial. We want to know that *this* object is of the same type as *that* object. We see *this* object perhaps by someone pointing at it or saying "there it is!" and the like.  The objects of symbols are a bit more subtle,

because symbols underdetermine their objects (something we take up again in chapter six when discussing how compositionality struggles with this natural underdetermination of the object by the symbol). This is a consequence of the nature of symbols referring only to *general* objects. "A dog" or "that dog" both contain the general (generic) term "dog," and thus while they can designate an instance of a dog, what a dog is nevertheless underdetermined by the word dog. We must triangulate the meaning intended.

If this sounds complicated, it is. The theory of signs is an organic whole. Like a language, you have to know all the parts and how they relate to one another in order to understand the theory. Thus when someone yells at you for something you did not do, their immediate object is wrong, though their dynamic object could be OK as a moral item. The constraint on dynamic objects or final interpretants is simple what is discovered *a posteriori* must fit what is predicted *a priori*. If there is a severe mismatch between the final object and the immediate object, therefore, the former is incorrect or incomplete.

As is now clear, there are three semiotic trichotomies: (i) the sign as mere quality, actual existent, or general law; (ii) the relation of sign to its object (based on (a) character of the sign itself; (b) existential relation to the object; (c) the relation to an interpretant); and (iii) whether the interpretant it is a sign of possibility; a sign of fact; or a sign of reason.

We can use different terms to produce another table paraphrasing to some degree to the table immediately above:

Basic Semiotic Typology II

|  | Sign Orientation | Object Orientation | Interpretant Orientation |
|---|---|---|---|
| FIRSTNESS | Qualisign (quality) | Icon (characteristic in itself) | Term (possibility |
| SECONDNESS | Sinsign (existent) | Index (existential relation to object) | Sentence (fact) |
| THIRDNESS | Legisign (general law - in language a purpose to signify) | symbol (generality of object) | Argument (reason) |

Most legisigns (law-governed signs) are simultaneously conventional and purpose-directed for communication. But this is not always the case. Laws of nature are not conventional, though they *are* general laws and thus legisigns. This is captured in the followed implications:

Conventional  -->       Legisign
¬ (Legisign      -->       Conventional)

With this introduction of Peirce's typology of signs, we now turn to the three semiotic subdisciplines Peirce urged as necessary companions to the typology of signs: Speculative Grammar, Speculative Rhetoric, and Logic. As Bellucci (2018, p3) defines the former, "Speculative Grammar is that branch of logic that 'takes the whole domain of signs as its subject matter, of which it should then produce an analysis and classification of signs." Peirce's original work on Universal Grammar, a term he inherited from the Modistae, transformed itself from his cotidian linguistic analysis in 1865 to logic, for which reason he substituted the term "Speculative Grammar" for Universal Grammar in later years. Basically distinguished, Peirce's original Universal Grammar was looking for empirical similarities between languages, along the lines of modern day grammatical typology. But Speculative Grammar was looking for a Universal Grammar common to all languages, thus corresponding superficially to what Noam Chomsky introduced as Universal Grammar in his work. However, although Peirce and Chomsky were both looking for what was truly universal and required for a language to be a language, i.e. they were both engaged in "normative science," Chomsky and his followers looked for universality in human biology. Peirce looked for the *logical* conditions necessary for any sign system. That is, he did not look for the logical requirements for having a *language*, but for those required of any *semiotic system*, language being but one of many, and not limited to biology.

Peirce found inspiration in the work of Thomas of Erfurt (though he thought the work was by Duns Scotus, a common, understandable mistake of the time given the obscurity of the manuscript pedigree). For example, in Thomas's model, there were three principal components of language:

Modi Significandi

Modi Intelligendi                    Modi Essendi
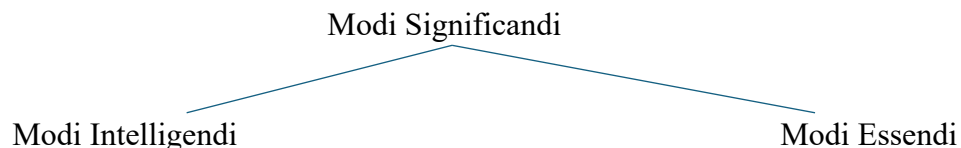
Thomas of Erfurt's triadic system links the "ways of meaning" with the "ways of being" and the "ways of understanding." This is superficially similar to the triadic view of signs that Peirce developed, with Representamens (roughly modi significandi), Interpretants (roughly modi

intelligendi), and Objects (roughly modi essendi). Signs needed to be linked simultaneously to minds and the real world.

Summing up this section, we have seen that the significance of a sign is based on "grounded" (the way that it represents the object) interpretability. And, as Peirce would put it, anything that can determine an interpretant is a sign. Moreover, it is a sign's prior relation to its object that gives it the capacity for an interpretant.

Peirce (ms. 318) further tied semiotics directly to his wider theory in statements like, "Pragmatism is not a general theory of meaning but pertains only to the meanings of those signs - words, concepts, statements, beliefs - of which cognition consists, and only to such of their meanings as belongs to cognition." And the action-orientation of Pragmatics is seen in his idea that he most important interpretant of a sign is not a verbal definition but a habit, or its "living definition."

Peirce further developed speculative grammar constraints on semiotic typologies, from 1902 on (Bellucci (2018, p4), by examining which combinations of parameters are possible. Although this eventually led to a little-used system of sixty-six signs, we focus here on his ten-sign system, listing interpretants, objects and sign vehicles (represenamens).

## Peirce's Ten-Sign-System[vi]

| Interpretant | Object | Sign-Vehicle | Examples (from CP2.254–263 1903) |
|---|---|---|---|
| Rheme | Icon | Qualisign | "A feeling of red" |
| Rheme | Icon | Sinsign; | "An Individual Diagram" |
| Rheme | Index | Sinsign | "A spontaneous cry" |
| Dicent | Index | Sinsign | "A Weather Cock" |
| Rheme | Icon | Legisign | "A diagram [type]" |
| Rheme | Index | Legisign | "A demonstrative pronoun" |
| Dicent | Index | Legisign | "A street cry" |
| Rheme | Symbol | Legisign | "A common noun" |
| Dicent | Symbol | Legisign | "Ordinary proposition" |
| Delome | Symbol | Legisign | "An argument" |

A rheme is a sign that has valence (such as any verb). An icon is a sign that corresponds in some way to its object. A qualisign is a type of quality, not clearly distinguished. A signsign is a secondness, an identified exemplar of a type. An index is physically or conventionally associated with its object used to "point out" its object in some way. A dicent, or dicisign, is a proposition. A symbol is a conventional legisign with a general object, i.e. a regular choice of sign used to represent generic entities. "The dog," for example, works because it says in effect "a specific exemplar of the generic "dog."" A delome is a more complex sign, an argument or discourse. Legisigns were discussed earlier - they are governed by laws or conventions (in which latter case they are symbols).

The interpretant of a sign is another sign of the same object. We interpret one sign or translate one sign via another sign. So if my uncle has never had a wife, I might refer to him as a bachelor. My uncle and the universe of discourse or my cultural knowledge of him constitute the object of my chosen sign, "bachelor." One interpretant of bachelor is "unmarried man." An interpretant of unmarried man could be "adult male who has no wife." And so on.

The interpretant need not be a word or any linguistic object, however. If I come to an intersection and the light turns red, the interpretant of the red light will most likely be my foot applying pressure to the brakes of my car. Or the interpretant, for a pedestrian, could simply be for walking to cease at the sign. If I see a picture of my long-deceased mother the interpretant might be a "lump in my throat."

This chart lists the only combinations of the earlier typology of signs that are logically possible, according to Peirce (Bellucci (2018); Liszka (1996)). Let's go through the list because an understanding of this list is crucial to a pragmatic application (e.g. analysis of a language in terms) of semiotics. A "feeling of red," which was mentioned above, is indeed a qualisign. But it is a rhematic, iconic qualisign. It is a rheme because it is a 'possibility' not yet realized. It is an icon because it contains a correspondence (redness) in itself to some other item not yet selected (e.g. a tomato). And it is a qualisign for the reasons already given. Consider the weather cock. It turns to point in the direction that the wind is blowing. This existential connection to the wind makes it an index. It shows resistance (to the wind) and so it is a sinsign, rather than a qualisign. And it expresses a proposition (that is, it is composed of an icon (the property of direction)) plus an index (its object and existential connection is the wind). The semiotic term for a proposition is *dicisign*. A syllogism is a *delome* (as is a discourse, composed of propositions) and a symbol (it represents its conclusion, for example) and a legisign (it is a conventional or natural law, in this case conventional).

Speculative Grammar is concerned not only with the typology of signs but also with the analysis of the components of signs. So, for example, a proposition is a symbol. But its predicate is an icon and its subject is an index and these components are what make the proposition as a whole a symbol (a dicisign), and what holds it together. Continuing with his analysis, Peirce's system further breaks down semiotic components by analyzing the index of a proposition as a word, phrase, direction of the wind, etc. and the icon of the predicate as a phrase, a verb, a painting, and so on.

Imagine the Mona Lisa. If we discovered this painting without its frame in the rubble of a building in Florence, Italy, we would immediately see that it is an icon of a woman, but nothing more. But if attached to the painting there were a name (especially one that we knew), that name would serve as the index and the entire framed picture would now be a dicisign - "This is the likeness of Mona Lisa," or some such.

There are three types of semiotic parameters for Peirce's classification: (i) the inventory of the trichotomies that specify semiotic classes; (ii) the determination of the classes of possible signs that result from the combination of the parameters, according to the rules of semiotic compositionality; and (iii) the phenomenological categories. These parameters give us not only the initial tables, but the list of ten signs (in the immediately preceding table, the result of the only possible combinations according to the logic of the symbols). Peirce believed (Bellucci (2018, p16) that "icons, indexes, and symbols isolate the classes of representations that logic is concerned with" (modulo later developments in Peirce's theory).[vii] Icons are correspondences; indexes are existential links; symbols are teleological or teleonomic signs.

All of inference ("illation" was a common Peircean designation for inference), is about sign relations. Inference is always and only the relating of one sign to another. Let's say that you see an "Open" sign in the window of your cleaners (and it doesn't matter whether the sign is cardboard or neon, whether the letters are black or red, etc). You infer that the store is ready for your business (that it is "functioning" as one would say in Portuguese). But what sort of sign is "ready for your business?" It must be a sign somehow if Peirce is correct. It is a proposition.

Therefore the sign of "Open" infers the sign of "business is functioning:" *Open --> The business is functioning*. Instead of an "Open" sign, you might know that the business is open simply by the sign of its door being ajar: *Door ajar --> The business is functioning*. Or you could see the door ajar and this sign could call to mind an icon-sign of a business operating *Door ajar --> Icon of a business operating* (e.g. as a moving picture in your mind or visible through the window in front of you). But always for any illative relationship, the arrow "-->" is bordered on its left and right by signs.  Let's look more closely now at the intersection of phenomenology with signs, using as illustrations three familiar examples from Peirce's early work on signs.

Icons are firsts because (i) they have no truth values (because what is an icon of one thing is always subjective, always in the eye of the beholder); (ii) icons have *connotation without denotation*.  They have qualities that correspond to something, but we do not know what, based only on the qualities of the icon.

Indexes are seconds because (i) they indicate only specific objects, never general objects; (ii) they lack truth conditions (for example, redness in the face in itself is neither true nor false but it can be interpreted, correctly or incorrectly as an index that the person behind that face has been drinking or has a fever). Indexes have *denotation without connotation*.  They point out something but tell us nothing about that something.  Symbols are thirds because (i) they always refer *and* describe; (ii) they both denote and connote; (iii) symbols (dicisigns, arguments, and discourses) can be true or false.

Interestingly for the philosophy of linguistics, the logic of semiotics is *not* concerned with whether or not a sign has a linguistic form. Interpretations of signs, therefore, need not be linked exclusively to linguistic units, e.g. sentences, words, and the like. This is important because it claims that linguistic philosophy in fact is a subset of semiotic philosophy (if it is delimited as separate at all) - recognizing that linguistic forms emerge as one mode of semiotics, not requiring or allowing a single discipline.

As mentioned already, Peirce invented three distinct subbranches of logic specifically for the study of signs. These are: (i) Speculative Grammar; (ii) Speculative Rhetoric; and (iii) Logic Critic. Speculative Grammar is the logic of signs. Speculative Rhetoric is about the logic of the power and presentation of signs. Logic Critics is the form of logic as semiotic, primarily concerned with the relation of a symbol to its object (Bellucci (2018 pp21-22)).  More generally, logic in Peirce's philosophy is about signs and inference (which is itself about signs). It is therefore difficult to overestimate the importance of semiotics to Peirce's philosophical program.

The functions of signs can also be viewed in a triadic classification: *terms* represent possible characters (e.g. 'man', 'dog'), including generics (which turns out to be important in understanding the differences between generics and universals discussed in Appendix Two below. There cannot be a sign system without generics, because no sign system is possible without terms. Universal quantifiers are not terms, however, they manifest themselves as dicisigns, arguments or discourses. This reinforces what Everett (2012) discusses briefly, namely, that generics are a communicative essential - one must be able to talk about, for example types of animals, e.g. fish, cats, dogs, timbó, etc, for hunting, for gathering, for warning, for cultural festivals, for conversing in general. Generics cannot be eliminated from human communication therefore.  A term (i.e. a generic) specifies a class. We can contrast other terms and generics with quantifiers easily. A quantifier for Peirce specifies a set of referents that is provided to the hearer in a certain way. So an existential quantifier gives the hearer a choice of referents while a universal quantifier provides no choice. *Propositions* function to link a character with what Peirce called a "subject" (what linguists today would refer to as either a subject or an object,

depending on its position, or, more neutrally, as an argument, though this type of argument should not be confused with Peirce's concept of argument). So "Socrates is a man" has "is a man" as the character and Socrates as the index of the bearer of that character or correspondence. Finally, an *argument* has the function of representing the object, as a proposition also does but also represents the interpretant that may substituted without loss of truth: All men are mortal. Socrates is a man. Socrates is mortal. This particular argument tells us that if "Socrates is mortal" then also "Socrates is a man" and vice-versa in this particular argument.

Recall that Peirce's logic and semiotics were not focused on words or sentences per se, but on semiotic entities, e.g. terms, propositions, and arguments. But semiotics was and is crucial to logic. As Peirce put it (W1: 309) "logic is the study of the validity of certain substitutions of symbols." In light of some of the controversies about propositions, especially that inspired by W.V.O. Quine (1960; 1969; inter alia) it is perhaps worth saying why Peirce considered these settled beyond doubt. Quine's objection to the proposition is, according to Atkin:

> *"Regimented theory contains no abstract objects other than sets. Many abstracta, however, can be defined in terms of sets: numbers, functions, and other mathematical entities being the most obvious. Quine excludes other alleged abstracta, such as properties, propositions (as distinct from sentences), and merely possible entities. The chief reason for this is that he finds the identity-criteria for such entities unclear. He holds, quite generally, that we should not postulate entities without having clear identity-criteria for them. This is the view that he sums up in the slogan "no entity without identity"; see (1969, 23) and elsewhere."* (Atkin 2022)

Quine's objections fail, however. For one thing his slogan is wrong because his "identity" criterion seems to confuse reality with existence. If you can refer to something and explain its properties via inference, then it is real. It might not exist, but it is real. Moreover, Peirce does provide identity-criteria in the very theory of semiotics that we are examining here (a proposition is a combination of index and icon) and goes on to show how in fact if any entity is ephemeral or of secondary importance it is not the proposition but the sentence, since a proposition can be expressed without a sentence, but a sentence requires a proposition. Peirce *predicts* the existence of dicisigns or propositions from Speculative Grammar. Stjernfelt (2014) offers a sustained argument not only for the reality of propositions but for the fact that propositions are *natural* objects (whether they exist or are merely real, via interpretation, is a separate question) and, again, do not need sentences for their expression.

There are other potential objections to Peirce's semiotics, such as the crucial importance of the object, which leads directly to the controversial (for some) correspondence theory of truth, especially when combined with Peirce's realism. There is not space here to respond to such objections, except to say that not one objection, contrary to Peirce's theory, arises from a theory of how we mean that is deeply connected to a well-worked out theory of how objects, interpretants, and signs come together.

Peirce's triadic theory of inference also falls under his phenomenology and semiotics: (i) abduction is a first and is *iconic*; (ii) induction is a second and is *indexical*; (iii) deduction is a third and is a *symbol*. How do (i)-(iii) follow? Abduction points to no answer. It merely suggests a way of proceeding. It offers a rough correspondence (its iconicity) to what an answer might look like. Induction points to a specific (indexical action) and from this specific suggests a general (a third), though the index itself only identifies a specific. Deduction offers a general conclusion. Another way of distinguishing abduction, induction and deduction is that the former

two are a priori and the latter is a posteriori, a distinction carrying over into forms of inference. For example, consequents are inferred a priori while antecedents are always inferred a posteriori: *If John is here, then Mary is unhappy*. "Mary is unhappy" is an a priori inference based on the known characteristics (a posteriori) of her relationship to John, for example. Moreover, other logical properties of the three forms of inference follow from this: (i) in deduction the conclusion is represented by a symbol in the premise; (ii) in induction the conclusion is indexed in the premise; (iii) in abduction the premise is an icon of the conclusion.[viii]

Speculative Grammar and Speculative Rhetoric further address an important concept that Peirce helped pioneer and that is of extreme important in computer science, at least from the time of Shannon (1998), namely, *information*.

For Peirce (W1: 287; Bellucci (2018, 40)) information is the amount of comprehension a symbol has beyond its extension. Icons have no extensions. Indexes have only extensions. Only a symbol has both extension and intension (connotation). Thus only a symbol can carry information. Also truth requires both denotation (extension) and connotation (comprehension) so only symbols (at least a subset, from the dicisign up) can be true.

Peirce's theory of information purposely departs from Kant's. Kant (Bellucci (2018 p39)) claims that a generic like "horse" has less comprehension/intension, yet greater extension that "black horse," which has greater comprehension, but less extension (showing levels of genericity). From this Kant concludes that the greater the comprehension or connotation, the less the extension. However, Peirce counters that as knowledge changes, Kant's formula turns out to be false. So, for example, if I say that "non-risible" (Peirce's example) does not apply to man, then I have enriched the connotation of man without affecting the extension - we just learned more about the individual members of the set without changing the number of members.

Or imagine that a blind man learns that "red" includes "not blue," which he did not previously know. Then his comprehension is increased while the extension of red is unchanged. Again symbols connote and denote; icons connote only; indexes denote only.  Information is not as simple as Kant thought and this is linked to Kant's failure to recognize that in an extensional set we are concerned only with denotation and thus increasing connotation increases information without affecting denotation.

An increase in information in Peirce's semiotics is an increase in either the extension or comprehension (intension) of a sign, without diminishing any other quantity (i.e. that increase extension without reducing connotation = information and increase connotation without decreasing extension = information). Peirce puts this in an interesting idea of "education:" "Men and words reciprocally educate each other; each increase of a man's information involves and is involved by, a corresponding increase in the word's information." (Bellucci 2018, p41).[ix]

This pragmatic theory of "Peirce-information" has similarities to, yet is ultimately very different from, modern computational views of information, as pioneered in Claude Shannon's famous 1948 paper "A Mathematical Theory of Communication."  Shannon discussed the information conveyed by symbols in terms of a couple of axioms: (i) An event with probability 100% is perfectly unsurprising and yields no information; (ii) The less probable an event is, the more surprising it is and the more information it yields.; (iii) If two independent events are measured separately, the total amount of information is the sum of the self-informations of the individual events.[x]

Is this incompatible with Peirce's definition of information? Somewhat. The major difference between Shannon-information and Peirce-information is that Shannon's model is not concerned with meaning but with the character of the message, while Peirce-information is based

on the interpretant of the message sign assigned by the recipient. And if the interpretants are the same, the pragmatic or Peirce-information of the message is the same, unlike in Shannon's model.

For example, imagine that you and your friend both enroll in Chemistry 101. But you take separate chemistry sections from separate professors. One professor enriches her lectures with brief histories of discoveries in chemistry. She looks at different types of chemical reactions in different periods during the term than the other professor does. She engages the class in discussions of chemistry. The other professor is a dry lecturer. Not many classroom discussions. Nothing about the history of the field. But at the end of the semester all students take the same standard exam for Chemistry 101 prepared by the department of chemistry. And all the students do well. In fact, both sections do equally well on the standard exam. If this is the case, then, ceteris paribus, we conclude that the pragmatic or Peirce-information communicated over the term was the same for both sections relative to the goal of taking the test (the final cause of the test). This would not be the case relative to Shannon-information, however, since the ways in which the material were communicated by the different instructors means that each communicated different messages, i.e. different information.

Weinberger (2002, p3) summarizes the pragmatic approach to information (for which he offers a mathematical formalization) as: "A fundamental assumption of the present work is that the practical meaning of information stems from its usefulness in making an informed decision. One important implication of this claim is a natural, quantitative measure of pragmatic information, which is the impact of a message on the receiver's subsequent actions..."

From Peirce's perspective, if we add to the extension or intension (comprehension or connotation) of any sign we have added something we did not know - we have increased its information. Therefore in a sense Peirce-information, like Shannon-information, is also partially based on surprise. In fact, Peirce designed his concept of abduction to serve as the inferential tool exactly in the case of surprising information. When we are surprised by something it creates doubt. We do not like doubt. It is an unstable and irritating cognitive state. We therefore use abduction/retroduction to relieve our surprise, reviewing here with somewhat different wording:

A - x is a surprising fact.
B - if hypothesis y were true, x would no longer be surprising.
C - therefore B provides some evidence for y.

Surprise has been built into Peirce's semiotics and inference from its very beginning. However, what is crucially different between Shannon's and Peirce's concepts of information is that Shannon's theory "says nothing about the semantic content of information." (Weinberger (2002)) Shannon's system, by definition proposes that the quantity of self-information carried by some event depends only on the probability of that event, such that when an event's probability is smaller, its "self-information" - that associated with receiving the information that the event indeed occurred - is larger.[xi] As Peirce puts it "... when the information is increased there is an increase of either extension or comprehension without any diminuition of the other of these quantities." (W1: 464-465)

Semiotics requires a mind. But the mind need not be human. All the universe is controlled by "effete" mind, therefore signs exist everywhere and always in the universe. Effete ("no longer fruitful") in Peirce's sense refers to any mind in which all habits are rigid and there are no more to develop. The laws of physics are such habits, for example and thus the universe is governed by fixed habits and thus is effete mind. Human minds are not effete, because we are free to form new habits (which are interpretants). In fact, that is the major distinction between the

evolution of human vs. non-human minds - greater habit/cognitive freedom for humans and more instinctual/fixed habits for non-humans. My dog's mind is not effete, but it is farther to that end of the scale than mine. (See Everett (2016) for more details).

When we conceive of thinking and acting as different kinds of events (as opposed to different modes of interpretants), this tempts us to break apart the mental from the physical, leading to a view of the mental, at least to Brentano and Descartes, that is dualistic. One cannot explain the mind naturalistically they would maintain, that is, in the same terms that one can explain the body.

For Peirce, however, the disagreement with Brentano and Descartes's dualistic perspective comes down to whether or not the mind can be explained naturalistically. Peirce's own position is that the mind is real, it is intentional, and it has a naturalistic explanation.

Thus a difference between Peirce's semiotic and Saussure's semiology is that while both studied signs, only Peirce worked out a theoretically and phenomenologically motivated *typology* of signs. Indeed a typology derived from his wider theory of Pragmatism. Another difference between these two systems is that for Peirce there were universal and logical constraints on signs such that all signs fit within his theory of inference, itself a part of his Pragmatism. Semiotics therefore emerged for Peirce from a larger, logical theory.

For Peirce, the tokens of individual signs are shaped by the final cause of their use, including their interpretations. My signs are merely senseless gestures or meaningless babble until they have an interpretant-provider. This is true as well for all non-human animals. The main reason a lion roars is so that its roar will be interpreted (and the lion must behaviorally infer that its roar will be interpreted). Whatever typology of signs emerges from research, it will make no sense without a specific part of the theory dedicated to a semiotic interpretant. Saussure's theory lacks any such component (an interpretation is not an interpretant - interpretations are general, while interpretants are specific) and thus the two systems are incompatible, in spite of superficial overlap (and this is not the only point of incommensurability).

All creatures learn signs either phylogenetically (as in human facial expressions, which Augustine would have labeled *signa naturalis*) - signs of bodily dispositions or instincts or ontogenetically.[xii] As always, one must take care not to over-attribute instincts, an epistemological move that can be simply a manifestation of laziness or hazy thinking on the part of the researcher (see Blumberg (2006) for examples of problems with such thinking). Short (2007, p25) makes this point in some detail, remarking that what we all have are "dispositions" to "replicate and respond" to signs of our culture. For any replication of a culturally appropriate sign, there must be a responder, or the "sign" is not a sign. Augustine drew the distinction between purposeful signs (*signa data*) and natural signs (*signa naturalis*). Signa data correspond roughly to what Peirce came to refer to as "legisigns" (see below). Augustine's division is compatible with Peirce's but best understood in terms of the sign typology in the tables above.

Returning to a comparison of Saussure and Peirce, both of them agree that the study of human language is either part of the theory of signs or otherwise governed by that theory.

> *"Linguistics is only a part of the general science of semiology; the laws discovered by semiology will be applicable to linguistics; and the latter will circumscribe a well-defined area within the mass of anthropological life."* Saussure ([1916] 1959, 16)[xiii]

For many linguists this point of agreement between the two semioticians/semiologists will only serve as a reminder that semiotics is no longer relevant to linguistics as it is practiced today. After all, linguists, like most scholars, know where they belong or "fit." And most linguists see themselves as fitting the role of scientist, not humanist (which is how semiotics is

often (however mistakenly) perceived). Linguistics, it is widely believed, fits appropriately into the enterprise of science and is equal to any other scientific discipline. Within their field of study a linguist will usually claim to belong to a particular subfield - e.g. phonology, syntax, semantics, pragmatics, or phonetics.

Therefore, few modern linguists, in spite of what they might know of Peirce or Saussure, would refer to themselves as both linguist and semiotician, nor as either a linguistic semiotician or as a semiotic linguist. And yet, again, both inventors of modern semiotics, Peirce and Saussure, agreed on at least this one claim: linguistics is subordinate to semiotics. For Sassure, linguistics was a branch of "semiology." For Peirce, Semiotics was a normative science, linguistics a subordinate and classificatory science, taking its terms and theoretical modeling, as all classificatory sciences do, from the superordinate science of semiotics. Moreover, for both Peirce and Saussure, another strong point of agreement, linguistics is a branch of psychology. One fundamental difference, however, was that for Saussure linguistics was to be interpreted semiologically. While for Peirce the semiotic connection to linguistics is through logic and and local, cultural preferences.

Underscoring Peirce's focus on the relationship between semiotics and logic, Liszka (1996, p5) accurately describes semiotics as concerned with the "conditions for what is to count as true." For Peirce, because all thought takes place via signs, "truth" is a matter of sign usage, transmission, creation, etc.[xiv] Saussure on the other hand envisaged his semiology as a science that "studies the life of signs within a society" (Liszka 1996, p14ff). Unlike Saussure, Peirce's semiotics was built into a larger architectonics of philosophy and science and, in particular, was part of his Pragmaticism.

From the earliest days of the theory of semiotics, Peirce claimed that recursion is a required component of semiosis. For any sign, its interpretant will be another sign. "Signs all the way down." But one can see that there is no way for a sign to begin, for language to evolve in fact, in this view. If you cannot interpret one sign without another and so on, then how could the process ever begin? Peirce's proposed solution is the index. We learn a new sign ostensibly (see Everett (2017); (2012) for suggestions). If we share no language or have no language, we might begin to build one by, say, pointing and inventing a sign for what we pointed at. Then the interpretant of the sign is what we pointed at.

Peirce argues that meaning is learned, by learning to speak. Our thoughts' meanings must necessarily *follow* acquisition of language. Saussure (Short 2007, p17) apparently agreed with Peirce on this point when he said "No ideas are established in advance and nothing is distinct, before the introduction of linguistic structure." Saussure's emphasis on structure rather than meaning, however, is another way in which I believe Peirce's thinking on the subject is superior. Structure is a focus on representamens rather than the entire triadic sign. Peirce's theory, however, also has the apparent shortcoming of denying thought (since they have no language) to animals. I do not think that this follows from his theory, however. Rather what I will interpret Peirce to mean here is that symbols (in the sense of signs with general objects) are what guide human thoughts. Nonhuman animal inference is also thought, but of a different kind from the productive, open-ended though teleologically-guided symbolic thought typical of all humans.

Ultimately, however, Saussure's theory is incompatible with Peirce's. Indeed it is incompatible with Peirce's entire philosophy. For Saussure (Short 2007, p19) signs can be studied in isolation from actual languages (or comprehension). For Peirce this is wrong. Peirce's semiotics is compatible with Aristotle's conventionalism - signs fall under the logic of inference in a social setting. Signs are constrained by the logic of Speculative (Universal) Grammar,

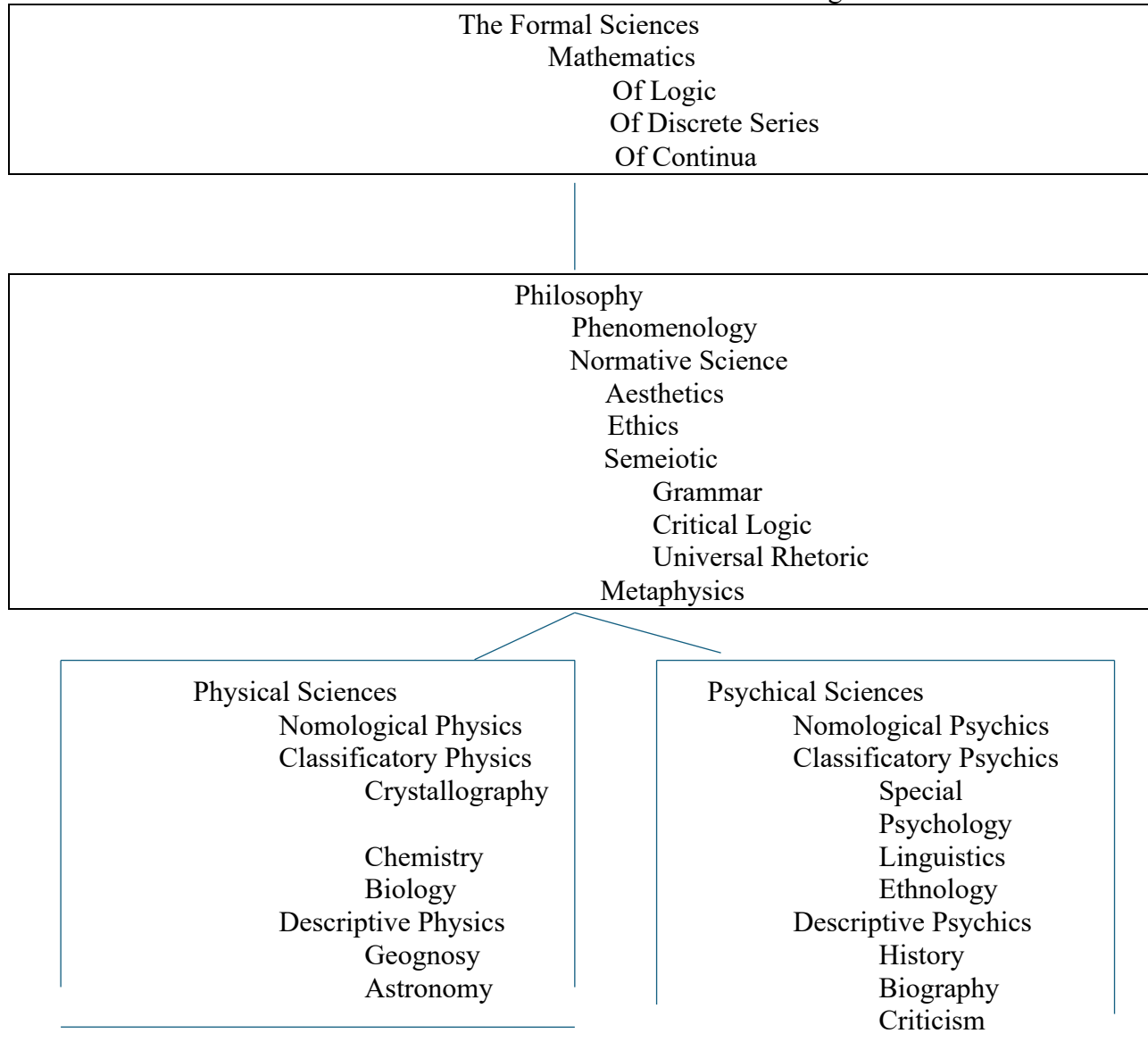Speculative (Universal) Rhetoric, and Methodeutic, but they are created by inference by real creatures.

Sextus Empiricus argued against the theory that all signs governed by inference because he observed that animals use signs. But he should have argued differently, namely, that because animals use signs, they must use inference in interpreting signs, as we argue in what follows.

In a discussion of the philosophy of linguistics, one might reasonably wonder whether a Peircean semiotics has any role to play. Unlike Saussurean semiology, of which linguistics was explicitly discussed a subfield, Peirce's view of semiotics and its relationship to linguistics was more indirect.

Peirce considers all objects of signs that can appear in the plural to be ipso facto universal. So "I read about many unicorns," means that "unicorn" is a universal (I would say instead "generic." Universals and generics and real, though nonexistent. We return to discuss such examples in detail in the discussion of Pirahã nominalism in Appendix Two).

Peirce claims that the person Socrates is not a universal because one cannot say "I saw many Socrateses." This works when the object is the person. But the object could be the person's name, rather than the person itself. So in Brazilian Portuguese if I went to a meeting where many people named José were present, I could say "Tem muitos Josés na festa" (There are many Josés in the party.) In this case, I am pluralizing the name not the person labeled by the name. That is, the sign of a person-object is now an object in its own right and therefore a universal or generic, though the person is not.

Peirce classifies semiotics as a normative science within his larger architectonics:

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The Formal Sciences
        Mathematics
                Of Logic
                Of Discrete Series
                Of Continua
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                    Philosophy
                        Phenomenology
                        Normative Science
                            Aesthetics
                            Ethics
                            Semeiotic
                                    Grammar
                                    Critical Logic
                                    Universal Rhetoric
                        Metaphysics
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    Physical Sciences                          Psychical Sciences
            Nomological Physics                        Nomological Psychics
            Classificatory Physics                     Classificatory Psychics
                    Crystallography                            Special
                                                               Psychology
                    Chemistry                                  Linguistics
                    Biology                                    Ethnology
            Descriptive Physics                        Descriptive Psychics
                    Geognosy                                   History
                    Astronomy                                  Biography
                                                               Criticism
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Notice that part of the classification above is based on abstractness - sciences are classified in part based on their level of abstractness and the diagram above shows them in descending order of abstractness. A notice that linguistis is a less abstract division of classificatory psychology.

Peirce's semiotics is a matter of logic, a normative science that determines logically what signs *must* be like and how they thus constrain logic and thought. As Liszka (1996, p4) puts it: "Semeiotic as a branch of philosophy, is a formal, normative science that is specifically concerned with the question of truth as it can be expressed and known through the medium of signs, and serves to establish leading principles for any other science which is concerned with signs in some capacity." Saussure on the other hand defines semiology as (Liszka ibid) as "a science that studies the life of signs within society." Thus Saussure sees semiology as a special empirical science while for Peirce it is an *organon* in Aristotle's sense, i.e. an instrument for acquiring knowledge.

For Peirce, moreover, what it means to say that linguistics is a branch of psychology and that semiotics is a branch of logic, is that logic tells us how we *ought* to think while psychology tells us how we *do* think. Likewise, linguistics does not tell us how we ought to speak. It tells us how we do speak.[xv]

Therefore, Peirce is careful to defining what a sign is before a full elaboration of his theory: "... a sign is something, A, which brings something, B, its *interpretant* sign determined or created by it, into the same sort of correspondence with something, C, its *object*, as that in which itself stands to C." (Peirce 1902, NEM 4, 20-21.)

As we see in chapter seven, words, propositions/sentences, paragraphs, conversations, and discourses (as well as gestures, semaphores, etc) are all signs. Therefore Speculative/Universal Grammar in Peirce's terms differs in two principal ways from the modern, Chomskyan usage of this expression. For Chomsky UG is a feature of biology. For Peirce it is a type of logic. For Chomsky UG applies only to human language. For Peirce it applies to any semiotic system, i.e. to almost all of nature.

This is because semiotic principles are universal and require no context nor human mind for their operation or relevance. On the other hand, individual human ability to interpret given signs and objects depends on individual or cultural familiarity with the objects to which signs apply. Thus a completely unfamiliar object in principle has an associated sign and interpretant, but an individual might not know these and thus would be unable to interpret the sign. Think of the technical names for disease in medicine, for example.

Peirce was interested in all aspects of cognition - even, somewhat confusingly for the non-initiated, referring to the entire universe as "effete" mind and physics and other law-governed behaviors as "habits." But his focus was always on human semiotics and communication - as is indicated in the citation from T.L. Short at the beginning of chapter nine. I want to turn now to a related issue, which is linguistics as a field and how different subfields focus on parts of signs, rather than whole signs, leading to unnecessary confusion and division in the field.

There are two broad divisions in modern linguistic theories - those that focus on meaning and those that focus on form. These are often known as "functional" (or "cognitive") linguistics vs. "formal" linguistics. There are many correlaries of each approach to human language. But if we take communication as the principal purpose of human language (see Everett (2017) for arguments that, contra formal linguistics, communication indeed fits this bill), then meaning is the core feature of language. If we take a semiotic approach to the problem, language is indeed for communication, but meaning (interpretants), form (representamens), and their connections to objects must be considered the tripartate core of language.

Thus in a Peircean-semiotic approach to cognition and language we do not choose between meaning or function on the one hand vs. form on the other hand as the "core" of language. Language is about signs and signs incorporate form and meaning simultaneously and necessarily. Saussurean semiotics would likely have a similar take on the core of human language.

Whether in the scientific literature or in general speech, magazines, or other media of human communication, the word "language" is used in a wide variety of ways. The Oxford English Dictionary (online version) dedicates more than thirty pages to the definition of this word. "Language" is borrowed from the French, *langage*, and its earlier spellings reflect its French origin. The word "language" has extended its semantic branches like a great baobob tree. So we come across expressions like "the language of love," "the language of music,"

"mathematics is the universal language," "music is the universal language," "the language of bees," "dolphin-language," "bird languages," "the language of dance," "don't use that bad language," "unlawful language," "woke language," ad infinitum, ad nauseum.

But because language is such an important component of human cognition and, as many argue (including me, see Everett (2017), Everett (2012), among others) a marker of human uniqueness, an understanding of human cognition must consider the nature of language and how it faciliated and faciliates the central components of human cognitive development. Cognition and language were central to Peirce's research program as well.

It seems inescapable that there is a semiotic continuum (something in fact required by Peirce's doctrine of synechism) linking humans and all other creatures. Along this continuum one could think of various places to introduce the label "language" for the kind of communication taking place. But it would be confusing at best if any definition or usage of the word language failed to capture the many ways in which human communication differs from that of other species. Therefore, it is important to establish in what sense human language (and thought) differ from other communication systems (thought is self-communication in Peirce's system, as well as how they are like other systems. This comparison has the interesting side-effect of forcing us to consider and reject the "design features of human language" proposed by Hockett (1960). Instead we propose (following Everett (2017) and Deacon (1997), interalia) a semiotic (quantitative rather than qualititative) differentiation between human communication and all other biosemiotics. Human semiotics creates new semiotic units creatively and productively, as needed, and is based on multi-layered semelfactive and culturally-constrained constructions.  In order to understand the constrast between human and non-human animal semiotics, we first survey insect communication, followed by inter and intra cellular communication, then communication among prairie dogs.

Let's begin by considering the now famous proposal of the "language of bees" or "the dance of the bees."  In 1923, the future (1973) Nobel prize winner, Karl von Frisch, published an article that got worldwide attention: "Über die, Sprache' der Bienen. Eine tierpsychologische Untersuchung" ("About the Language of Bees: An Animal Psychological Study") in *Zoological Yearbook*).

In this study, von Frisch argued that knowledge about the location, distance, and other facets of food sources can be communicated by bees to other bees.  He argued further and colorfully that bee communication took one of two forms of "dances," the "waggle" dance and the "round" dance. The round dance purportedly communicates that there is a food source within fifty to one-hundred meters of the beehive. According to Frisch, this dance also provides information on the type of food available.  von Frisch's research was painstaking and careful:

> *"I was curious to learn how bees could tell their fellows about the presence of food at a new location. But it is not possible to observe what happens as the bees crawl about between the honeycombs inside an ordinary beehive. I therefore constructed an observation hive in which the honeycombs were arranged edge to edge so that they formed one large comb, the surface of which could be watched through glass windows..."*
(von Frisch (1971 [1950], p69ff).

He went on to color code hundreds of bees with shellac paint. Observing the bees after they visited his honey supply he noticed that:

> *"After she has returned to the hive our marked bee is first seen to deliver most of the sugar-water to other bees [trophyllaxis, DLE]. Then she begins to perform what I have called a round dance. One the same spot she turns around, once to the right, once to the*

*left, repeating these circles and again and again with great vigor. Often the dance is continued for half of a minute or longer at the same spot. Frequently the dancer then moves to another spot on the honeycomb and repeats the round dance and afterwards ordinarily returns to the feeding place to gather more sugar."* (ibid, p72)

Von Frisch also observed that odors are an important part of the bees' ability to find honey. Regardless of any dance, in fact, it must be emphasized that if there is no odor at the source, the source cannot be found: "...  I did not succeed when I chose flowers without any odor at all... then the new bees that swarmed out of the hive searched earnestly in the vicinity for the food that had been announced to them; but a dish of bilberry [odorless, DLE] placed in the meadow did not receive any more attention than the surrounding grass or other unscented objects..." (ibid, p76) Thus the dances are only part of the semiotics of honey-source localization or recovery employed by bees. In addition to indexical and iconic dances, bees require the aid of the indexical information of smells.

Looking in more detail at bee semiotics, in the round dance the bee begins by going around in a tight circle, turning right and left and changing directions, clockwise/anticlockwise, in quick movements. In each direction the bee will turn roughly two circles. The bees nearest the dancing bee try to maintain contact with the dancer's abdomen. All the bees near the dancer try to dance along.

The other dance (illustration from Wikipedia) Frisch labeled the "waggle dance." As the illustrations below show, the movement (thus the semiotics) of this dance is quite different from the round dance.



The waggle dance
(von Frisch 1972)
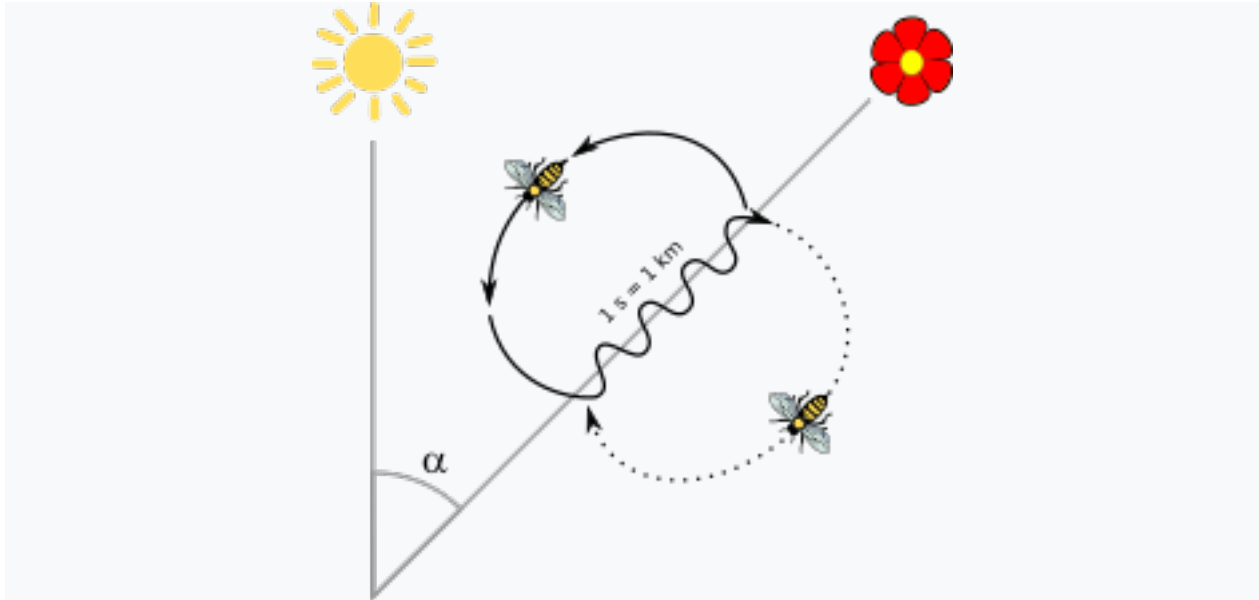
Interpretation of the waggle dance: direction relative to the sun is shown by angle to the vertical; distance by the time taken on the central stretch.[xvi]

This dance communicates about food sources farther than one hundred meters from the hive. To communicate this information, the dancing bee moves forward a certain distance on the vertically hanging honeycomb. After this it traces a half circle to return to her starting point, whereupon the dance begins again. Then, as shown in the diagram, on the straight stretch, the bee "waggles" with its posterior. The direction the bee moves on the straight stretch iconically represents the direction of the food source. Additionally, and also iconically, the angle between the straight stretch and the vertical being represents the angle of the direction of flight relative to the sun. The distance to the food source is, again iconically, but this time using temporal as well as visual icon, relayed by the time taken to travel the straight stretch. According to von Frisch, one second of waggle-dance represents approximately one kilometer. This indicates, as he points out, that the speed of the dance is inversely related to the actual distance, also an iconic representation (not symbolic).[xvii]

As in the round dance, other bees interpret the iconic movements of the dancing bee in part through physical contact with the dancing bee, including imitating its movements. Beyond their interpretation of the iconic representations of the dancing bee, the other bees receive indexical information via smell, which indicates what type of item, e.g. food, pollen, propolis, and water, is at the source. One of von Frisch's key and most important points made is that the iconic representation of the dance functions so well that the bees can find a food source even if there is no straight path indicated by the dance might include hidden detours, e.g. going around an intervening mountain. (But they cannot find it without smell.)

von Frisch's analysis, however, raises a number of questions, e.g. what is a bee's sense of time, how are bees able to know that any period as precise as a second has occured? And, more importantly, how does a bee or hive of bees understand a spatio-temporal ratio such as one second $\cong$ one kilometer? Many adult humans would get lost here. The description sounds to me at least incredulous and, at the least, in need of much more explanations of the purported cognitive powers of literally brainless bees.

Be that as it may, what is most telling is that subsequent investigations indicated that how this information is represented iconically by bees in their dances varies dramatically between bee varieties. Some have classified these differences as "dialects."

Thus, nearly as soon as von Frisch published his results, other experts offered alternative explanations as is common practice in science. Wenner and Wells eventually wrote a book-length criticism of von Frisch's work (Wenner and Wells 1990). In this they state (p8):

*"Few hypotheses in biology conceived during this [20th, DLE] century have gained more attention than the celebrated honey bee dance language hypothesis of Karl von Frisch ... " p9: "The dance language hypothesis thus remained untested and unchallenged for two decades. The claims of accuracy in use of information continued unabated." "Few biologists recognized the fact that a bee "language" hypothesis of one sort or another and an odor-search hypothesis can each explain virtually all of the experimental evidence that has been gathered on honey bee recruitment during the several decades. Neither do biologists seem to appreciate the fact that both explanations have been with us for centuries..."*

Wenner and Wells went on to argue that the "language" of the bees seems not to be either necessary or sufficient for bees finding their food sources. They argued that in fact, as von Frisch himself alluded to, bees use odors, not dances to locate food sources. After years of debate, however, it is generally (not unanimously) conceded that von Frisch's account is somehow superior (modulo my criticism above), i.e. bees' "dance behavior" is occasionally necessary (though not sufficient) for food source location. But say that Wenner and Wells are correct when they claim that odors are both necessary and sufficient for honey-source location. Odors are indexes. Dances are indexical and iconic. Why use the latter if the former is sufficient? Odors are every bit as semiotic as dances, after all. The authors give some suggestions as to what in the environment can favor the use of odors exclusively or the combination of the two semiotic sources.

Moreover, it has been argued that the bees' dance is less effective than originally thought by von Frisch. In an interesting paper Price, et. al. (2019 p1) argue that the importance of the waggle dance "... in colony foraging success remains unclear. We tested whether spatial dance information affects colony foraging success in a human-modified temperate environment by comparing colonies with oriented and disoriented dances [i.e. under conditions under which normal hive lighting, etc. were altered by the researchers]. Strikingly, colonies with disoriented dances had greater foraging success. Over time, bees explosed to disoriented dances showed reduced interest in dancing nestmates. This may explain why disoriented colonies had a higher foraging rate than oriented colonoies, as bees did not waste time waiting for information." Nevertheless, they did find indexical information worth engaging in as well, smells.

The authors go on to claim that this variation in strategies show that "bees learn about the value of dance information (ibid p1)." This in itself is of course of major significance for cognitive science, though we set that aside for now. What is important is that odor, i.e. an index (still a sign of course), can be of greater importance than bee "language," i.e. the iconic movements of dancing. As the authors state (Price et.al. 2019, p1), "... the relative benefit of social information [e.g. "dances," DLE] is dependent on the current conditions, and therefore, individuals should adopt flexible strategies that dictate when to use a particular type of information." Dances provide indexical and iconic information of some sort, though, again, I do not believe that von Frisch's account gets close to a "final interpretant."

When resources are plentiful, the authors conclude (Price et. al. 2019, p5), social communication is less effective (in terms of sugar actually consumed in the hive) than individual foraging and so matters less. They speculated that in times of scarcity, however, that social communication plays a greater role. Thus they argue that social communication is both *learned* and *dispensible* for bees.

Bee semiotics continues to be of research interest, long after von Frisch's work. For example, another recent paper (Howard et. al. 2019) discusses another aspect of bee semiotics, what they call "symbol-recognition" in bees.[xviii] While the paper is fascinating, it illustrates the need for a better understanding of Peirce's semiotics throughout science. This study claims that bees can be taught (would are for humans) symbols:

> *"Here we show that honeybees are able to learn to match a sign to a numerosity, or a numerosity to a sign, and subsequently transfer this knowledge to novel numerosity stimuli changed in colour properties, shape and configuration. While honeybees learned the associations between two quantities (two; three) and two signs (N-shape; inverted T-shape), they failed at reversing their specific task of sign-to-numerosity matching to numerosity-to-sign matching and vice versa."*

But the article seems to confuse what are symbols for humans with what are almost certainly indexes for bees. The article does indeed demonstrate that bees can recognize particular numerical signs and correctly associate human symbols with the correct quantities, e.g. learning that the symbol "7" means seven objects. They do not show that what are symbols for humans are symbols, rather than some other type of sign, for bees. And this is crucial. Because the ability to use a symbol, as discussed above, is the ability to use a law-governed sign with a general object. However, while the researchers have clearly trained bees to interpret "If x, then y and if y then x (x-->y; y-->x)", i.e. "if you see an 'x' expect a 'y,'" it is more plausible that the bees recognize numerals as anything other than indexes, which we already know all animals recognize (as they use smells, footprints, broken branches, etc. to track other animals). In other words, even though x and y are symbols to humans, there is no evidence presented in the referenced study that they are symbols for bees. Use the number '7' for any group of seven objects, or for matching tasks etc. There is no compelling reason, in the absence of the demonstration that the objects of "bee symbols" are general, to believe that Apoideans have learned anything other than the kind of stimulus of an index for an object, as with Pavlov's dog. Bees can learn that the appearance of one sign *indicates* the presence of a particular kind of object (whether that object is another sign or simply a natural object), i.e. that the first sign is an index (not a symbol) of the latter. Moreover, for humans symbols require culture but indexes do not (indexical legisigns do).

Peirce's theory claims that, "... all this universe is perfused with signs," which is found in this fuller quote:

> *"It seems a strange thing, when one comes to ponder over it, that a sign should leave its intepreter to supply a part of its meaning; but the explanation of the phenomenon lies in the fact that the entire universe - not merely the universe of existents, but all that wider universe, embracing the universe of existents as a part, the universe which we are all accustomed to refer to as "the truth" - that all this universe is perfused with signs, if it is not composed exclusively of signs. Let us note this in passing as having a bearing upon the question of pragmaticism."* Peirce (CP 5:448, note)

Now, if the universe is composed exclusively of signs this means that there are signs everywhere, it is "signs all the way down." That would mean that we can expect to find semiotics at the level of atoms and the level of galaxies - at whatever extremities exist in the universe. Thus

it is not surprising that in his 2020 book, Jon lieff makes a convincing case that cells communicate, internally and externally (intracellular and intercellular communication). Although calling this communication "language" is an error, it is nevertheless a species of semiotic communication, further supporting Peirce's view of life and signs.

The cell (of any type) has to coordinate the activities of all of its internal components. It does this semiotically - communicating via signs. Lief's study is useful, though like many authors he lacks a vocabulary for precise discussion of his findings. After all, given that there is an entire field of study, semiotics, for understanding communication, not knowing about that field and writing nevertheless on communication is like talking about gravity while ignoring physics. For example, per Everett (2017), a language requires symbols. Cells show no obvious evidence in their communication systems for symbols and, therefore, they cannot be said in any precise sense to have a language. But of course, as lieff presents in an enlightened, clear, and convincing way, they do communicate. They do this, however, not with symbols but by using indexes and icons. If we simply define a conversation as the exchange of information between at least two individuals, then cells do converse. However, the problem here is that all human conversations require open-ended production of symbols, conscious intentionality, and inference (especially abduction). Can animals other than humans be characterized as consciously intentional, inferential, and creators of open-ended symbols? If so, their semiotics can lead to or is language. If not, not (though they could be getting very close). So while Lief's use of terms like "language" and "conversation" are understandable in spirit, they are used imprecisely when applied to any entity except humans. Nevertheless, the following statement seems exactly right:

> *"The greatest secret of modern biological science, hiding in plain sight, is that all of life's activity occurs because of conversations among cells. During infections, immune T cells tell brain cells that we should "feel sick" and lie down. Long-distance signals direct whie blood cells at every step of their long journey to an infection. Cancer cells warn their community about immune and microbe attacks. Gut cells talk with microbes to determine who are friends and enemies. Instructor cells in the thymus teach T cells not to destroy human tissues." (Lief, 2020, 1)*

Recall that a sign, any sign, is composed of three elements and it is *not* a sign if one of these three is missing: an object, an interpretant, and a representamen. Do we find these three things throughout the universe? Yes. And in fact we have seen that they are found in cells. DNA repairs occur when the sun is bright.

Signs are found in all species. One interesting series of studies addresses the semiotics of Gunnison's prairie dogs. Constantine "Con" Slobodchikoff (1944) is a professor of biology at Northern Arizona University, where he developed a multi-year program of research on Gunnison's prairie dogs' alarm calls. He formed the "Animal Language Institute," as part of his work (https://animallanguageinstitute.com).[xix]

In his 2012 book, Chasing Doctor Doolittle, Slobodchikoff claims that (p9) "To declare that animals cannot have language, with no evidence to show for it, is not very convincing. Much more convincing would be conclusive scientific evidence that animals either did not have language or are completely incapable of understanding anything even remotely related to language."

Taking this challenge seriously, he has argued that Gunnison's prairie dogs *do* have language, in the sense of an (ibid p19) - "an open system of communication."[xx] In an earlier book, Slobodchikoff and his co-authors claim that (Slobodchikoff, et. al. (2009, 65) "Like most other animals, including humans, prairie dogs are extremely dependent on a communication

system for survival." But this tells us nothing new from a Peircean perspective because *all* living creatures depend on *the* communication, semiotics, for their survival.

The authors further claim (ibid p67) that "The alarm call system of the Gunnison's prairie dog is a very complex one. Gunnison's prairie dogs have different alarm calls for several different species of predator..." including a specific call for humans. There is nothing particular striking in any of this information, however. Just a run of the mill semiotic communication system if this were all that we knew about this species. What becomes far more interesting is the following description (2009 p74ff), "... Gunnison's prairie dogs can modify the structure of the call to encode information about the general size, shape, and color of clothes that the human is wearing. In a serious of experiments to demonstrate this... [researchers] asked four humans to walk separately through two prairie dog colonies ... wearing different clothes." The authors' claims here are remarkable.

The authors have already argued that the signs/calls of prairie dogs take generic objects (not just "this human" but "human"). They are not, therefore, merely indexes (though they are indexical legisigns when they point to a specific intruder in the area of the colony). To the degree that these signs are invented in a given colony and have general objects (e.g. human, hawk, and so on), they are indeed open-ended symbols, in the sense delineated earlier. If this is correct then under the distinction below, prairie dogs have language, as I define it and distinguish it from communication:

Communication: Exchange of information (using teleonomic signs).

Language: Exchange of information using open-ended, teleological symbols.

The crucial question is whether the signs used by prairie dogs are (relatively) open-ended (e.g. can they create symbols for any object as needed or desired) and whether these signs are symbols, in the sense of having general objects. Slobodchikoff and his colleages seem on the right track to show that some of the signs used and invented by prairie dogs fit the definition of symbol that distinguishes language as a special type of communication above.

But surely language is more than a comparatively small list of symbols. Prairie dogs lack recursive syntax (but so do several human languages (Pullum (2020)), nor do their symbols even approach the number of symbols the average human masters and can create with little difficulty.

But prairie dogs do place symbols in a particular order and the interpretations of their utterances by them (the prairie dogs themselves) seem clearly propositional in nature, taking the researchers' descriptions at face-value (and using Peirce's concept of the proposition as index+icon). This seems to indicate at least the possibility of incipient language among Gunnison's prairie dogs. It is not human language. But it is far more, apparently, than merely a list of indexes or icons, or a closed set of symbols. Linguists often object to such claims because they expect to find human-like grammars in any "language," not merely symbols. But linear ordering is itself a grammar. The discussion of $G_1$-$G_3$ languages in chapter six below should make it clear that prairie dogs could have a $G_1$ grammar and thus be at least very close to the threshhold of language. It would be misguided to expect that all languages will look like the languages of humans, given the cognitive disparities between all other species and humans. But Slobodchikoff's claims are by no means unreasonable. At the same time, given the lack of understanding of either semiotics or linguistics in most of the research by these researchers that I have seen, much more work needs to go into investigating these claims, using the semiotic typology of Peirce's discussed in this chapter, as well as some discussion and testing of "prairie dog grammar."

There are of course, many other claims in the literature about animal communication. More recently, for example, it has been claimed that chimpanzees and humans can communicate gesturally and that chimpanzees use inference in their interpretation of signs (Shmelz, Call, and Tomasello 2011).  In her famous work on the African gray parrot, Alex, Irene Pepperberg makes several suggestive claims, including that  "... I proposed that Alex had a rudimentary understanding of categorical concepts. This ability is important because a full understanding of such concepts would demonstrate that he could handle information with some level of abstraction." (Pepperberg 2002, p52)

According to Peirce, all species, plant or animal, communicate semiotically. Speculative Grammar is designed to apply to all forms of semiotic communication. To some this might seem to be either controversial or an indictment of semiotics itself. Speculative Grammar claims that the same principles governing the use of signs in humans are equally valid for non-humans. It might also be seen as indictment of semiotics if it applies too widely to be of significant specificity or explicitness for the needs of modern science. Both concerns are misplaced, however.

Regarding the first claim, that all creatures communicate, consider again a couple of well-known animal signs. A rattlesnake "warns" a creature approaching it that they are too close by shaking the end of its keratin tail. A cat purrs when they are relaxing without a concern. A dog barks at intruders. Ants lead other ants to picnics. Bees lead other bees to honey. Trees in the forest communicate.

But how about interspecies communication? It happens all the time. Consider the interpretation of dolphins' behavior by local fisherman, discussed earlier. The dolphins (unintentionally) communicate to humans the location of fish by producing in their behavior both indexes (pointing) and iconic (level of activity corresponding to volume of fish perhaps). There are other examples as well. Wohlleben and Flannery (2015, pviii) claim that, "If a giraffe starts eating an African acacia, the tree releases a chemical into the air that signals that a threat is at hand. As the chemical drifts through the air and reaches other trees, they "smell" it and are warned of the danger. Even before the giraffe reaches them, they begin producing toxic chemicals. Insect pests are dealt with slightly differently. The saliva of leaf-eating insects can be "tasted" by the leaf being eaten. In response, the tree sends out a chemical signal that attracts predators that feed on that particular leaf-eating insect."

The giraffe is sensed by the tree, which interprets the giraffe's actions by releasing a chemical sign. This chemical release is at once a sign on its own and simultaneously interpretant of the giraffe's eating. It is the interpretant of the sign of danger of the giraffe's bite. The release of ethylene gas is in turn a sign interpreted by other acacia trees as a warning (an index of the giraffe). The other trees in turn interpret the ethylene by generating more bitter-tasting tannins. (which exemplifies one sign to be interpreted by another sign, the latter serving as the former's interpretant). And the tannins are interpreted by the giraffes by avoidance of those trees. Everything that happens in nature is the creation and interpretation of signs.

This semiotic meeting of species is summarized wonderfully by Helga Vierich in her blog:[xxi]

> *"When I first arrived to begin my fieldwork among the Kalahari hunter-gatherers, I expected to find them occasionally hunting giraffe. I had seen the film made in the far western Kalahari by John Marshall, a film called "The Hunters" – which showed a giraffe hunt. So I was puzzled to see plenty of giraffe herds but no evidence of their being hunted by the Kua. I asked about this. I was told that a giraffe that "offered itself" would not be refused, but that this was extremely rare, and that giraffes were not generally targeted. If I wanted the whole story, I was told, I should go and see a certain woman. So I did.*

*I found her in a campsite deeper into the remote area, very near the Central Kalahari Game Reserve. She was tending her grandchildren and eagerly agreed to answer my questions about giraffes. Apparently she was the local expert; obsessively interested in anything to do with giraffes since childhood. She had assembled a massive number of observations, both on her own, and from accounts of hunters and other people, and handed down through many generations. I found this out in later interviews. Her answer to my query was masterful in its simplicity and accuracy. Hunting giraffe is unwise, she said "because they were the midwives of the Acacia trees." God had made the giraffe, she told me, just tall enough to eat the leaves and harvest the pods of the tree, because they would then deposit the offspring of the tree far from the parent plant. She had often noticed the young sprouting from giraffe dung heaps. Giraffe and Acacia were also symbiotes, equally critical in keeping the savanna green."*

What kinds of signs are these? Does anyone's theory cover them? Yes. Peirce's theory of signs accounts for all of this just fine. The effect of the giraffe's eating the acacia on the acacia itself is as an index of the giraffe - a physical connection to its object (giraffe). Notice that little intentionality is required, except in the basic sense of directed attention. The chemicals emitted by the plants in response to the animal ingestion are themselves interpretants and indexes that mean to other plants or predators "there is something here that will harm you" (e.g. a botanical alarm call) or "there is something here you can eat." These are responses that the plants have learned phylogentically (where "learned" = "changed behavior when exposed to new information," a form of inference). All living entities (at a minimum) learn and communicate. The world could not exist otherwise.

What can we say in detail about the actual semiotic process entailed by the chemical emitted by the acacia when the giraffe starts to eat it? If the chemical identifies only the notion of "threat" then it might plausibly be interpreted as merely an indexical legisign. It is an index because it is causally linked to the physical contact with the giraffe. It is a legisign because it is a habit. It is propositional, a dicisign, because it links an index to an icon (the property of being eaten) and the index of a giraffe. It is not a symbol, however, because it is not a conventional sign. It is an dicisign (or dicent) indexical legisign. That is, the emission of the ethylene and tannins is "saying," "Here giraffe!" or "Giraffe eating me," or some such. Additionally, like any dicisign, this one can be true or false. (See Stjernfelt (2014) for discussion of "natural propositions.")

An alternative analysis is that the ethylene gas emitted is simply a reflex, like your knee responding to the doctor's reflex hammer (which is, however, itself an interpretation of the hammer blow). But that analysis will not work because the gas serves simultaneously as an interpretant of the giraffe's feeding and an index of danger, interpreted by other acacia trees. Is this gas a symbol? I have argued elsewhere (Everett 2017; as have Deacon (1997), Favareau (2016); Hoffmeyer (2009); Marrone and Mangano (2018); among many others) that only humans create open-ended types of symbols, created by cultures. But in this case, there is no need to say that acacia trees "utter and interpret" symbols. Instead we can more modestly claim that acacia trees follow a regularity (hence the regular sign is a legisign), developed phylogenetically, in a dicent indexical legisign. The object of the indexical legisign (regular index) is a specific species, i.e. it has intensional properties. Thus it cannot be a simple index. It is an index dedicated to a specific type of object (what linguists might refer to as a "classifier)." It can be false because if the acacia tree caught fire and the heat caused the release of the chemical (no idea if that is possible), then there would be a chemical assertion of a giraffe's presence, without a giraffe. This type of use of the chemical would be an inadvertent "mention" as opposed to a "use" of the sign. But the chemical sign for "giraffe," barring pathology, is only emitted through physical connection to a giraffe. It is thus a dicent indexical legisign.

Giraffe-acacia semiotics is just one example of semiotic communication across species. One species can interpret the signs of another in an exchange or it can incorporate one entity in to its semiotic system, as an icon, index, or symbol, etc. Other species do not possess open-ended semiotic inventories to the degree that they lack culture and the ability to generalize that undergird all cultures, though this is a somewhat open research question (Everett (2017)). This distinction of signs has been influential, but apparently insufficiently so, because one sees confusion throughout the literature on what a symbol is.

Although Peirce always considered himself first and foremost a logician, his view of logic was that it was ultimately about correct reasoning and thus crucially relied upon his semiotics. Semiotics is vital for correct reasoning about culture, language, evolution, biology, and many other domains of inquiry.

For many linguists, neither language nor communication are of primary importance. The crucial component of their science is a theory of grammar, which includes phonology, syntax, and semantics (though for some linguists, semantics is a subtype of syntax). To convince such linguists of any theoretical interest in a semiotic approach to grammar, it is necessary to go through at least some analyses of classic cases and show how a semiotic approach is more insightful.

Peirce's ideas have frequently been borrowed piecemeal in linguistics and anthropology. One theory builds around his iconicity (Perniss, Thompson, and Vigliocco (2010)), another around indexes (Silverstein 2003), and yet another on his algebraic logic (Font and Jansana (1996)). Thus one of the goals here is to offer a brief discussion of some of the ways that overlooking or misinterpreting Peirce has deprived modern linguistics and philosophy of a number of insights that seem beneficial empirically and theoretically to the objectives of that discipline, regardless of one's particular theoretical orientation, though the focus here is on formal linguistics (Tomalin (2006); cf. Everett (in progress) for a more detailed discussion of these and many other issues).

Even those superficially acquainted with C.S. Peirce's work will know that he was a brilliant polymath (Everett 2019). But many might be surprised to know that, according to Nöth (2000),

*"Although Peirce had 'no pretension to being a linguist' (CP 2.328), the Annotated Catalog of his publications and manuscripts lists no less than 127 papers classified as 'linguistic' and contains references to many other manuscripts dealing with language ...* [in Robin, 1967, p133-142] ...*"* xxii

The issues distinguishing Peirce's views from much of modern formal linguistics can be seen in a series of theoretical contrasts of the latter relative to Peirce's quite different approach. Thus modern linguistics (i) takes form as the principal explanandum for linguistics, whereas Peirce takes interpretation of signs as the core of of the discipline; (ii) Some modern linguists assert that recursion in sentences is the core pre-condition for human language, whereas Peirce sees semiotic recursion as the sine qua non of language; (iii) modern formal linguistics commonly takes unconnected sentences, rather than discourse, as its principal empirical responsibility, whereas semiotics sees discourse as a perfect symbol, i.e. a principal object of investigation; (iv) modern linguistics recognizes three three components as essential to its investigation - intuitions, introspection, and compositionality, whereas these are for Peirce but manifestations of inference; (v) modern linguistics misinterprets much previous use of the word "instinct" in earlier literature as a genetic endowment rather than as a set of inferences (genetic-based, cultural, idiosyncratic apperceptional experience), each with a variety of distinct implications for our understanding of the sources of human language. (Thus modern linguistics has come too often to embrace an overly narrow concept of "instinct.")

But perhaps the most significant contrast between modern, especially Chomskyan, linguistics and Peircean semiotics and pragmatism is the concept of Universal Grammar. Peirce first used the term Universal Grammar in 1865 (C.S. Peirce, 1865, Harvard Lectures on the Logic of Science. Lecture X: Grounds of Induction, W 1:274) - the first usage of this term by anyone in the USA so far as I can tell. He did not invent the term of course. This dates back to Roger Bacon in the thirteenth century (Covington 1983; Rosier 1983, and chapter two). But Peirce's usage was the first in the USA. Peirce being Peirce, the term did not satisfy him for long, however, and so he experimented with other terms, e.g. "pure grammar," and "formal grammar," finally settling on Speculative Grammar (CP 1.191, 559 and many other references in the Collected Papers, as well as Bellucci (2018)). This grammar was one of three branches of the study of Logic/Semiotics, the other two being Logic proper (Critic) and Universal Rhetoric.

In his classification of the sciences (CP 5.203-283), Peirce separated universal grammar from linguistics. Thus, whereas Universal Grammar falls under Peirce's Logic (Peirce 1903), linguistics as the study of individual human languages falls farther down in his list, in the classification of Idioscopic sciences (those dedicated to making new observations). These are a subtype of Classificatory Ethnology or Psychics (a classification that later linguistic anthropologists such as Franz Boas (2002) and Edward Sapir (1921) would have found congenial. As Nöth (2000) points out, Peirce wrote on both UG and individual languages.

This division echoes Peirce's similar distinction between his logical UG and individual languages. Chomsky's latest research program, Minimalism, continues the decades-old program of building a theory of how propositions become linguistic objects. As we have seen, Peirce's theory was also concerned with this (in his theory, again, the subject is an index and the predicate an icon, the entire proposition being a symbol), though Peirce saw propositions as constituents of arguments and discourses. With this conceptualization of the role of UG in the study of human language, Chomsky, in a sense, then is continuing Peirce's division of UG from linguistics proper, whether consciously or not.

To restate this slightly, in Chomskyan theory, arguably the most widely-known theory of Universal Grammar, all of linguistics emerges from UG, which is the "biological capacity for language."  Likewise for Peirce, linguistic objects emerge from UG, though without biology. For Peirce, once the logic of signs and their arrangements are worked out, all the rest is culturally and historically constrained.

Peirce's splitting of the responsibility between semiotics (Speculative or Universal Grammar) and languages (linguistics) logically rather than biologically has a variety of healthy empirical implications, e.g. allowing for the natural evolution of human language from other animal forms of communication (Everett 2017).  One implication of Peirce's theory that arguably broadens its interest is that all plant (Simard 2021, inter alia) and animal communication (Bradbury and Vehrencamp 2011) must follow UG. [xxiii]

Non-human creatures are unlikely to manifest productive invention of symbols because they lack culture (in the sense of Everett (2017), which is contrary to the claims of many that animals do have culture), as well as the cognitive firepower underling all cultures. This lack of open-ended symbol creation among non-humans has been resisted by some, leading to confusion in the literature on what a symbol is (reminding me at times of Inigo Montoya's comment that "You keep using that word. I do not think that word means what you think it means.")[xxiv]

Moving on to the semiotics of other primates, as we saw, chimps use inference and can recognize sign language of humans, and use hand signs to communicate among themselves.  The evidence is strong that evolutionary continuity produces signs among other primates that are similar in some ways to human primates' semiotic systems.

For example Graham and Hobaiter (2023) claim that: "We show that humans may retain an understanding of ape gestural communication (either directly inherited or part of more general cognition), across gesture types and gesture meanings, with information on communicative context providing only a marginal improvement in success. By assessing comprehension, rather than production, we accessed part of the great ape gestural repertoire for the first time in adult humans. Cognitive access to an ancestral system of gesture appears to have been retained after our divergence from other apes, drawing deep evolutionary continuity between their communication and our own."

And Hobaiter, Graham, and Byrne (2022): "... ape gestures are made intentionally, inviting parallels with human language; but how similar are their gestures to words? In this paper, we examine these questions and set out ways in which they can be resolved, incorporating data from wild chimpanzees."

And Graham et. al. (2018) claim that: "We compare a matrix of the meanings of bonobo gestures with a matrix for those of chimpanzees against 10,000 randomised iterations of matrices con- strained to the original data at 4 different levels. We find that the similarity between the 2 species is much greater than would be expected by chance. Bonobos and chimpanzees share not only the physical form of the gestures but also many gesture meanings."[xxv]

Interestingly, without an accurate understanding of Peirce's semiotic typology, any discussion of animal "language" suffers from the problems that strong AI faces. Strong AI claims that computers can *understand* English or, less seriously, that they pass the Turing test. But then such scientists were faced by the problem posed by philosopher John Searle, in his famous "Chinese room" Gedankenexperiment.

In 1980 John Searle published an article discussing lessons he drew from a recent visit he had made to the AI lab of Roger Schank at Yale.[xxvi] His article presented what eventually became one of the most widely-cited and influential Gedankenexperiments in modern

philosophy, the "Chinese room." It turns out that this experiment is an example of how semiotic theory can help us to better understand differences between humans and machines.

Paraphrasing his actual experiment, Searle asks us to imagine that we are standing in a room with a large bucket of plastic pieces which, unbeknownst to us, represent words in English. In front of us is a list of instructions - a computer program - that we are to follow upon receipt of symbols that are fed to us through a door or window into our room.

Suddenly a "symbol" is pushed under the door of our room. We pick it up, look up the symbol in the program (alternatively we scan the symbol and the program speaks to us, "Match this symbol to the following symbol from the bucket"). Then push that symbol under the other door in your room.[xxvii]

Let's say that we get very good at this. Symbols start coming in very quickly and we match and push them out the door just as fast as they come in. In fact, we get so good at this that someone reading the symbols we are pushing out and comparing them to the Chinese symbols we are receiving asserts that we are excellent translators from Chinese to English.

Now do I even know that the symbols I am receiving are Chinese or that those I am putting out are English? Not necessarily. Do I know what any of the symbols mean or even that what I am doing is called translation? No. Searle seems right for drawing these conclusions.

But then, stepping back a bit, what *am* I doing in this Chinese room? This is what everyone in the vast literature who has discussed this problem has missed. Although the input and output of the Chinese room are symbols for those reading them, they are *not* symbols for me or the computer. For each squiggly line the computer receives and pushes out of the room, the interpretants are actions and the signs *from the computer's perspective* are indexes. They are not even indexical legisigns to it. Just indexes, like smoke is an index for fire. The computer is, like the bees earlier, to whom symbol-recognition was also incorrectly attributed, merely responding to one index with another. The computer is designed to produce interpretant y for sign x, i.e. "x --> y" in the learned routine "if you get an A push out a B," nothing else. I do not need to know anything about x, even less than about smoke and fire or footprints and animals. My interpretant, my action, is not based on understanding and meaning, i.e. thirdness, but merely on secondness, "this goes with that." Meaning plays no more role for me than it does for acacia trees emitting ethylene gas or tannins in response to giraffes. I am only matching one index to another. Searle humorously remarked that it does not matter whether my Chinese room is in the head of an enormous computer or whether I am shrunken small enough to place in a normal-sized computer, the Turing test is still irrelevant.

What is being slipped under the door could be in any language for this experiment to work. For example, assume the input is formal Mandarin register and the output is an informal register of Mandarin. The computer is, let's say, asked to paraphrase the input material or to answer questions in it. Alternatively, assume that the input received by the computer is Chinese but the output is idiomatic English. The person watching the computer from the outside understands the meaning of what happens because they are interpreting symbols, unlike the computer. And they will be tempted to assume that the computer is understanding symbols and meaning just as they themselves are. They are not merely using one index as a signal to pick up and push out another.

Recall that the semantics here in question resides in interpretants of *symbols* (signs with general objects). Therefore, to show that the computer is understanding Chinese, we must first be able to show that it is interpreting symbols and outputing other symbols as the interpretants of the input symbols. But this is not shown anywhere in the literature. Again, this entire experiment

can be understood as the computer having a list of specific indexes interpreted kinetically by pushing out (what are from its perspective) indexes. It is not even clear that a supposition of syntax is necessary. The computer is doing exactly what the bees seem to have been doing: "take index x and replace it with sign y (or behave in "z way towards y")." Only if AI researchers can show that the computer is correctly interpreting and learning (Peircean) symbols, rather than icons or indexes only, can they show that AI has mastered semantics.

So if I train my dog to get seven things when she sees "7," well, yes, it is significant that she can distinguish seven things. But since there is no dog culture and since canine cognition $\neq$ human cognition, there is no pre-symbolic "agreement" between dogs that the sign '7' means 'seven things.' To argue that dogs know that the object of '7' is general, i.e. any seven things, the evidence required is more demanding. As described, however, such behavior simply shows a response to the stimulus of an index to a particular referent. It is learning of course, but with no need to invoke symbols. I think it is reasonable to investigate the hypothesis that some animals might be able to learn symbols. It might be possible for bees and computers to learn symbols. But that is not shown in the experiments because the experimenters and computer scientists failed to take Peirce's ideas into account. Pavlov's dog did not interpret the bell initially as a symbol of food, but as an index of food. When you see one, you see the other. But symbols are more abstract and general. It is possible that Pavlov's canine subjects did interpret the bell's object as general at some point, e.g. "food" but if this cannot be demonstrated then the bell or whatever sign is used is an index. In Peirce's sense they are thirds and their objects are not specific but general (another manifestation of Peirce's universal-embracing realism). They do not require an immediate connection between an object and a form for effective use. Only Peirce's semiotics captures this distinction.

Of course, for computer scientists strongly influenced by Shannon, the problem of meaning is not as crucial as a non-computer scientist might think. "The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem. The significant aspect is that the actual message is one *selected from a set* of possible messages. The system must be designed to operate for each possible selection, not just the one which will actually be chosen since this is unknown at the time of design." (Shannon [1948] 1998)

Shannon is describing index interpretation. And this is exactly the Chinese room. Based on this computers do not have understanding. That is, the so-called Turing test does *not* do what it is purported to do - show when computers have matched human understanding. [xxviii] There is no understanding in the operation of such programs, only in their design by humans (but they could be designed without understanding as well, which is the case of speech speech recognition or language programs). The thrust of this chapter has been that human language is but one semiotic system in the universe. Anything "special" about human language can be explained by the complexity of the multilayered semiosis that it requires. But was we saw earlier, many linguists reject this and propose species-specific language features that by their very nature are intended to limit the attribution of "language" to humans alone.

One particularly famous example of this type of attempt comes from Hockett (1960). Hockett argued that there are language-specific "design features" that only human languages have. If this is correct, then my reasoning above is beside the point. Human languages are different in kind from other systems not because of their semiotics, but because of their organizing features. But do Hockett's design features hold up as a way of distinguishing language from other semiotic systems? I think not. Let's conclude here by reconsidering the claims of the uniqueness of human language in Hockett's work. I consider and then reject Hockett's design features as being either mistaken or misapplied to language instead of to cognition more generally.

Consider first Hockett's discussion of the design of language relative to its medium of transmission:

**Vocal-auditory channel**:  This tells us that human language uses the mouth and the ears, that human language is primarily an oral-aural channel. But this is wrong. In effect, what Hocket was trying to get at was that human language had a *specific* physical implementation, but that is also wrong. As Helen Keller showed, even tactile representation is sufficient to communicate language. Any physical implementation works. So we can toss out this "design feature."

The next feature of Hockett's is what he calls:

**Broadcast transmission and directional reception:**  This feature is important because it states that although sounds and sign-languages might come from different directions, the hearer is able to see or hear, focus on, exactly who is speaking to them, in principle. Hearers know in general who is communicating them and are able to focus their attention on that person or thing. Such a feature can be discarded as a specific feature of language, however. It merely implies that we need intentionality (and other platforms that I mention in Everett (2012:PAGES)). But intentionality is neither limited to language or to humans.

**Transitoriness:** This feature is also known as "rapid fading." Human language, whether spoken or signed, in real-time interactions does not linger for long. This is an advantage because we can focus on what is *being* said instead of what *was* said many minutes or hours ago. But

written language violates this intentionality, as it was invented to overcome this limitation, in order to keep information available long after a particular conversation/interaction is over. It turns out that without recording devices or a written language, language is indeed as transitory as Hockett observes - it passes quickly when spoken or signed (as do dog barks, bee dances, bird songs, and so on). And because it takes more cognitive and cultural machinery to create nontransitory language, we expect transitory communication to always come first, in humans or any other species. The communication systems of *all* creatures share transitoriness, or no "rapid fading" in others (e.g. bobcat scat on a trail). Hockett lacked a theory of semiotics and it shows in these features.

**Interchangeability**:  We all share a communicative system. Therefore, humans (animals, etc) can give and receive identical linguistic signals. If someone tells a woman "I am a man." She can say and be interpreted as saying the same thing, even though she is a woman. Whatever we can understand we can say. Hockett claims that only human languages possess this feature. For example, in order to communicate their status, queen ants produce chemical scents that no other ants can produce (see animal communication below). Thus this signal is not interchangeable. Nevertheless, most creatures do communicate with signs that in fact are interpreted by and generated by any conspecific. Queen bees may have a special chemical and, perhaps, sound release that indicates their status. But this is the exception that proves the rule. It is a phylogentically social (indexical) and semiotic fact about ants. Hocket has again failed to distinguish between types of signs or "signals." Just as exclusive jargon or particular language subtypes, such as Autralian Mother-in-Law language (Dixon 1990), limit language's interchangeability to all members of our species or of a society, Queen-ant communication does not imply that this exception means that most ants cannot emit and interpret the same signs (see Casacci et. al. 2013). Performative verbs show a similar characteristic in human languages. Although anyone can say "I now pronounce you man and wife," it is only when the words are uttered by a socially-authorized person in a socially-authorized situation that they trigger the interpretant "marriage has now occured." This design feature also fails.

The next purported design characteristic of human language proposed by Hockett is what he calls **Total feedback:**  Speakers of a language can hear their own speech and can control and modify what they are saying as they say it. But all signers see, feel, and control their signing. Dogs can hear their own barking and modulate it according to their communicative intentions. The ability to control or modulate a  message as you emit it is indeed quite important. Yet there is no evidence that this is limited to humans. Certainly, Hockett did not show that, for example, dogs do not monitor and modulate their communication with humans. In fact, my dog changes and amplifies her sounds when trying to get treats, depending on how long it is taking me to get up and get her something.

The next feature to consider is **Specialization:**  The purpose of linguistic signals is communication according to Hockett (and Peirce). Although for Chomsky the purpose would be thought perhaps, rather than communication, all animals and plants use semiotic means for communication (and see Piantadosi, Tily, and Gibson (2012)) for futher evidence that the primary purpose of human language is communication - a view not shared by all linguists). But all signs are for communication in semiotic theory so this feature fails to add anything to our understanding of human language.

The feature of **Semanticity** intends to capture the idea that specific sound or visual signals are produced to communicate certain *meanings*. Meaning is an ineluctable part of language and communication. It is by no means unique to human languages, however and

follows directly from a theory of semiotics, as we have seen. Therefore, it is another "design feature of human language" that we can dispose of as not being unique to human language or indeed to language of any kind.

The next design feature proposed by Hockett is one that is commonly discussed in connection to human language but, once again, it needs a serious rethink. It is the feature of **Arbitrariness**. This tells us that a human language uses conventional *symbols* in which a form is matched to a meaning not by necessity but by convention (see Everett 2017 as well). These are arbitrary, unlike indexes and icons because their form is not caused by the object. There is nothing about a canine that causes its sign to be pronounced as 'dog' in English and 'perro' in Spanish. Only humans use productive systems of symbols, if Everett (2017) is correct. However, this should not lead us to ignore the fact that many animals might generate symbols to a limited degree (see Stjernfelt (2014) as well on "natural propositions").

**Discreteness** is the idea that human languages create signs that can be broken into discrete units. Many linguistic theories assume this characteristic as important in much the same way that Hockett intended. Thus a word like [boiz] 'boys' can be broken into [boi] and [-s]. The component [-s] has an assigned meaning and this meaning cannot be made "more or less plural" (e.g. dual, trial, plural) merely by increasing or decreasing the level of voicing in the sibilant, i.e. using an analog feature as opposed to a digital feature. However, bird songs have been shown to have this feature. (Suzuki 2016). And indeed anytime a proposition (or dicisign to use Peirce's term) is created (by a windsock indicating the weather, for example) it is composed of an icon (a feature that corresponds to some subject or object) and an index (which indicates the subject). Windsock icons correspond to their direction. And the index of their proposition is the wind: "[[The wind$_{index}$] [is blowing westward/coming from the east$_{icon}$] $_{symbol/dicisign}$]." The signs produced by windsocks and birds are also discrete. Ultimately arbitrariness also fails to distinguish human semiotics from other systems.

**Displacement**, which is proposed by Hockett as another crucial design feature of human languages. This refers to the ability of a language/semiotic system to talk about things that are not present. This is, again, not limited to human language though. A lion can certainly read the signs of potential prey that is no longer present (notably violating both rapid fading and displacement). And human signs other than symbols can show displacement. For example, a portrait of a loved one hanging on a wall of your home is a displaced sign that communicates about, say, a relative without them being present or even alive. But by using symbols we can say anything we want about anything in our minds whether physically present or not. However, again, Displacement is not limited to humans. Non-human communication showing displacement includes bee dances, as we have seen. Ape communication can also involve displacement (Lyn et. al. 2014) Even my dogs' communication shows displacement. For example, my fila brasileiro often wants the treats that our smaller dog, Bruno, has buried in the blankets of his bed. So Doce will go to the door and scratch to be let out (she of course will not use the expensive dog-door we had installed). Bruno wants to go out with her, so he runs over. I open the door. Bruno runs out. Doce then runs to Bruno's blanket and starts pawing around for a possible hidden treat. No one is seeing the treat (they might be smelling it, but the evidence suggests otherwise, since the dog cannot be sure it is there because there are smells lingering from previously placed objects). The dog is exploring. This is a form of displacement - communicating one thing with an alternative intention. It is a form of lying. Another form is using the term "walk." If I utter "walk?" with question intonation, the dogs get excited and run to the box by the door where their leashes are kept. The walk itself (we take one route commonly) is not present. But if we have just completed

a walk and I utter "walk?" with question intonation, the dogs ignore me. They know they have already been on a walk. In both cases we are "discussing" a walk that is not present, but which is called to mind. Note that the dogs also appear to be using inference here.

Hockett's **Productivity** feature refers to the idea that language-users can create and understand novel utterances. In Everett (2005) I argue that productivity is limited culturally and that it is not merely a property of a particular sign system. However, a symbol-based system is in principal capable of talking about anything its speakers care to create symbols for (but they have to create them). To date I am unaware of any animal communication system that is convincingly productive in Hockett's sense (cf. Beecher 2021). However, this still doesn't appear to be a clear feature defining human language. Rather it seems best attributed to human cognition and its cultural creations rather than to language or semiosis per se. It is very important but not for that reason a feature of language proper. Only with higher-powered, human cognition can a semiotic system become productive. And that is one of the crucial features distinguishing human vs. non-human semiosis. But it is not a "design feature of human language" for that very reason.

**Traditional transmission:** This is the idea that languages are passed on from parents to children, caregivers to children, cultures to members, etc. It is therefore also known as cultural transmission. This is true even if one believes with Noam Chomsky that there is a biological Universal Grammar or with Peirce that there is a logical Universal Grammar. This is obviously passed from parents to children if it is genetic, but is unrelated ex hypothesi to the learning and teaching of specific languages, about which Hockett must certainly be correct. However, observe that Garland and McGregor (2020) argue for traditional transmission in nonhuman species, rendering this feature non-diagnostic of human language.

**Duality of patterning:** The basic idea here is that meaningful units are made up of meaningless units. So take the word "cat" [kʰæt]. The whole thing refers to a member of the class of felines. But the individual components (phonemes or letters) themselves have no meaning. However, this depends on what we mean by "meaning." Shapiro (1983) argues that each phoneme has an interpretant/meaning along the lines of "I signal distinction and differentiation." This might be missing from animal systems. But if a phoneme has a meaning, then there is no "duality" of patterning in Hockett's sense. Instead this feature emerges from multilayered semiotics, something quite different from duality of patterning (triadicity for one thing, not duality) and is dependent on cognition, rather than language per se. As discussed later, however, it should not be seen as a special feature, but another level of semiotics, where interpretants are all the same at the level of the representamen as sign.

**Prevarication:** Prevarication is the ability to lie or deceive. Hockett felt that nonhuman animals could not lie and that this was a feature of human languages only. But, as we saw in this chapter, it is not at all clear that humans are the only liars in the animal kingdom. Not even in the plant kingdom. Contra Hockett, one can make the case that both animals and plants, as well as humans prevaricate. I gave the example of my dogs already. My dog is a liar, as we saw. Venus fly traps are also dishonest prevaricators. They resemble pollen-bearing plants (a phylogenetic lie). And by thus tricking insects to come close enough to be trapped, they acquire food.

**Reflexiveness:** This design feature means that there can be metalanguage - language can talk about language. This is indeed an unusual feature in the kingdom of life and semiotics. And this very well may be, unique to humans. Once again, however, this does not seem to be a feature or property of language per se, but rather a by-product of human cognitive abilities.

A crucial feature in Hockett's system is **Learnability**. This design feature means that people can be taught or independently learn how to speak languages. There are some who claim

that the ability to learn languages shuts off in some way after a "critical period" (just before puberty). But this is another matter open for discussion (Everett 2012). Learning is of course found across animal species. Not unique to human language.

Therefore of Hockett's sixteen design features, not a single one seems diagnostic of because none are unique to human language. Moreover, because signs have meaning, contra Hockett, there is therefore no duality of patterning. For example, each phoneme semiotically *means* "I am distinct from other phonemes" it is an index, as is its position within the word, of a particular word (the phonotactics). There is no feature of Hockett's that is a "design feature" of language. And the reason for that within a Peircean semiotics is straightforward - there can be no such feature because language is *not* unique. It is a sign-system, like millions of others in the universe.

Therefore there is little evidence from Hockett or anywhere else that human language is qualitatively different from other semiotic systems. If many animals have symbols, why don't they also have language? Recall that for Peirce a symbol "... is a general sign, *i. e.*, *a sign that represents a general object*." (Bellucci 2021, 169) This means that if we want to attribute symbol creation or recognition to animals, the object of each of their symbols must be shown to be a general concept, a type.

The evidence suggests that nonhumans of any species, plant or animal, are unlikely to produce symbols productively to the degree that they lack culture and the ability to generalise that undergird all cultures, though their communication will nevertheless entail signs (including some symbols). I think it is reasonable to investigate the hypothesis that some animals might be able to learn or create symbols. It is even possible that insects, e.g. ants and bees, can learn or create symbols. But so far the creation of open-ended symbol systems has not been shown for any creatures other than humans. When a creature sees one sign, they offer or anticipate another. Pavlov's trick was to eventually take away the object (food) of the index from the immediate environment, while producing the same interpretant (salivation), much as Lucy does to Charlie Brown regularly in the Peanuts comic strip by Charles Shulz, when she urges him to kick the ball and then removes the ball just as he goes to kick it. She has removed the object leaving only the representamen, her kneeling, and the interpretant, Charlie's kicking. But symbols are more abstract. They do not require an immediate connection between an object and a form for effective use and their objects are general. Only Peirce's semiotics captures this distinction. And so it is the most appropriate set of principles for testing claims about animal communication, not "design features" or grammar.

Icons and indexes, like symbols (and Peirce's other types of signs) fall under Peirce's concept of Universal Grammar. Once again, it is significant that Peirce's Universal Grammar accounts for all signs, the full range of signs (including animal legisigns where these are found) used by both non-human animals and humans.[xxix] The biological Universal Grammar of Chomsky cannot do this. This would of course not bother Chomsky, since he believes that there is little or nothing in common between animal and human communication (at least in the "human computational system"). In his theory, human linguistic communication is based on a recursive grammar while animals lack recursive communication.[xxx] Thus there is nothing to compare. He has said (paraphrasing from public lectures) that claiming that animals have language "is like comparing bird flight with a man flapping his arms."

According to Samuels, Hauser, and Boeckx (2017), who address animal communication relative to Chomsky's version of UG, animals have no biological UG. But these authors' objections fail for semiotics and Pragmatism because they focus on a purported biological

language faculty, based on grammar, rather than a logical set of constraints on signs. And this choice impedes our understanding of language evolution (as, inter alia, Deacon (1997), Everett (2017) argue), making it appear to some that language came out of nowhere phylogenetically, whereas the Peircean semiotic UG renders the evolutionary progression much clearer.

Peirce's Universal or Speculative Grammar is intended to provide a theory for the understanding of all communication, not merely human language, which is but a special case of a universal, logical system. His classes of signs can account for the core of any communication system, in fact the entirety of all communication systems, once grammar (often used to distinguish human communication as "unique" in the animal kingdom) is seen as itself governed by semiotic principles.

Now let us turn to what I see as an ironic echo of Peirce's triadic semantics in the architecture of modern syntactic theories. For example, Chomsky's tripartite division of the theory of grammar into Logical Form (interpretant), Phonological Form (representamen), and syntax (object) is a triadic semiotic (Peircean) conception of grammar. Take a sentence like *John ordered Bill to come in the room.* Chomsky's Minimalism proposes that the atomic objects of this sentence (roughly the word tokens) are selected from the dictionary and then formed into syntactic objects by a recursive process of pairing units from the "bottom up." Thus we take "room" and pair it with "the" and take the result "the room" and pair it with "in" to derive "in the room," and so on until we finally pair the penultimate structure, the predicate, with "John," the subject, to form the sentence. This pairwise, recursive operation, which Chomsky calls Merge, is the "basic operation" for the formation of linguistic signs.[xxxi]

Chomskyan theories of linguistics thus all share the architectonic ternarity one would expect of a semiotic system, though not all theories recognize this ternarity explicitly. To see what is meant by ternarity in more detail, consider diagrams of the basic theories of Tagmemics of Kenneth L. Pike and Minimalism of Chomsky. Chomsky's theory is represented as:

Diagram One:
Triadic Organization of Chomskyan Theory
Syntax

Logical Form               Phonological Form
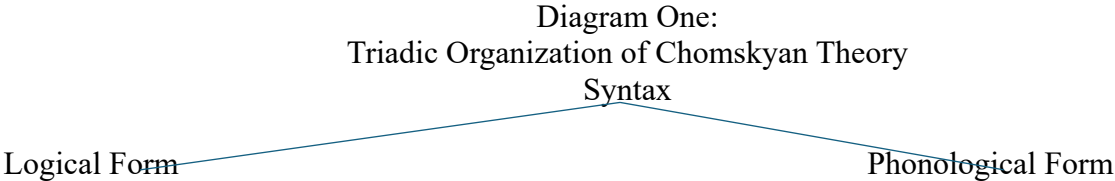
In Chomsky's theory the components are to be interpreted as follows. First, Logical Form in Diagram One produces the semantic interpretant. Phonological Form is the representamen of the sentence. The syntax is the linguistic object to be interpreted in the linguistic semiosis (real world objects are brought in/linked through the Logical Form).

In Tagmemics (Pike 1967; Pike and Pike 1976) there is a similar triadic organization. Three hierarchies are linked (next diagram), with the phonological corresponding to representamens, the grammatical corresponding to objects, and the referential corresponding to overall meaning.

Diagram Two: Ternary Organization of Pikean Theory

| Phonological Hierarchy | <--> | Grammatical Hierarchy | <--> | Referential Hierarchy[xxxii] |
|---|---|---|---|---|

| Ph. Discourse | | Discourse | | Highest meaning unit |
|---|---|---|---|---|
| Ph. Paragraph | | Paragraph | | |
| Breath Group/Contour | | Sentence | | |
| Ph. Phrase | | Phrase | | |
| Phonological Word | | Word | | |
| Phoneme | | Morpheme | | Lowest meaning unit |

Both the Chomskyan and Pikean (and most other linguistic theories) can be compared to semiotics by the diagram below, in which a diagram of a sign semiotics precedes the architecture of the typical linguistic theory:
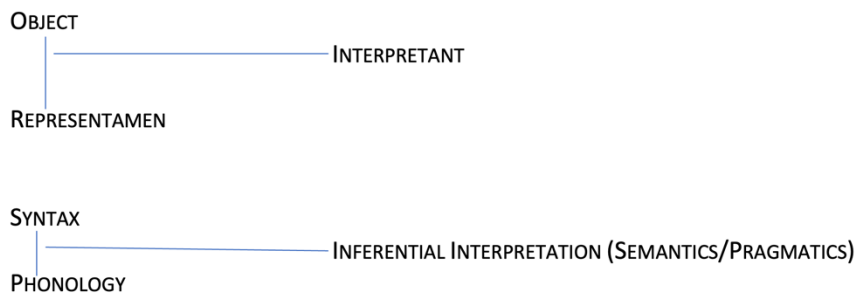


The ternarity in linguistic models (and these are two of many samples one might provide) however inadvertently, recognizes implicitly that language is a semiotic system, with a Peircean structure. Phonology is about the construction of Representamens; Logical Form/Referential Hierarchy is about Interpretants; Grammar/Syntax is about the production of propositions (themselves symbols) and linguistic *objects*. The extra step in linguistics is that the syntactic interpretations of "objects" of linguistic structures do not merely link them to extra-linguistic objects but also to linguistic objects, producing multilayering. In *John saw Mary* we interpret 'John' as a referring to a person in Logical Form, but in the syntax as a subject, an agent, a topic, or more. In the phonology we interpret "John" as a unit composed of prosody (stress, intonation, length) and segments (ʤ, o, n), the representamen of the sign in Logical Form of a person named "John."

Given these design similarities between semiotics and modern theories of language, one of the most puzzling facts of modern linguistics is the near-absence of any overt role for Peircean ideas. Major current theories such as Chomsky's Minimalism (Chomsky 1995), Van Valin's Role and Reference Grammar (RRG; Van Valin and LaPolla (1997)), and the various versions of the popular theory of Construction Grammar (CG, especially in the work of Princeton linguist Adele Goldberg (1995)), as well as Hans Kamp's Discourse Representation Theory (Kamp and Reyle 1993) make no detailed references to Peirce. This is ironic because (i) Chomsky claims Peirce as

a very influential source, (ii) DRT is nearly identical to Peirce's much older Existential Graphs (Sowa (2013)); (iii) RRG contains linking rules and constructions that are reminiscent of Peirce's Universal Grammar; (iv) Construction Grammar takes linguistics utterances to be "signs" (primarily in the Saussurean sense, but Peirce's ideas would work better for them for a variety of reasons) and could thus benefit from the more formal and much more mature theory of signs in Peircean semiotics.

Ultimately, evaluating modern linguistics against Peircean theory, the proof must be in the pudding. Comparisons between modern theories and Peirce therefore can be instructive. To take Chomsky's theory, for example, it arguably has few, if any, non-theory-internal discoveries, and even those are based on the idea that grammar is the center of language and that it stops/replicates once it reaches the sentence, with little concern for the causal role of meaning and culture, and paying scant attention to the growing neurolinguistic evidence in favor of storage of symbols rather than grammar in the brain (Fedorenko and Thompson-Schill (2013); Fedorenko et. al. (2020) Ivanova et. al. (2021)). Can such a theory survive and thrive empirically (theories long outlast their empirical utility due to professional pressures) over newer theories without such limitations? Time will tell.[xxxiii], [xxxiv]

Ironically, Chomsky does cite Peirce, especially with regard to the concept of abduction, also referring to Peirce as the philosopher to whom he felt the greatest affinity. So he says in his interviews with Mitsou Ronat (1976, 71) that "In relation to the questions we have just been discussing [philosophy of language, DLE], the philosopher to whom I feel closest and whom I'm almost paraphrasing is Charles Sanders Peirce."  And yet in all of his work on Peirce, including the interview with Ronat, Chomsky talks as though Peirce's ideas are rationalist and nativist, when in fact they are realist and empiricist (with allowance, to be sure, for his commitment to Darwinian evolution of instincts as either cultural or biological habits). This is unfortunate and seems to result from a tendency to interpret terms in earlier eras anachronistically. So again, "instinct" and "innate" are used in philosophical literature prior to the emergence of the cognitive sciences, though they did not necessarily mean then what they mean now.

Chomsky's interpretation misses/misunderstands key points of Peirce's concepts of abduction and instinct. Chomsky refers in places to Peirce's "one essay" on abduction, claiming that Peirce never pursued this further. But this is incorrect (Everett in progress). Of course, Peirce's papers are in much better shape now (largely due to Harvard's Houghton Library and the Peirce Edition Project of IUPUI) than they were in the 50s, but the Collected Papers were already available at that time to Chomsky (they were published in 1932 by Harvard - thanks to initial editors Charles Hartshorne (1897-2000) and Paul Weiss (1901-2002)), and they include many, many references to abduction.

When Chomsky claims (ibid) that Peirce asserted that "... you can't get anywhere by association, you can't get anywhere by induction..." he is mistaken. In fact induction was crucial in Peirce's philosophy, where all three forms of inference were keys to human cognitive advancement. Abduction (or Retroduction as Peirce later called it) is but one of three components of or types of inference, as we see in chapter six. The guesses of abduction needed to be tested by induction and deduction to have value.  In this sense Chomsky's remarks miss the point entirely, because he overlooks the crucial point that for Peirce inference is a triadic logical process.  For Peirce abduction is of course an important first step of ampliative inference, to be tested via iconic reasoning, induction, deduction, and scientific method.

Other linguists might have had both overt and covert Peircean influences. With regard to the latter, much of Roman Jakobson's work occurred during his time in Prague in the late 1920s

with the Prague Linguistics Circle, then later at Harvard.[xxxv]  In Prague Jakobson and Prince Nikolai Trubetskoy, among others, developed the concept of "oppositions" in phonological theory that led to the theory of "distinctive features." Although I have not been able to find any direct link between the work of the Prague Circle and Peirce, their influential ideas on binary oppositions seem almost inspired by Peirce's theory of secondness and thirdness.

More direct influence might one day be found between Peirce and these early phonological theorists. But in the absence of any evidence for the direct influence of Peirce on the Prague Circle, we can point to Roman Jakobson, a prominent member of that circle who acknowledged his inspiration from Peirce. In Jakobson (1977), an introduction to Peirce's "pathfinding" work to linguists was presented.[xxxvi] It may be that Chomsky heard of Peirce in part through Jakobson, since Jakobson was admired by and known personally by Chomsky.

Another distinction we have seen between the methodologies of Pragmaticism and much of modern linguistics is that Peirce (1868), argues at length that there is no such thing as intuition, a central component of cognitive research from Descartes to the present, and vital to many linguists (e.g. Chomsky). Defining intuition as a "cognition unlinked to a previous cognition," Peirce concludes that no such cognitions exist and that all cognition is part of a chain of inference with other cognitions.[xxxvii] He claims that the only evidence for intuition is that we think we have it (CP 5.218).

In spite of potential problems, intuition nevertheless has long played a significant role in modern linguistic theory and is used as an important way to determine the grammaticality of utterances and thus has become a vital part of the methodology of generative linguistics.[xxxviii] But intuition also figures into the very goals of linguistic theory. One leading psycholinguist puts it this way:  *"The goal of syntactic theory is to account for linguistic intuitions,"* (Slobin 1974; see also Chomsky 1986; 2006; 1980, 9; Larson and Segal (1995, 10ff); Fodor (1981, 200ff).

But this cannot be the right way to proceed.  Even regarding the very idea that intuitions or native speaker inference about grammaticality could aid the linguistic researcher, via a speaker's connection to their "internal grammar," Levin argues that this must be argued for empirically, not merely assumed: *"... it is an empirical hypothesis that the grammarian's formal explanation has an empirical realization in speakers."* (Levin 1983, p182)

Such quotes illustrate an immense divide among those who study natural languages regarding the very object of their inquiry. Is linguistics about epistemology or is it about language? There are some theories (e.g. Pullum (2023)) offer analyses of the data and try to understand the empirical implications of those data in relation to linguistic behavior, avoiding all talk of introspection or intuition.

All of our judgments and theories emerge from networks of knowledge and arguments and propositions and these are too complicated to sort through for any judgment of a single utterance of a given language to determine whether our acceptance of that utterance as grammatical is a direct deliverance of our grammatical competence or inferring from our Central Process Unit "CPU," as Devitt argues. Given the fact that speakers' grammaticality judgments change in different circumstances, it seems most likely that Peirce's arguments against intuitions as special forms of cognitive evaluation are correct. Certainly no one has explained what intuitions are in any deep sense, other than to claim them as the source of native speaker judgments (see the papers in Schindler, Drozdzowicz, and Brocker (2020) for more details).

What Peirce contributes in this regard to linguistic theory is a set of arguments that intuitions are inference and reflect no special power or immediate connection to the "voice of competence."[xxxix] And, as seen above, partially and more fully in the next chapter, this holds true

not only for intuitions, but also for compositionality, FLN, and introspection, and other dubious tools in the arsenal of modern linguistics claimed to enjoy special cognitive status.

To drive this home, the lesson is to draw from all of this is that if intuitions, compositionality, and introspection are not privileged linguistic tools directly tied to our competence, then we can interpret these in more general inferential terms when talking about language (and other human behaviors). It becomes reasonable then to shift our methodological commitments towards the use and understanding of inference, especially when based on quantitative data and corpora. Although the standard data of gleaned from intuitions and introspection can be of value, we can only evaluate such data inferentially and never take them as offering a "voice of competence."

Introspection, like intuition, has served as a cognitive tool for modern linguistics. Peirce calls this likewise into question. Introspection about grammaticality judgments as a window into native speaker competence go hand-in-hand with intuitions in Chomskyan (and many other theories). Schwitzgebel (2010)·is a useful discussion of this concept as it is generally accepted.

However, the problem for introspection is the same as for intuition. If we think of these as just labels for inference about one's own knowledge or memory, then there is no Peircean objection. We draw information in some way about our inner life and test our judgments about this following standard forms of induction, deduction, and abduction. But if we think of introspection as a special mental ability or special access to truth, knowledge, or inner states, rather than a form of inference, using data and standard scientific and logical argumentation, we delude ourselves. Once again, Peirce emphasizes that all knowledge is acquired by inferential reasoning, not by special powers (into which forms of spiritual revelation would also fall).

Since we have no way to understand the world within and around us other than by inference, it is crucial that modern linguistics develop more scientific methods for evaluating theories other than intuition and introspection. The widespread reliance on intuitions and, by extension, introspection in linguistic theory is representative of the unscientific foundations of much of modern linguistics, exacerbated by the embrace of Cartesian ideas (as in *Cartesian Linguistics*).

Intuition as used by Descartes is an *infallible* dyadic relation to an object. Once we have settled on an intuition our knowledge is certain, claims Descartes. No inference is involved and there is no criticism possible. Chomsky's 1966 work, *Cartesian Linguistics: An Essay in the History of Rationalist Thought*, makes it clear that his own theoretical assumptions are prefigured in Cartesian philosophy. Not coincidentally, intuition entered into the methodology of generative linguistics from its founding and remains a pillar of the theoretical methodology of the research program even today. Ironically though, in this book Chomsky argues that Descartes's work prefigures his own in crucial respects, in his Language and Mind (Chomsky (1975)), Chomsky also claims that Charles Peirce is his favorite philosopher. Ironically, these two philosophers represent separate poles of Rationalism and Dualism against Pragmatism, Realism, and Monism, respectively. One cannot have them both.

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i Bruner 1990, p2

ii Thus we see that Saussure's theory excludes other species, unlike Peirce's.

iii Dark matter of the mind is any knowledge-how or any knowledge-that that is unspoken in normal circumstances, usually unarticulated even to ourselves. It may be, but is not necessarily, ineffable (e.g. Majid and Levinson (2014); Polanyi (1974; 2009); Collins (2010); Gascoigne and Thorton (2013); Turner (2013)). It emerges from acting, "languaging" and "culturing," as we learn conventions, knowledge organization, and

adopt value properties and orderings. It is shared and it is personal. It comes via emicization, apperceptions, and memory and thereby produces our sense of "self."

iv https://www.washingtonpost.com/climate-environment/2023/01/31/dolphins-fishing-mullet-brazil-climate-change/
v On tychism, Peirce wrote to Lady Welby, May 20, 1911 that, "… the universe is not governed by immutable law. The proof of this is surprisingly simple. Namely, I show that if precisely the same consequence always resulted from the same cause, there could be no real progress. Now there is real progress."
vi From Queiroz: https://cspeirce.iupui.edu/menu/library/aboutcsp/queiroz/10-biosem-jq.pdf

vii In my grammar of Pirahã (Everett 1983, 1986) I provide a chart of verbal affixes in this language. There are sixteen sets of suffixes. Forgetting for now the fact that verbs are formed by combinations of other verbs, this gives $2^{16}$ possible verb forms for each verb of the language, i.e. roughly 65,000 possible forms (cf. Spanish with forty or so and English with five verb forms (e.g. *sing, sang, sung, singing, sings* or the impoverished verb "hit":"I *hit*," "you *hit*," "He *hits*," "We *hit*," "They *hit*," "He is *hitting*").  However, this does not mean that every verb in Pirahã actually allows this many forms. To determine that limit, it would be necessary to carry out a theoretically-informed analysis of combinatory possibilities and restrictions. In English, for example, I cannot use "hits" with the subject "I:" *"I hits." Likewise in the analysis of semiotic combinatorial possibilities.
viii Interestingly, in his Speculative Grammar writings of about 1867 (Bellucci (2018 p36)) Peirce proposed that substitution was a basic logical operation, later analyzed into two component steps, deletion and insertion. In more recent years this has been rediscovered in linguistics and biology.

ix Another definition of information Peirce offers is this: "'information' is the reference of a symb ol to all synthetical propositions in which the symbol's objects are subject or predicate (i.e. interpretants)." (EP 1, p10)
x These distinct ideas of information might help explain why many computer scientists fail to see the significance of philosopher John Searle's "Chinese Room" argument. Searle is in effect claiming (see later in this chapter) that the computer recognizes only information of signs not meaning, i.e. that computers have no semiotic or semantic theory built in (at least at the time of his experiment, though I suspect that the criticism is still valid today). That is, Searle is concerned about content while most computer scientists are concerned about the form of and response to the message.
xi Self-information has the following property. If a particular event is composed of two mutually independent events, x and y, then the amount of information at the proclamation that $C$ has happened, equals the total information of y + z. In other words, information aggregates. This is not, however, the same as compositionality or inference and is, once again, based not on the interpretation or reception or semantics found in interaction with the message by a recipient, but merely in formal properties of the isolated form of the message.
xii In Everett (2016) I argue that unlike the case for other animals, human cognition and culture have moved us away from instincts to a large extent to greater behavioral, cognitive, and cultural freedom.
xiii Everett (2016) seeks to develop a theory of culture compatible with Saussure's statement here.
xiv In a sense to be addressed in the final chapter of this book, this means that truth entered the world of humans with Homo erectus.
xv Most linguists would agree with this statement, I believe, though there are times when linguists argue so vehemently over how to assign a form to a sentence that one might get the impression that they are arguing about how people *ought* to talk. But linguistics has no logical-mathematical means of deriving an *ought* relative to speech patterns, whereas semiotics does.
xvi The diagram above with the sun and the flower is also from Wikipedia.
xvii This is open to discussion, however. Jamin Pelkey, p.c., suggests that these dances do include symbols. I have no objection to the idea, virtually a truism, that other animals have symbols, so I allow this might be correct.
xviii http://dx.doi.org/10.1098/rspb.2019.0238
xix There are many definitions of language. To argue about such definitions in the application of the term can be useful, but often the term does little more than name the researchers' biases and so debate becomes nearly useless.
xx It is not entirely clear what is meant by this phrase, unfortunately.

xxi "Gardening in Eden" (https://anthroecologycom.wordpress.com/2018/09/21/gardening-in-eden/)

xxii By convention, all papers in Peirce's Collected Papers are referred to by CP + volume number + paragraph number. So CP 1.1 refers to these papers, volume 1, paragraph 1.The chonological edition of his papers, published by Indiana University Press, are referred to by W + volume number + page number.

xxiii Though UG has no such applications in Chomsky's theory, since from Chomsky's Cartesian perspective, non-human and human communication are unrelated in any significant way.  But they *are* related in Peirce's theory because for Peirce non-human communication and human languages are all semiotic systems, subject to the logical constraints of UG (discussed in more detail in Everett (in progress)).

xxiv From the film "The Princess Bride."

xxv Finally, Kuhle (2018) makes an important related point: "This article argues in favor of a significant continuity, i.e., a homology, in underlying cognition between prelinguistic tool use in nonhuman primates and linguistic behavior in humans. In terms of theory, the evidence for such a cognitive homology is based on the distinct criteria for intentional behavior and cross-group cultural variation. I argue that these criteria are equally valid in primatological and human linguistic research. In past decades, tool use and natural language use have indeed been considered analogous with one another. However, this analogy has never been applied outside of the human domain. In fact, the discussion of intelligent behavior in animals has grown so controversial that even where the issue of concern is not language, much opposition emerges against the idea that the human capacity for culture is based on inherited cognitive capacities that we share with our closest living relatives. My argument challenges such extreme skepticism and supports the continuity hypothesis. The empirical evidence is based on data from ethnographic fieldwork on ape tool practices and natural languages."

xxvi In 1981, not long after his talk at Yale, I shared an office with Searle at the Universidade Estadual de Campinas in Brazil. We talked about his Chinese Room example and he expressed surprised that the AI folks at Yale had no answers. Many claim to have such answers now. But not if they ignore the semiotics.

xxvii     Here is how the Stanford Encyclopedia of Philosophy explains Searle's experiment (first page of entry): "The argument and thought-experiment now generally known as the Chinese Room Argument was first published in a 1980 article by American philosopher John Searle (1932– ). It has become one of the best-known arguments in recent philosophy. Searle imagines himself alone in a room following a computer program for responding to Chinese characters slipped under the door. Searle understands nothing of Chinese, and yet, by following the program for manipulating symbols and numerals just as a computer does, he sends appropriate strings of Chinese characters back out under the door, and this leads those outside to mistakenly suppose there is a Chinese speaker in the room.

    The narrow conclusion of the argument is that programming a digital computer may make it appear to understand language but could not produce real understanding. Hence the "Turing Test" is inadequate. Searle argues that the thought experiment underscores the fact that computers merely use syntactic rules to manipulate symbol strings, but have no understanding of meaning or semantics. The broader conclusion of the argument is that the theory that human minds are computer-like computational or information processing systems is refuted. Instead minds must result from biological processes; computers can at best simulate these biological processes. Thus the argument has large implications for semantics, philosophy of language and mind, theories of consciousness, computer science and cognitive science generally. As a result, there have been many critical replies to the argument."

xxviii Alan Turing proposed in 1950 that a valid way of determining whether a computer could match human intelligence would be through conversation (via computer inputs and outputs, just as Searle described it). If a human judges natural language conversations between themselves or other humans and a machine could not reliably tell the machine from the human, the machine would be said to have passed the test. The test results would not depend on the machine's ability to give correct answers (think ChatGPT), only on how whether the answers were like (in some way) those a human would give.

xxix The warning signs of many animals, e.g. vervet monkeys, chimpanzees, meerkats, dolphins, and others are indexical legisigns, rather than symbols. But even if it turned out that other animals could invent and use symbols, this would not alter the basic point that no animal other than those of the genus Homo invents open-ended symbols to apply to any new situation or interest.

xxx S(ign) --> S (one sign is interpreted by another)

xxxi  The phonological form of a sentence on the other hand is the analysis of the spoken, signed, etc. physical form of a sentence. Its representamen (which must also include accompanying hand gestures, intonation, and so on or the absence of speech sounds in sign languages, though these are ignored in Chomsky's "syntactocentric" theory (see Culicover and Jackendoff (2005)) for further exploration of syntactocentrism.

xxxii Although Pike and Pike (1976) refer to a "referential hierarchy" as part of the triadic structure of linguistic theory - Pike saw most topics as triadic in structure, though he never to my knowledge cites Peirce as a source for this approach.

xxxiii In the academic climate of Chomsky's early years as a junior fellow at Harvard (when he developed the basics of his Transformational-Generative Grammar), major concerns involved the proper analysis of propositions and sentences and how such analyses could be incorporated into computer science. His theory reflects these concerns, has never really moved beyond them. Peirce on the other hand always saw propositions as constituents of larger units, i.e. arguments, including what we would today call discourse.

xxxiv  For example, the shell structure hypothesis of Larson (2017) makes a series of valuable predictions within Chomsky's theory, but it is largely ignored outside of the literature of that theory. The reason is not because the other theories are inferior but rather than this kind of form-only analysis is less desireable for theories in which the principal causative power lies in meaning rather than form.

xxxv Where his students included the late Morris Halle, who eventually would "discover" Noam Chomsky and recommend him for employment at MIT, where Halle was already established in a project directed by Victor Yngve (Yngve, p.c.).

xxxvi Shapiro (1983) presents an extended argument for a Peircean linguistics, but one based on the largely Jakobsonian idea of "markedness." But this idea is no longer as widely accepted as it once was and I am a bit leary of a theory based on one particular, and slightly outmoded, idea.

xxxvii Peirce allows that indexes, by simply pointing out an object in the real or imagined world, may halt this recursive process or begin it. Infinite regress is thus avoided. In general, however, there is no need to restrict "infinite semeiosis."

xxxviii Peirce was a hard-working scientist who left copious documentation of his working methods, such as his analysis of Tagalog grammar - see Everett (in progress) for analysis. Intuition played no role in his work - as chapter one discusses, it was a false "capacity claimed for man."

xxxix Harman (1973) argues, as Peirce would, that inferences can be fast, instantaneous perhaps, and need not be conscious.