FREGE'S ERROR?
COMPOSITIONALITY, INFERENCE, AND FINAL CAUSES

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"Inferring is a kind of doing ... The status of inference as something that be done accordingly holds out the promise of securing an appropriate relation between pragmatics, the study of the practices, and semantics, the study of the corresponding contents." Brandom 1994, 91

"... [rules of inference] are essential a matter of social interaction..." Peregrin 2009, 157

Abstract

This paper argues that compositionality is a form of inference that needs to be embedded into a larger theory of inference, e.g. Peirce's triadic theory (abduction, induction, deduction). Otherwise Fregean compositionality is not only insufficient but misleading, creating artificial problems (e.g. Pseudogapping, Antecedent-Contained Deletion, Sluicing and other pseudoissues). The paper also makes a case that the fixation on propositions/sentences as the beginning point of linguistic analyses misses significant generalizations about human languages. It is also argued here that Peircean semeiotically-based inference theory and Peirce's Existential Graphs provide much simpler and more useful theories of meaning-form correspondence, by analysing linguistic forms as "anchors" for inference and restricting inferential space. The paper also claims that the final causes (in the Aristotelian sense) relevant to modern linguistics are sentence structures and meanings (for Frege and Chomsky), unlearnability (Chomsky), and the logic of discourse (Peirce).

1. Introduction
1.1. Frege vs. Peirce

Gottlob Frege (1848-1925) is a towering figure in logic, mathematics, philosophy of language, linguistics, and other disciplines. Charles Sanders-Santiago Peirce (1839-1914) is also a major figure in those same disciplines, as well as physics, astronomy, chemistry, and other fields.[1]

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[1] Peirce added Santiago to his name unofficially during his career, perhaps to honor William James. Some believe that this was after William James began to support Peirce financially, after Peirce's move to Milford, PA. But archives of the British Museum show Peirce's signature in the Reading Room as Charles Santiago Peirce, during a trip to Europe before Peirce had lost his employment or moved to Milford.

Our purpose in what follows is evaluate the widespread linguistic and philosophical concept of Compositionality introduced by Frege in the latter half of the nineteenth century and compare and contrast this, also known as "Frege's Principle," with Peirce's triadic concept of inference, as deduction, induction, and abduction.[2]

Compositionality, as stated by Szabó (2000, 3) is the idea that: "the meaning of a complex expression is determined by meanings of its constituents and by its structure."[3],[4] Within this concept there lurk subconcepts. For example, the SEP entry on compositionality also includes Frege's idea of context-dependence of meanings: "In section 60 of the *Foundations of Arithmetic* (1884) Frege famously declares that only within a complete sentence do words have meaning. This has come to be referred to in the literature as Frege's *context principle*. Frege writes that "it is enough if the sentence as whole has meaning; thereby also its parts obtain their meanings" (Frege [1884] 1950: section 60). On the face of it, this asserts that words have their meanings in virtue of the meaning of sentences in which they occur as constituents. ..."

Among the advantages of compositionality theory it is often claimed is that this Fregean principle can explain the productivity and systematicity of natural languages: "the possibility of our understanding sentences which we have never heard before rests evidently on this, that we can construct the sense of a sentence out of parts that correspond to words. (Frege [c. 1914] 1980: 79)"[5] (Szabo 2022, 26) In other words, Compositionality is the key to understanding individual word meanings, sentence meanings, and the relationship of grammatical structure to meanings more generally.

However, in what follows, I argue that compositionality does not offer a solution for many problems in linguistics that Peirce's inferentialism handles easily. I argue as well that compositionality itself is a subtype of deductive or inductive inference (top-down vs. bottom-up or parsing vs. production models of language). But the inference of

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[2] Deduction and Induction may be interpreted here as classically understood. Abduction on the other hand is not to be understood as has become popular through the work of Gilbert Harman as "inference to the best explanation." That is about conclusions. But for Peirce abduction was hypothesis, about beginning a search for a solution. This is a crucial difference. Inference to be best explanation is a matter of induction and deduction for Peirce, not abduction.

[3] See Pietarinen (2005) for a different view.

[4] Montague (1970) formalized Frege's Compositionality in a way that has been widely used in philosophy and linguistics: " Let us think of the expressions of a language as a set upon which a number of operations (syntactic rules) are defined. Let us require that syntactic rules always apply to a fixed number of expressions and yield a single expression, and let us allow that syntactic rules be undefined for certain expressions. So, a *syntactic algebra* is a partial algebra E=⟨E,(Fγ)γ∈Γ⟩, where *E* is the set of (simple and complex) expressions and every Fγ is a partial syntactic operation on *E* with a fixed arity. The syntactic algebra is interpreted through a meaning-assignment *m*, a function from *E* to *M*, the set of available meanings for the expressions of *E*.

Consider now *F*, a *k*-ary syntactic operation on *E*. *m* is *F*-compositional just in case there is a *k*-ary partial function *G* on *M* such that whenever F(e1,...,ek) is defined,
m(F(e1,...,ek))=G(m(e1),...,m(ek)).
(In English: there is a partial function *G* from the meanings of e1,...,ek to the meaning of the expression built from e1,...,ek through an application of the syntactic rule *F*.)"

[5] Szabó (2022, 26) also notes that "Occasionally, the fact that natural languages are *learnable* is also used to argue for compositionality."

compositionality is insufficient to capture the full range of sentence meanings. For this we need also abduction, which takes in context (linguistic, cultural, psychological, etc.) as well as whole linguistic units (sentences, discourses, etc.)

As Szabo puts it, "...the arguments in favor of compositionality tend to be based on general considerations about linguistic understanding—which, I shall suppose amounts to nothing more or less than understanding what linguistic expressions mean..." SEP "Compositionality" p1

Most semanticists recognize, however, that Compositionality requires a bifurcation of domains of study in linguistics into semantics (the domain of compositionality) and pragmatics, the domain of usage constraints. But if the type of inferentialism I appeal to in this paper is correct, all meaning is usage-based and all is inferential.

Perhaps no philosopher or logician has developed a theory of inference of more relevance to modern problems and theories of meaning than Peirce. Peirce's originality and continuing relevance to linguistics, mathematical logic, and many other fields can best be appreciated, but then only partially, by comparing and contrasting his work to his, perhaps, more influential contemporary in these areas, Gottlob Frege.

In this chapter, there are some detours from discussion of compositionality philosophically to a discussion of meaning and its relation to syntactic structures in linguistics more generally. These detours can be long (and hard to follow for nonlinguists), but I believe they are necessary to understand both the originality and the continued importance of Peirce to modern science and philosophy, as well as the intellectually important contrasts between his work and Frege's, in particular in those areas where I believe Peirce's theory is superior, i.e. interpretation of natural languages.

The thesis of the paper is that inference obviates the need for compositionality and that the semantics-pragmatics divide that compositionality requires is unnecessary.[6]

1.2. The nature of communication

To better understand the issue of meaning and communication, it is worth beginning by asking "What is it that we do when we communicate with one another?" To answer this in part consider the following example. In 1976 I visited the town of Mitla, in the state of Oaxaca, Mexico. We were there to spend the summer working with SIL International. On our first day, we needed groceries. So we went to the local open-air market. The vendors spoke Spanish, though their native language was the local dialect of Zapotec. My Spanish was pretty rough and my Zapotec non-existent. I could only walk up to a stand and point at what I wanted. The vendor would pick up what I pointed to and place it on the scale or the counter, depending on whether it needed to be weighed or not. I recognized what a scale was and what a counter was for, so I followed their actions with comprehension (at least I thought I did and the successful conclusion of our transaction indicated to me that I was correct). Then I would point to other things I wanted. I pulled out my wallet. The vendor wrote a number down. That is the amount I paid in pesos. Easy, right? Yes, but think of all that went into that inferentially. First we

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[6] I will not be discussing various proposals on inference that deserve to be treated in this context, e.g. Relevance Theory, Role and Reference Grammar linking rules, or Gricean implicatures. But these are all addressed in Everett (in preparation).

shared a common cultural-semeiotic scheme of "market transaction." I had never been to this market. This vendor had never seen me before, though she had likely seen plenty of other "gringos."

When I pointed the vendor inferred that I was interested in what I was indicating with the (indexical legisign) pointing gesture. I inferred that the vendor sold by weight, which is why they placed the item on the scale. Next the vendor inferred from me holding up my wallet that I was ready to pay. She wrote down the number. I inferred that these symbols indicated what I had to pay.

What just happened? In Peircean terms, your pointing and looking were indexes. Your money was a symbol. The shopkeeper's actions interpreted these signs: indexes and symbol of exchange value. Moreover you yourself are an icon of the people you come from - whether African-American, or Anglo-American. No language was used. No words. Your speaking in an unknown language produces an icon of the shop-keepers' language and this icon underscores to them that you are a fellow language possessor - even though what are words to you are not words to others.[7]

Are there lessons in such an exchange for the understanding of human language? Perhaps this is, after all, nothing more than an ad hoc strategy for dealing with the absence of language? Yet notice that language and meaning are inescapably present. There are the native languages of the shop-owner and the customer, even though they are here only icons of languages to their hearers. There is a shared shop-purchase-exchange cultural template that people in the world (though to be sure not the Amazonian hunter-gatherers I have worked with) share. Each reasons using signs of their own language, but in the knowledge that their languages are not shared in this particular environment, both interlocutors resort to nonlinguistic, culturally shared signs, indexes and icons especially. They assume that these signs are universal.

This is a proof-example of the claim that grammar and compositionality are not necessary for either communication or thought. Indeed, market examples raise several interesting questions. They also illustrate our power of inference. Questions that arise with regard to inference in contrasting Peirce's vs. Frege's theories of linguistic meaning are (i) is inference is dependent on language, (ii) is it essential for language; (iii) is it unique to humans; (iv) if inference is recognized as essential in language, can it do multiple duties at once, eliminating the need for puportedly specialized linguistic-theoretical concepts. Communication is accomplished only via inference from one sign to another however. One cannot infer a painting from a blank canvas. Signs supply the paint.

These types of nonverbal exchanges like the above are not heavily symbol-dependent (money is symbolic so the exchange above was also not symbol-free). In other words, although they can use signs, including symbols, e.g. money and pointing, even when otherwise monolingual, often people do not use symbols per se because they are culturally-created, just as language is (Everett 2012; 2016; 2017) and so are shared *within* rather than across cultures (there are often counterexamples because, as I argue in Everett (2016) cultures are not monolithic and many aspects of cultures belong to various cultures

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[7] I have given several demonstrations on how to do this over the years, called "monolingual demonstrations." One of the most viewed was at the 2013 Linguistic Society of America's summer meetings at the University of Michigan, which may be viewed here: https://www.youtube.com/watch?v=sYpWp7g7XWU

simultaneously). However, market exchanges like this one do create one type of symbol, propositions, as they go, even without a language in common. For example, if I point at a head of lettuce in the market, my intention is to communicate the proposition that "I want that." It can be true or false. If the vendor offers an apple instead, they have misinterpreted my meaning. They have inferred incorrectly by giving me the wrong item. It is not true that I want an apple. Or perhaps I didn't really want anything, I was just trying to see what the vendor would pick up.

But this doesn't prove anything about language, surely, since language is more than a random collection of signs. Language requires at least one other component that, for many linguists, is not only crucial to language, but even more central than signs, i.e. grammar. And this component of language is crucial for Frege and his followers. Although grammar is also important to Peirce, it is not the same type of grammar that Frege develops. Whereas Frege's grammar is closer to the ordinary language understanding of grammar, and that of many linguists, Frege's concept is little more than the idea that there are propositions manifested as sentences, which are built from phrases, which are built from words. Meaning, for Frege, emerges from this process of combination, a process he discusses and that has subsequently been labled "compositionality" (see Thomason and Szabó 2018; Szabó 2015, inter alia) Peirce's concept, on the other hand, is that there are logical constraints on how symbols can be combined and interpreted, chief among which is inference (abduction, deduction, induction).

But our market exchange has no *linguistic* grammar in it (there is some structuring of signs via the ordering of events which are surely related to grammar). That is, there are no phrases, no sentences, or other overt components of sign-organization common to natural languages. Thus, at one level a linguistic grammar is not essential to communication. But we already knew this looking at animal communication - animals communicate effectively for their survival without need of grammar in this sense (no lexemes, sentences, phrases, discourses, inference across sentence boundaries, quantifier-variable binding, etc). But according to Peirce, on the other hand, there is a type of grammar that underlies even market-communication, namely, Speculative Grammar (Bellucci (2017)), which tells us how to combine signs and interpret them. The structure of the proposition is a matter for this Speculative Grammar. The distinction between types of signs, as we saw in the previous chapter, is also governed by Speculative Grammar.

2. Bloomfield, Meaning, and Semiotics

Of course a semeiotic theory of language must eventually elucidate the relationship between Speculative Grammar and linguistic grammars. The former according to Peirce, as discussed in the previous chapter, is "normative" (telling us how signs *should* be organized) while the latter is classificatory (again, according to Peirce).

Peirce's semeiotic theory explains how inference enables us to meaning from the world. This may not be the most important question our species has ever asked, but the activity itself - understanding what is around us, what we hear, what we see, and the people in our lives - is the most important activity any of us will ever engage in. Without

meaning, there is no life. We must be able to understand some portion of our world to function and to live.

So how do we do this? Religion and philosophy, followed closely by natural science, psychology, and other disciplines have placed the question of meaning near the top of their agendas for most of human existence (though answers vary tremendously across disciplines).

In linguistics, however, meaning has had a checkered existence. (Partly because the vast majority of linguists ignore(d) Peirce.) Thus the pioneering linguist Leonard Bloomfield was skeptical of linguistics' ability to provide an understanding meaning and how it is transmitted by language: "In order to give a scientifically accurate definition of meaning for every form of a language, we should have to have a scientifically accurate knowledge of everything in the speaker's world. The actual extent of human knowledge is very small, compared to this." (Bloomfield 1933, 139) Or "We have defined the *meaning* of a linguistic form as the situation in which the speaker utters it and the response which it calls forth in the hearer. The speaker's situation and the hearer's response are closely coordinated, thanks to the circumstance that every one of us learns to act indifferently as a speaker or hearer." (ibid, 139) This is painfully false and betrays a lack of understanding of the world of signs and their role behind all of life.

Additionally, Bloomfield took a Behaviorist approach to meaning: "... we usually discuss and define meanings in terms of the speaker's stimulus." [Because it is simpler, DLE] With such statements, Bloomfield dramatically complicated the semanticist's task. He claimed that (ibid, p141) "the external circumstances and the speaker's internal state must be understood." That is a tall order. Of course it would always help to know more and more about more and more. But in Peircean inferential theory, where speakers rely on abduction to hypothesize fillers for gaps in their understanding of their interlocutors, this understanding of everything is unnecessary.

Moreover, Bloomfield seemd to lean towards an externalist semantics (ibid, p145): "... the linguist cannot define meanings." [but must appeal to other sciences or common knowledge, DLE]. This is correct, as I have argued above and elsewhere. Nonetheless, Bloomfield's error, which seems to have discouraged semantic studies in the USA for some time, is twofold: first, he confuses the task of the linguist with the task of the natural scientist and metaphysician; second, he fails to recognize the role of inference in finding the *appropriate* meaning for a particular utterance in a particular context. He also fails to understand the functions and interpretations of signs. We can always add information in the Peircean sense (where information equals the product of extension x intension of a sign), as Bloomfield seems preoccupied with. But these additions are not always relevant to the inference at hand. Bloomfield is correct that no one knows the full meaning of the things in the world. Nor does anyone have a full understanding of either their or their interlocutor's inner state before communicating. But in spite of his concerns it is never necessary to know everything to produce an appropriate interpretant.[8]

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[8] Even though, as Putnam (1975) and Peirce (CP 2.302) argued, symbols grow and their meaning is enriched by external knowledge.

Bloomfield is correct of course that some aspects of the situations in which the speaker and hearer find themselves are crucial to understanding meaning. So we need to understand the terms they use given what Peirce called their "universe of discourse," the things that they believe that they are discussing. But not only do we not need to know what "water," say, actually means (H_2O or some other molecule or just "refreshing liquid" or some such, Putnam 1975), we do not need to know our inner state or our hearer's inner state. We take signs and we communicate them - via spoken words, signed words, or, when we speak no language in common with our interlocutors, motions and facial gestures.

Bloomfield's error was to think that understanding the linguistic process requires understanding the world. But this is not so.[9] In field research (see Sakel and Everett 2012) understanding grows gradually, but meaning can be studied from day one, with no knowledge at all of the language teacher's world. For example, in the movie "Arrival" Amy Adams's character, a professor of linguistics, is able to communicate with aliens, even though neither she nor they understood each others' worlds. Indeed, this happens frequently in field research where no language nor culture is yet shared in common, yet the linguist and the native speaker recruited to help the linguist are able to communicate up to a point more and more successfully by building up their mutual semeiotic understanding, without a language in common.[10]

Linguistic meaning has been successfully transmitted and understood when the signs have been interpreted by the hearer in a way close to what the speaker intended. But the signs are not all linguistic (in fact, in the case of the monolingual demonstration, the hearer "informant" responds with linguistic signs that the speaker may have never encountered before to nonlinguistic signs of the speaker "eliciter").

Bloomfield's (1933, p139) approach to meaning is overkill. He puts the burden on "complete understanding" of the internal and external environment, rather than inference. And his account, again, complicates its task still more by ignoring semeiotics: "We have defined the meaning of a linguistic form as the situation in which the speaker utters it and the response which it calls forth in the hearer. The speaker's situation and the hearer's response are closely coordinated, thanks to the circumstance that every one of us learns to act indifferently as a speaker or a hearer." And (ibid) "In order to give a scientifically accurate definition of meaning for every form of a language, we should have to have a scientifically accurate knowledge of everything in the speaker's world. The actual extent of human knowledge is very small, compared to this." This all led Bloomfield (and perhaps Chomsky and certainly others (ibid, p 140)) to the conclusion that: "The statement of meanings is therefore the weak point in language-study ... and will remain so until human knowledge advances very far beyond its present state."

3. Culture, Meaning, and Inference

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[9] And for reasons I have discussed elsewhere, Quine's (1960) similar Gavagai problem is not really a problem in field research.

[10] For a live example of this process, one which has guided my field research for decades, see https://www.google.com/search?client=safari&rls=en&q=dan+everett+monolingual+demonstration&ie=UTF-8&oe=UTF-8

Anthropologically, meaning has been viewed much like it would be in semeiotics, even without knowledge of semeiotics. In the very book that first introduced Peirce's work to a British audience, Ogden and Richards (2013), anthropologist Bronislaw Malinowski discusses meaning at length. He claims that: "... words can only be translated into English, not by giving their imaginary equivalent - a real one obviously cannot be found [in particular for "special words," e.g. those that describe the native social order, DLE] - but by explaining the meaning of each of them through an exact ethnographic account of the sociology, culture, and tradition of that native community... In the structure of sentences [of "primitive languages," DLE] an extreme simplicity hides a good deal of expressiveness, often achieved by means of position and context. .. The enthnographer has to convey this deep yet subtle difference of language and of the mental attitude which lies behind it, and is expressed through it." Malinowski ([1927] 2013, p300)

Or again, on p300 of the same piece Malinowski asks the reader to "Imagine yourself suddenly transported on to a coral atoll in the Pacific, sitting in a circle of natives and listening to their conversation. Let us assume further that there is an ideal interpreter at hand, who, as far as possible, can convey the meaning of each utterance, word for word, so that the listener is in possession of all the linguistic data available. Would that make you understand the conversation or even a single utterance? Certainly not."

Let us have a look at such a text, an actual utterance taken down from a conversation of natives in the Trobriand Islands, N.E. New Guinea. In analysing it, we shall see quite plainly how helpless one is in attempting to open up the meaning of a statement by mere linguistic means; and we shall also be able to realize what sort of additional knowledge, besides verbal equivalence, is necessary in order to make the utterance significant.

Tasakaulo   kaymatana   yakida
we run   front-wood   ourselves

tawoulo   ovanu;   tasivila   tagine
we paddle   in place;   we turn   we see

soda;   isakaulo   ka'u'uya
companion ours   he runs   rear-wood

oluvieki   similaveta   Pilolu
behind   their sea-arm   Pilolu"

Malinowski comments that a literal translation of the above would appear as a "meaningless jumble of words." Crucially, he goes one "Now if the listener, whom we suppose acquainted with the language, but unacquainted with the culture of the natives, were to understand even the general trend of this statement, he would have first to be informed about the situation in which these words were spoken. He would need to have them placed in their proper setting of native culture." The mini-discourse is about a competitive race. Boasting is idiomatically "front-wood: (kaymatana) and **ka'u'uya**,

literally"rear wood," idiomatically means "behind." The "sea-arm of Pilolu" is interpreted by use of imagery and special use of the possessive pronoun and refers to the local geography.

The inference and cultural knowledge represented in these examples is characteristic of all languages. However, inference in this language is the same as inference elsewhere. Apart from the relationships in the following diagram, no knowledge enters the mind:

<div align="center">

Data

Knowledge —————— Inference

</div>
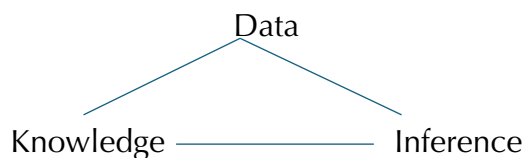
In other words, according to Peirce, if there is no inference, there are no concepts. No inference, no knowledge; no data, no inference; no knowledge, no inference.[11] Without inference, even the simplest of communications is impossible. Consider, for example, the following seemingly trivial statement (Jaszczolt 2016, 80ff):

"Trams are out of service. The temperature fell below -20 degrees Celsius and the rails shrank."

Where is the inference here? The first inference is between the first two sentences. Something about the temperature falling is inferred to account for the trams being out of service. And in the second sentence, the conjunction "and" links two sentences, the first of which explains the second. "The temperature fell to -20 degrees *and for this reason* the rails shrank."

The interpretation of all sentences in all languages requires cultural knowledge, linguistic knowledge, and real-world knowledge, along with inferential connections between each. But as the very mundaneness of this example shows, the use of inference is not a special device called upon to interpret unusual or hard-to-process sentences. It is used in all sentences. There is no meaning without inference. No concepts. No communication. Syntax is an aid ("anchor" - see below) to inference, an arrangement of signs. Nothing more. The inference from syntax employs all three forms of inference - deduction, abduction and induction, in all or at least most communicative interactions, in order to get at meanings.

Peirce wrote a good deal about linguistic topics (Nöth (2002)) and developed terms that are still in wide use throughout linguistics, e.g. universe of discourse; valence; three argument limit on verbs; type vs. token; sign; index; icon; universal grammar. But it is what he wrote on the philosophy of acquiring knowledge, i.e. inference and semeiotics, that lays the groundwork for a new approach to linguistics, relative to currently popular theories. His theory of inference has become the foundation for what is called "Inferentialism" (expounded and advocated for by Peregrin (2014) and Brandom (1994), among many others), though he is not always given the credit he deserves.

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[11] Innate knowledge, should there turn out to be any, would be inference selected for and transmitted phylogenetically.

According to Peregrin (2014, page), "Inferentialism is the conviction that to be meaningful in the distinctively human way, or to have a 'conceptual content,' is to be governed by a certain kind of inferential rules." Inferentialism, which Peregrin attributes to Brandom (1994), actually goes back to Aristotle, but arguably achieved many of its most significant developments prior to Brandom, in the work of Peirce. Inferentialism is empirically superior, in the eyes of a few, to Fregean-inspired compositionality for a number of reasons. But the two most important, which I pursue in this chapter, are that (i) inferentialism can do anything compositionality can do and (ii) inferentialism can resolve issues of meaning about which compositionality is silent. In fact, as we see in what follows, compositionality, when understood as a specifically linguistic operation, creates unnecessary problems. In this head-to-head competition with Frege, Peirce wins, if such conclusions hold up.

4. Frege and Compositionality

Frege is rightly given credit for introducing the concept of compositionality into philosophy and linguistics, although he never formally spelled out a definition of it in his work. Because it was his idea, however, and because I believe that it led us away from the correct theory, Peircean inferentialism, I refer to it generically as "Frege's error." Of course, on one hand, it is an important insight. At the same time, however, compositionality is too weak because it does not generalize beyond propositions to implicit information, leads to distraction for its failure to incorporate cultural knowledge, and discourse meaning. Moreover, it is too strong because it predicts meanings which do not come about.[12] Finally, compositionality itself just turns out to be a form of inference. [13]

Compositionality is often treated or discussed in linguistic theory, as though no theory of linguistics or philosophy can do without it. It is the idea that the words that compose a sentence *in conjunction with* the way that they are arranged, i.e., their syntax (and for some their phonology), determine the meaning of the sentence.[14] Showing that inference is superior to compositionality, would therefore be an important result, because it could move us closer to seeing human language and cognition as forms of semeiotics, a

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[12] Consider a sentence pair like:
*Twelve months ago, John claimed/reported that Mary is pregnant.
Twelve months ago, John reported that the elephant is pregnant.
     Why is the first sentence bad and the second sentence OK? Because we know that human females are pregnant for eight months, while elephants are pregnant for over twelve months. There is nothing in the words themselves that provides this understanding or the grammaticality judgements. Compositionality cannot predict this without flying buttresses, but inference predicts it fine. This shows that Compositionality is too weak. Now consider simple sarcasm:
     He is a really smart guy (uttered to underscore the opposite). Compositionality cannot predict such meanings and requires a strong distinction between semantics and pragmatics (literal meaning vs. nonliteral, context-based meanings) to work. Peircean inference requires no such proliferation of entities.
[13] Frege never actually stated this principle. It became known from George Boolos and later formulated by Frege's student Rudolf Carnap (1947).
[14] This is an AI-way of looking at things. But as already discussed, AI currently has little of interest to say about meaning or semeiotics.

more general science (Peirce labeled it a cenoscopic science) than linguistics (which he called idioscopic), sharing the basics of its system with all living creatures.[15]

In understanding a word in inferential theory, Peregrin states that: "The inferential role of a word w, IR(w), then, is an entity whose constitutive property is that the inferential potential of every complex sentence can be seen as the sum of the contributions of its parts, i.e. that the inferential potential of every sentence $G(w_1...w_n)$ (where G symbolizes any kind of grammatical way of assembling a sentence from its ultimate parts - words) equals the result of some way of combination of inferential roles of w1...wn, i.e., there is a function G^* such that $IP(G(w1,...wn) = G^*(IR(w1,...wn))$, for every n-tuple of words w1,...wn and every grammatically possible way G of putting them together in a sentence." (Peregrin 2014)[16]

On the other hand, a definition of compositionality 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."[17] But compositionality does not offer a solution for many problems in linguistics that Peirce's inferentialism handles easily.[18] For example, how does one 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). Compositionality cannot achieve the proper interpretations (not an isolated case). A variety of resources of inference are required to arrive at appropriate temporal interpretations.

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 judgments about what is grammatical or not, because in Peirce's inferentialism Cartesian intuition (truth based on direct personal insight, i.e. in Peircean terms "a cognition without previous cognitions") simply does not exist. As an example, 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.

Frege's error causes several problems for linguistics not encountered by Peirce's inferentialism:

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[15] Cenoscopy and idioscopy are two of Peirce's three types of sciences of discovery:

   (1) Mathematics – draws necessary conclusions about hypothetical objects

   (2) Cenoscopy – philosophy about positive phenomena in general, such as confront a person at every waking moment, rather than special classes, and not settling theoretical issues by special experiences or experiments

   (3) Idioscopy – the special sciences, about special classes of positive phenomena, and settling theoretical issues by special experiences or experiments

[16] This is still too compositional in my opinion and therefore undesireable. Peregrin's definition here could not account for temporal semantics, to take just one example (Everett 2023).

[17] See Pietarinen (2005) for a different view.

[18] For example, elsewhere I have discussed how Peirce's theory, not Frege's, can handle otherwise simple time expressions in Pirahã (Everett 2023 and Everett forthcoming).

First, the fixation on the proposition (rather than discourse) as the basic unit of analysis has led many linguists to their most serious, unforced, and unfixable error - making the sentence the central explanandum of linguistics. There are many linguists who have argued for years that the discourse (stories, novels, speeches, etc.), not the sentence, should be the basic unit of analysis for students of language (e.g. Longacre (1996); Pike and Pike (1976); Kamp (1993), under some interpretations, among many others). Peirce's theory of Existential Graphs is designed to provide analyses of discourse meaning, which subsumes sentence meanings. Frege and theories inspired by his approach to meaning (i.e. almost all modern theories of linguistics and philosophy of language) focused on sentences, rather than stories, because philosophers and logicians took on Frege's preoccupation with the proposition and lacked conceptual tools (until Peirce's existential graphs) to analyze linguistic items larger than sentences.

Second, and related to the first, Frege's ideas might be said to have delayed the arrival of a formal theory of discourse. Peirce's Existential Graphs, on the other hand, present an alternative inferential model of linguistic meaning, which avoids these problems of compositionality while providing a theory of discourse meaning.

Third, Frege's focus on specially-delimited propositional meanings to the exclusion of inference ironically has made meaning construction or retrieval more difficult. Thus he could not acount for even sentence-level meanings if those are determined in part from outside the sentence (as in the case of Pirahã tense discussed in Everett (2023)), which they always are.

Fourth, assuming that compositionality plays the central role in sentential or propositional meaning, forces us, at the very minimum, superfluous additional theories of meaning (e.g. "pragmatic meaning") to account for those meanings that cannot be captured by compositionality.

The major focus of a Peircean-semeiotic linguistics must be the "abduction problem: " in interpersonal communication abduction is the core form of inference: *Much of language is built on providing anchors to reduce the burden on inference. The primary form of inference to be reduced is abduction in quick communication. But deduction and induction are always active and essential.* We understand utterances of our language in part via deduction and we compose them by induction.

My further assumption is that inference is based on semeiotics. Semeiotics and inference are the two crucial building blocks of language. Once these have been built into our reasoning about language, the evidence for an innate grammar appears more and more ephemeral. What is claimed to exist is based on theory-internal reasoning, largely uncorroborated by (in fact often better explained by other theories of language; see Pullum (2020), Piantadosi (2023) and others). Inference is to be preferred over arbitrary syntax (see below on the final cause of unlearnability that guides some linguistic theories) at all times. Convention plays a large role in syntactic forms and interpretations as cultures settle into communicative patterns.

Any understanding of human language must include semeiotic constituents, especially those of conversations and discourses, alongside propositions, predicates, subjects, and other components of Peircean theory. Language is built from Speculative

Grammar alongside specific language-particular components, such as word-ordering and other locally specific linguistic grammatical structures.[19]

Frege's theory and much of the work of formal logicians and semanticists, as well as believers in compositionality (as distinct from inference) all ultimately lack the means to understand meaning without a very questionable distinction between what is often called "literal meaning" (semantics) and the use of meanings that go beyond most common meanings of words (pragmatics). A Peircean approach to language, then and now, is a radical, path-breaking alternative to the standard wisdom of the past one-hundred years. Under Inferentialism and this view of grammar, a Pragmaticist theory of language will offer detailed analyses of discourses, propositions or sentences, and their parts. Moreover, linguistic concepts (e.g. valence, sentence structure, and so on), like all concepts, whether by linguists or first language learners, are built inferentially.

5. Zellig Harris's Pragmaticist, Deductive Parsing

One might wonder how a Pragmaticist linguistics might work without compositionality. Fortunately there is a (very partial) preview of some aspects of such an approach in the literature, namely, Zellig Harris's 1951 monograph *Methods in Structural Linguistics*.[20],[21]

Harris at least adds to his account the statement that "Exact linguistic analysis does not go beyond the limits of a sentence; the stringent demands of its procedures are not satisfied by the relations between one sentence and its neighbors, or between parts of one sentence and parts of its neighbors. There are, however, structural features which extend over longer stretches of each connected piece of writing or talking. These can be investigated by more differentiated tools, e.g. by setting up equivalence classes of elements which are in a restricted sense substitutable (or positionally similar) in respect to

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[19] It should further include a subtheory of the effective or practical inference-based usage of semeiotic units for communicative purposes. This "practical inference" is what Peirce called Speculative Rhetoric. And the glue holding together and constraining Speculative Grammar and Speculative Rhetoric is logic.

[20] With its famous acknowledgements, written four years before the appearance of the University of Chicago Press edition: "'In preparing this book for publication, I had the benefit of many discussions with C. F. Voegelin and Rulon S. Wells III, and of important criticisms from Roman Jakobson, W. D. Preston, and Fred Lukoff. N. Chomsky has given much-needed assistance with the manuscript' Z. S. Harris Philadelphia January 1947"

[21] Harris would not have characterized his work as I do. He sets the goal of linguistics as: "The basic approach of structural linguistics (in this book) is to characterize each linguistic entity (element or construction) as composed out of specified ordered entities at a lower level. A different linguistic analysis can be obtained if we try to characterize each sentence as derived, in accordance with a set of transformational rules, from one or more (generally simpler) sentences, i.e. from other entities on the same level. A language is then described as consisting of specified sets of kernel sentences and a set of transformations. The transformations operating on the kernels yield the sentences of the language, either by modifying the kernel sentences of a given set (with the same modification for all kernels in the set) or by combining them (in fixed ways) with other kernel sentences. Such an analysis produces a more compact yet more detailed description of language and brings out the more subtle formal and semantic relations among sentences. For example, sentences which contain ambiguities turn out to be derivable from more than one transformational source." (Harris [1951] 1963, pv)

other elements or classes of elements throughout a connected discourse. The procedures useful for finding such discourse structures are extensions of the methods of linguistics." (Harris [1951] 1963, vii) However, if the "stringent demands" of Harris's deductive methodology are not met in discourse, this means that other forms of inference are required.

To repeat, Harris's work presents a method of deductive parsing - inference as a key component of language analysis. He begins from a set of assumptions (about distribution of linguistic elements) and from those derives initial divisions of sentences into words and morphemes. His assumptions do not extend transparently to discourse (at least he recognizes it), but he says that they ought to, eventually, with suitable adjustments. Later he offers examples of "transforms," including how the passive and active represent distributional variations at the *level of the discourse* (see Harris 1970). Harris is careful to point out that this deductive procedure is only tentative (given that the premises are not syllogistically or algorithmically precise, in my reading). He adds abduction and induction to the overall process, leaving plenty of room for empirical work - his inference procedures are not intended as an algorithm).[22],[23]

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[22]"These procedures also do not constitute a necessary laboratory schedule in the sense that each procedure should be completed before the next is entered upon. In practice, linguists take unnumbered short cuts and intuitive or heuristic guesses, and keep many problems about a particular language before them at the same time: they may have figured out the positional variants of several phonemes before they decide how to cut up into segments certain utterances which presumably contain a phonetically unusual phoneme; and they will usually know exactly where the boundaries of many morphemes are before they finally determine the phonemes. The chief usefulness of the procedures listed below is therefore as a reminder in the course of the original research, and as a form for checking or presenting the results, where it may be desirable to make sure that nil the iiiformatidii called for in these procethiies has been validly obtained.' The methods described here do not eliminate non-uniqueness- in linguistic descriptions. It is possible for different linguists, working on the same material, to set up different phonemic and morphemic elements, to break phonemes into simultaneous components or not to do so, to equate two sequences of morphemes as being mutually substitutable or not to do so. The only result of such differences will be a correlative difference in the final statement as to what the utterances consist of. The use of these procedures is merely to make explicit what choices each linguist makes, so that if two analysts come out with different phoneme lists for a given language we should have exact statements of what positional variants were assigned by each to what phonemes and wherein lay their differences of assignment." (Harris [1951] 1963, p1)

[23] Harris's book was reviewed very positively when it first appeared: "This epoch-making book was much read in manuscript before publication, and its author's influence was patent in many articles and reviews long before this summation appeared. Not since Bloomfield's Language has there been such an ambitious attempt to cover a whole field. Unlike Bloomfield's, however, this book is limited to the presentation of one principle and one method of linguistic analysis and description. The principle is that of relative distribution, the method that of controlled substitution. The author develops the thesis ... that 'the logic of distributional relations ... constitutes the basic method of structural linguistics.' The pursuit of this 'logic' is based on two suppositions: that the investigator is able to perform an initial segmentation of the speech continuum (on any one of a number of levels), and that he is able, by substituting his initial segments one for another and by observing a native speaker's reaction, to judge which segments are equivalent for that speaker and which are not. The results of this operation constitute 'the original data'. All other procedures are "... merely ways of arranging the original data." That the operations on the original data are valid is indicated by the fact that the data "will show different structures for different languages." The same results could be achieved by 'simpler intuitive practice'; but formalized logical procedures are to be preferred, since they alone are definable,

Interestingly, if Harris's deductive parsing method is altered to run in reverse, it could produce the kind of *inductive* assemblage of sentences that would normally be taken as "composition" of the sentence, eliminating the need for compositionality as a distinct theoretical tool, placing the work on independently needed components of Peircean inference.

So Harris's methods of analysis combine deduction (that distribution of morphemes should follow certain patterns), induction (checking units and hypotheses against the corpus), and abduction (making best guesses on extending conclusions to discourse, for example). In its basic idea that linguistics is about classifying constituents and their parts, Harris's method fits Peirce's architectonic view of linguistics as a classificatory science (with semeiotics and logic functioning as the "overseeing," normative sciences).

Although it is a common belief among linguists that Chomsky's own theory of Transformational Grammar made a severe rupture from Harris's merely "descriptive and procedural" work, as well as from anything resembling a Peircean model, it is not at all clear that the break between Harris, Peirce, and Chomsky is as great as it is thought to be by some. Chomsky's approach in all of its forms appeals to inference (deduction (from a biologically assumed universal grammar), induction , and abduction). It places heavy emphasis on the classification of transformations and construction types (Antecedent-Contained Deletion, Island Constraints, and so on), but ignores discourse. Unlike Harris, however, Chomsky's deductive method does not acknowledge discourse at all so if a principle operates across sentences, it falls outside of his theory by design. That is strikingly different from Peirce, and largely contrasts with Harris's theory.

One significant break with Harris's model is often overlooked in reviews of Chomsky's subsequent work, however. This is the fact that while inference in both theories is mainly applied sentence-internally, in Chomsky's (and others') theories it is further applied almost exclusively theory-internally, i.e. from one sign of the theory to another sign of the theory, rather than from the world to the data and back. This would be an anathema for Peirce, but in such theories it shows heavy influence from Frege's principal assumption that the proposition is basic to the study of meaning, rather than the discourse. This means that many of the analyses proposed follow from assumptions and principles that, while inferrable from these assumptions, are not inferrable for language learners or within other theories by and large. One could reply that this is the way of all theories. And perhaps one does find non-inferrability built into the architecture of other theories, whether by design or by accident. But by and large other theories of the natural sciences, apart from linguistics in case someone classifies linguistics as a natural science, have reflected Peirce's ideal of progress by inference, mathematics, and availability to all members of a disciplinary community (and usually anyone with the mathematical and scientific background to engage from anywhere).

6. Chomskyan Meaning, Frege, and Final Cause

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describable, and communicable. Intuition is personal; science requires that its methods be public, and that its results be subject to multipersonal check." Mcquown (1952, p495)

To see what I mean, let's look at a few statements that underscore how Chomsky established his reputation as one of the most innovative thinkers about language of the twentieth century, beginning with his famous rule of "affix-hopping." The name, itself quite innovative, reflects the idea that verbal inflection is a syntactic effect, with affixes moving ("hopping") to combine with verb roots and stems via transformational rules.

To contrast the leading compositionality theory of modern linguistics with the inference-based theory of Peirce, let's consider a famous example of the former and how it would be treated by the latter.

As Bjorkman (2018) puts it: "The intuition expressed by the Affix Hopping analysis is that inflection on verbs belongs systematically to other positions in the clause, an idea that underlies subsequent developments in syntactic theory...Chomsky implements this intuition by introducing each affix together with the auxiliary that determines it, as in (1a) with a subsequent transformation moving each affix onto the next verb in the sequence, as in (1b).

(1)   a. the student (-S) (have -en) (be -ing) (read) the book

        b. the student (have -S) (be -en) (read -ing) the book"

Most linguists liked the idea of simplifying the organization of the grammar (but see Gazdar, Pullum, and Sag 1982 for a strongly contrary view, pointing out many empirical problems. Sampson 1979 also offers important criticism). Affix-hopping eliminates some morphological processes in favor of a syntactic approach, modifying thereby Harris's concept of transformations from discourse functional to essential for the forms of all sentences. It transfers learnable complexity of word structure to unlearnable, innate complexity in syntax. Although this idea was not at the time nor is at the present accepted by all linguists, it was very influential. In the examples above, each affix (in parentheses), moves to attach to their host. The affix *-ing* moves to attach to *read*, *-en* moves to attach to *be*, and *-s* moves to attach to *have*, producing *reading, been, and has* in the final phonological form, "The student has been reading."[24] There are purported advantages in making this a transformational system realized by movement rules which continue to be touted today as a high point of generative theory that is asserted to be still important for cross-linguistic analyses of morphology. And within that particular theory (but no other linguistic theory) this type of analysis indeed has useful consequences.

But there are problems with such an analysis both from a cognitive and a Peircean standpoint. It proposes what are in effect indexes of morphosyntactic structure (the series of tree structures assumed) that are uninferrable from what is heard, i.e. it relies on abstract entities underdetermined by experience (recall though that it is the goal (final cause) of some theories, unlike Peirce's, to explain why language is *un*learnable). It is possible to infer many things from a sentence in spoken speech, e.g. what the scope of its elements are or the structural relationship of its non-abstract elements. A linguist might be able to infer theorematically that a linguistic tree, an icon of their knowledge of the structure of a sentence, has certain properties. But, say, the Chomskyan analysis of affix-hopping has the property of being uninferrable by the non-linguist by design (or disregard

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[24] Nowadays in Chomskyan theory all movement is upward and leftward, but we can ignore that here. This entire analysis in whatever version suffers from the same non-inferentiality problem.

for this crucial cognitive constraint), leading to the famous claim that grammar is innate, because its inferential scope is completely theory-internal (and, no, this is not the case of all theories). Such analyses have no "family resemblance" to work in the cognitive sciences which, by and large, do respect general cognitive constraints, e.g. inference.

In other words, the analyses of this family of theories seem intentionally developed so that that there is no way for the child to learn the structures predicted. Unsurprisingly, therefore, van Gelderen (2016) summarizes that: "I conclude by arguing that features have to be innate ... " But there is no surprise here in her "conclusion". This conclusion follows naturally because if a general theory of inference is purposely omitted from the theory, replaced by the special case of inference known as compositionality, then the theory alone cannot provide an explanation of how children learn and interpret communication. That is, when a theory only permits analyses of representamens rather than whole signs, it virtually bars an inferential analysis by the architecture of favored solutions. It is thus becomes circular in this context to claim that "this analysis is unlearnable." Unlearnability (a consequence of non-inferrability) is foundational to Chomskyan analyses, a self-fulfilling prophecy. For many theoreticians, there is nothing about the phenomenon of affix-hopping (inflectional morphology is the term used by most linguists) inherently that makes knowledge of how to do it impossible to come by ontogenetically (see for example Jackendoff and Audring (2020) or Booij (2015)). And many other theories have produced far simpler analyses of at least equal empirical coverage that fit better into what we know about human cognition and evolution. (see Piantadosi (2023)).

Moreover, if one is proposing a phylogenetic inference or rule development that has been passed down genetically in some way, Peirce would argue that we must offer an explanation in terms of natural selection for how it might have come about, like any genetic feature. Chomsky, as is well-known, doubts Darwinian evolution. As Bolhuis et. al. (including Chomsky) (2014) put it: "there has been no detectable evolution of the language faculty since it emerged, with no known group differences. This is another signature of relatively recent and rapid origin. For reasons like these, the relatively sudden origin of language poses difficulties that may be called "Darwin's problem.""

These authors, for no detectable reason, choose to offer an anti-Darwinian analysis. In the place of an evolutionary account of human language, Chomsky and his co-authors offer nothing other than the remark that "there is no detectable evolution," a claim showing very little evidence of empirical effort. One might say in defense of this position that evolutionary theory recognizes many mechanisms other than natural selection for the appearance of new traits, e.g. mutations, genetic drift, genetic bottlenecks, and so on. But all of these when proposed must be defended on evolutionary terms, something that has never been done in Chomskyan theory to my knowledge, offering instead "mutation," as though this alone could explain anything (without even specifying what the biology behind such a mutation might be, nor what the natural selective factors might have been that would have led to the spread of the mutated trait). I refer to this as the "X-men theory" of language origins. The statement above therefore in effect amounts so saying "I can't think of how this fits, so I will assume it doesn't, even though I have no other hypothesis about it other than that it must have "popped into being."" Moreover, such unsupported assertions are then used as further justification for a non-inferrable, Cartesian, rationalistic

analysis of the type that would not only be an anathema to Peirce, but even to Thomas Reid, and certainly to Darwin. Thomas Huxley might have found such a position similar in intellectual profundity to the church's position on evolution. I have argued in Everett (2017) and Barham and Everett (2020), and as Dediu and Levinson (2013) argued from a different perspective, that language is in fact much older than than many seem to think, going back likely to Homo erectus, nearly two million years ago. Moreover, as argued in those sources, the evidence strongly supports a gradualist, Darwinian view of language evolution. However, the evolutionary record (Everett 2017) offers no support for the idea of a sudden emergence in just the past 100,000 years or so.

So what alternatives are there that can respect the constraints of Peircean inference, especially his notion of ontogenetic inference?[25] Is it possible to bypass the anti-cognitive, anti-Darwinian, anti-inferential proposals of much of modern linguistics? I emphasize again that the analyses discussed above emerge partially from an ulterior motive or "final cause", namely, to guarantee analyses that are unlearnable or, more simply, non-inferential (for the child learning a language) in order to support the prior commitments of Cartesian-Rationalism that, strangely in my view, motivates much of modern linguistic theorizing. For as many other theories of language show, there are alternative analyses available for the structures that most engage Chomsky that are in every way inferrable from the data (Piantadosi 2023). Very few of the analyses emerging from the Chomskyan enterprise question the founder's prior assumptions such as his focus on the form of sentences, rather than the full semeiotic properties of sentences and their containing discourses. This deliberate development of a program of proposition-limited anti-learnability situates this research as an outlier in the history of science. (Descartes at least produced brilliant mathematics.)

Thus I will have little further to say about Cartesian/Rationalist theories, except this: the practice of ignoring evidence that says to us that language *is* learnable can be labeled "Chomsky's Problem." On the other hand, the acceptance of the idea that language is learnable, per logical principles of inference and semeiotics, we can refer to as "Peirce's Thesis."

In light of these distinctions, let's consider a couple of examples that became famous over the years as support for abstract, innate, form-based analyses:

John saw Jerry.

This sentence can be taken in part as an icon for a proposition expressing an agent as topic.

Jerry was seen by John.

This sentence is in part an icon for a patient topic.

In contemporary linguistic theory, such as Role and Reference Grammar (RRG, Van Valin and La Polla 1997), sentences like these are analyzed in terms of the different communicative purposes of making the agent or the patient semantic roles the topic of an utterance (and although RRG currently provides no theory of discourse, it accepts that discourse plays a fundamental role in the structuring of sentences). This is similar to

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[25] Peirce famously claimed that there is no entry for knowledge in our minds except "through the gate of inference." However, he claims that the knowledge so obtained can be the result of evolution, i.e. entering via phylogenetic survival pressures over time, or ontogenetically, over the courses of an individual's life.

Harris's work, cited above, on transformations and discourse. The passive has one discourse role to play, the active another. Each is an independent sign linked by lexical induction but separated by their discourse-constrained interpretant. And the structure of the passive and the active are simple in these theories, inferrable from the evidence for any child, thought they are not, per se, the central concerns of either Harris or RRG. Peirce was also interested in the structures of sentences and among his manuscripts are analyses of morphosyntax in different languages. Peirce would agree with all linguists that structure is not trivial and that it must be analyzed to understand how human languages work. But like Harris and many other researchers in linguistics, I take the form of sentences to be only a small part of the semeiotic nature of human language and a relatively small part of the task of the field of linguistics.

7. Inference vs. Compositionality Head-to-Head
   Another type of inferential model of human language is found in Large Language Models (LLMs) seem to be making tremendous progress without linguistic specialization (see Piantadosi (2023) and Ambridge and Blything (2024) for an explanation of their significance to some linguistic theories). ChatGPT, for example, (Piantadosi 2023) seems on its way to achieving thirdness (generalizations) - judged by its performance. This technology therefore points in the same direction as a pragmaticist theory of language, namely, the goal of understanding of language without a profound role for linguistics as presently conceived. ChatGPT serves as a near-proof that linguistics is not necessary for the emergence of coherent language. On the other hand, ChatGPT does *not* obviate the need for semeiotics. ChatGPT just *is* an inferential semeiotic theory, a semeiotic theory that produces linguistic signs from non-linguistic signs, but is subject to all of the same constraints as any other system of signs.
   A Pragmaticistic grammar must be able to address sentences that illustrate empirical issues that exercise some formal theories, e.g. (see also section 12 below):
     Who do you wonder whether John saw ___? (questionable, but OK for many)
     Who do you wonder if John saw ___? (worse than the previous example)
     Who do you wonder that John saw ___? (not great)
     Who do you wonder John saw ___? (not great)
     Who do you wonder that ___ saw John? (not great)
     Who do you wonder ___ saw John? (pretty bad)
     John are nice. (doesn't work)
     **Saw saw saw*. (Trying to make "saw" the subject, verb, and object doesn't work. Why can't verbs act like nouns?)[26]
   An inferentialist approach to these requires no abstract entities (which following the conventions of some theories place-marked in the examples above by the blank lines, theory-internal signs for arguments missing from their expected position). In English a Wh-word (who, what, where, why, which) indexes that what follows will not be a simple

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[26] In Everett (2012) I call this "Lyon's Problem," named after the late John Lyons who pointed out a similar problem with formal linguistics, from Lyons (1977).

clause. And the hearer must infer from that item that the rheme's is satisfied at a distance.[27] The question word is thus an index, an indexical legisign (which is likely why it usually appears in sentence-initial position, to indicate the mood or purpose of that sentence at the outset). The analysis says that a WH-indexical legisign indicates that the following sentence is a query about the argument indexed by the WH-word (WH-word = information question word, as opposed to the strategy in English of "yes/no questions"). The WH-index is a sign that the speaker would like the hearer to tell them what the object of the questioned argument is. For largely processing reasons (see Liu et. al. (2022) for a non-sentence bound, grammar-internal explanation) some of these signs (so-called "islands") are harder to process than others.

Some have explicitly argued *against* the type of Peircean inferentialist approach to meaning that Peirce developed with his Existential Graphs and that I am assuming here, in favor of Frege's compositionality thesis. For example Lepore and Stone (2017), provide a book-length argument against inferentialist theory. Fortunately, these claims are easy enough to check against analyses and facts. The goal of Lepore and Stone is to reduce or eliminate inference in studies of linguistic semantics (though they focus primarily on the so-called "Gricean maxims" (Grice (1991)), in favor of compositionality via the introduction of what appear to be *arbitrary* lexical and grammatical cues and structures. And yet ironically their theory retains inference throughout, since at least since Harris's methodology parsing and compositionality can be analyzed as deductive and inductive inferential strategies.

The shortcomings of their approach include (i) a failure to define inference, even though they are opposing it; (ii) a narrow focus on Grice's use of contextual inference; (iii) a failure to distinguish and deal equally with the three main types of inference; (iv) a failure to grasp the significance of sentences as constituents of discourse, and (v) a narrow (and therefore unrealistic) focus on what Peirce called the "imperfect symbol" of the proposition.

Additionally Lepore and Stone argue that Grice's (1957) conversational implicatures "... rely not on general interpretive principles but instead on essentially arbitrary links between forms and their interpretations." (2018 p4) But why call a well worked out theory of inference arbitrary? Their solution in any case is to build in abstract diacritics (i.e. syntactic signs that cannot be heard only read) into utterances. Thus for a phrase like "Can I have French toast" which is literally an information question about my ability to do something, but is inferentially a request in most common usage, they claim that the sentence encodes in its grammar an indirect speech act (that is, it is marked

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[27] For example, in "Who did John see?" "Who" tells the hearer that (i) what follows is a question and that (ii) who is part of a rheme which is otherwise incomplete in the sentence, producing the well-formed proposition "John saw who?" that fits local sentence rules of English (see Van Valin and Lapolla (1997) for extensive discussion of questions that offer analyses compatible with the statement here, though in nonsemeiotic terms).

abstractly in some sort of way).[28] Moreover, they they go on to assert, also incorrectly, that such diacritics are especially needed when it comes to temporal semantics (ibid p4).[29]

That Peircean inference is operative in normal linguistic interactions is seen in the background information used for inference in an example like:

"Can I hand in my assignment late, Professor Everett?"

"Yes, but there will be a penalty."

How does the student interpret my response? Here are some unlikely options:

The penalty is a firing squad.

The penalty is buying the professor lunch.

The penalty is being expelled from college.

The penalty is forty lashes with a hippopotamus-skin whip.

Here are some likely options:

The penalty is a loss of points on the assignment.

The penalty is a lowering of the grade by one full letter point (e.g. A->B)

The penalty is failure to earn an honors degree.

Lepore and Stone might reply that since the right background for interpreting such sentences is cultural, that inference is necessary for sentences, adding that this would not be linguistics. But this reply would be unresponsive. If I say "That cat is black," inference still plays a role in determining the literal meaning of the sentence. Semeiotic units (valence, terms, rhemes, dicisigns, delomes, and so on) are formed or combined in the interpretant of the clause via inference (using iconic and indexical syntactic information along with lexical information of parts of the sentence to infer the meaning of the sentence as a whole). Compositionality understood as subtype of inference is compatible with semeiotics, as terms like intuition and introspection are when interpreted as forms of inference. So long as we recognize that each of these is a subtype of inference. But as a distinct syntactic or semantic operation linked exclusively to linguistic structures, compositionality is unnecessary.

On the other hand, Miller and Pullum (2013) argue that "silent syntax" approaches are empirically inferior to more pragmatic, i.e. in my terms inferential, approaches to the problem. Jacobson (2014), in defending compositionality, for example, must propose that

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[28] A sign that is reflected neither by silence nor an overt representamen would not exist in semeiotic theory. Something else must signal the indirect speech act of using an ability question as a permission request. That something else seems to be nothing more than inference. But this is not a solution available to Frege's compositionality theory unless, as these two authors advocate, we postulate a sign that, although it has no representamen, is useful only to enable compositionality. Of course, it is obvious that if we allow such abstract signs into our theory we can use them to derive just about any meaning from any sentence, depending on how far we are willing to go with their use.

[29] In Everett (2023) I argue that no diacritics can produce the correct readings of Pirahã temporal interpretation. The answer in semeiotics is that "saw" can tell us something, but it cannot serve as an index, so there is no symbol produced and the construction is uninterpretable.

in short answers to questions, responses contain "invisible categories," to fill in meaning for compositionality. She does this rather than developing a theory of inference.[30], [31]

One infers literal meanings from simple lexical information linked semeiotically to the context. All creatures infer. This is not an ability that must be part of a species-specific biology. So to continue with our discussion, in "that cat is black," one has a proposition with an icon ("is black") and an index, 'the cat,' telling the hearer which particular item the predicate icon describes. One infers the relationship between the predicate-icon and subject-index from clues on the predicate and subject (there precisely to aid this inference in my view). Compositionality is not requred. Moreover any connotation of the sentence is also inferentially derived. Inference does the work of both pragmatics and semantics, which compositionality cannot do.

Moreover, *all* communication, human or otherwise, is based on inferring the meanings and intentions of the signs we perceive. In this context, I repeat my conclusion: *All of syntax, indeed all of language, has the purpose of anchoring our inferences in order to grasp the contents of other minds and our place in society.*[32]

Of all of these simple examples above, standard problems in generative linguistics, are iconic and indexical of the central theoretical problem (as icon) of all generative linguistics. Remember that for Chomskyan or other formal theories, our search and solution spaces are relatively modest. This is so because most, if not all, problems of formalist, Chomskyan syntax are the attempt to understand the relationship between silence (or "covert") and hearable ("overt") material in a sentence when these are interpreted together (repeated here):

[[Overt$_i$] ... [Covert$_i$]][33]

And this pair, overt-covert (also called "gap-filler" pairs) is and has been the central problem of a large part of formal linguistics for the past six decades.

Let's look at each of these constructions from a semeiotic perspective. The first thing to say is that not all linguists agree that there are "covert" categories. Peirce would surely have denied the idea that there is a sign that differs from others in having no representamen and that there are signs distinct in interpretants that lack representamens (something otherwise missing in the sentence from a verb's valence requirements can be understood at the level of the proposition).[34] He would have said that someone is missing an insight. Many modern linguists (Jacobson (2016) and Miller and Pullum (2013) would also deny that there are covert categories.

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[30] Jacobson's own theory, "Direct Compositionality Theory," in my opinion, fares no better relative to the shortcomings discussed here. To anticipate here is a widely accepted view of compositionality: 'Principle of Compositionality: the meaning of a complex expression is determined by meanings of its constituents and by its structure.' (Szabó 2000, 3)

[31] Tantalizingly, Jacobson's discussion includes a brief allusion to what might become an interesting theory of discourse, but she doesn't take it far enough.

[32] Enfield and Zuckerman (2024) discuss a related idea that they refer to as "mooring" where I use the term "anchoring."

[33] Under this structure/diagram fall phenomena like the following: Antecedent-Contained Deletion, Sluicing, Gapping, Pseudogapping, and Syntactic islands.

[34] Silence can be a sign, however. John Cage received fame and fortune from silent musical signs.

ChatGPT, as a proper inferentialist theory, looks outside of sentences, to the larger context and discourse, to determine the meaning of each sentence (but it has not yet achieved semantics, so is currently still somewhat more like Chomsky's theory than a semeiotic theory).

8. Formal Non-compositional Linguistics

Reviewing formal linguistic analyses, some historical perspective is in order. Linguistic formalization has long been claimed to be a major contribution of Noam Chomsky to modern linguistics. In a monograph examining the nature and history of formalization in linguistic theories, Tomalin (2006) provides an overview of the influence of the "formal sciences" (mathematics, logic, computer science, and the like) on the development of Chomsky's formal linguistics. It is often assumed that formal theoretical research on human languages began with Chomsky. For example, Robert Lees states in his well-known 1957 review of Chomsky's first published book, *Syntactic Structures* that Chomsky had offered the first formal theory of language. But this statement ignores entirely Peirce's well-worked out *formal* theory of words, propositions, and discourse (in his EGs and semeiotics), which themselves together provide a comprehensive theory of language, far more formalized than anything Chomsky has done.[35]

Tomalin's book, while well-written, knowledgeable, and highly informative, nonetheless errs by omitting Peirce from his history of the study of language, the history of the formal sciences, and the history of the classification and purposes of scientific theory, an omission difficult to reconcile with the fact that Peirce is a major, perhaps the most important, figure in the history of formalization of linguistics concepts.

The formal study of language in the West began no later than Peirce's theory of signs. In the East Panini (Kumar 2017)) was the pioneer. Peirce's formal studies continued into his Speculative Grammar and beyond (1865) and were developed in detail over the years (Bellucci 2018), reaching its pinnacle in Peirce's Existential Graphs (Roberts (1973); Shin (2002)).

Tomalin's (2006) review of the history of the formal sciences focuses on mathematics, explaining how it was foundational for formal linguistics. He is careful to note the contributions of Whitehead, Russell, Frege, Peano, and Schroeder, for example, though he fails to notice the fact that behind all of these figures (except Frege, who was, ironically, somewhat orthogonal to often-recounted parts of the actual history) 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. Ironically, however, although Russell and Whitehead give credit to Frege for the invention of formal logic, they use Peirce's ideas and notations, either via Peirce directly (Nubiola 2008) or indirectly via Peano and Schroeder (Putnam (1982); Eisele (1976)). Tomalin also fails to answer Peirce's objections that Russell and Whitehead got things backwards, by taking the

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

logicist position that logic is foundational to mathematics, rather than the other way around, that mathematics is foundational to logic, as Peirce and other mathematicists argued.

9. Conceptualism, Realism, and the Ontology of Linguistics Devices

With regard to the objectives of modern linguistics, Katz and Postal (1991, 515) claim that a realist view of the field leads to a very different conception of what linguistics is about than either conceptualist linguistics or the nominalist linguistics of the American structuralists:

"In the early eighties, conceptualism was challenged by a new view of NLs [Natural Languages, DLE]. *This Platonist, or, as we say, realist, view takes NLs to be abstract objects, rather than concrete psychological or acoustic ones (as American structuralists had claimed); see Katz (1981, 1984) and Langendoen and Postal (1984, 1985). This view is the linguistic analog of logical and mathematical realism, which takes propositions and numbers to be abstract objects; see Quine (1953, p. 14). On a realist view, linguistics, like logic and mathematics, has no psychological goals, depends on no psychological data, and has no psychological status. And as in logic and mathematics, results can be of value in the natural sciences. But linguistics is an auton omous formal science with its own goals and domain of facts."*

Katz and Postal here agree with Peirce that there is indeed a coherent area in language that a single discipline can study, namely the abstract and universal characteristics revealed via inference in specific phenomena cluttered by their individual haecceities, i.e. a realist rather than the nominalist-conceptualist perspective urged by many. Like Peirce, Katz and Postal want to rid the science of linguistics of the psychologism that has attracted so many but, as Peirce has argued in many places, can have little to do with the logical-semeiotic constraints on any language or communication system. And yet this version of realism is itself anemic, by ignoring semeiotics and the range of realist analyses of perfect symbols. Of course, inferences are psychological in one sense. But the psychological aspect of how inferences might work in the mind or be implemented is distinct from a logic of inferences.

Although Chomsky (1986) attempted to clarify his conceptualist perspective on language by introducing the terms E-language versus I-language to refer to the contrast between linguistic behavior and linguistic cognition, he does not manage to escape, in fact he embraces, the psychologism that, according to Katz, Postal, and Peirce, inter alia, should have nothing to do with the logical understanding of language or other semeiotic systems. On one particular interpretation, E-language is an enumeration of formal units that we find in communication, expression, and society in the broadest sense. I-language is the system of grammar and the lexicon which E-language draws upon-but it is only a part of E-language, along with cultural values, politics, gender, and so forth. E-language is shaped by discourse structure and sentence selection, as well as cultural values and inference as part of the final cause in one sense (our languages must present structures that aid inference and do not block it). However, E-language does not actively affect sentence

form, per se. An E-language grammar in this sense would be nothing more than an extensional set, a list, of the allowable sound-meaning matchings that discourse can use. This is not incompatible with semeiotics, Peircean or Saussurian, but it is a distinction with no difference. We study individual overt signs to understand the logic of signs. No one is interested exclusively in a list of signs, nor does anyone believe that we can grasp the abstract and universal semeiotic aspects of human language without understanding the actual manifestations that so vex the field researcher from the outset of their work in any field, from conversations to morphemes.

Is it useful or logical to study forms independently of function? Biologists have long wondered about this question. So, consider Darwin's admonition in 1859 (p191): "In considering transition of organs, it is so important to bear in mind the probability of conversion from one function to another." Forms change allegiances. This means that a representamen for one object with one interpretant today may associate with a different object and/or a different interpretant tomorrow. This is just historical linguistics after all (and it is, as we will see, the answer to Goodman's (1955) "grue paradox"). But forms and functions are always together even during and after shifts in earlier pairings.

The representamens of signs are not part of the meanings of signs. They are linked to an interpretant to reveal an object. Of course, it takes only a little reflection to see that representamens may become separated from their function in linking interpretant and object. Anyone who has ever had a wisdom tooth or appendix removed knows that these are body parts with definite forms, but with little or no current function in the body. Whatever object the wisdom tooth once interpreted (eating of bones, for example), it today merely is a sign for "future surgery." That they likely had a function is beside the point.[36]

Semeiotically, this means that as diachronic processes alter, break down, or create new sighs, different parts of a sign can take on greater or lesser prominence in the process. A good example of the relationship relative return on evolutionary investment in forms vs. functions is wings. Wings may have been built out slowly from more and more efficient bodily heat regulators, rather than as instruments for flying (that is, no prebird creature was just born one day with fully formed wings and then learned what they were for). The function of flying was made possible by, that is, subsequent to, the form that thermal regulators came to have. In fact, all of natural selection is predicated on the assumption that unmotivated changes in form (mutations) led to new functions for the organism, guided by the final cause of survival. New objects receiving new interpretations or becoming representamens for new relations.

Consider a semeiotic example from the common English-language marriage ceremony. "With this ring I thee wed." This is an old construction from the days that English had its original German SOV (subject object verb) word order. In this sense, the word order component of the representamen of the phrase has been separated from its

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[36] Other examples include lungs, which used to function as swim bladders, and salt in the blood, presumably from our previous existence as fish. All of these examples just illustrate the creation of new form-object-interpretant links, from existent representamens, transforming (by substitution and deletion) previous connections.

original function by simply retaining an archaic ordering of words and has now taken on a more self-indexical function of saying "this is being uttered in a wedding ceremony."

Therefore, we would be seriously misguided to neglect the study of form in connection to E- or I-language functions. However, let us set these arguments aside and assume instead that no matter what anyone says, function drives form, to put a linguistic spin on it, meaning drives syntax. Clarifying such a theses must begin semeiotically with the fact that *objects* drive meaning and form, an insight from semeiotics (Peircean). What does this mean? It means that cultures are free to create, eliminate, or modify the objects of conversation and cultural focus, conceptual and physical objects. As these objects shift meanings, new forms or new interpretants for the old and new forms become necessary. So if your culture semeiotically characterizes (the object) time in one way, its signs (words, sentences, gestures, positions of celestial bodies) will reflect this (chapter eleven).

This raises a central question then: "Just what *is* the function of language?" The straightforward answer from a semeiotic perspective can only be that the function of language is communication. From evolutionary and synchronic perspectives, communication might appear to be logically dependent on thought formation and expression, which originate in psychology rather than social interactions. Clearly, any semeiotic system rich enough to support communication must require a robust cognitive representational and inferential system to support it. This representational system, however, contra Fodor (1983; 1987) must follow from general cognitive processes. It cannot be encapsulated because semeiotics cuts across modalities and is not bound by language. Again contra Fodor, language is very different from perceptual input systems, such as vision or hearing, where flexibility of interpretation is a disadvantage rather than an advantage (though as we see later, perception, like language, also necessitates inference and cannot in fact, contra Fodor, be encapsulated in any strict sense). Perceptual systems are like embodied software or firmware. Language is not nearly so far to the deterministic side of things as perceptual input systems. In language, flexibility of interpretation is an advantage, veritably a requirement.[37]

10. Peirce's Reduction Thesis: Limiting the Scope of Inference (and Compositionality)

I want to turn now to consider a crucial Peircean insight into natural language syntax that cuts across transitivity and valence, namely, the connection of these to Peirce's "reduction thesis (or theorem)" (Atkins 2018). Atkins (2018, 57) describes this thesis as meaning that Peirce maintains "... (1) that the most basic propositional forms are either monadic (a relative term taking one subject, one), dyadic (a relative term taking two subjects, two), or triadic (a relative term taking three subjects, three), and (2) that there is no need to posit any other basic propositional forms." This view fits in tightly with Peirce's triadic theories of inference, semeiotics, and all other aspects of Pragmaticism.

What interests me in particular about this thesis is how well it fits what we know about all languages in the world studied to date. But for brevity, just consider the English examples below:

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[37] Perception is always a partial function of inference. The eyes may tell me that there is something about the height and build of a human being in front of me. My inference will tell me whether it is a real human or a mannequin, or that the person is far away and I need to "reinfer," for example.

It is raining. (monotransitive - no arguments)
I am running. (intranstive - 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)

Some take it that such verb-argument combinations represent semantically basic verb types. There is a problem, however. The last example, a so-called tritransitive, appears to violate Peirce's reduction thesis. However, consider that in the active form of 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.[38]

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 questioned 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 (cf. Van Valin 2007). Tritransitive verbs apparently violate Peirce's reduction theorem for valence.[39] The only way to produce a tritransitive verbs are to increase the sentence's transitivity (not the verb's valence) in a deviation from the verb's basic semantics. See, inter alia, Atkins (2018, 71ff); Burch (2001)). But these extra arguments are not part of the verb's lexical valence, only its superficial transitivity (see Thomason and Everett (2023)).

It is crucial in evaluating Peirce's reduction thesis to draw a strict line between valence (which means "number of required lexical arguments" for most linguists) and transitivity (number of arguments of a verb in a particular sentence). This distinction can be overlooked in casual analyses of languages. Perhaps the very best study of the difference between transitivity and valence is Hopper and Thompson (1980).[40]

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[38] Of course, one can also say "Peter bet two dollars" or "Peter bet Noam" (as in "Who did Peter bet?" or "Whom did Peter bet?" But the fact that in some ditransitive verbs one of the three arguments can be omitted does not violate Peirce's theorem, which although it establishes a maximum numer of arguments, three, and a minimum, one, has nothing to say about verbs that alternate between one and two or two and three or one and three. These alternations tend to be a matter of transitivity rather than valence in any case.

[39] Peirce introduced the concept of "valence" into linguistics from chemistry (Peirce (1897, 170ff).

[40] This issue of tritransitives is further discussed competently in this piece written for a general audience by Thomas Wier in 2014: https://slate.com/human-interest/2014/04/does-english-have-any-tritransitive-

Semeiotically, valence is a property of rhemes while transitivity is a property of propositions (shown in different ways within the propositional predicate).

As is well-known, transitivity (the number of syntactic arguments) can be reduced or expanded while valence (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 built into Peircean (and Sausurrean) Semeiotics. But arguably only Peirce in the long history of the study of human language predicts these valence facts from the building blocks of his theory, the reduction thesis of his Speculative Grammar. And he predicted this after being the first to recognize (or at least name) valence as a verbal property.

11. Compositionality, Inference, and Recursion

Consider sentence clusters such as "You drink. You drive. You go to jail." and "No shirt. No shoes. No service." These have recursive interpretations (along the lines of "If you drink and then you drive then you will go to jail" or "If you are not wearing a shirt or shoes then you will receive no service") without recursive syntax. (They are not limited to these interpretations. For example "You drink (in your teens). You drive (in your twenties). You go to jail (in your fifties).") Inference requires no direct match here between interpretation and structure. The structure is not always a direct match. Another example is "Happy belated birthday" where the scope of "belated" is "Happy birthday," not "birthday." That is a formulaic expression that underscores the role of inference. (Calling it an "idiom" as though this resolves the issue is can-kicking.)

The structure of sentences in formal theories is constrained by more than argument valence or transitivity, however. Hauser, Chomsky, and Fitch's (2002, 1569) claim that the "Narrow Faculty of Language" (that capacity upon which all human languages are built), is *recursion*, an idea partially based on the idea (empirically false, Everett (2005)) that there is no longest sentence in any language.[41] But when I (Everett 2005) argued 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 nearly two-decade acrimonious "debate." Ironically, recent work on the implications of my claim on discourse recursion has suggested that this idea has positive consequences for Chomsky's own theory (Maier 2021).[42]

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verbs.html. See Thomason and Everett (1993) and below for a discussion of transitivity and valence along these lines in Flathead/Montana Salish.

[41] "We hypothesize that FLN only includes recursion and is the only uniquely human component of the faculty of language" and also "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..."

[42] 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

The well-known Chomsky vs. Everett debate on recursion is marred by ignorance of Peircean semeiotic recursion and the assumption of Fregean compositionality as the primary source of meaning from syntax. The debate is built in part on the misunderstanding that syntax and semantics are connected compositionally rather than inferentially.[43]

Had HCF and Everett (2005) adopted Peirce's perspective on recursion, universally overlooked in both function-centered syntax and formal syntax, some of this debate could have been avoided. The reason for this is that semiosis, which is as important to the Pirahãs 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 in the object or even in the representamen (as Hauser, Chomsky, and Fitch would have it, by talking about syntactic FLN, rather than a broader semeiotic capacity), that is, in the semantics, since each sign must be interpreted via another sign - a recursive process. There can be, according to this work, languages which have semeiotic recursion and discourse recursion, but which lack sentential recursion (see Futrell, et. al. (2016); Everett and Gibson (2020)). This is very different from the Fregean concept of compositionality that Chomsky (Montague and many, many others) has long assumed in one form or another. In fact, the idea that Fregean compositionality must apply leads some linguists to a conundrum over sentences like those discussed in section 13. regarding Sluicing, Antecedent-Contained Deletion, and the like.

If Chomsky simply wants to claim that recursion anywhere in language supports his FLN, there is no problem. Peirce already explained this more than a century ago. But if Chomsky wants to claim that recursion in syntax is what is central, that finds neither support in Peirce nor in the facts of natural languages. However, this is forced by the assumptions that (i) the sentence or proposition is the core of language and that (ii) the semantics must be read off the syntax. Also, for Peirce, since semeiotics and semeiotic recursion are found across species, this cannot be a distinguishing characteristic of human language. It is a fact about the logical nature of semiosis, i.e. Speculative Grammar. But this is most definitely not Chomsky's claim. His final cause in this case is his idea of Merge, a recursive and binary adjoining procedure for building phrases. So for Chomsky,

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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.""

[43] Pike (1967) never made this assumption. He in fact argued explicitly that the syntax-phonology-semantics hierarchies did not have to match (though when they did not, inference (my interpretation) would be less transparent).

although Merge might not be mentioned, what he is referring to, however occultly, when he talks about recursion is sentence-internal recursion, a Fregean constraint on meaning construction and interpretation.

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, arguing that "the operation Label, not Merge, constitutes the evolutionary novelty which distinguishes human language from non-human computational systems..." (Murphy 2015)

In other words, Murphy argues that syntax per se is not unique to humans but rather the 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," or the node they form. Other creatures put things together. But only humans label them (i.e. attach symbols to them). Murphy is absolutely correct it seems to me. And almost Peircean in his insight, however unknowingly.[44] Labeling is a sophisticated cognitive operation, requiring Peircean inference and hypostatic abstraction. But notice that *all* animals have categories. A category is an interpretant, not part of the representamen of a syntactic tree (which is itself an interpretant of a string of words from one perspective and an index of the words' relations from another).

Thus although Murphy's idea about labeling is interesting, it cannot ultimately be what distinguishes human communication from animal communication. It does argue for a quantitatively more complex array of interpretants for humans than other animals, but since all animals have categories and signs and all animals infer, "labeling" simply won't do the work Murphy had hoped for. These animal categories are in effect symbols for generic categories. Since animals lack universals, are they nominalists? (See Appendix Two for discussion of nominalism.)

Chomsky has argued for close to seventy years that the best theory of language takes form to be the principal explanandum and that the explanada 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, as we saw above, Chomsky's claims that just one faculty of the mind 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 (if for no other reason than that Peirce was a mathematician and Chomsky was not). See Pullum (2011).

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[44] 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.

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 UG.

1. For Chomsky data are selected and evaluated largely based on intuition, or what Michael Devitt refers to as the "Voice of Competence." But for Peirce, all interpretation and learning are inferential semeiotics. Inference generalizes more and fits cognitive science better than a special category of intuition, which does not stand up to Peircean scrutiny.

2. Form, not meaning, is the principal explanans of linguistic analysis and understanding for Chomsky. But signs are central for Peirce. And this has many advantages, extending its empirical reach far beyond humans. As Piantadosi (2023) points out, a serious problem for Chomsky is the failure to mix syntax and semantics (which Peircean semeiotics does by design).

3. Universal structural principles in Chomsky's theories are biological in nature, but logical in nature for Peirce. This again is an advantage for Peirce, expanding the empirical reach of his work 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, although 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 or at least so I argue in Everett (2017).

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.

Having discussed syntax and semeiotics, now we look a bit closer at phonology and semeiotics.

One thing to recall is that your object can be my interpretant. Your representamen can be my object. In this sense, phonology serves simultaneously as an interpretant of the phonetics, an object of the emotive interpretants, and a representamen of the syntax.

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. In CP 3.459, Peirce says that while we expect proper nouns and pronouns in all languages, the function of common nouns is less central (his terms are compatible with what has been studied as "topic-continuity" (Givon (1983)).

So for a sentence like "John promised to go," a Peircean analysis would propose an underlying logical constraint on predicates that interprets the positions generated by their valence, but would not posit an invisible or "covert" syntactic subject[45]. The subject is

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[45] 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

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 lexically inferred. On the other hand, for a Fregean compositional analysis to work (as in Chomskyan theory), we would need to posit either "empty categories" or some other way to overtly identify the "gap" in the subject position of "to go." This would be unnecessary in a Peircean linguistics.

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 (Van Valin and LaPolla (1997) and Jelinek (1994)). For Peirce this would explain his observation that common nouns are rarer than pronouns (which have indexical meanings) in sentences cross-linguistically. That is, he these saw independent words as themselves inflections of verbs. Indexes, including pronouns, resolve the ambiguity and the regression between the imagined and the actual, the regress of semeiotic interpretant recursion, by pointing outside the interpretative procedure and providing insteand an ostensive interpretant that needs no further interpretant.

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, as we saw, is a formal operation that takes as input some predicate and outputs a relation. The example given above 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 functions.[46] 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/semeiotically 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

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"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 sign of the subject is verb inflection in Portuguese, but is lost in the impoverished verb conjugations of English. In any case, Peirce was aware of such examples and took them quite seriously.

[46] 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.

proposition, "honey is sweet," into "honey possesses sweetness." CP 4.235 But here the "transformation" is a logical one, not a syntactic derivation.[47]

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 1.383[48]

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 semeiotic constraints are thus a separate domain of study for Peirce from the study of actual natural languages, which is a study of implementation of these more general principles of Speculative Grammar (just as linguistic studies of natural languages are separate from the study of Universal Grammar for many Chomskyans).

12. Semeiotics and Cognition

Semeiotics predicts that languages are shaped by cultural values in many ways, from the superficial to the profound. An example of the latter comes from New Guinea. In his grammar of the Amele language of New Guinea, John Roberts (1987) discusses how and why the expression of the predicate "to give" uses no verb, treating the verbal agreement morphemes as types of predicates in order to communicate the cultural immediacy (signs reflect cultural values) "experiential basicness" (Newman 2002, 79) of giving in this language (and this type of analysis is faciliated in theories that are more functionally or semantically based, such as in Role and Reference Grammar (Everett 2016, 173ff):

(5) a. **Naus Dege ho ut -en**.
         Naus Dege pig $3_{SG.IO}$ -$3_{SG.SUBJ.PAST}$
         'Naus gave Dege the pig.' (Roberts 1987: 34)
     b **Ija dana leis sab al -ig -a.**
         I man two food $3_{DU.IO}$ -$1_{SG.SUBJ.}$ PAST
         "I gave the two men food.' (Roberts 1987: 316)

Again, there is no verb "to give" in Amele, only agreement pronominals occuring in clauses of giving. However, for other expressions verbs are required:

(6) **Jo eu ihac –i –ad –ig –en.**
     house that show PRED -$2_{PL.IO}$ $1_{SG.SUBJ}$ - FUT
     'I will show that house to you (plural).' (Roberts 1987: 69)

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[47] For an enlightening discussion of the concept of "transformation" in the sciences, see Stjernfelt (2011).

[48] 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. The use of "intuition" in this phrase is ironic in light of earlier discussion. But it meant a form of inference for Peirce in any case, as we saw.

This is a sentence lacking a verb, which triggers in Amele an interpretation as a sentence about "giving." A compositional analysis would have to call this an "idiom," missing its productivity. But an inferential analysis has no problem with such examples. This is unlike languages with overt verbs of giving, since it is claimed that the experiential basicness of giving in Amele culture favors deriving the semantics from the reversal of the pronominals marking indirect and direct objects along with simultaneous zero marking of the verb. *Giving* is culturally significant and thus is inferred by convention from a proposition in particular contexts. A sentence missing a verb can therefore be object whose interpretant includes "give." Here is a case in which a missing item, as part of a larger semeiotic entity, serves as an aid to inference. Compositionality has no role to play in such examples, without proposing invisible verbs (which of course many are happy to do).

Wierzbicka (1992, 1997, 2014) provides further examples of cultural constraints on grammar in Russian. She shows how the "key word" *sud'ba* "fate, destiny", for example, designates a Russian way of looking at life, manifesting itself in the Russian lexicon, phrase structure, and morphosyntax (see Goddard (2002) for details). For Cliff Goddard (2002, 55) ethnosyntax is the encoding of a "particular 'ethnophilosophy'" in the grammar proper (as in Wierzbicka's and Roberts' examples). I accept this conceptualization as well.

13. Peirce, Frege, and Syntactic Problems

Now let's move to consider English-based syntax to illustrate that classic "problems" in syntactic theory often arise as an artifact of a Fregean compositional approach. Linguistics evolved without much attention to Peirce and it is right to ask the question if it is simply not too late, too retrograde, to look back to the nineteenth and early twentieth centuries for conceptual tools relevant to the twenty-first century (even thought so much of modern linguistics is based on Frege's nineteenth century idea). For example, consider a few examples of issues that engage many modern syntacticians to greater or lesser degree. I will show that none of these is in fact proposition or sentence-bound, thus fitting better with Peircean semeiotics (especially his Existential Graphs) than sentence-bound formal linguistics.

Let's begin with a phenomenon that has drawn the attention of many syntacticians over the years, Antecedent-Contained Deletion (ACD) (cf. Pesetsky (2000) among many others).

ACD is a special case of "Verb Phrase (VP) Ellipsis," wherein the proverbal (as opposed to pronominal) word *did* refers back to an earlier VP. VP-Ellipsis is shown in:

John washed the dishes and Mary did too.

Did refers back to the VP "washed the dishes," according to standard, sentence-bound analysis. This is VP-ellipsis. ACD is similar but presents problems as standardly conceived:

John washed every dish that Mary did.

The issue is the VP referred to by *did*. That VP is "every dish that Mary *did*." So *did* appears not only as the proverb at the end of the clause, but within the VP that it refers back to, thus creating a recursive reference that never stops, an infinite regress:

John washed every dish that Mary did (wash every dish that Mary did wash every dish that Mary did...)[49]

Linguists proposed a number of solutions but one in particular emerged as very popular. This was proposed by Ivan Sag (1976). In this analysis there is abstract (i.e. unheard) "raising" of the quantifier phrase "every dish that Mary did" to the front of the sentence:

[s[Every dish that Mary did$_{read}$]$_i$ John washed t_i]]

After Quantifier Raising, the elided VP no longer contains the object relative and can refer to only *washed t*, thus eliminating the infinite regress. This analysis is both abstract (there are components that are never heard) and ordered, i.e. we set the reference for *did* following the movement of the quantifier phrase (this need not be an artificially-imposed order, if we also assume an abstract level of Logical Form at which reference, quantification, and the like take place). This is also a compositional, rather than an inferential, analysis.

But now consider the following exchange:
A: John washed every dish.
B: What, that MARY did?
A: No, that John did.
Or:
A. John washed every dish.
B. But I thought I saw Mary in the kitchen earlier. She told me she washed the dishes.
A. Well, I know that John washed every dish.
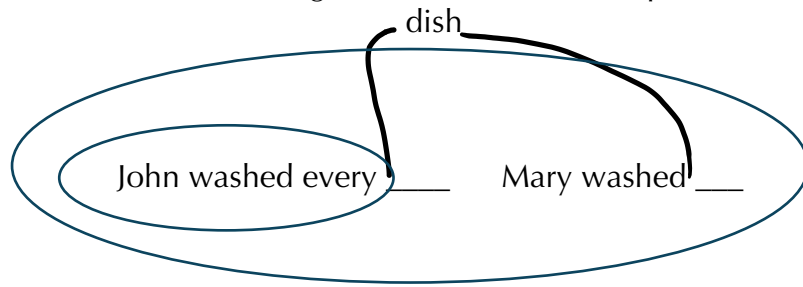B. That MARY did?

If we take *did* in B's last line to refer back to "washed every dish," there is no infinite regress because *did* does not occur in either of A's sentences and thus the *did* in the last line of B does not have an antecedent which contains it. Its antecendent is given inferentially, not compositionally. The infinite regress problem is thereby avoided, no abstract solution is needed. Compositionality is not applicable here (in its most common sense) because more than one sentence is involved. In fact, we could say that insisting on *compositionality is the source of the problem with these examples*.

How can we unify the analysis of these different signs within and across sentences boundaries? A Peircean solution is available that handles both cases easily. This solution is not available to a compositional approach, however. Again, the compositional approach is what forces those who adopt it to also employ an abstract analysis that must respect compositionality via the [overt$_i$ - covert$_i$] pairing that is the hallmark of a generative and the very source of this enigmas, which disappear in an inferentialist model. A simple, inferential, non-compositional Existential Graph shows how Peirce's theory encounters no problem at all with Antecedent Contained Deletion, an artifact of Frege's Error.

The enclosing solid lines can be read for now (see sources cited above as well as Everett (forthcoming b) for discussion of these graphs) as "it is not the case that," i.e. negating what falls within them. Two juxtaposed items in an EG are interpreted as a

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[49] Where the material in parentheses is the understood reference of *did* in infinite regress.

conjunction. And graphs are read from the inside out (what Peirce called the endopeuretic method of EG-reading). This leads to the interpretation of the graph given just below:

The free reading here (always from the outside in, the endoporeutic procedure required in EGs) is that "John washed every dish that Mary did." Literally, it means that It is not the case that that John did not wash a dish and Mary did (wash that same dish). Since this is an inferential graph not a compositional graph (e.g. a tree-structure as most commonly interpreted in generative theory), the sentence is predicted to be one that is relatively easy to process, with no problem of regress - just as the average speakers seems to interpret it. Because we take signs and their interpretants as the goal and not formal modeling of the hearable syntactic form of sentence this is straightforward. The need to posit abstract categories in the formal modeling of the sentence by and large is a by-product of compositionality. Valence tells us that "wash" has two arguments. Inference tells us that "did" is referencing "wash" and the procedures for drawing EGs to model sentence interpretants are straightforwardly applied (see chapter eight for an introduction to EGs).

Because of valence, propositional structure, and his theories of Existential Graphs and inference, Peirce's model can handle the "infinite use of finite means" constraint of Fodor, i.e. capturing the productivity of natural language, without recourse to compositionality - which in the case of Antecedent Contained Deletion was the cause of the faux problem in the first place.

Let's consider another well-known syntactic operation and its sentence-level formal, non-semeiotic analysis, Sluicing, illustrated in the next few examples:

Phoebe ate something, but she doesn't know what. (=what she ate)

Jon doesn't like the lentils, but he doesn't know why. (=why he doesn't like the lentils)

Other examples are plentiful, e.g.

Someone has eaten the soup. Unfortunately, I don't know who. (=who has eaten the soup)

Sluicing occurs in embedded clauses with indirect questions. But sluicing is also frequent in direct questions *across* speakers, and thus not sentence-bound *nor compositional*:

Somebody is coming for dinner tonight. - Who? (=Who is coming for dinner tonight)?

They put something in the mailbox. - What? (=What did they put in the mailbox)?

The examples of sluicing above have the sluiced material following its antecedent. This material can also precede its antecedent:

I don't know why, but the pictures have been moved. (=why the pictures have been moved)

When and how is unclear, but somebody should say something. (=when and how somebody should say something)

Hopper (2015, 127), proposes a non-syntactic analysis, one that also avoids the problems of Frege's Error, i.e. it is not forced to search for a sentence-bound compositional analysis. As Hopper says at the outset of his analysis, "However, while syntacticians have occasionally made reference to live data to supplement the manufactured examples that they use, the topic has not received a treatment based purely on evidence from natural discourse, and especially none from conversational transcripts. Yet sluices are quite common in spoken English discourse."

To see this, consider the following actual fragment of conversation (Hopper 2015, 128ff):

SHANE: … We were planning.. for them to drive up, and I was gonna fly. That was the original plan.

DOLORES: … Oh it was?

SHANE: .. Yeah.

DOLORES: … ((SHAKING ENVELOPE) [edited slightly, DLE])

DOLORES: Say when.

JULIA: .. What's that.

DOLORES: … Chili powder.

As Hopper (2015, 128) puts it, "In this excerpt three people are conversing while cooking. Earlier, there has been discussion of what spices to use, but the topic has now changed to Shane's upcoming trip. Dolores's *say when* is a common English formula used when pouring things. Here it refers to her action in shaking chili powder into the dish. It has no linguistic antecedent, and so the sluice cannot refer to ellipted syntactic information. Such examples present a serious difficulty for ellipsis based accounts of sluicing. Hopper continues with his own analysis, based on discourse and inference (and though he doesn't put it in terms of inference, his analysis is compatible with such an interpretation).

There are many other syntactic "problems" whose problematic nature disappears once we abandon Frege's Error and work in an inferential, discourse-based model such as Peirce's EGs. The representation of the meaning (without the gaps) in the example immediately above is iconic. It assumes knowledge of English propositions based on more

than indexical symbolic forms.   We have rules for interpreting signs in English that allow us to infer that the two cases of eating can have the same object. We can infer this with or without the two predicates in the same sentence as they are here. For example, "Some people ate bread. Wow. Did they really? For others just rice." Or "Some ate bread. We saw them driving up." "But what did the others eat? Only rice." Whatever this phenomenon is, it is not a sentence-internal syntactic process, but an inferential interpretation of propositions and their relationship within a discourse. Then why does the implicit predicate of the second clause or sentence "Some only rice, etc" seem to require the inference that the understood predicate be "ate?" Because otherwise the sentences would not form a coherent discourse.

Another widely studied construction is known as "Pseudogapping" (which elides most but not all of a finite verb phrase). It is compared below to V(erb)P(hrase)-ellipsis.

He drinks milk more often than she does _{drink milk}. - VP-ellipsis

He drinks milk more often than he does _{drink} *water*. - Pseudogapping

She is working today, but he isn't _{working today}.- VP-ellipsis

She is working today, and he is _{working} *tomorrow*. - Pseudogapping

Larry might read the short story, but I won't _{read the short story}. - VP-ellipsis

Larry might read the short story, but he won't _{read} *the play*. - Pseudogapping

Once again, though, any problem of deriving the meanings of these sentences is created by a sentence-bound, Fregean-influenced compositional theory. Like all of these phenomena, these latter two related phenomena operate across clauses as well:

A: "Did you know that Fred likes to pet their cat?"
B: "Yes, and Sally their dog."
Or:
A: "I was talking to Bill. Larry might read that short story after all."
B: "Yeah, well I won't."

        dog   cat

Bill likes to pet ---.   Sally likes to pet ---.[50]

And so on. Theories based on discourse, e.g. Peirce's EGs and Hopper's theory not only do not face the "problems" faced by some compositional theories, problems created by sentence-bounded Fregean analyses focusing excessively on propositions and their common sentential manifestations, but they, unlike the standard formal account, can also handle the cross-speaker, transsentential discourse manifestations of such phenomena.

Next to be considered is perhaps one of the most intensely studied phenomena in formal linguistics, "Syntactic islands," which likewise operate across sentence boundaries. Island constraints are interesting because they show that the inferential content of syntactic structures is extra-sentential, requiring such inference, based in part on the cultural values of extant theories. Abeillé, et. al. (2020) make this claim about island constraints.

"Ross (1967) observed that "island" structures like "Who do you think [NP the gift from __] prompted the rumor?" or "Who did you hear [NP the statement [S that the

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[50] No enclosure is used here because nothing is negated.

CEO promoted __]]?" are not acceptable, despite having what seem to be plausible meanings in some contexts. Ross (1967) and Chomsky (1973) hypothesized that the source of the unacceptability is in the syntax. Here, we summarize how theories of discourse, frequency, and memory from the literature might account for such effects. We suggest that there is only one island structure—a class of coordination islands—that is best explained by a syntactic/semantic constraint. We speculate that all other island structures are likely to be explained in terms of discourse, frequency, and memory " (Abeillé, et. al. (2020))

Consider the following island constraints.

Whom does Carl believe that Bob knows that Mary likes __?

*Whose is John talking to __ friend?

Though, for those who use this concept, "extraction" is allowed in the first example, it is prohibited with possessors, as in the second. This is another example, of many more, of the [overt-covert] problem. This type of problem in my analysis as with a Potential Evidential Domain in Pirahã (Everett (forthcoming b)), which presents a related, even though somewhat dissimilar problem) is partially based on valence, because possessors are not part of the valence of the verb, not called for by the rheme of the proposition and therefore need to be asked as part of the item that does saturate the valence of the rheme, i.e. "whose friend" (*friend* completes the valence, *whose* does not). An inferential rule based on semeiotics rather than syntax might be "Questions about non-rhemal completing material must be clearly marked." Since *"Whose did you like __ friend" is not clearly marked as a non-rhemal question, it produces difficulty in interpretation (not impossibility, however). But in "*Whose friend* did you like?" The question is marked clearly as a rhemal-valency-completing element question, so there is no problem.

This characterizes these "islands" as an inference problem, a problem that disappears in discourse. Because sentences are interpreted as signs within a discourse, such questions work transsententially unproblematically. Across sentences valence and propositional structure are inapplicable.

A: "Carl believes that Bob knows that Mary likes someone's friend."

 B: "Whose?"

Here B is asking about "someone" from "someone's friend," but there is no interference from an "island." Why not? The reason is that the "whose" of B's question across clauses is not part of the valence of any clause, just a question word whose interpretation is based on inference unencumbered by the inferential rule of "ask questions that are about the rheme or mark the deviation clearly."

Ted Gibson and his co-authors have written extensively on non-syntactic, non-compositional, inferential factors in island effects.[51] For example, as Liu, et. al. (2022) summarize the problem: "We suggest that there is only one island structure—a class of coordination islands—that is best explained by a syntactic/semantic constraint. We speculate that all other island structures are likely to be explained in terms of discourse, frequency, and memory." (Gibson, et. al. 2022) They go on to claim that (in harmony with the approach in this section, with Hopper's approach, and others: "The main problem with

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[51] See TedLab "publications" for a full list: http://tedlab.mit.edu/publications.html

the notion of "syntactic island" is that its definition typically presumes that the source of the unacceptability is due to syntactic constraints. Such a definition is contradicted by the existence of the counterexamples above, along with many others."
Coordination islands are seen here (Liu et. al. 2022, 507ff):

> *What did John buy [NP a shirt and __]?
> They go on to observe that (507ff):
> "Whereas there is disagreement in the literature about how to explain most island effects, there is no disagreement with respect to certain conjunct islands as in examples 15 (Ross 1967) and 16 (Chaves 2012, Chaves & Putnam 2020), where one or several of the full conjuncts have been extracted:"
> (15a) *Who did you invite Mark and __?
> (15b) *Who did you invite __ and Mark?
> (15c) *Who did you invite __ and __?

The explanation offered by Liu et. al. is that a conjunct, e.g. *and* requires two argments so such examples violate this requirement.[52] In semeiotic terms these coordinate islands violate the indexicality of the conjunction - it cannot index two arguments if only one is found with it, yet it is required by its meaning to do so (not a problem for predicates or their arguments since they are constituents of the proposition/sentence as a whole).

Liu et. al. suggest (2022, 502) that " The main problem with the notion of "syntactic island" is that its definition typically presumes that the source of the unacceptability is due to syntactic constraints. Such a definition is contradicted by the existence of the counterexamples above, along with many others."

In the context of an inferential theory of the type Peirce advocated and that indirectly implied by the work of Hopper, Gibson, and many others, I am going to assume from this point onward that the [overt$_i$-covert$_i$] (or "gap-filler") phenomena are, contrary to decades of arguments that these constraints support Chomskyan theory, largely artifacts of a sentence-bound, Fregean approach. Such an approach is only remotely plausible if it ignores language in its natural contexts, especially discourse and conversation.

Again, the misconception that all of these (and many other) problems in modern syntax have in common is that they are concerned with the relationship discussed above between silence (or "covert") and hearable or "overt" material in a sentence interpreted together.

On the one hand, this configuration represents roughly the entire empirical core of Chomskyan linguistics. But this core problem itself disappears in a Peircean theory based on inference rather than compositionality and further taking as its primary empirical

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[52] But then why are there grammatical examples of "extraction" from coordinate structures (Liu et. al. 2022, 501ff):

> "Counterexamples to the coordination island:
> (13a) How much can you [drink __ and still stay sober]? (Lakoff 1986, example 2)
> (13b) How many lakes can we [destroy __ and not arouse public antipathy]? (Pollard & Sag 1994, p. 201)
> My own analysis of these is that these is that the "and" is coordinating two sentences and the internal movement within one sentence leaves the coordination of the two sentences intact.

domain "perfect symbols," i.e. discourses and conversations rather than merely propositions or sentences. Thus I agree with the following Pragmaticist conclusion: "To insist and hope that Peircean linguistics be compatible with the presuppositions of mainstream linguistics, or that it bear some resemblance to the preoccupation of most modern day linguists is to miss the boat, and be left with sterile distinctions which do little else than distort the nature of linguistic reality." Veera (1994 p71)[53]

13. Diagrammatic Reasoning, Frege and Peirce

　　　Modern linguistics and, during my school days, public education, value diagrams for teaching and illustrating grammar. My elementary school English teachers taught us to represent our knowledge of language in the form of Reed-Kellogg diagrams. These diagrams are icons of sentence structure. Students learn to think more clearly about the structure and expression of their language through such icons and semeiotic reflection. Consider such a diagram for the sentence "The subject was defining big words:"

_subject_____was\ defining| words_____
　　　\　The　　　　　　　　　　　　　　　\　　big
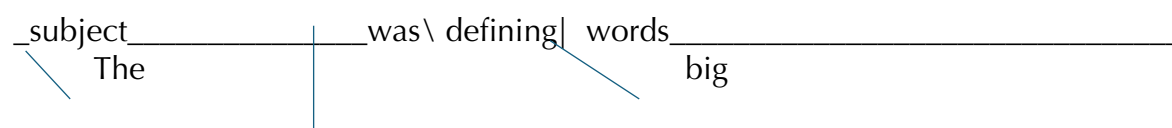
　　　But while such diagrams are effective in illustrating particular aspects of sentence structure, they are unable to represent how each word in a sentence is connected to and dependent on the words around it. That is, they fail to support adequate corellarial and theorematic reasoning (Stjernfelt (2014)). For example, consider a classic example used in introductory linguistics courses "an old dog lover." Does this mean "a lover of dogs and who is old" or "a lover of old dogs?" A Reed-Kellogg diagram can only link "old" as a word that modifies the noun "dog," because "old" is adjacent to "dog." The Reed-Kellogg diagram cannot, however, illustrate the ambiguity of the interpretations just given of the sentence here. We need something more.

　　　To overcome such difficulties and to illustrate theoretical issues of his own interest, Chomsky ([1955] 1975, 181ff) further developed work on icons initiated by other linguists (e.g. Wells (1947)) on "tree diagrams" in linguistic theory to provide a simple, iconic method of rendering sentence constituent relations clearer visually in a Fregean compositionality context. Chomsky's icons, once introduced, quickly became (in a way that Peirce would heartily endorse) objects of experimentation in their own right, as all diagrams potentially do, though Chomsky's diagrams are intended to support a compositional approach to meaning that omits inference theory.

　　　Diagrammatic reasoning (Stjernfelt 2010) has always been an important philosophical and scientific tool. This is for the simple reason that we think iconically

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[53] Veera (1994, p71ff) goes on to say that: "If the goals of analysis are merely to search for certain regularities whatever they may be, without any regard for what is it that such regularities are supposed to explain, then in a sense, a reference to the corpus of data may be excluded, but then too, not completely. But if our attempt is to explain something by means of such regularities, say, particular aspects of a discourse event, then a reference to the total discourse situation becomes absolutely essential. So our observations concerning the regularities of discourse are, truly speaking, fallible hypotheses that perform the role of explaining something about the concrete discourse event that may be under consideration at the moment."

(some people think this way more than others apparently), as well as symbolically. Icons can reveal aspects of entities that symbolic representations cannot (think of a map vs. a list of prose directions).

Corrollarial reasoning refers to inferences that can be read directly off of the diagram in question. For example, in the tree for John saw Mary, John is "higher" in the tree than Mary, based on one model of diagramming:

```
                        S
   NP_____/     _____
   John                VP          
                   V  /  \  NP       
                   saw     Mary
```
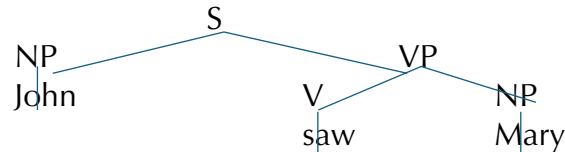
The statement that "John is higher in the tree than Mary" is a simple corollary of the tree diagram. Iconic or diagrammatic representations provide handles for inference than are often unavailable to symbolic representations. Thus many prominent authors, Temple Grandin, Frans de Waal, Charles Peirce, have claimed that they think mainly in images, at least for many tasks). Consider, for example, the well-known and well-studied syntactic relationship in formal linguistics referred to as c-command (from "constituent-command"), developed initially by Tanya Reinhart (1976; see also Reinhart 1981; 1983; Reuland 2007).

"Node N_1 *c-commands* node N_2 if and only if:

Node N_1 does not dominate N_2, N_2 does not dominate N_1, and
The first (i.e. lowest) branching node that dominates N_1 also dominates N_2.

A node y immediately above a node x dominates x. Domination is a transitive relation. Therefore, if y dominates x and x dominates z, then y dominates z. So in the structure below M dominates A and A dominates John, so M dominates John. M dominates B and therefore M dominates everything in the tree. B dominates C, D, likes, and her. And therefore, John c-commands C and D and likes and her by the definition above. M does not c-command any node because it dominates all nodes."

42
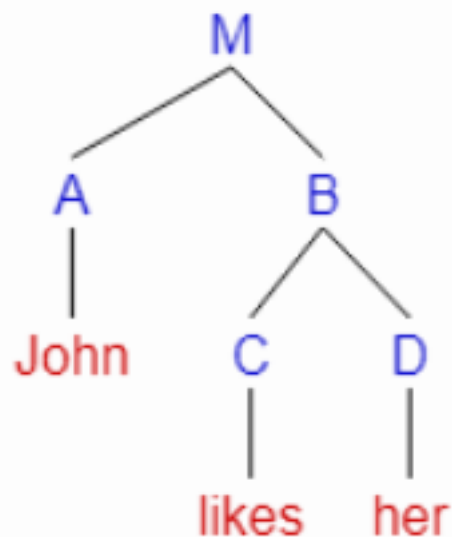
The application of c-command is found in various subframeworks of Chomskyan theory such as "Binding Theory," which analyses the syntactic relationship between pronouns, reflexives, and their antecedents. Chomsky's analysis thus places an iconic constraint on the relationship between a pronoun and its antecedent. The first major revision to binding theory is found in Chomsky (1980), to cover reflexives and reciprocals which Chomsky refers to as "anaphors:"

a. An anaphor α is *bound* in β if there is a category c-commanding it and coindexed with it in β.

b. Otherwise, α is free in β.

Another form of binding is quantificational binding. Quantificational expressions work differently from definite anaphora and this type of binding is more restrictive. According to Reinhart (1973) a quantificational expression must c-command any pronoun that it binds:

[Every man] thinks that [he] is intelligent.

a. $\forall$x(man(x)): x thinks x is intelligent. (bound)

b. $\forall$x(man(x)): x thinks y is intelligent. (coreferential or 'free')

In this example, the quantifier [every man] c-commands the other pronoun [he] and a bound variable reading is possible as the pronoun 'he' is bound by the universal quantifier 'every man'. The sentence above in show two possible readings as a result of the bounding of pronouns with the universal quantifier. The first reading states that for *all man*, they each think that *they (he)* are intelligent. Meanwhile, the next sentence states that for *all men*, they all think that *someone (he)* is intelligent. In general, for a pronoun to be bound by the quantifier and bound variable reading made possible, (i) the quantifier must c-command the pronoun and (ii) both the quantifier and pronoun have to occur in the same sentence:
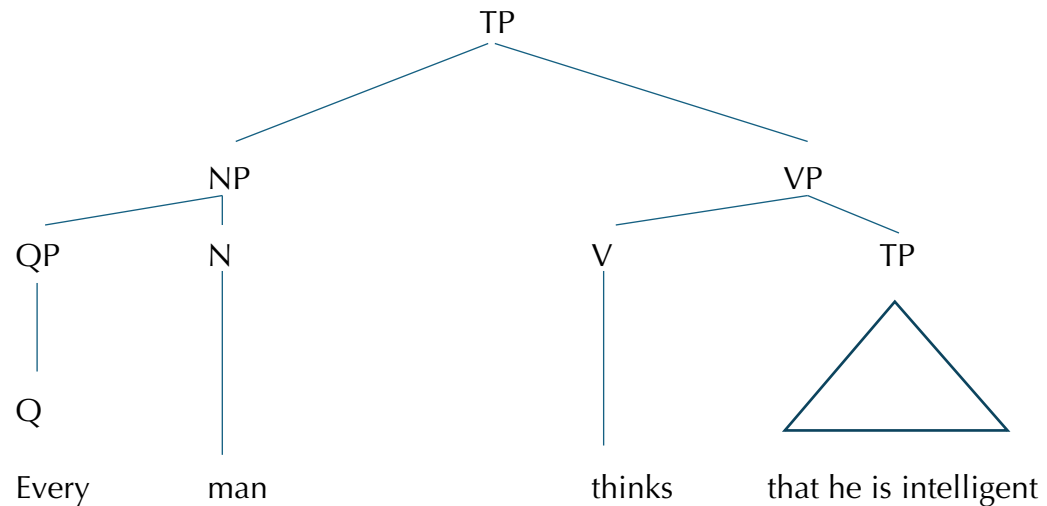
In other words, c-command is theorematically derived from tree diagrams/icons that was *inferred* by examining natural language syntax. And vice-versa. Properties of natural language, such as what can serve as an antecedent for a pronoun, can be inferred from icons, either corollarially or theorematically. Diagrams work within semeiotics by serving simultaneously as icons and indexes of structural relationships (though their theorematic reasoning might be wrong). The next two sentences show this.

John$_i$ likes himself$_i$.

*John$_i$ likes him$_i$.

In these two examples, *John* c-commands *him* and *himself*. This means that the first sentence respects the rule that anaphors must be bound in their clause but that the second sentence violates the constraint that pronouns cannot be bound in their clause.
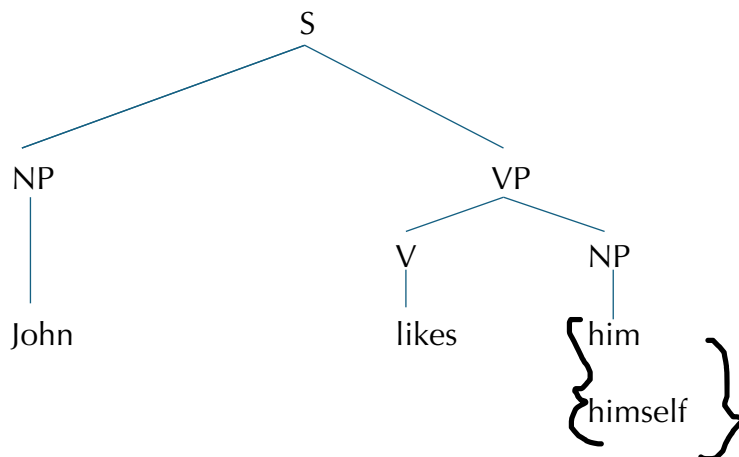
The standard view of these two sentences in generative linguistics (Chomsky 1981), is that "John" and "him (a pronoun)" could never refer to the same person (even though they are both third person singular masculine) while "John" and "himself (an anaphor)" must refer to the same person. What is important for this chapter's point is that the analytical reason for this was proposed to be that "a pronoun is free in its c-command domain" but "an anaphor is bound in its c-command domain." "Bound" here means "has an antecedent (i.e. a co-indexed/co-referent NP) and "free" means "has no antecedent" in its c-command domain where c-command is defined above.

Since John c-commands both him and himself, we can state the different conditions on pronouns vs. anaphors as: "A pronoun must not have an antecedent that c-commands it, while an anaphor must have an antecedent that c-commands it."

This generalization became part of the basic theoretical arsenal of the phase of Chomsky's work known as "Government and Binding Theory" and c-command became for a while almost a foundational assumption of generative linguistic theory more generally. It is an example of theorematic inference from the icons of tree structures to linguistic behavior. These are all variations on the compositionality theme.

This particular form of representation is not required by Speculative Grammar, however, so we do *not* expect it to be universal and indeed it is not, contra the theory just given. To see that it is not universal, consider the following data from clitic-doubling in Pirahã (Everett 1984). The reflexive vs. pronominal interpretations are both available in the same structure, with inference from context the only way to decide on the correct interpretant. In Everett (1984, 52ff), I discuss the following examples:[54]

hi	**hi**	**xib**	**-ao**	**-b**	**-a**
$3_{(i)}$	$3_{(i/j)}$	hit	-telic	-perf	-rem

(i) 'He hit himself'
(ii) 'He hit him.'

ti$_{(i)}$	**ti**$_{(i)}$	**xibaoba**
1	1	hit

'I hit myself,,'

| **gi**$_{(i)}$	**gi**$_{(i)}$	**xibaoba**
2	2	hit

'You hit yourself.'"

There is no lexical or morphosyntactic distinction of any kind between the sentences with the different readings in these examples. Rather the relative interpretations are determined inferentially, not compositionally, linked to the time, place, and context of utterance.[55]

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[54] Though in that analysis I add unnecessary abstract diacritics to make the data fit Chomsky's theory.
[55] One can always augment the abstractness of any analysis by proposing unhearable additions to the structures that are claimed to remove dependence on inference. If we assume, for example, that the pronominal clitic **hi** comes in two varieties, one of which has phonologically null/abstract reflexive tag and the other without, then the one with the reflexive tag apparently requires no inference. But how would a hearer know which variant of **hi** was to be interpreted, the abstract or concrete one, except by inference? This abstract, unhearable morpheme strategy gains nothing. Inference is inescapable.

More generally, diagrams need not look the same as Chomsky's. For example, in the theory of Stratificational Grammar (Lamb (1966); White 1969, 193-194), the diagrams constructed look very different from the Chomskyan diagrams just seen:

Figure 1
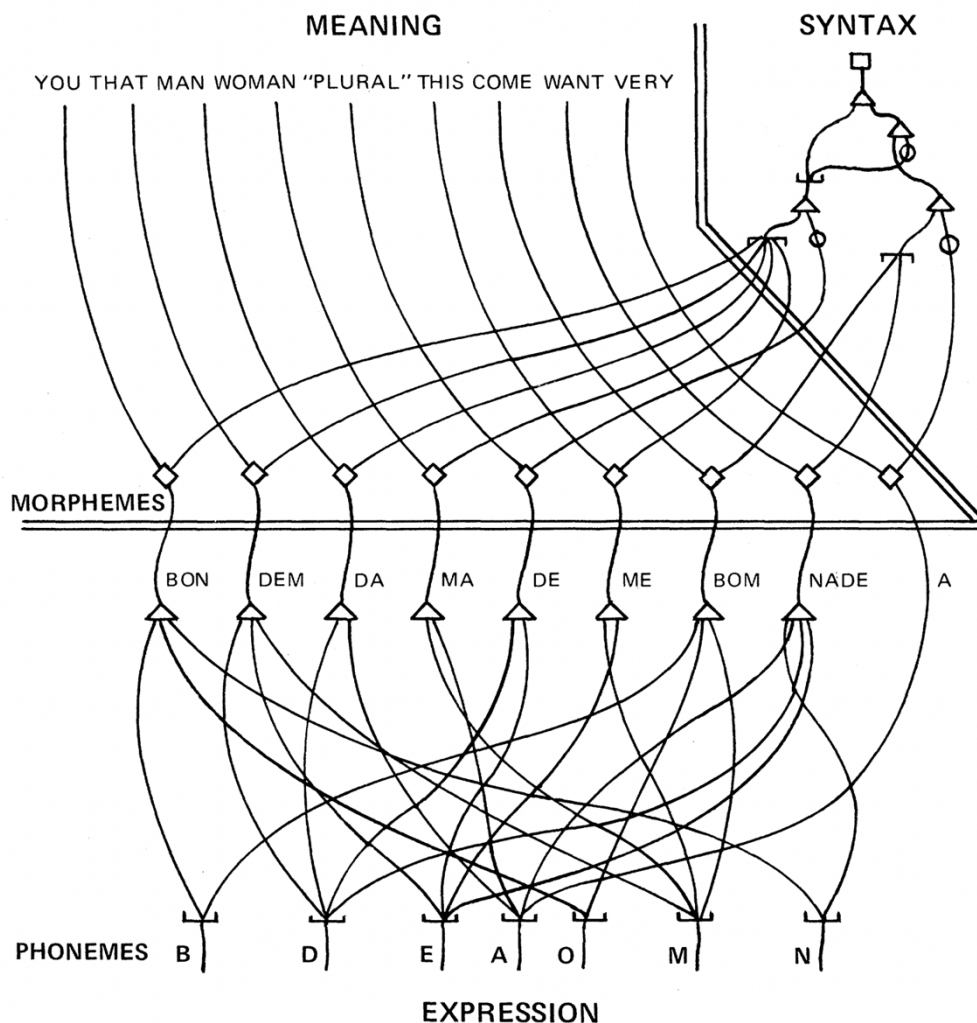
This diagram illustrates the very distinct theoretical proposals of Sydney Lamb's (1966) Stratificational Grammar in which: "A language has both structure and process, corresponding to neurological network and neural impulse. Structure provides the means whereby process may occur. In a language, the primary processes are encoding and decoding... In stratificational grammar, this is shown in the diagram as moving downward to expression (encoding) and moving up- ward to meaning (decoding)... In production of a sentence (encoding), meaning always precedes expression, while the reverse is true for

decoding. Therefore all the decisions necessary to produce any linguistic form are made before the expression is actualized." (White (1969, 193-194))

In Stratificational Grammar theory, therefore, the purpose of a diagram is not merely to diagram a static linguistic constituent or set of constituents, guided largely by Fregean assumptions, but to represent as well their dynamic aspect in planning and active neural connections. Thus the diagrams of the two theories just discussed are not intertranslatable. This is because they have different objects. Peirce (1906,) made it clear that part of the nature of or identity of a diagram is determined by the intention of the person(s) at the source of the diagram. Thus there are many diagrams for the same sentence across (and within) linguistic theories and each diagram will, if successful, render clearly (once the intentions of the author are known) what the theoretical cartographical points are.[56]

In linguistics more broadly, however, iconic, diagrammatic representation of theoretical proposals is largely done in a simple manner corresponding not to the logic of sentences (and almost never to either the logic or the form of discourses) but to some level of structure of sentences, along with, in very few theories, more complex notions, e.g. the interrelationships between structures or levels or speaker intentions, etc.

This brings us back to the Fregean problem with most early proposals for diagramming linguistic constituents, namely, that they are limited to sentences and their subconstituents rather than including the discourses and conversations that sentences are merely constituents of.

Just as all linguists know that one cannot study words apart from their including phrases, nor phrases outside of their including sentences, many linguists today are coming to realize that sentences themselves can only be fully understood semantically, functionally, and structurally as constituents of discourses, with discourses and conversations constituent signs of cultures. We return to this matter momentarily. First it is important to understand some differences between sentences and propositions.

A proposition, as discussed in chapter six, is composed of a predicate-as-icon and a subject-as-index. For example, in the sentence "John fell down," the predicate is an icon (i.e. embodies a set of correspondences) to something. But itself "fell down" asserts nothing. "John" is the index that points to the person about which these corresponding properties are true. But apart from the icon, the index also asserts nothing. A proposition is found always and only therefore as an icon linked to an index, whether expressed in words, in art, by pointing, in weather vanes, or whatever. Whatever the physical manifestation, a proposition is, iconically: [$_{proposition}$ [$_{index}$] [$_{icon}$]], where the initially non-referring icon acquires its reference by linking to its index by means of the relevant structure or simply by inference.

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[56] There is even a subtheory of Chomskyan linguistics referred to as Cartographic Syntax (Cinque and Rizzi 2008) in which cartography - is a diagram, whose purpose is to assert the testable claim that all languages organize certain semantic categories in the same way. Similar claims preceded cartographic linguistics, such as in most versions of so-called Role and Reference Grammar (Van Valin 2007), which derived the "cartographic" effects not from syntax (the representamen) but from the meanings of individual affixes and words, based on the semantic scope of their interpretants.

The proposition has long been a central concern of philosophers of language, linguists, and logicians. And because its principal linguistic manifestation is the sentence, it is unsurprising that in most formal theories, the sentence became the basic constituent or "start symbol" (Chomsky 1965) of grammar. But a sentence is a fact about a specific language, whereas a proposition is a logical constituent of semeiotics. Thus sentences in Peirce's classification fall under classificatory linguistics and propositions under Speculative Grammar. And sentences further are analyzed in terms of word order alternations, typology, and phenomena that are distinct from the study of propositions.

For anyone who follows Peirce's work, however, it is clear that propositions (and thus sentences) are themselves constituents of larger units - arguments and (therefore) discourses. Of course, there is no doubt that a great deal of linguistic action takes place in sentences. Studying sentences is vital to any theory of linguistics. Just as morphemes are. Or phrases. Or words. But no one would think of studying these other units apart from their containing units (or tagmemes, to use a Bloomfieldian term). And the same standard should be held for sentences - no theory should focus exclusively on sentences, any more than they should focus on words alone. Chomsky has long defined language as a set of sentences. But if Peirce is correct, or many other theories, this is a serious mistake and shortcoming of any theory. A language is not a set of anything. It is a process of communication and is characterized most appropriately by its conversations and stories.

Getting back to the concept of "syntax as inferential anchor," what could this mean? It means that information can only be transferred from one entity to another if there is a way to figure out what that information is. There are many non-verbal ways. But language makes it much easier because it provides multilayered, organized, conventional signs, of which syntax is just one of the layers (figuratively). From the concept of anchoring, we move to how inference underlies the supposed independent principles of compositionality and parsing.

14. Anchors and Grammatical Transparency

Seeing syntax as principally an anchor for semeiotic interpretation, inference, rather than as a compositionality building block leads us to the proposal in Everett (2017) and Barham and Everett (2021) that there is more than one bauplan behind the organization of the individual languages of the world. These language types (which are not exhaustive) are classified according to the relative degree of inferential transparency, i.e. how tight the fit is between the syntax and the semantics. I proposed three organizational structures and argue that we find examples of all three in the world's currently spoken languages (Everett 2017). Only one of these organizational plans might support the compositionality that Szabó (2000) and others advocate for, however. And even in those languages compositionality is unnecessary.[57] For the other two types, compositionality is less directly connected to the syntax. The broad language types that I defend here are: a linear order grammar, G_1, (subject-verb-object) that conveys meaning (Figure 1), which provides less inferential anchoring than a G_2 grammar, which have

_____

[57] Below we discuss the non-compositional, recursive interpretation of non-recursive sentence clusters such as "You drink. You drive. You go to jail."

hierarchical structures but no recursion (Figure 2). And a G_2 grammar can provide less inferential anchoring than a G_3 grammar, which has overt recursion, and simultaneously represents all that G_1 and G_2 languages represent (Figure 3) (Everett 2017: Chapter 9). In this hierarchy of grammars, there is no need for a protolanguage in language evolution; a G_1 language is sufficient to convey nuanced, abstract meaning. G_1 languages may have evolved first (or not), but in any case with syntactic recursion a late and unnecessary expectation for early languages (Karlsson 2009; Everett 2017; 2012a). G1–G3 coexist today with G_1 and G_2 languages found in some societies without graphic traditions (Everett 2005; Gil 2007; Pullum 2020).[58]

The empirical differences in these three grammars are illustrated diagrammatically using the sentences below:

John came in the room. John sat. John slept. (Interpreted as 'John came into the room, sat, and then slept.')

John entered the room by the garden. John slept. (Interpreted recursively, as in ())

John came in the room, sat, and slept.

The illustrations in the first three diagrams conform to a G_1 grammar. In these diagrams, there are no category labels, e.g. "noun" or "verb", and no phrase labels, such as "verb phrase". The simplest grammatical structure would be a linear arrangement of words as a proposition/sentence. There are modern languages arguably represented by G_1 grammars, for example, Pirahã (see also Futrell et al. 2016; Everett 2005; 2009a; Everett and Gibson 2020) but also Warlpiri,Wargamay, Hixkaryána, Kayardild, Gavião and Amele among others (Pullum 2020).

A G_2 grammar would allow the next type of structure, with hierarchical nesting of sub-phrases. A G_3 grammar allows structures such as that shown in the final figure. Two sentences are contained in or "dominated by" the highest sentence making this a grammar without constraints on recursion. These different grammars can understood as a set of 'templates' in the Role and Reference Grammar sense (Van Valin 2001).
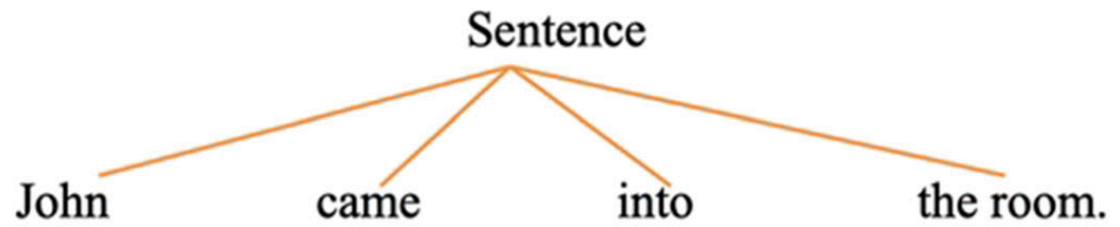
Three diagrams illustrating the linear sentence structures enabled by G_1 languages:

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[58] Perhaps a more workable definition of compositionality in light of the above discussion is that of Pietarinen's 'Pragmatic Principle of Compositionality (PPC)':

(i) 'The meaning of a sentence is the meaning of all sentences that follow from that sentence either by inductive or deductive principles and permissions under all authorized circumstances (i.e., those arising out of mutual consent by [the interlocutors, DLE].' Pietarinen (2005: 525ff)

But this is clearly intended as inference. And it also fails to account for the greater amount of information found entirely outside of sentences, as per Jaszczolt (2009) and above discussion.
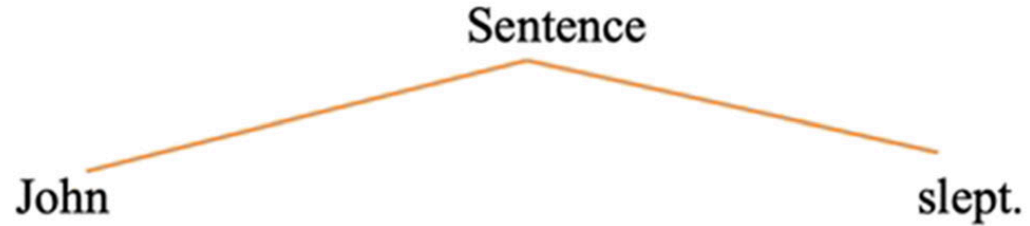
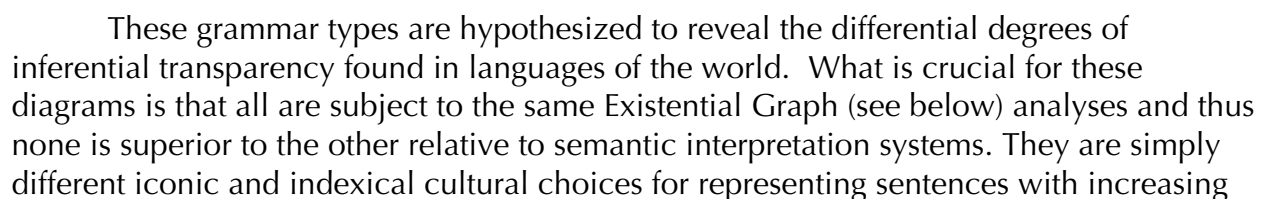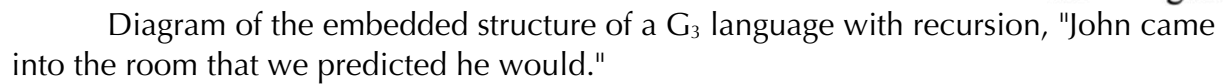a

Sentence

John   came   into   the room.

b

Sentence

John   sat.

c

Sentence

John   slept.

An example of the hierarchical nesting of sub-phrases in a G_2 language

Diagram of the embedded structure of a G₃ language with recursion, "John came into the room that we predicted he would."

These grammar types are hypothesized to reveal the differential degrees of inferential transparency found in languages of the world. What is crucial for these diagrams is that all are subject to the same Existential Graph (see below) analyses and thus none is superior to the other relative to semantic interpretation systems. They are simply different iconic and indexical cultural choices for representing sentences with increasing

or decreasing information rate within individual sentences (the propositions continue the same) and different degrees of inferential transparency. Nothing about innate principles of grammar is relevant to any of these structures. As Everett (2017) argues, they are partly cultural and not exclusively linguistic choices.

Returning to Frege's Error, recall that linguists have made two major bets on the way that people get meaning out of language. One of these wagers is that sentences (representing propositions) are the locus of interest and that meaning results via composition, defined by one of its leading bookies as: "The meaning of a complex expression is determined by its structure and the meanings of its constituents." Szabó (2022). The other money is placed on the horse called "Inference". Inference is the use of reasoning (abduction, deduction, induction) to reach a conclusion. Inferential semantics is around as a major competitor to compositional semantics (though not necessarily ruling out composition as a part of the process of inferring meaning), as in Default Semantics.

Peirce, Brandom, Peregrin, Jaszczolt, myself among many, others are inferentialists. (And so, to a lesser degree, would be Relevance Theory proponents.) Szabó, Lepore & Stone, Chomsky, Montague, etc. fall on the compositionalist, Fregean, sentence/proposition-bound side. It is a stimulating debate. But the winning side is clear from the above examples alone.[59]

As mentioned, others have worked out variants of inferential linguistics. For example, in a series of works Kasia Jaszczolt has developed a theory of default semantics she describes as follows:

> "Default Semantics (DS) is a theory of discourse that represents the main meaning intended by the speaker and recovered by the addressee, using truth-conditional, formal, but pragmatics-rich representations." (Jaszczolt 2021)

This is not the full-blown inferential linguistics I urge here, but it is a huge step away from artificial formalism to a semeiotic-based language theory.

The reason that compositionality and its concomitant abstractions in natural language are sociologically crucial for some subsystems of cognitive scientists is that it by its very existence is an icon for the slogan "language is special." Many linguists want to believe that language is qualitatively special, unlike any other semeiotic system produced by earthly evolutionary history. Compositionality fits this desideratum because it is a special kind of operation that, in its common intepretation, makes thought and language special in human cognition. It is often talked of as a special property unique to human language. So Hinzen, Werning, and Machery (2012, 1) claim that "... compositionality today is widely recognized as a key issue all over the cognitive sciences and remains a challenge for various models of cognition that are in apparent conflict with it."

Yet I have been arguing that compositionality is an epiphenomenon one way of looking at inductive inference, the mirror image of Harris's deductive parsing. All forms of inference take data as input and infer conclusions as outputs. The data could be any kind of fact that an individual is interested in. Induction applied to natural languages takes words and structures (symbols, icons, or indexes) as inputs and returns partial meanings as

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[59] Here is a good review of LePore and Stone and why inference is harder to abandon than they suppose. (Clapp, 2015: https://ndpr.nd.edu/.../imagination-and-convention.../)It is not impossible to provide compositional analyses that work if enriched by diacritics.

input to further inference. But when I say that it "takes words and structures" this is not a chronological or logical claim. It's just one facet of communication. Meanings can be inferred without careful breakdowns of sentence structure, as we will see, and *sentence structure can be overruled* in interpretation by discourse structure, conversational requirements, cultural knowledge, and the like.

In fact, propositions do not require language at all. A weathervane expresses a proposition - "the wind is blowing from the west." No words needed. The function of the words, if used (images also work) is to provide an interpretant (another sign) for the sign of the proposition of the weathervane. (See Deacon (1997) and Stjernfelt (2010))

Some authors confuse computation with grammar and compositionality, rather than seeing linguistic computation as a special case of semeiotic inference. As Thomason, et. al. (2006) put it:

> "We present a formalization and implementation of these principles for a simple conversational agent, and draw on this case study to argue that pragmatic reasoning is holistic in character, continuous with common-sense reasoning about collaborative activities, and most effectively characterized by associating specific, reliable interpretive constraints directly with grammatical forms. In showing how to make such claims precise and to develop theories that respect them, we illustrate the general place of computation in the cognitive science of language."

The category of primary meaning, as it is understood in Default Semantics (Jaszczolt (2016)) and represented in its semantic *qua* conceptual representations, cuts across the explicit/implicit divide. Semantic representations are not limited by the constraints imposed by the logical form of the sentence; they allow for its modifications but also, unlike in other post-Gricean theories, they allow for it to be overridden when the main informational content is conveyed through sources other than the linguistic expression itself. Default Semantics identifies five sources of information, all operating on an equal footing (my paraphrase, DLE): word meaning and sentence structure (WS); situation of discourse (SD); properties of human inferential system (IS); stereotypes and presumptions about society and culture (SC); and world knowledge (WK). Since all of the sources can contribute to the truth-conditional representation, the traditional syntactic constraint that ties the representation to the logical form of the uttered sentence in principle could be abandoned, resulting in modeling a cognitively plausible, main message as intended by a Model Speaker and recovered by a Model Addressee.

Compositionality, then, taken as a special linguistic device rather than as a form of inference, ironically faces a problem with the bread-and-butter gap-filler phenomena of formal linguistics. The foundational observation of modern theoretical syntax, rightly attributed to the early work of Noam Chomsky and developed in subsequent years and decades by generations of "Chomskyan," "generative," or "formal syntacticians," is that constituents of phrases (units that do not form whole sentences) need not be adjacent to or "contained" within the phrases that they are related to interpretationally (though they do need to occur, ex hypothesi, in the sentence in which the phrase itself is contained - a false but very common assumption).

So consider a basic sentence again:

John spoke to Mary.

In this sentence we have joined different signs. "John" and "Mary" are nouns (not very important in themselves, often omitted in many languages, in English conversation and monologic discourse), "to---" is a prepositional rheme requiring a term to complete its meaning (i.e. it has a valence of one) and "--spoke--" is a "rheme" requiring two arguments for completion. Peirce proposed the term "rheme" as an unsaturated predicate (both his terms and used lines to show the "valence" (also his invention) of the argument. For example, knowing the valence of a rheme, we can deduce that it requires two "terms" (or other, more complex unit) to complete its meaning. In this respect, Peirce's inventions of valence, saturation, and so forth have been replicated in just about all linguistic theories, including Chomskyan linguistics, so should be unsurprising to linguists. They arguably form the basis of all linguistic structures below the paragraph.

The sentence is thus parsed (i.e. a structure is deduced, including part-whole relations or hierarchy) from general knowledge (the full sentence) and deduction (getting to the parts, either of meaning, phonology, morphosyntax, as in Harris's work). Alternatively a sentence can be "assembled" by induction, going from parts to the whole (inference again eliminating any role for "compositionality").

As a reminder the information that speakers draw from, in descending order of generality is:
Culture --> Psychology --> Discourse context --> Sentential context and linkages --> Lexical

Now consider:
Who did John speak to ___ ?
In this example, "Who" appears at the beginning of the sentence (a position normally reserved for the subject) and in place of the object of the preposition "to" we have nothing (or some abstract theory-internal entity). But there are many more examples:
To whom did John speak ___?
*Speak to whom did John ___?

For compositionality, which proceeds syntactic constituent by constituent, how do we link "to whom" with "speak?" The solution favored by many formalists as seen above is to propose a gap linked to a filler, as shown by the blank lines. These examples raise type of questions we have seen. Why is there such an alternation in English? Is this found in other languages? How many of the world's languages have this kind of alternation? Why does the auxiliary verb "did" appear immediately to the right of the first phrase in the question sentences, but not in unmarked indicative sentences (John spoke to Bill vs. *John did speak to Bill)? Perhaps we might begin with an alternative question: Why does it have to be second position from left rather than second position from right or some such?[60] The left is where we need indexes of the sentence that follows. And elements that require a host can only appear on the left most host (see footnote).

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[60] Wackernagel's position is named for Jacob Wackernagel (1853-1938), who in Wackernagel (1892) proposed that unstressed, or enclitic, elements are placed in the second position of a clause. This is a semeiotic perspective since this position serves as an important index of a number of grammatical characteristics of the material to follow, surpassed in indexical-semeiotic importance only by the material that precedes it (usually a single constituent, such as a subject, topic, or question word).

Now let us look at similar phenomena that become more interesting on a number of levels:

Mary invited everyone that I invited ___.

Mary invited everyone that I did.

*Mary invited everyone that I invited everyone.

*Mary invited everyone that I ___.

The ungrammatical examples (marked with the asterisk, *) provide contrasts. Ungrammatical examples contrasted with grammatical examples provide important data for constraining linguistic theorizing. Modern syntacticians assume that you must account for what is allowed as well as what is prohibited in syntactic structures, whether these items are considered overt or covert (phonologically absent but syntactically present).[61] This strategy has the goal of rescuing a compositional, Fregean analysis. But it complicates the analyses of these sentences.

Or take a garden-path sentence like "The horse raced past the barn fell." This is known as a "garden-path' or "false scent" sentence.[62] These sentences can be defined as grammatically well-formed but wherein the hearer's or reader's first parse or interpretation is incorrect, yielding a nonsensical or unintended meaning.

Bever (1970) first brought these sentences to the attention of generative linguists and psycholinguists (though as seen Fowler and others had observed them long before). Computational linguists and psychologists (see Liu et. al. (2022) for an important and influential study) have seen many theories come to break on the shore of garden path sentences. Most of the successful solutions on how to parse these examples use highly specific linguistic principles. The entire process is considered "special" in the sense that it is given a new name, "parsing," as though it were unrelated to other processes of natural language or cognition.

An inferential approach to garden-path sentences might look like the following:

Step One: Apply normal deductive inference of meaning from signs (using rhemes, valence, and other semeiotic components of the proposition).

Step Two: Recognize failure of the first attempt.

Step Three: Employ abduction if necessary to guess the meaning you missed in Step One.

Step Four: Check the output of Step Three via deduction and induction.

Through this correlation of semeiotics with formal grammar we see that Peirce's insight, while not formally recognized as such, is reflected in the organization of almost all syntactic theories. In Pikean Tagmemics, for example, the theory is represented as three hierarchies - phonology, grammar, and referential (semantics). There are many other types of correlation and this, like all iconic reasoning, can only be pressed so far. For example syntax is an object composed of other objects, as is phonology and semantics. And within each domain there are representamens and interpretants. But at a macro-level it is

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[61] From a semeiotic perspective there are never "covert categories." Signs are always overt. Even silence is overt, whether it violates an expectation or fits a pattern.

[62] The "garden path" label means that these sentences lead one "up the garden path" to a false interpretation - they trick us. Fowler's A Dictionary of Modern English Usage from 1926, describes these sentences as "laying a 'false scent.'"

interesting that all theories of grammar (except early structuralist theories and perhaps some radical versions of formal grammar) take the shape of a Peircean sign.

The syntax is a semeiotic object in a theory of language. It is what needs to be interpreted. That is, most linguists consider the formal structure of the sentence (or discourse) as the direct encoding of propositions (abstractions which, though useful, when taken as basic obscure the importance of the "perfect symbol" - the discourse (at least certain types) in Peirce's system.

In a Peircean grammar, what you see is what you get. No movement, no covert/overt distinction, no abstract diacritics (e.g. as used in Lepore and Stone (2017) to jerryrig structures to get compositionality to work out). Multiple levels of organization are allowed, so long as they are subject to the Pragmatic Maxim.[63]

Imagine a semeiotic theory in which nothing specific to language aside from greater complexity. A theory without syntactic movement. Without the assumption that human language is a biological adaptation. Language would be constructed around semeiotics, with hypostatic abstraction, prescission, and other semeiotic or logical tools available and waiting only for the right level of cognition to use them. And these principles are relevant to all living species.

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[63] " Consider what effects that might *conceivably* have practical bearings you *conceive* the objects of your *conception* to have. Then, your *conception* of those effects is the whole of your *conception* of the object." Peirce 1905.