

**Peirce's Universal Grammar:
Some Implications for Modern Linguistics**

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"Symbols, as such, are subject to three laws one of which is the conditio sine qua non of its standing for anything, the second of its translating anything, and the third of its realizing anything. The first law is Logic, the second Universal Rhetoric, the third Universal Grammar." C.S. Peirce, 1865, Harvard Lectures on the Logic of Science. Lecture X: Grounds of Induction, W 1:274¹

"... we are born into a wholly symbolic realm, and forever obliged to defend it as a reality." Paterson (2018,p111)

1. Introduction

This chapter discusses ideas of Peirce's philosophy, especially his semeiotics, that bear on the development and assessment of the methods, results, and objectives of modern linguistics, especially in regard to the theme of Universal Grammar (UG). Because a single chapter must restrict its scope, I will keep to those topics which seem to me to distinguish Peirce's views, and those of any future Peircean linguistics, from current theories of language.² As a further narrowing of the latter subtopic, I intend to focus my discussion of UG on the ideas of Peirce and Noam Chomsky (see Chomsky (2007) for his perspective).³

Peirce's ideas have frequently been borrowed piecemeal in linguistics and anthropology. One theory builds around his iconicity (Permiss, Thompson, and Vigliocco (2010)). Another around indexes (Silverstein 2003). Another on his algebraic logic (Font and Jansana (1996)). But this type of "inspiration by Peirce" as opposed to "engaging with Peircean theory" as a whole can create empirical, and conceptual problems. Thus one of the goals here is to offer a brief discussion of some of the ways that overlooking 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] ..."*⁴

The issues distinguishing Peirce's views from much of modern formal linguistics reject the following theoretical presuppositions of the latter in favor of Peirce's quite different approach: (i) taking form as the principal explanandum for linguistics; (ii) asserting that recursion in sentences is the core pre-condition for human language rather than recursion in

interpretations; (iii) building models of language based strictly on unconnected sentences, rather than discourse; (iv) failure to recognize that three essential components of modern linguistics' methodology and values, viz. intuition, introspection, and compositionality, are each specific manifestations of the larger reasoning operation of inference; (v) failure to recognize that the word "instinct" in earlier literature possesses several distinct senses, each with a variety of distinct implications for our understanding of the sources of human language.

This chapter is organized into six sections: introduction to the issues to be addressed, Peirce's view of Universal Grammar, Peirce's linguistic depth of analysis, the semeiotics residue in modern linguistics, contributions of Peirce to current analytic issues in modern linguistics, and Peirce's role in the mathematical foundations of linguistic theory.⁵

2. Peirce on Universal grammar

2.1. Terminology and Classification

Peirce referred at different times to Universal Grammar, Formal Grammar, Pure Grammar, and Speculative Grammar. I do not believe these terms differed in meaning, but that the variation results from the Peircean tendency to experiment lexically in search of just the right term.

In any case, Peirce first used the term Universal Grammar in 1865 - 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 the thirteenth century Modistae (Covington 1983; Rosier 1983). But his 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/Semeiotics, 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). There linguistics is listed as a subtype of Classificatory Ethnology/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.

For Noam Chomsky, on the other hand, Universal Grammar refers to the *biological* capacity that underlies its direct offshoot, Linguistics. Linguistics is part of biology as is psychology, neither of them part of anthropology. This is part of the revolution that Chomsky instituted, differing from earlier figures in linguistics history such as Sapir, Saussure (and also Peirce). By classifying linguistics as a branch of biology, Chomsky removes any possibility that logic or culture exercises major ontogenetic effects on the "core grammar" of a language. (Chomsky 1986)⁶ And yet there is something to Chomsky's conception that, superficially at least, is reminiscent of Peirce's. In the words of two prominent Chomskyan followers:

"... we decide to study the language faculty in its universal properties, rather than concentrating on the way it manifests itself differently in various languages. We study those aspects of language that may be thought of as 'structural,' as opposed to merely 'behavioral.'" Lasnik, Uriagereka, and Boeckx (2005, 1).

This statement echoes Peirce's distinction between UG and individual languages, at least superficially, in that it separates the study of UG from that of actual languages. Chomsky's latest

research program, Minimalism, is in one sense a theory of how propositions become linguistic objects. As Lasnik, Uriagereka, and Boeckx (2005) describe it, Chomsky's latest "theory/program" in linguistics is like Peirce's theory in this one respect (though they do not notice this). 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 is not clear, though see 4.3.1. below..

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," while for Peirce UG is not biological. For Peirce, rather, UG is set of semeiotic (thus logical) constraints on grammars, defining, classifying, interpreting, and building signs into larger units.

Peirce's splitting of the responsibility between Language (UG) and languages (linguistics) in this way has a variety of healthy empirical implications, e.g. the evolution of human language from other animal forms of communication (Everett 2017 and 5.11. below). 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* in Peirce's sense.⁷

2.2. Animals and Universal Grammar - Two Approaches

2.2.1. Symbols vs. Indexes and Icons in Communication

Pursuing this implication of Peirce's UG in more detail, animals, like all entities (even minerals), communicate via signs. The crucial Peircean difference between animal communication and human communication according to Everett (2017) is that non-human animals do not create symbols, or at least they do not create open-ended classes of symbols. I have argued (Everett 2017) that animals tend to use icons and indexes primarily, though much more research is needed to establish such a claim.

It is often overlooked 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. But how can this be determined?

We can address this question following a methodology based on upon Pikean theory, drawing upon the important *etic* vs. *emic* dichotomy. When we observe a behavior outside our own language or culture (e.g. in non-human communication), linguistic or otherwise, we observe it pre-analytically from an "etic" perspective (Pike 1967).

If we think we are viewing a symbol, i.e. a sign with a general object (at least according to Bellucci), then we must test our thinking by analysis. Our "etic" view, once analyzed, transforms from an outsider's preanalytic perspective into an insider's postanalytic perspective, or an "emic" perspective (these Pikean terms are drawn from "phonetic" and "phonemic," respectively).⁸ Only by achieving this insider, post-analytic perspective, in conjunction with Peirce's semeiotics, are we able to determine whether non-humans use symbols.

If my understanding is correct, nonhumans of any species, plant or animal, are unlikely to possess symbols to the degree that they lack culture and the ability to generalise that undergird all cultures, though their communication will nevertheless entail signs and be guided by Peirce's version of UG.

But again we must be careful that our analysis of non-human animal communication is based on a clear semeiotic understanding of the extent of signs they use. A recent paper on symbol-recognition in bees illustrates the need for a better understanding of Peirce's semeiotics

in science more generally. The article in question claims that bees can be taught symbols (Howard, et. al. 2019, 1):⁹

"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."

This article (as pointed out in Everett 2019) appears to confuse what are symbols for humans with what are almost certainly indexes (or indexical legisigns) for bees¹⁰. The paper shows that bees can recognise particular numerical symbols and correctly associate these human symbols with the correct quantities, for example, learning that the symbol '7' means *seven objects*. However, while the researchers have clearly trained bees that $x \rightarrow y$; $y \rightarrow x$ – ie, if you see an x expect a y – they don't seem to have taught the bees anything other than indexes, which we already know that all animals recognize (as they use smells, footprints, broken branches, etc., to track other animals).

In other words, even if x and y are symbols to humans, they need not be for bees. There is no compelling reason to believe that members of Apoidea have learned anything other than an index for an object, as with Pavlov's dogs. 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. Symbols require culture but indexes do not.

Such (in my analysis) inaccurate understanding of symbols is also seen occasionally in computer science and elsewhere in the cognitive sciences (Everett (in progress)). This seems to underlie the difficulty pointed out by philosopher John Searle (1980) in his "Chinese room" thought-experiment about the Turing Test. In this work he argued computers cannot understand symbols semantically when they perform automatic machine translation (thus even if their behavior would otherwise pass the Turing Test, this is of little significance, according to Searle). In semeiotic terms we can restate Searle's results more economically by seeing computers as able to interpret indexes, though perhaps not symbols in the particular translation case that concerned Searle (I am not making a global claim about AI).

Searle's experiment, simply put, states that we can express what the computer is doing translation by imagining a human as the CPU. As Chinese comes in, the human CPU takes Chinese symbols and outputs, correctly and quickly, English symbols. The question that arises is "Does the human/CPU understand Chinese?" And the answer, for Searle, is a resoundingly obvious "No." Though Searle did not use these terms, we can reinterpret Searle's "Chinese Room" gedanken experiment semeiotically. Thus the computer translator's input, say a squiggly line (unbeknownst to him/her/they a Chinese character), serves as an index of another squiggle (English) which functions as the output. If this is characterization is correct, then the computer is not using symbolic meaning but only indexical reference, being programmed to treat one squiggly line as an index of another, like the bees in the experiment discussed earlier. So far as we know, only humans use the former (Everett 2017) , but all animals use non-symbolic signs. The computer is not interpreting signs as having general objects, but only linking one sign to another, i.e. using one sign as an index of another. Thus semeiotically, Searle's results and subsequent discussion make sense. Anyone arguing against Searle's conclusions needs to discuss the significance of the semeiotic interpretation of this experiment.

To take another example, if one could train their dog to fetch seven things when she sees the numeral '7', it would be scientifically interesting if she could distinguish seven things as "seven things," but since there is no dog culture, there is no presymbolic 'agreement' between dogs that the sign '7' means seven *things*, which in this sense is an abstraction (see also Everett 2005 for a quite different explanation of why the Pirahã people lack numbers in their Nominalistic culture (Everett (in progress))). The behaviour 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. On the other hand, even if my dog is understanding a symbol when I ask her to get a specific toy (which I doubt), she is not creating symbols (especially if we restrict these to general objects). But notice that in the case of non-human animals and computers, semeiotics and therefore UG are crucial to any explanation of what they are doing in communication tasks.¹¹

2.2.2. Creating Symbols

Let's explore these ideas a bit further. 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 creation of open-ended symbol systems has not been shown for non-humans. To put it another way, Pavlov's dog did not interpret the bell as a symbol of food, but as an index of food. When you see one, you see the other or so it seems to have been learned. Pavlov's trick was to eventually take away the referent 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 Schulz, 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 form, 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 semeiotics captures this distinction. And so it is the most appropriate set of principles for testing claims about animal communication.

Icons and indexes also obey UG in Peirce's theory. Once again, it is significant that Peirce's UG accounts for all signs, the full range of signs (including animal legisigns where these are found) used by both non-human animals and humans.¹² The biological UG of Chomsky does not. This would of course not bother Chomsky, since he believes that there is little or nothing in common between animal and human communication. In his theory human linguistic communication is based on a recursive grammar while animals lack recursive communication (though this is only a claim, to be tested empirically).¹³ 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."

To drive this point home, consider the following quote from Samuels, Hauser, and Boeckx (2017), who address animal communication relative to Chomsky's version of UG:

Do animals have Universal Grammar? The short answer must be 'no.' Otherwise, why do human children learn language with strikingly little conscious effort, while no other animal has even come close to approximating human language, even with extensive training or exposure to massive linguistic input? However, many of the cognitive capacities which clearly serve our linguistic ability—rich conceptual systems, vocal imitation, categorical perception, and so on—are shared with other species, including some of our closest living relatives. This suggests that the question is more complicated than it might first appear. In the present work, we use phonology as a case study to show

what type of cross-species evidence may bear—now and in future work—on the issue of whether animals have various components of UG, which we construe here broadly as the systems that are recruited by language but need not be specific to it.

But their objections fail to consider the possibility that the crucial distinction between the genus *Homo* and other genera rests not on a universal grammar of forms but on a universal grammar of signs. And this is a serious problem in understanding language evolution (as both Deacon (1997) and Everett (2017) make clear).

3. Peirce's Syntactic Depth of Analysis

3.1 Surfacey

From one perspective, Peirce's view of linguistics seems to be what modern linguists might refer to as "surfacey." Peirce tended to look at what speakers actually said, not what they might be implying covertly. For example, in a sentence like *John came in and sat down*, many linguists would propose that "sat down" has its own subject, but that the subject is covert, i.e. it is syntactically and semantically present but phonologically absent. Peirce's view was different.

Consider the following quote:

"... proper nouns must exist in all languages; and so must such 'pronouns,' or indicative words as this, that, something, anything. But it is probably true that in the great majority of the tongues of men, distinctive common nouns either do not exist or are exceptional formations. In their meaning, as they stand in sentences, and in many comparatively wide-studied languages, common nouns are akin to participles, as being mere inflections of the verbs. If a language has a meaning 'is a man,' a noun 'man' becomes a superfluity..." (CP 3.459).

So for the sentence above a Peircean analysis would propose an underlying logical constraint on predicates requiring a subject, but not for an invisible or "covert" syntactic subject¹⁴. The subject is inferred in the interpretant of the construction as a whole, from verb forms and context. It need not be present in the phrase (neither syntactically nor phonologically present) in any form in order to be contextually inferred.

As an "inflection of a verb" a syntactically separate common noun (Peirce here seems to almost paraphrase the hypothesis that nearly a century later would come to be known as the "predicate argument hypothesis," the idea that the functions of noun can be manifested as verb affixes and need not actually manifest as independent words) is not necessary to grammar. For Peirce this would explain his observation that on the surface common nouns are less common than pronouns (which have indexical meanings) in sentences cross-linguistically. That is, he these saw independent words as themselves inflections of verbs, along the lines of "pronominal arguments" found in many languages, e.g. those of Salish family (Jelinek 1994)

As Nöth (2000) puts it:

"Peirce defends the thesis that only proper nouns and not common nouns are universal categories of language (CP 2.328, 2.287 fn., 3.440, 3.459, 4.56, 4.151, 7.385 fn., 8.337). The reason for this assessment is the "impotence" (CP 3.419) of a mere common noun to evince reference by itself, without an indexical expression to specify it... The word donation, e.g., "is indefinite as to who makes the gift, what he gives, and to whom he gives it" (CP 4.543). Hence, in contrast to proper nouns, which always have a specific referential object, common nouns are referentially open in the same way as verbs and adjectives are."

3.2. Deeper - Hypostatic Abstraction and Transformations

On the other hand, Peirce's understanding of language was not based on surface forms alone. For example, in his concept of hypostatic abstraction there is evidence that Peirce's view of UG entailed a concept similar to what modern linguists, following Chomsky, once labelled "deep" vs. "surface" structures. Hypostatic abstraction is a formal operation that takes as input some predicate and outputs a relation. An example often given of this is the transformation of "Honey *is* sweet" into "Honey *has* sweetness." The original assertion of fact about a topic is turned into a property about that topic. This transformation is not merely (as in Harris's 1951 concept of transformation) a relationship between synonymous phrases with distinct discourse functions¹⁵. Nor is it claiming that one of these sentences is the syntactic base for the other (as in Chomsky's original theory where passive constructions are "transforms" of active constructions, e.g. *John saw Mary* (active) --> *Mary was seen by John* (passive)). Rather Peirce is claiming that semantically/semiotically one implies the other. He does, however, leave open the possibility of a deeper analysis not unlike that of early Transformational Generative Grammar (Chomsky 1957; 1965), when he claims that "Thus, we transform the proposition, "honey is sweet," into "honey possesses sweetness." CP 4.235 But here the "transformation" is a logical one, not a syntactic derivation. For an enlightening discussion of the concept of "transformation" in the sciences, see Stjernfelt (2011).

Peirce claims that hypostatic abstraction is not only crucial to understanding propositions and signs, but that it is vital for rational thought: "Intuition is the regarding of the abstract in a concrete form, by the realistic hypostatization of relations; that is the one sole method of valuable thought." CP 1.383¹⁶

The general properties of semeiotic relationships thus constrain natural language forms in order to allow for the proper evaluation or selection of interpretants as well as to provide for an understanding of and restrictions upon reasoning, characterized by Peirce as a semeiotic process. These general semeiotic constraints, UG, are thus, as mentioned earlier, a separate domain of study for Peirce from the study of actual natural languages.

3.3. Language of Thought

Another point of similarity between Peirce and modern linguistics and philosophy of language is that, like philosopher Jerry Fodor (1980), Peirce's theory requires that there be a "language of thought." At the same time, unlike Fodor and others, Peirce's language of thought is more nuanced, and he argues that the language of thought should not rely exclusively on symbolic thought, because this can lead individuals astray in their reasoning. We must also think iconically and indexically (as animals appear to do, see below). As Peirce puts it,

"It is not English grammar which forces these [illogical, DLE] words upon them, but it is the very grammar of thought - formal grammar - which forces the idea upon them. The idea of supposing that they can think of motion without an image of something moving."
CP 4.127

Peirce argues here that a purely symbolic language of thought is a problem leading our thinking astray at times. The problem can be corrected by supplementing symbolic reasoning with iconic thought/reasoning.

This is not only an important distinction for philosophers. Some artists have independently arrived at this conclusion. For example, Joan Didion (2021, 50ff) recognizes this issue of thinking in images and symbols in her essay, "Why I Write:"

"Grammar is a piano I play by ear, since I seem to have been out of school the year the rules were mentioned. All I know about grammar is its infinite power. To shift the structure of a sentence alters the meaning of that sentences, as definitely and inflexibly as the position of a camera alters the meaning of the object photographed. Many people know about camera angles now, but not so many know about sentences. The arrangement of the words matters, and the arrangement you want can be found in the picture in your mind. The picture dictates the arrangement... The picture tells you how to arrange the words and the arrangement of the words tells you, or tells me, what's going on in the picture."

Fodor (1980) was of course not the first to propose a language of thought. But the point here is deeper than mere chronological priority. Peirce's language of thought is more detailed, more sophisticated, and more closely predicted by theory than any other version on offer.

Now let us turn to what I see as an ironic echo of Peirce's triadic semantics in the architecture of modern syntactic theories.

4. Semeiotic Residue in the Architectonics of Modern Linguistics

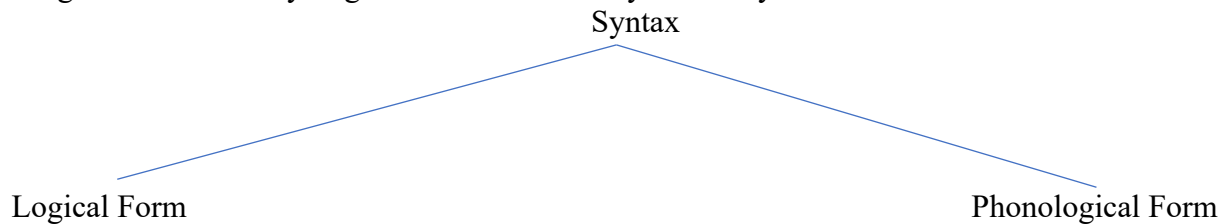
4.1. The Overall Design of Modern Theories is Semeiotic

For example, Chomsky's tripartite division of the theory of grammar into Logical Form (interpretant), Phonological Form (representamen), and syntax (object) is a triadic semeiotic (Peircean) conception of grammar. Take a sentence like *John ordered Bill to come in the room*. 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.

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.

Chomskyan theories of linguistics thus all share the ternarity one would expect of semeiotic systems, 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: Ternary Organization of Chomskyan Theory



Logical Form in Diagram One produces the semantic interpretant. Phonological Form is the physical interpretant of the syntax, i.e. 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).

Tagmemics (Pike 1967; Pike and Pike 1976) is similar - three hierarchies are linked, 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 ¹⁷
Ph. Discourse		Discourse		Highest meaning unit
Ph. Paragraph		Paragraph		
Breath Group/Contour		Sentence		
Ph. Phrase		Phrase		
Phonological Word		Word		
Phoneme		Morpheme		Lowest meaning unit

The ternarity in these models therefore, however inadvertently, recognizes that language is a semeiotic 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 and linguistic objects (unfortunately omitting arguments/discourses in Peirce's theory). 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. 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, etc. In the phonology we interpret "John" as a unit composed of prosody (stress, intonation, length) and segments (dʒ, o, n), the representamen of the sign in Logical Form of a person named "John."

4.2. Peirce as Theoretician

As part of our investigation of the significance of Peirce's for modern linguistics, it is important to note that overlooking Peirce or any other researcher does not diminish their contributions, only the scholarship of the person overlooking them. For example, consider the following statement by a British journalist on the relative inferiority of American, as compared to European and British theoretical work:

"Americans are not naturally given to grand theory. A glance across the social sciences and humanities for the 'great theorists' of the past century makes this abundantly clear, whether in philosophy (Wittgenstein, Heidegger, Derrida, Foucault, Habermas, Levinas), history (Bloch, Braudel, Hobsbawm, Needham, Elliott), sociology (Mosca, Pareto, Weber, Simmel, Mann), anthropology (Mauss, Lévi-Strauss, Dumont, Malinowski, Evans-

Pritchard) or literary studies (Bakhtin, de Man, Barthes). All these foundational figures are European. The grand American exception is Chomsky ..." Anderson (2016).

As a statement of about science and the arts, this quote is profoundly, laughably ignorant. It is both too strong and too weak. It is too weak when it claims that there is only one American exception to the rule, Chomsky. One could mention many American social scientists and humanists with broad theories - Leonard Bloomfield, Edward Sapir, Clifford Geertz, Marvin Harris, Napoleon Chagnon, Harold Bloom, and many more - all of which are at least as important in theory construction as the European figures.

But the statement is also too strong when we consider (see below) how many times Chomsky has changed theories in substantial ways, leading one to question whether he ever had a grand theory (as Peirce did, one still going strong after more than 150 years) or simply a large group of followers and a succession of research ideas. By any standards, the leading American theoretician for the past 155 years is Charles Sanders Peirce, arguably surpassing all of the European and other American figures mentioned.¹⁸

No one creates theories ex-nihilo, though. Modern linguistics and anthropology borrow ideas from varieties of traditions and theories within and outside of their disciplines, regularly incorporating these ideas and practices into new theories and methods. This is both sound intellectual husbandry and the useful curation of ideas to help with the resolution of current problems and concerns.

In well-designed theories all concepts are interrelated and each depends for its significance in part from how it is related to all other concepts of the containing theory. This is in essence the Duhem-Quine thesis (Harding 1976), where philosophers Pierre Duhem (1954) and Willard Van Orman Quine (1951) argued independently that scientific hypotheses cannot be tested in isolation, but that only theories can be tested, not their individual components.¹⁹

One of the most puzzling facts of modern linguistics is the near-absence of any overt role for Peircean ideas in understanding the nature of human language. 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 (1993) make no detailed references to Peirce. This is particularly ironic in the case of DRT and CG, since DRT is "isomorphic" (Sowa (2013)) to Peirce's Existential Graphs and CG takes linguistics utterances to be "signs" (primarily in the Saussurean sense, but Peirce's ideas are clearly related).

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 passé 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 little attention to the growing neurolinguistic evidence in favor of storage of symbols rather than grammar in the brain (Fedorenko and 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.^{20 21}

4.3. Misinterpretation of Peirce in Modern Linguistics

4.3.1. Chomsky on Peirce

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 Chomsky is not paraphrasing Peirce. He is caricaturing him. Just a small sample of how misunderstood Peirce can be comes from the following commentary by Chomsky.

"QUESTION: I'm really intrigued by your concept of abduction. [Mitsou Ronat interview]

Abduction? Well, Peirce had this one very stimulating essay, which I don't think he ever pursued further, called — when it was reprinted in the fifties, it was called — "The Logic of Abduction." I don't remember what he called it; I think that was the first time it ever appeared, actually — when the Peirce stuff started coming out in the fifties — but it was about the turn of the century. He began by saying that you can't — he's talking really about theory construction in the sciences, but the same would be true in any kind of learning whatever, and he made that clear — he said that you can't get anywhere by association, you can't get anywhere by induction; induction is not a method of acquiring any knowledge. He said that induction and confirmation, and so on, may be ways of checking out what you've discovered, and clarifying it and filling out the details, and so on, but there's something else going on. And the other thing that's going on is what he called abduction. He didn't tell you much about what it was, which is not so surprising, but he said whatever it is, it's instinctive. He said it's on a par with a chicken pecking at grain, so there's some instinctive mechanism we have that is a kind of a theory construction module of the brain, to put it in contemporary terms. And that maps — that constructs — theoretical interpretation from scattered data. And we do it instinctively. And then we check it out by induction and methodology of science and all that kind of stuff [yes, the two other forms of inference, DLE]. And he said if you really understand what happens in science — or what happens in ordinary life when people gain a conception of the world — why, you have to understand this instinctive]. And I think that's exactly right."

Chomsky's interpretation misses/misunderstands key points of Peirce's concepts of abduction and instinct. When Chomsky claims that Peirce had only one essay on abduction and that he never pursued this further, he is profoundly 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 (they were published in 1932 - thanks to Hartshorne and Weiss), and they include many, many references to abduction.

When Chomsky claims that Peirce asserted that "... you can't get anywhere by association, you can't get anywhere by induction..." he is being very misleading, because for Peirce inference was key to human cognitive advancement and abduction is but one of three components of/types of inference, the others being induction and deduction. The guesses of abduction needed to be tested by induction and deduction to have value. In this sense Chomsky's remarks miss the point almost entirely, because although he mentions these in the quote above, the vital significance of inference as a ternary operation is overlooked. For Peirce abduction is always a first step of ampliative inference, to be tested via iconic reasoning, induction,

deduction, scientific method, etc. As for Peirce's concept of instinct, we return to this in section 5.8. below.

4.3.2. Jakobson on Peirce

Roman Jakobson was one of the most important linguists of the past century. Some of his most significant work occurred during his time in Prague in the late 1920s with the Prague Linguistics Circle and at Harvard, 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.). 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 were quite similar to Peirce's perspective on "secondness."

More direct influence might one day be found between Peirce and these early phonological theorists. But in the absence of evidence of direct influence of Peirce on the Prague Circle, we can point to one prominent member of that circle taking inspiration from Peirce, Roman Jakobson. In Jakobson (1977), an attempt was made to introduce Peirce's "pathfinding" work to linguists, though arguably it failed. This is, in my view, because Jakobson, while claiming that Peirce's work was important, failed to consult the greater body of Peirce's work and so missed crucial points. (see Shapiro (1983)). Peirce has little overtly acknowledged influence in linguistics. In general Jakobson seems to have not understood Peirce's theory of signs well. On the other hand, it is likely that Chomsky heard of Peirce in part through Jakobson, since Jakobson exercised considerable influence over Chomsky directly and indirectly, through Halle.

5. Peirce and Current Linguistic Research Issues

5.1. Methodology: Intuition, Introspection, and Inference

5.1.1. Intuition

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.²² He claims that the only evidence for intuition is that we think we have it:

*"A child has, as far as we know, all the perceptive powers of a man. Yet question him a little as to *how* he knows what he does. In many cases, he will tell you that he never learned his mother tongue; he always knew it, or he knew it as soon as he came to have sense. It appears, then, that he does not possess the faculty of distinguishing, by simple contemplation, between an intuition and a cognition determined by others [which would be an inference, DLE]."* (Peirce CP 5.218)

In spite of potential problems, intuitions nevertheless play a significant role in modern linguistic theory and are crucial to determining the grammaticality of utterances and thus in turn also crucial not only to the goals of linguistic theory but its methodology as well.²³ 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)

Chomsky agrees that the goal of the linguist is epistemological, based on intuitions (which have direct access to grammatical knowledge):

"The linguist ... is trying to determine what constitutes knowledge of a language - to construct a correct grammar." (Chomsky

And again:

"... it seems reasonably clear, both in principle and in many specific cases, unconscious knowledge issues in conscious knowledge... it follows computations similar to straight deduction." (Chomsky 1986).

"... we cognize the system of mentally represented rules from which [linguistic] facts follow." (Chomsky 1980,9), i.e. the facts expressed in intuitive judgments, DLE).

"Thus at several levels, the linguist is involved in the construction of explanatory theories, and at each level, there is a clear psychological interpretation for his theoretical and descriptive work. At the level of a particular grammar, he is attempting to characterize knowledge of a language." (Chomsky 2006)

Similar remarks are not hard to find from other authors:

"Our ability to make linguistic judgments clearly follows from our knowing the languages that we know." (Larson and Segal (1995, p10))

"We can use intuitions to confirm grammars because grammars are internally represented and actually contribute to the etiology of the speaker/ hearer's intuitive judgments." (J. A. Fodor (1981, pp. 200-1)).

But there are some who express reservations. For example, that "intuitions" might be forms of inference or at least not a direct connection to an internal grammar:

"As Black, Stich and others have stressed, it is not clear that the native speaker is right about anything when he accepts a sentence." (Levin 1983,p182)

Levin also says:

"... it is an empirical hypothesis that the grammarian's formal explanation has an empirical realization in speakers." (Levin 1983, p182)

And, very tellingly:

"The whole idea that grammars explain comes from smuggling into the idea of an empirically adequate grammar the quite separate assumption of its realization in human speakers." (Levin 1983, p182)

These quotes illustrate an immense divide among those who study natural languages regarding the object of inquiry. Is linguistics about epistemology or is it about language? Some theories (e.g. Pullum (2020)) 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.

But perhaps the most articulate critic of intuitions in linguistic theory apart from Peirce, is Michael Devitt (2006b, 481):

"Linguists take the intuitive judgments of speakers to be good evidence for a grammar. Why? The Chomskian answer is that they are derived by a rational process representation of linguistic rules in the language faculty. The paper takes a different view. It argues for a naturalistic and non-Cartesian view of intuitions in general. are empirical central-processor responses to phenomena differing from other responses only in being immediate and fairly unreflective. Applying this to linguistic intuitions yields an explanation of their evidential role without any appeal representation of rules..."

Devitt's view is to be contrasted with what he calls the Chomskyan "Representational Thesis:" "A speaker of a language stands in an unconscious or tacit propositional attitude to the rules or principles of the language, which are represented in her language faculty."

Devitt goes on to argue that intuitions could only serve as evidence for grammatical rules if they "really were the voice of competence." "These linguists" (Chomskyans), Devitt claims, are "committed to the Cartesian view that intuitions are the voice of competence... [that these speakers] simply by virtue of being competent, have information about linguistic facts..." Devitt rejects these ideas.

Peirce offered the best criticism of this type of research program, thus any theory that relies on grammatical "intuitions" or "intuitive judgements." The problem with such theories from a Peircean perspective is that whenever a speaker offers a judgement, they are *inferring* the grammaticality of a given example based on their experience (unconsciously or consciously). The issue is that if, as Peirce would have it in "Questions Concerning Certain Capacities Claimed for Man," (CP5.213-263) an intuition is a "premiss which is not itself a conclusion," then we simply cannot be sure that no premiss in a judgement/conclusion has not been previously a conclusion. That is, we have no special power to ensure that our judgements are "cognitions not determined by a previous cognition." Intuitions can thus never be proven to be intuitions in the sense of a special cognition, as opposed to inference.

All of our judgements and theories emerge from networks of knowledge and arguments and propositions and these are too complicated to sort through for any judgement 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 (as Chomsky would have it) or inferring from our CPU, as Devitt argues. Given the fact that speakers' grammaticality judgements 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 judgements (see the papers in Schindler, Drozdowicz, and Brocker (2020) for more details.

What Peirce contributes in this regard to linguistic theory are strong arguments that intuitions are inference and reflect no special power or immediate connection to the "voice of competence."²⁴ And this holds true not only for intuitions, but also for compositionality and introspection, and other questionable tools in the arsenal of modern linguistics.

One lesson to draw from 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). In other words, quantitative data and corpora are crucial to linguistic theory. Although the standard data of "intuitions" and "introspection" can be of value, we can only evaluate these inferentially and never take them as offering a "voice of competence." This is what many cognitive scientists have been arguing for for some years now (see especially Gibson and Fedorenko (2013)).

5.1.2. Introspection

Another crucial cognitive tool for modern linguistics that Peirce calls into question is the concept of introspection. Introspection about grammaticality judgements as windows into native speaker competence go hand-in-hand with intuitions in Chomskyan (and many other theories). As Schwitzgebel (2010) puts it:

Introspection is a key concept in epistemology, since introspective knowledge is often thought to be particularly secure, maybe even immune to skeptical doubt. Introspective knowledge is also often held to be more immediate or direct than sensory knowledge. Both of these putative features of introspection have been cited in support of the idea that

introspective knowledge can serve as a ground or foundation for other sorts of knowledge."

Moreover, as the author continues:

"Introspection is generally regarded as a process by means of which we learn about our own currently ongoing, or very recently past, mental states or processes. Not all such processes are introspective, however: Few would say that you have introspected if you learn that you're angry by seeing your facial expression in the mirror. However, it's unclear and contentious exactly what more is required for a process to qualify as introspective."

However, the problem for introspection is the same as for intuition. If we think of these as just labels for types of inference, then there is no Peircean objection. We draw information in some way about our inner life and test our judgements 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, and not 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 quotes given at the beginning of this section claiming a special place for intuition and, by extension, introspection in linguistic theory are representative of the unscientific foundations of much of modern linguistics, which would almost certainly have appalled Peirce.

I now want to turn to consider another special form of inference, one that is considered a vital and special part of linguistic theory, yet distinct from inference in most work, namely compositionality.

5.2. Compositionality

There are various related concepts of compositionality in linguistics and philosophy. It is an extremely important concept in modern linguistics. And it is usually assumed to have originated with Frege, who writes that "it is enough if the sentence as whole has meaning; thereby also its parts obtain their meanings" (Frege 1884, section 60)

In more recent work, perhaps the most succinct definition of it is found in the following quote from Szabó (2000, 3):

"Principle of Compositionality: the meaning of a complex expression is determined by meanings of its constituents and by its structure."

Another take on compositionality comes from Pietarinen (2005):

"Charles S. Peirce's pragmatist theory of logic teaches us to take the context of utterances as an indispensable logical notion without which there is no meaning. This is not a spat against compositionality per se, since it is possible to posit extra arguments to the meaning function that composes complex meaning. However, that method would be inappropriate for a realistic notion of the meaning of assertions."

To accomplish a realistic notion of meaning (as opposed e.g. to algebraic meaning), Sperber and Wilson's Relevance Theory (RT) may be applied in the spirit of Peirce's Pragmatic Maxim (PM): the weighing of information depends on (i) the practical consequences of accommodating the chosen piece of information introduced in

communication, and (ii) what will ensue in actually using that piece in further cycles of discourse. Peirce's unpublished papers suggest a relevance-like approach to meaning. Contextual features influenced his logic of Existential Graphs (EG). Arguments are presented pro and con the view in which EGs endorse noncompositionality of meaning." (

But these versions of compositionality do not offer a solution for the temporal interpretations to be discussed in this section (see also Everett (in progress)). The question is how we achieve temporal interpretations for time words, affixes, and discourses in languages like the Amazonian isolate Pirahã, which do not use either precision time words or tense morphosyntax (Everett 1986). The concepts of compositionality given above do not work. The reason is that compositionality is a special form of inference and the entire resources of inference are required to arrive at appropriate semantic interpretations.

Consider the example from the Amazonian isolate Pirahã (my field notes):

- (1) **Kohóai -xiigá. Tíi gí ?ahoái -soog -abagai**
 eat -continuative I you talk -want -frustrated initiation
 "(You) are eating. I want to talk to you."
 (Free translation: "When you finish eating, I want to talk to you.")

The interpretation of this example depends on the extralinguistic context, seeing someone eating or hearing someone quoting someone else. The interpretation also depends on the cultural understanding of **-abagai** which can also be an illocutionary force marker, i.e. this is an indirect speech act (literally it is "I almost begin to want to talk to you." making it not quite a direct statement). So we only know the temporal meaning of this example, like the English examples in (55)-(65) below by a combination of real-world knowledge and experience, with cultural values on how best to express ideas. Here are more examples:

- (2) **ti gáí -sai. asi ti so?óá ?áab -óp -á -p -á.**
 I say -old information assim I alreadyturn -go -up -remote
kapiiga -kakaí-sai ?oogiái hi ?igí - o
 paper -mark -old information Dan 3 with -loc
 "I spoke. I just arrived. I want to study with/teach Dan."

These sentences *underdetermine* their semantics. Pirahãs (like all speakers everywhere) use inference to incorporate extralinguistic information and linguistic information into interpretations. Thus we see that in spite of the fact that an absence of tense morphemes and precise temporal lexical items (see Everett (1986) and (in progress)), the speakers of Pirahã are nevertheless able to come up with precise temporal understandings, modulo culture (see below)²⁵. To accomplish this, they must *infer* from the context, the discourse, the words, expressions, gestures and so on what time frame is implicated in the meaning of individual utterances.

In fact, English presents similar cases:

- (3) a. John reported that Mary has COVID-19/is happy.
 b. Yesterday, John reported that Mary has COVID-19/?is happy.
 *c. Almost a hundred years ago, scientists concluded that the ivory-billed woodpecker is pregnant/happy/flying. (modification of example from Barbara Partee, p.c.)

- d. Almost a hundred years ago, scientists concluded that the ivory-billed woodpecker is extinct. (example from Barbara Partee, p.c.)
- (4) a. John claimed that Mary is pregnant.
b. Yesterday, John claimed that Mary is pregnant.
- (5) ?a. Twelve months ago, John claimed/reported that Mary has COVID-19.
*b. Twelve months ago, John claimed/reported that Mary is pregnant.
- (6) a. Twelve months ago, John reported that the elephant is pregnant.
*b. Thirty six months ago, John reported that the elephant is pregnant.
- (7) *a. Two years ago, John reported that his neighbor Tricia is happy.
?b. Two years ago, John reported that the Virgin Mary is happy.
?c. Today, John reported that his neighbor Mary is happy.
d. Two thousand years ago, John reported that the Virgin Mary is happy.
e. Zookeepers who examined Ellie the elephant in the Cincinnati zoo five months ago announced/published that she is pregnant. (example from Barbara Partee, p.c.)
- (8) *a. One thousand years ago, John reported that Bill is his friend.
b. One thousand years ago, John reported that Muhammed is God's prophet.
c. Two thousand years ago, John reported that Jesus is alive.
*d. Two thousand years ago, John reported that Bill is alive.
e. The ancient Egyptians believed that the earth is flat.(example from Barbara Partee, p.c.)

People interpret and evaluate the grammaticality of the sentences above inferentially, via cultural and real-world knowledge, in conjunction with their knowledge of the words and structures of their languages. All of the conclusions relative to the grammaticality of these sentences rely exclusively on inferential reasoning (including memory, cultural associations, apperceptions, etc (see Everett (2016))). Thus in (8c), Jesus, as an eternal being to some religions, can be alive after a thousand years, while Bill cannot be in a physical sense (though for some he is eternal in heaven). Each of the contrasts in (3)-(8) depend on inference in which the linguistic information is just one part of the final felicity/grammaticality of the example. One might of course argue that compositionality plays its role then submits the result to pragmatics to determine if the constructed meaning fits the context. But there are a couple of problems with this suggestion. First, we must ask why this division is desirable or whether it only arises in order to artificially distinguish compositionality from the general inferential abilities independently known to be possessed by humans (indeed, all animals). Parsimony favors taking compositionality to be a special form of inference, continuous in fact with nonlinguistic inference.²⁶ Cooking by a recipe or solving crimes seem to be abilities that require a power and process of inference identical in operation to the construction of sentence meanings, within their own data-guided and data-specific domains..

The idea that there are only inferences in understanding our native tongues, not some other special capacity of the mind, obviously means that no speaker is able to make intuitive judgements about what is grammatical or not, because intuition doesn't exist. We only judge whether something is grammatical or not just as we only judge what something means in the first place - via inference, using one or more of the three "-ductions" - induction, abduction, or deduction. If I ask you if the following sentences are OK, what is the process by which you answer me?

- (9) John is three years old and is CEO of a major company.
 (10) John are the nicest guy I know.
 (11) Talking about Mary, he is a smart woman.
 (12) Who do you wonder whether saw John?
 (13) Who do you wonder whether John saw?

According to Peirce, again, there is only one answer for any form of reasoning, inference. You (child or adult) know the answer to these questions because you *infer* (however tacitly and quickly) that it is ungrammatical or grammatical, as well as why it is based on its comparison to other sentences, using known signs to infer properties of unknown signs (as we have seen, Peirce demonstrates the vacuity of notions like "intuition" and "introspection," replacing them with inference).

But for Peirce the forms of inference are dependent on his theory of signs, his semeiotic. Simply put, Peirce's semeiotic system differs from all others in its strict triadicity. A sign must have three components (not merely the Saussurian dyadic of form+meaning). These are the Object, Interpretant, and Representamen (the form of the sign). So "apple" has the phonemic form "apple" that varies by dialect and it has as object the red, sweet fruit that we make cider with. But the form and the object can only come together as a sign of some type if they have an interpretant - if they can be interpreted by other signs in the language. In "apple of my eye" the interpretant of apple will be different than in "apple in my eye" and so on. Semeiotic inference uses knowledge of linguistic signs and their arrangement (the arrangement is also a sign) and other forms of knowledge in an inferential process built on cultural learning and semeiotic principles, such as "closeness in function --> closeness in syntax" (known by some as a form of iconicity). Also Peircean semeiotics enables us to see compositionality/inference in the interpretation of iconic signs, such as street signs and so on, without concern for the fact that the signs mix symbols, icons, and indexes at different times.

This inference is distinct in beginning with words and structure and proceeding to context (or the other way around). As we saw, some meanings are thus produced holistically as well as being built up piecemeal by recursive processes, e.g. Merge.

But the examples above from Pirahã and English show us that native speakers cannot derive meanings from naive compositionality or structure-building alone, but also require inference, the ability to interpret context, drawing on reasoning, cultural knowledge, and so on.

5.3. Transitivity, Valency, and the Reduction Theorem

Consider the following examples from English:

It is raining. (monotransitive - no arguments)

I am running. (intransitive - one argument)

He sees you. (transitive - two arguments)

Sheila gave Mary a gift/Sheila gave a gift to Mary. (ditransitive - three arguments)

Peter bet Noam two dollars that it would rain. (tritransitive - four arguments)

There are linguists who believe that such verb-argument combinations represent semantically basic verb types. There is a problem, however. Consider that in tritransitives, an argument can be omitted, but not in the others:

**Running.*

**He sees.*

**Sheila gave a gift*

**Sheila gave Mary.*

Peter bet Noam two dollars.

Peter bet Noam that it would rain.

What is interesting in these examples is that intransitives, transitives, and ditransitives require their full complement of arguments or the sentence is ungrammatical. However, this is not true for tritransitives. While there are linguists who believe that tritransitives do constitute a basic, non-derived semantic type of verb, there are no convincing answers to the paradigm above. If the fourth argument of a tritransitive were basic as the arguments of the other types are, it should not be able to be omitted.

Some linguists have long wondered why three arguments seem to be the maximum number allowed without semantic additions to the verb, e.g. adpositions, causative morphology, and so on. Interestingly, this is exactly what Peirce's theory predicts. Three is the maximum number of basic arguments a verb can have in its lexical meaning, though extra arguments can be added or indicated by prepositions, affixation, or lexical processes (Van Valin 2007). Tritransitive verbs violate Peirce's reduction theorem for valency (the lexically basic semantics of a verb). Peirce introduced the concept of "valency" into linguistics from chemistry (Peirce (1897, 170ff) (this was natural for him, because he came into science through chemistry; he held the first-ever Summa Cum Laude degree in chemistry from Harvard). The only way to produce a tritransitive verb is to superficially increase valency (what we would call today a transitivity alternation) in a deviation from the verb's basic semantics, one argument at a time.

Peirce's thesis is stated by Atkins (see also Burch (2001)) as follows:

"Peirce's reduction thesis—that the basic forms of propositions are three and only three, named firstness, secondness, and thirdness—is a point of scholarly contention, but it is also at the root of Peirce's phenomenology. Peirce came to this thesis through his formal logical notation, the Existential Graphs. Peirce maintains that all n-adic propositional forms where $n > 3$ can be constructed from triadic propositional forms. All n-adic propositional forms where $n > 3$ can be decomposed into triadic propositional forms. Moreover, triadic propositional forms cannot be constructed from dyadic propositional forms, and dyadic propositional forms cannot be constructed from monadic propositional forms. Finally, all triadic propositional forms contain as abstractical logical ingredients dyadic and monadic propositional forms. These four theses, elucidated by his work in graphical logic, entail his reduction thesis."

(<https://oxford.universitypressscholarship.com/view/10.1093/oso/9780190887179.001.0001/oso-9780190887179-chapter-4>)

This is also stated in Atkins (2018, p71)

"(1) All n-adic propositional forms where $n > 3$ are constructable from triadic propositional forms; (2) All n-adic propositional forms where $N > 3$ can be decomposed into triadic propositional forms; (3a) Triadic propositional forms cannot be constructed from monadic propositional forms alone; (3b) Dyadic propositional forms cannot be constructed from monadic propositional forms alone; and (4) All triadic propositional forms contain as abstractable logical ingredients both dyadic and monadic propositional forms. Hence, we may allow our most basic propositional forms to be monads, dyads, and triads and all other propositional forms to be constructable from or decomposable into these forms."²⁷

It is crucial, however, in evaluating Peirce's reduction thesis to draw a strict line between valency (this, appropriately, seems to mean "number of required lexical arguments" for most

linguists) and transitivity (number of arguments of a verb in a sentence). This distinction can be overlooked in casual analyses of languages, by linguists, philosophers, and anthropologists. One superb study of the difference between transitivity and valency is Hopper and Thompson (1980).²⁸

Thomason and Everett (1993) discuss transitivity and valency in Flathead/Montana Salish:

"Flathead, a Salishan language spoken in northwestern Montana, has a verbal system that seems at first glance to distinguish transitive constructions from intransitive ones in a quite straightforward way: transitive verbs have a transitive suffix and a characteristic set of subject and object markers, while intransitive verbs lack the transitive suffix and have a completely different set of subject markers. In addition, the two constructions differ systematically in their marking of adjunct (or argument) noun phrases. Initial appearances are deceiving, however. It turns out that morphologically intransitive verbs can take object noun phrases, and that certain transitive constructions, notably monotontransitive continuatives, lack part of the transitive morphology. The goal of this paper is to explore the morphosyntactic means by which different degrees of transitivity are signalled in Flathead, and to propose an analysis that pulls apparently disparate facts together in a unified way."

As is well-known, transitivity (the number of syntactic arguments) can be reduced or expanded while valency (the number of lexical arguments) is held constant:

John saw Mary = transitive, bivalent

Mary was seen by John = intransitive, bivalent (see Everett (1996) for detailed discussion).

All serious theories of human linguistic capacity address the interrelationship between linguistic form and meaning. This is certainly built into Peircean (and Sausurrean) Semeiotics. But arguably only Peirce in the long history of the study of human language predicts this from the building blocks of his theory, UG.

5.4. Field Research

Peirce's phenomenology captures the task of linguistic field research well. Sakel and Everett (2011) offer a number of suggestions and guidelines for the conduct of linguistic field research. One of the things that we point out is that as the linguist moves from an etic perspective to an emic one, many sounds and structures and meanings in the language under study will go from vague impressions (tones) to clear oppositions (tokens) and finally will be related to particular emic analytical units (types). In Peircean terms we move from firstness to secondness to thirdness in field research. In terms of specific units we notice tones, analyze tokens, and construct types.

Kenneth Pike's (1967) ideas on proceeding from the unknown to the known, while he does not mention Peirce, mirror Peircean ideas. When we arrive in a new field situation, hearing a language for the first time that we do not speak or know anything about, we begin our work with Phonetics (articulatory, acoustic, or auditory), which is the study of speech sounds from the perspective of a non-native speaker, say, a physicist or linguist. But phonetics has already been preceded by vague and unclear perceptions we have of the language before we begin to transcribe or analyze. Once we complete our phonetic analyses and transcriptions, we are in a better position to analyze the Phonemics which is the study of the set of phonetic sounds that native speakers perceive as single sounds, i.e. the sounds that are important from the perspective

of a native speaker, an insider.²⁹ For example, English speakers all hear one sound, /p/ in the words [park], [spark], and [carp], when in fact there are at least three sounds, all written as 'p' in these words, namely, [p], [p^h], and [p̄], respectively.³⁰ Native speakers thus know less *explicitly* about the sounds of their language than they tacitly know about them, since speakers in general never perceive the separate etic sounds but only the single emic sound that an etic sound is associated with. Yet they never confuse etic sounds in use. In just the same way, native speakers know how to use all the etic sounds of their language appropriately, e.g. the three separate manifestations (technically, *allophones*) of /p/ in this example: "Use [p] in syllable-medial positions, [p^h] in (some) syllable-initial positions, and [p̄] in phrase-final position."³¹

It is interesting that Peirce in effect predicts the order of field research in his phenomenological categories. However, to fully utilize his insights, linguists need to be aware not merely of his terms *type* and *token* but also of the etic, preanalytic category, *tones*, that are a crucial part of Peirce's model. And these correspond to Peirce's basic phenomenological categories of firstness (tones), secondness (tokens), and thirdness (types).

5.5. Recursion

In 2002, Marc Hauser, Noam Chomsky, and Tecumseh Fitch (HCF) offered a novel take on what they thought the core nature of language was:

"We submit that a distinction should be made between the faculty of language in the broad sense (FLB) and in the narrow sense (FLN). FLB includes a sensory-motor system, a conceptual-intentional system, and the computational mechanisms for recursion, providing the capacity to generate an infinite range of expressions from a finite set of elements. We hypothesize that FLN only includes recursion and is the only uniquely human component of the faculty of language." (Hauser, Chomsky, and Fitch 2002, p1569)

They discussed their evidence for this claim, which was based on the idea that there is no longest sentence in any language:

"There is no longest sentence (any candidate sentence can be trumped by, for example, embedding it in "Mary thinks that . . ."), and there is no nonarbitrary upper bound to sentence length. In these respects, language is directly analogous to the natural numbers (see below)." (HCF, p1571)

When I later argued (Everett 2005) that the Pirahã language of the Brazilian Amazon lacked recursion in its sentential syntax and that it *did* have a longest sentence, this led to a sixteen-year (and counting) debate. I always claimed that the language did have recursion in its discourses, just not in its sentences. Recently work on the implications of my claim on discourse recursion has shown this idea to have interesting consequences (Maier 2021).³²

Apart from discourse, however, had HCF and Everett (2005) adopted Peirce's perspective on recursion, universally overlooked in form-centered syntax and formal (math-based) syntax, much of this debate could have been avoided. The reason for this is that semiosis, which is as important to the Pirahas as to English-speakers, is inherently recursive. In other words, Peirce already claimed in effect that recursion is the heart of language (because it is the heart of semiosis) and thus that all languages must have recursion, just not necessarily in their sentence structures. In Peirce's system, recursion is found in the interpretant, not the object or representamen (as HCF would have it), that is, in the semantics, since each sign must be interpreted via another sign - a recursive process. There can be, if my work on Piraha is correct (see Futrell, et. al. (2016); Everett and Gibson (2019), etc), languages which have semeiotic recursion and discourse recursion, but which lack sentential recursion.

We can think of the interpretation of signs recursively via the following interpretation rule:

SIGN --> SIGN

One sign will always produce another Sign as its interpretant. This cycle need not go on forever, just as even in Chomsky's systems there are no ten thousand word sentences. We can account for this either by introducing an index to the right of the rule to stop the process at a physical connection to an object or we can simply allow the process to stop due to lack of interest, memory limitations and so on. Logically it need not stop. But in terms of human capacity it will in natural languages.

If Chomsky simply wants to claim that recursion in language is the FLN, there is no problem. Peirce already explained this more than a century ago. But if Chomsky wants to claim that recursion in the syntactic form is what is crucial, that finds neither support in Peirce nor in the facts of natural languages.

One interesting proposal in more recent years within Minimalism is found in Murphy (2015). Although he gives no reference to Peirce, the proposal introduces an element of semeiotics into Chomsky's theory:

"It is shown that the operation Label, not Merge, constitutes the evolutionary novelty which distinguishes human language from non-human computational systems; a proposal lending weight to a Weak Continuity Hypothesis and leading to the formation of what is termed Computational Ethology." (Murphy 2015)

In other words, Murphy is claiming that syntax is not unique to humans but labeling of syntactic nodes is. Thus putting the words "hit" and "John" together in "... hit John" to form a verb phrase is less significant than the label "verb phrase." Other creatures put things together. Only humans label them (i.e. attach symbols to them). Murphy is absolutely correct it seems to me. And absolutely Peircean in his insight, however unknowingly.³³

5.6. Speech Acts and Peirce

Though a full discussion of Peirce's view of speech acts is beyond the scope of this paper, it is worth noting that not only did Peirce anticipate the theory of speech acts, but that is "commitment view" of assertions also prefigures Brandom's (1998) view of inference and responsibility.

"... it is no pragmatic doctrine that responsibility attaches to a concept; but the argument is that the predication of a concept is capable of becoming the subject of responsibility, since it actually does become so in the act of asserting that predication. Thereupon it follows that the concept has a capability of having a bearing on conduct; and this fact will lend it intellectual purport. For it cannot be denied that one, at least, of the functions of intelligence is to adopt conduct so as to subserve desire. If the argument is correct, this applies to any concept whatsoever, unless there be a concept that cannot be predicated." CP 5.477-478, cited in Brock (1981, 324)

"C.S. Peirce held what John MacFarlane (2011) calls a "commitment view" of assertion. According to this type of view, assertion is a kind of act that is determined by its "normative effects": by asserting a proposition one undertakes certain commitments, typically to be able to provide reason to believe what one is asserting. Peirce's most explicit statement of his commitment view of assertion is that when one asserts a proposition one "takes responsibility" for its truth." (Boyd, 2016: 21)

Brandom (1983, 641) discusses assertions in similar words:

"This use suggests taking the commitment involved in asserting to be the undertaking of justificatory responsibility for what is claimed.⁹ In asserting a sentence, one not only licenses further assertions on the part of others, but commits oneself to justifying the original claim."

Unfortunately, Brandom does not cite Peirce in this article nor in his later work, e.g. Brandom 1998. But though Brandom commits the common act of "discovering" a fact that Peirce had already discussed, Peirce's theory still holds the advantage, because Peirce's assertion theory is embedded in a logical theory of semiosis and therefore, stands as part of a larger architectonic, its principal features derived rather than stipulated.

5.7 Peircean Discourse Analysis

The thesis of Longacre (1996,1), *The Grammar of Discourse*, is:

".. language is language only in context. For too long a time, linguistics has confined itself to the study of isolated sentences, either such sentences carefully selected from a corpus or, more often than not, artfully contrived so as to betray no need for further context."

Although much of modern linguistics ignored careful study of discourse until the 1950s (two of the foundational monographs from US scholars are Longacre (1991, but written much earlier and published under a different title) and Grimes 1975), Peirce's pioneering work had already argued that arguments (a form of discourse) were "perfect symbols" which could be analyzed via his system of Existential Graphs (EG). Interestingly, Chomsky has never acknowledged the important differences between discourse and sentences and that a failure to recognize discourses in his theory leaves him with no account of sentences as discourse constituents (which even his advisor Harris had done (Harris 1951).

In more recent years, a new and widely-respected theory of discourse has arisen in some areas of formal linguistics, developed by Hans Kamp and others (Kamp and Reyle 1993) which is, as Sowa (2013) puts it "isomorphic" to EGs (CP 4.347ff; see also Sowa (<http://www.jfsowa.com/peirce/ms514.htm>)). Modern theories of linguistics that focus on sentences seem to have done so via an implicit recognition that the proposition is, as Peirce claimed, essential to understanding speech acts. Sentences are primarily the realization of propositions in linguistic form. Unfortunately, they were never intended by Peirce or any other researcher, until Chomsky, to be the principal focus of linguistic theory to the exclusion of discourse. (Hilpinen (1982) offers an interesting analysis of the proposition in Peircean theory.)

Once again, however, we see that Peirce's theory is superior to modern formal linguistics in not only having a sophisticated theory of discourses, but also embedding the study of discourses and sentences into a larger, comprehensive theory of semeiotics.

5.8. Peirce and Instinct

For Peirce, human "instincts" were derived from "feeding and breeding." (CP 1.118)³⁴

When Chomsky refers to abduction as "instinctive," he naturally interprets "instinct" as he uses it in his theory, which is an innate predisposition or knowledge. However, it is anachronistic to think that this is all Peirce could have meant by the term. Clearly Peirce did believe that innate knowledge in humans is plausible and likely. But in a survey of all occurrences of "instinct" in the *Collected Papers*, there are many references that are best interpreted as cultural or another form of acquired, not innate knowledge, along the lines of what

I refer to as "dark matter of the mind" in Everett (2017). Here are a couple of Peircean quotes on instinct:

"... the study of animal and *vegetable* [emphasis mine, DLE] instinct (both of which, especially the latter throw much light on man's nature)." CP 1.266

In discussing the role of instinct in understanding the temporal relationships implied by logical relationships (CP 1.496) Peirce says that this "... instinct may, therefore, be presumed to be an obscure perception that temporal succession is a mirror of, or framework for, logical sequence." But when Peirce here uses "obscure perception" he is not claiming that this ability is of necessity innate conceptual knowledge, but that we have an innate ability to perceive types of relations (similar to Everett 2016's interpretation of instinct as "dark matter"). This is crucial because in Chomsky's theory instinct usually refers to innate conceptual knowledge (this is also the meaning of instinct/"core knowledge" that is found in Elizabeth Spelke's work (Spelke and Kinzler (2007))).

There is simply no unambiguous support in Peirce's work for the "instinct" that Chomsky uses and attributes to Peirce. Nor for Spelke's core knowledge (which goes against the definition of knowledge in pragmatism and Brandom (1998), among others, with no justification offered in Spelke's work). Moreover, Chomsky also misses the range of meanings associated with Peirce's use of the word "instinct," in his discussion reviewed earlier. Peirce nowhere made any statements that could be construed in modern terms as a "theory construction module of the brain."

What Peirce said is that our guessing is not random and that this could be guided by instinct of some form, which in his writings could be either biological or cultural. The most one can get out of this is that children have a type of solution space - either through biology or experience in language and culture - for making guesses that are "wrong most of the time [according to Peirce]." There is thus no support in Peirce for anything but the fact that children will somehow guess at what sentences mean and how they are structured. Which of course we all know. They learn by bits and pieces, not innate theories. (I believe this latter idea would have appalled Peirce.)

In his discussions of Peirce, Chomsky simply did not spend the time necessary to actually understand Peirce or Descartes or the Port Royal Grammarians, etc. In his "history of philosophy" work, he cherry-picks. And the result can be misleading, as it is above.

Examples of how "instinct" can be abused is found in often anachronistic expositions of other philosophers, e.g. Hume, who gave as an example of a "blind and powerful instinct of nature" that we see external objects and not images. But Piaget argued that in the sensorimotor stage infants' major accomplishment is the recognition of the separateness and permanence of objects. Idealism has a problem with bumping into things. So it is not clear, superficially at least, what Hume means with this phrase. More to the point, what could Hume have meant by "instinct" in an age before genetics and theories of hereditability? He could have meant an unlearned categorization process. He could have meant unlearned conceptual knowledge (which is self-contradictory, contra Spelke). Or he could have meant tacit knowledge, regardless of the source (since "nature" can refer to experience as much as the a priori). My reading of Hume indicates that the word in his writings was vague and ambiguous in the ways just described and that it should not be appropriated qua term to support theories of nativism. It seems to have generally meant nothing more than tacit knowledge.

5.9. Linguistic Relativity and Peirce

Since Sapir and earlier the idea that language influences our thinking has been explored and discussed heatedly by linguists (for a historical review of linguistic relativity and very careful, detailed discussion, see C. Everett (2016)).

Again, though, Peirce was there at the beginning. For Peirce, since language is a semeiotic system and since all thinking is in signs, language could not be secondary to cognition, nor could words be secondary to, or otherwise independent from, the ideas which they express. As Peirce puts it, “it is wrong to say that a good language is important to good thought, merely; for it is the essence of it” (CP 2.220).

5.10. Peirce, Language, and the Brain

Consider the following remarks by Fedorenko et. al. (2020):

"To understand what you are reading now, your mind retrieves the meanings of words and constructions from a linguistic knowledge store (lexico-semantic processing) and identifies the relationships among them to construct a complex meaning (syntactic or combinatorial processing). Do these two sets of processes rely on distinct, specialized mechanisms or, rather, share a common pool of resources? Linguistic theorizing, empirical evidence from language acquisition and processing, and computational modeling have jointly painted a picture whereby lexico-semantic and syntactic processing are deeply inter-connected and perhaps not separable. In contrast, many current proposals of the neural architecture of language continue to endorse a view whereby certain brain regions selectively support syntactic/combinatorial processing, although the locus of such “syntactic hub”, and its nature, vary across proposals. Here, we searched for selectivity for syntactic over lexico-semantic processing using a powerful individual-subjects fMRI approach across three sentence comprehension paradigms that have been used in prior work to argue for such selectivity: responses to lexico-semantic vs. morpho-syntactic violations (Experiment 1); recovery from neural suppression across pairs of sentences differing in only lexical items vs. only syntactic structure (Experiment 2); and same/different meaning judgments on such sentence pairs (Experiment 3). Across experiments, both lexico-semantic and syntactic conditions elicited robust responses throughout the left fronto-temporal language network. Critically, however, no regions were more strongly engaged by syntactic than lexico-semantic processing, although some regions showed the opposite pattern. Thus, contra many current proposals of the neural architecture of language, syntactic/combinatorial processing is not separable from lexico-semantic processing at the level of brain regions—or even voxel subsets—within the language network, in line with strong integration between these two processes that has been consistently observed in behavioral and computational language research. The results further suggest that the language network may be generally more strongly concerned with meaning than syntactic form, in line with the primary function of language—to share meanings across minds."

What Ev Fedorenko has been finding in her lab at MIT's Brain and Cognitive Sciences Department over the years is that syntax seems secondary to meaning - to constructions and words. This makes perfect sense from a Peircean perspective because in Peirce's Universal Grammar, the purpose of the grammar is not to produce syntactic structures per se but to support the interpretation of symbols (e.g. words and constructions). The neurolinguistics of language is thus offering preliminary support for the superiority of the predictions of a Peircean Universal

Grammar over a Chomskyan Universal Grammar (or indeed almost any theory that takes lexical meaning as basic and syntax as derivative).

In other words, in my interpretation, Fedorenko's research shows that the brain network is a set of connections in which the principal functional nodes are symbols, not syntactic rules. This is worth exploring further from a semeiotic perspective, but for now it is evidence that Peirce's theory appears to predict the findings of Fedorenko's lab about language and the brain.

5.11. Peirce, Chomsky, and Language Evolution

In Everett (2017) I argue that proposals on the evolution of human language often fail to see evidence for language in the archaeological record because they are looking for the wrong things. Thus most archaeologists are willing to count paintings, decorative ornaments, and so on as evidence for "symbolic thinking" because they fit popular understandings of the growth of culture and thought. But few studies make use of Peirce's semeiotics in their analyses of the archaeological record.

Barham and Everett (2021, 1) argue that:

"... the origins of language can be detected one million years ago, if not earlier, in the archaeological record of Homo erectus. This controversial claim is based on a broad theoretical and evidential foundation with language defined as communication based on symbols rather than grammar. Peirce's theory of signs (semeiotics) underpins our analysis with its progression of signs (icon, index and symbol) used to identify artefact forms operating at the level of symbols. We draw on generalisations about the multiple social roles of technology in pre-industrial societies and on the contexts tool-use among non-human primates to argue for a deep evolutionary foundation for hominin symbol use. We conclude that symbol-based language is expressed materially in arbitrary social conventions that permeate the technologies of Homo erectus and its descendants, and in the extended planning involved in the caching of tools and in the early settlement of island Southeast Asia."

When we look exclusively for behavior reminiscent of modern Homo sapiens as evidence for the appearance of human language, rather than evidence for a full range of signs, especially symbols, we fail to understand the sophisticated behavior (boat-building, settlement divisions, tool refinement, and so on) characteristic of Homo erectus and dependent on the possession of language. Everett (2017) and Barham and Everett (2021) both argue that Homo erectus had language and that language, based on field studies of modern languages by Everett and others, need not conform to the grammar-bias of the Chomskyan Universal Grammar because language is fully expressive so long as it has symbols and a grammar just good enough to express them (a purely linear grammar suffices).

Moreover, because Peircean Universal Grammar also applies to the signs used by non-humans, the gap between human language and non-human communication is smaller than it is in the biological model of UG (which must produce a recursive grammar from nothing, via some sort of genetic saltation) and it is thus easier to comprehend that while other primates use icons and indexes (perhaps also the occasional symbol), humans (all members of the genus Homo) have fully expressive language as soon as they are able to create symbols (culturally) without a priori limits. Thus the Peircean view of Universal Grammar, among its many advantages, also provides a richer potential explanation for the evolution of language.

6 . Peirce and the mathematical foundations of modern linguistics.

Tomalin (2006) provides an overview of the influence of the "formal sciences" (mathematics, logic, computer science, and the like) on the development of modern formal linguistics, an outgrowth of the pioneering work of Noam Chomsky and others. It is often and incorrectly assumed that formal theoretical research on human languages began with Chomsky. As Robert Lees erroneously states in his well-known 1957 review of Chomsky's first published book, *Syntactic Structures*:

"Chomsky's book on syntactic structures is one of the first serious attempts on the part of a linguist to construct within the tradition of scientific theory-construction a comprehensive theory of language which may be understood in the same sense that a chemical, biological theory is ordinarily understood by experts in those fields..." (Lees 1957: 377-378)³⁵

Lees ignores Peirce's well-worked out and much more formal theory of words, propositions, and discourse (in his EGs), which together provide a comprehensive theory of language.

Tomalin's book, while well-written, knowledgeable, and highly informative nonetheless commits major errors of omission regarding the history of the study of language, the history of the formal sciences, and the history of the classification and purposes of scientific theory. Peirce is a major, perhaps the most important, figure in the history of all of these ideas and is not mentioned by Tomalin.

The formal study of language began no later than Peirce's theory of signs (with honorable mention to Panini (Kumar 2017)), continued into his discussions of UG (1865), was developed in more detail in his *Speculative Grammar* (Bellucci 2018), and reached its pinnacle, never surpassed for most of the intervening 120 or so years, in Peirce's *Existential Graphs*.

Tomalin's review of the history of the formal sciences focuses on mathematics, explaining how it was foundational for formal linguistics. Yet there are surprising misses in his history. For example, he talks about Whitehead, Russell, Frege, Peano, and Schroeder, inter alia, but fails to catch the fact that behind all of these figures except Frege stood Peirce, who influenced them all profoundly. Thus, Tomalin attributes great significance to Whitehead and Russell's *Principia Mathematica* (PM) and its setting an agenda which came to influence formal sciences directly and formal linguistics indirectly. But this fails to account for Peirce's influence throughout PM. For example, although Russell and Whitehead give credit to Frege for the invention of formal logic, they use Peirce's ideas and notations (via Peirce directly (Peire and Whitehead paper) as well as indirectly from Peano and Schroeder (Putnam (1982); Eisele (1976)

7. Summary - Signs, Form, Meaning, and Cognition

Semeiotics studies the ways that meaning can be communicated (encoded and decoded). This interpretation of semeiotics is not limited to human language since meanings are encoded and decoded throughout the universe, as Peirce argued. In this sense human languages are but one system in the universal communication of meaning and linguistics as a science is a branch of semeiotics. On the other hand, many linguists would argue to the contrary that linguistics, far from being a subdiscipline of semeiotics is a completely independent entity, because it is governed by different principles and because language emerged from a different evolutionary trajectory than semeiotics. To these researchers, semeiotics connects with linguistics from time-to-time, but it is a distinct discipline.

Chomsky has argued for over sixty years that the best theory of language takes form to be the principal explanandum and that the explananda are independent of meaning. (Hence one sense

of the label "formal linguistics," i.e. "centered on form;" though most agree that the central definition of formal linguistics is "based on mathematical formalisms," a task which occupied much of Peirce's energy during his entire life). Additionally, there is, as of Chomsky's work in the 21st century, just one faculty that is crucial to having language, recursion. Not meaning. Not symbols. Not nouns. Not verbs. Just recursion. Therefore any discussion of the relationship between Peirce's work and modern formal linguistics must discuss the opposing theses about what is central to human language, symbols or grammar.

According to Tomalin (2006) Chomsky has been keenly interested in recursion's role in grammar at least since his interactions with Yehoshua Bar-Hillel in 1950. But Peircean recursion is much older, applicable throughout semeiotics (not merely language), and, arguably, more rigorous in its theoretical development and presentation.

What follows are just a few of the points we have seen above in which Peirce's UG appears to enjoy advantages over Chomsky's:³⁶

1. Data are selected and evaluated based on intuition, or what Michael Devitt refers to as the "Voice of Competence," for Chomsky. All interpretation and learning are inferential semeiotics for Peirce. And inference generalizes more and fits cognitive science better than separate categories of intuition, which does not stand up to Peircean analysis.

2. Form, not meaning, is central to linguistic analysis and understanding for Chomsky.

3. Universal structural principles in Chomsky's theories are biological in nature, but logical in nature for Peirce. This extends the empirical reach of Peirce's beyond human cognition and communication in necessary ways.

4. For Peirce discourse, arguments, and propositions (sentences) can be recursive, but need not be. Since recursion is semeiotic rather than syntactic, Peirce has ready analyses for languages like Pirahã, though there is no unproblematic analysis in Chomskyan theory.

5. Peirce predicts semeiotic storage in the brain, whether specifically symbolic or, potentially with images, and this is supported by Fedorenko's "language network" in the brain.

6. Peirce captures similarities between human and non-human communication but most theories of linguistics, especially those that attribute linguistic principles to biology rather than logic or function cannot.

8. Conclusion: Peirce and the Nature of Cognition

One thing that emerges from detailed examination of Peirce's work is that it underlies a good deal of work in modern linguistics and that the latter would profit from a deeper understanding of the ideas that it has used so widely, an understanding that requires a return to Peirce's own writings. Peirce's own work on evaluating theories is found in two important theses (Atkins 2018, p33):

Function Thesis: The function of conceptions is to reduce sense impressions to a unity.

Validity Thesis: A conception is valid just in case we cannot reduce the content of consciousness to unity without it.

The idea that all humans are born with an innate UG. UG clearly satisfies the Function Thesis because its purpose is to unify many observations about humans' linguistic behavior under a single concept. But does UG satisfy the Validity Thesis? Is it crucial to understand humans' use and reducing all the observations about human language behavior to unity?

If the answer is yes, UG stands as a valid concept. If no, it does not. These theses apply to any concept, e.g. linguistic rules, religious beliefs, electronic components, Homo erectus tools,

and so on. The purpose of our reasoning is in part to deal with the phaneron - our conscious and unconscious experiences. Thus Peirce's phaneroscopy not only provides the best model for evaluating the simplicity of theories, focusing on the semantics rather than the syntax of theories, but it also contributes to our understanding of individual inferential operations. A child learning their first language, for example, can be expected to regularly winnow their inferential conclusions, e.g. rules of grammar learned, in light of the prerequisites of the Function and Validity Theses. These theses do not fall exclusively within the domain of philosophers but desirable for successful reason in science and daily life. Human reasoning must succeed by and large or we would go extinct.

By selecting its particular philosophies and objectives, any science's course of research is set for the future. This is what I call the "gyroscope issue." Two theories beginning with slightly different assumptions and goals will eventually be separated by large empirical and conceptual differences. And the wider the divergence in the initial settings of their gyroscopes, the greater the distance between the theories as time progresses. Their gyroscopes are leading them apart because they are set for different stars. We see this today in the contrast between Peirce's theory and Chomsky's, as representative of much of modern linguistics.

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Notes

¹ Peirce also said that:

"...it will be necessary, first of all, to study those properties of beliefs which belong to them as beliefs, irrespective of their stability. This will amount to what Duns Scotus called speculative grammar.¹ ... it must analyse an assertion into its essential elements, independently of the structure of the language in which it may happen to be expressed. It will also divide assertions into categories according to their essential differences..." CP 3.430

"... as long ago as 1867 I spoke of a trivium of formal sciences of symbols in general. "The first," I said, "would treat of the formal conditions of symbols having meaning, and this might be called formal grammar; the second, logic, would treat of the formal conditions of the truth of symbols; and the third would treat of the formal conditions of the force of symbols, or their power of appealing to a mind, and this might be called formal rhetoric (4.116)."¹

² In Everett (in progress), I am developing a much more detailed exposition of Peirce's relevance to modern linguistics.

³ There is no attempt in this review to offer an au courant introduction to Chomsky's work, though the basic concepts addressed continue to be relevant.

⁴ 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 chronological edition of his papers, published by Indiana University Press, are referred to by W + volume number + page number.

⁵ These issues are all discussed in more detail in Everett (in progress).

⁶ Saussure (1959) divided the study of language into two parts, parole and langue, where the latter is a social concept/application of the mental component/knowledge of language. Sapir placed psychology and linguistics both in anthropology. As we will see, Peirce's view separates out the logical components of sign representations usually located in linguistics and moves them into logic. The study of actual languages and their variation he considers to be a separate field. On the other hand languages are constrained by the logic of his UG, though his notion places these constraints outside of the nature-nurture debate.

⁷ 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 semeiotic systems, subject to the logical constraints of UG (discussed in more detail in Everett (in progress)).

⁸ Pike's theory treats all human behavior, including language, as a kind of semiosis (though Pike does not use this term) in which watching a football game or speaking a sentence can both be broken down into "-emes" (e.g. phonemes and behavioremes) which include form, meaning, and referential link to object.

⁹ The next several paragraphs on bees paraphrase Everett (2019).

¹⁰ For an introduction to Peirce's semeiotics, see Short (2007).

¹¹ My assertion that animals do not use symbols so far as we know might seem strange to some. So take a common example purportedly showing symbol use by animals in the wild, meerkat calls, these seem to fit the semeiotic definition of indexes (but also show reasoning). (Townsend, et. al. 2012).

¹² In Everett (forthcoming) I argue that 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.

¹³ S(ign) --> S (one sign is interpreted by another)

¹⁴ This is quite different from the Chomskyan analytic strategy known as "pro-drop" (Chomsky 1981), in which a missing pronoun is only missing in the phonology, but present in the syntax. This is analyzed as a "parameter" in Chomsky's theory. For example, Portuguese has the pro-drop (pronominal dropping) parameter, while English does not:

Está chovendo 'It is raining'

It is raining vs. **Is raining*

The Portuguese example is fine, because it is pro-drop, so it does not require a subject. But the English example is ungrammatical because it does require subjects. Peirce might simply have said that the subject is known from the verb inflection in Portuguese, but cannot be so recovered from the much more impoverished verb conjugations of English. In any case, Peirce was aware of such examples and took them quite seriously.

¹⁵ Harris's transformations would simply state the relationship between, say, *John saw Mary* and *Mary was seen by John* is a discourse relationship, where a proposition has more than one possible form to better fit discourse structure. In this case, if we want "John" as the topic, we choose the active "transform" (or "allosentence" in some theories) and if we want "Mary" as topic, we choose the passive.

¹⁶ It should be noted that hypostatic abstraction in itself, however important as a mental operation, is not a major grammatical operation or device in most of the world's languages.

¹⁷ 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 - it is not sufficiently worked out to include much detail here.

¹⁸ Moreover, Chomsky has never had a single theory last more than a few years. His most recent program, Minimalism, he has been careful to call a program rather than a theory. One could respond that advocacy for a biological Universal Grammar just is Chomsky's theory, but as the debate over recursion has shown, there is little if any substance (or science) to his UG. It is not recursion (Everett 2005; 2017; among many others), but that is what he claims it is, depending on how one construes his phrase "Narrow Faculty of Language."

¹⁹ It is also in harmony with Antoine Meillet who, in his *Introduction à l'étude comparative des langues indo-européennes* (1903: p. 407) wrote "que chaque langue forme un système on tout se tient."

²⁰ 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.

²¹ 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 desirable for theories in which the principal causative power lies in meaning rather than form.

²² 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."

²³ 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.

²⁴ Harman (1973) argues, as Peirce would, that inferences can be fast, instantaneous perhaps, and need not be conscious.

²⁵ By the expression "modulo culture" I mean that cultures have different rankings of time values and their relevance (see Everett 2017). Thus their understandings of what a "long" time or a "distant" time will vary, among other aspects of the mapping between temporal ontology and linguistic meaning.

²⁶ Compositionality might seem to be un-inference like to some, since it appears to be read off the structures of the sentences or other units it is assembling for semantic interpretation. However, all inference is sensitive to certain types of data. Compositionality can be thought of then as that form of inference that interprets signs as they are assembled by the grammar, but which is not necessarily monotonic - it can be overridden by new contextual information. So it infers from syntactic structures, but as a part of the more general forms of inference we have been discussing, since it can be overridden by contextual features, real-world knowledge and so on. Calling the form-based inference "compositionality" and the contextual inference "pragmatics" obscures the fact that both are forms of inference that use the same processes of abduction, deduction, and induction, though their inputs might begin differently (one with words and structure-building, the other with extra-linguistic context, but both -ductions that are underlyingly the same process).

²⁷ From this Atkins goes on (72ff) to derive Peirce's phenomenology (phaneroscopy) of "firstness, secondness, and thirdness." Atkins (p60ff) argues that the reduction thesis is closely related to Peirce's Existential Graphs: "These discoveries were made possible by - and arguably only make sense in the context of - Peirce's Existential Graphs." (p72).

²⁸ This issue of tritransitives is further discussed competently in this piece written for a general audience: <https://slate.com/human-interest/2014/04/does-english-have-any-tritransitive-verbs.html>

²⁹ These are both idealizations. Our understanding of "phonetics" seen, for example, in something so erstwhile objective or etic as the International Phonetic Alphabet, is shaped by our emic perspectives and most etic categories are already idealized in cultural ways. So there is no truly objective vantage point, just ones less contaminated in ways we know of.

³⁰ The standard convention in linguistics is that //s are used to enclose phonemic sounds and []s to enclose phonetic sounds.

³¹ For Generative Phonology, phonemics is not a theoretically recognized level of analysis. Nothing hangs on this debate here, however. So where I have written "phonemics" one can read "phonology" without any change in intended meaning.

³² Maier states:

"This paper explores the relation between the syntax of clausal embedding and the ability to represent what others are saying, thinking etc.. I'm using the Pirahã controversy as a lens through which to study this relationship because, supposedly, the Pirahã language has no clausal embedding and hence no analogue of English indirect discourse ('Katy

said/thought/dreamed that she was rich'). I first show how hearsay evidentiality and direct quotation, both of which are attested in Pirahã, differ semantically from each other and from indirect discourse. However, together, these two arguably embedding-free report strategies could cover two of the most common uses of indirect discourse in English, viz. efficient communication that keeps track of speaker's evidential sources through a not-at-issue information channel, and vivid description of speech and thought in narratives. I also argue that reporting in general is best understood as a discourse phenomenon, only optionally encoded in the grammar. Spelling this out in a formally explicit and independently motivated general model of discourse structure and coherence relations (including a non-veridical relation of Attribution) we actually derive Dan Everett's own diagnosis of the situation, viz. that "there can be recursive discourses in the absence of recursive sentences.""

³³ We might call this "Semeiotic Minimalism" in which, in accordance with Peirce, semeiotics is basic, grammar is secondary, though I realize this is not at all what Murphy intends.

³⁴ I would have preferred the alliterative "fucking and feeding," but that would have been even more offensive in Peirce's day.

³⁵ Lees was Chomsky's PhD student. It is questionable whether publishing such a review is even in good taste, given the personal connection.

³⁶ The principal developers of Construction Grammar were the late Charles Fillmore and his colleague at the University of California at Berkeley, Paul Kay. Currently among the many names associated with this theory perhaps the two most prominent are that of Adele Goldberg (Princeton) and William Croft (University of New Mexico).