CHAPTER 43

THE SYMBOL CONCEPT

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43.1 Introduction

The term symbol derives from the Greek stem of *ballein* 'to throw' and *syn* 'together'. This etymology characterizes the way that words are forced into correspondence with ideas and their physical referents irrespective of any natural affinities. Throughout philosophical history, the term 'symbol' is almost exclusively applied to spoken utterances, inscriptions, or other culturally generated meaningful artefacts and actions created specifically for representational purposes. These cultural phenomena include talismans, ritual performances, religious relics, military insignias, spoken words, and typographical characters, among innumerable other forms. In contrast, a cough is generally referred to as a *sign* of a respiratory infection, not a symbol, and portraits are generally described as depicting people, not symbolizing them. These latter are signs that represent by virtue of some 'natural affinity', irrespective of human cultural intervention.

Symbolic reference contrasts with two other categories of signs. *Iconic* reference is employed in pantomime and simple depiction. *Indexical* reference is employed in pointing and innate forms of communication such as laughter and facial expressions. Symbolic reference is a distinguishing feature of human language, in contrast with species-typical vocalizations and communicative gestures. Because of its arbitrary and conventional nature, symbolic reference must be acquired by learning, and lacks both

the natural associations and trans-generational reproductive consequences that would make such references biologically evolvable. This is why language is distinguished by extensive reliance on social (as opposed to genetic) transmission. However, this absence of natural constraints also facilitates the capacity for distinct symbol combinations to determine unique references—another hallmark of language.

Despite superficial agreement on most points, there are significant differences in the ways that symbols and non-symbols are defined in the literature. Symbolic reference is often negatively defined with respect to other forms of referential relationships. Whereas iconic reference depends on form similarity between sign vehicle and what it represents, and indexical reference depends on contiguity, correlation, or causal connection, symbolic reference is often only described as being independent of any likeness or physical linkage between sign vehicle and referent. This negative characterization of symbolic reference—often caricatured as mere *arbitrary reference*—gives the false impression that symbolic reference is nothing but simple unmediated correspondence.

Consequently, the term 'symbol' is used in two quite dichotomous ways. In the realm of mathematics, logic, computation, cognitive science, and many syntactic theories the term 'symbol' refers to a mark that is arbitrarily mapped to some referent and can be combined with other marks according to an arbitrarily specified set of rules. This effectively treats a symbol as an element of a code, and language acquisition as decryption. In contrast, in the humanities, social sciences, theology, and mythology the term 'symbol' is often reserved for complex, esoteric relationships such as the meanings implicit in totems or objects incorporated into religious ritual performances. In such cases, layers of meaning and reference may be impossible to fully plumb without extensive cultural experience and exegesis.

This multiplicity of meanings muddies the distinction between symbolic forms of reference and other forms and also contributes to confusion about the relationship between linguistic and non-linguistic communication. Within linguistics itself, ambiguity about the precise nature of symbolic reference contributes to deep disagreements concerning the sources of language structure, the basis of language competence, the requirements for its acquisition, and the evolutionary origin of language. Thus, the problem of unambiguously describing the distinctive properties of symbolic reference as compared to other forms of reference is foundational in linguistic theory.

43.2 THE CODE FALLACY

The father of 20th-century linguistics, Ferdinand de Saussure, described language reference as a mapping between a *signifier* and a *signified* (see Saussure 1983). Many

have described this as the linguistic code. Over the past century this approach has led to remarkable insights concerning the systematicity of language properties.

Computer 'languages' provide useful exemplars of simple signifier-signified relationships. The references assigned to bit strings in a computer 'language' directly correspond to specific machine operations or numerical values; hence, a code. A code is constituted by a one-to-one mapping between conventionally determined sign vehicles in two languages. Most familiar computer languages consist of terms and characters borrowed from English and mathematics. In order to control computer operations that lack the logical organization of a language, what amounts to a translation step is necessary. Software programs called interpreters and compilers substitute machine commands for certain terms and characters of programming language. A string of machine commands directly corresponds to operations to be performed. Computation is often described as 'symbol processing'. Of course, the only symbolic interpretation occurs in the minds of human users. Otherwise there is no more symbolic reference in a computer than in an internal combustion engine. That alphanumeric characters are not intrinsically symbolic becomes obvious when they begin to spontaneously appear on the screen due to computer malfunction. We interpret these as *indices* of an underlying functional problem, not symbolic of anything.

In a natural language, one-to-one mapping between elements of language and objects in the world is only characteristic of proper names (though the phonological mapping of letters to sounds in alphabetic writing systems offers an imprecise parallel). If a language consisted only of one-to-one correspondence relationships, it would consist entirely of something analogous to proper nouns. This could never produce anything other than lists. So clearly something is missing in this simplified account.

A close cousin to a code relationship is a translation. A completely literal translation between natural languages, such as that performed by a computer algorithm, is almost always seriously inadequate. Good translation is aimed at conveying meaning and reference rather than merely replacing words and their syntactic relations with counterparts from another language. The lack of simple counterparts inevitably forces the translator to deal with the complexity of the language-specific and culture-specific grounding of the symbols used in each language.

The symbolic reference that distinguishes language must instead rest upon a vast network of non-symbolic relationships that constitute the many nested contexts in which it occurs.

There are other serious consequences of adopting this simplified conception of symbolic reference. Codes are used for encryption because they add an additional layer of combinatorial arbitrariness between sign and reference. This astronomically increases the combinatorial possibilities. Even just provisionally assuming that language is code-like and made up of an arbitrarily structured set of components, arbitrarily assigned to correspond to another set of objects, gives the

misleading impression that the domain of possible language structures is vast and unbounded. From this perspective, the problem of learning the particular system of principles for generating a given language is treated as analogous to a decryption problem involving a highly complex code. This requires either that children are genius code-breakers or else that they come equipped with the code-key from birth.

The code model is not, however, entirely irrelevant to language. It just may not apply to all aspects of language function, and particularly not to any aspects that depend on language reference. The rough correspondence between alphabetic characters of written languages and speech sounds, and between speech sounds and referents, exemplifies an independence from any 'natural' correspondence. Thus, a typographical character is often described as a symbol: it is an arbitrarily chosen marker that can be assigned to any one of an indefinite number of correspondence relationships to a speech sound. This openness to multiple forms of referential use demonstrates, however, a confusion of two quite different conceptions of the concept of 'symbol'—one pertaining to the sign vehicle and its properties and another to its mode of referring.

43.3 The semiotics of symbols

The question then, is this: how is the relationship between a written letter from the alphabet and the sound it represents different from the relationship between a spoken word or sentence and what it represents? As discussed above, both relationships are often described as symbolic. Both are arbitrary: the form of the sign vehicle (e.g. character or utterance, respectively) is not determined by any features of what is being represented. The letter-sound relationship is at least approximately code-like (even if it is seldom strictly rule governed), but the word-meaning-reference relationship is considerably more complex. Unless we are willing to accept that there is a literal language of thought, we need to distinguish more carefully these conceptions of symbol.

The 19th-century philosopher Charles Sanders Peirce (1931) produced a taxonomy to account for the diversity and interdependencies of different sorts of sign relationships. His semiotic theory was never entirely completed, but it was sufficiently developed to provide distinctions that can help resolve this problem. Peirce's taxonomy is largely forgotten, and yet it differentiates many aspects of representational relationships that have since become confused. Specifically, it distinguishes the properties of sign vehicles, sign-object relationships, and the contextual basis for interpreting their relationships as hierarchically nested dependencies. To clarify these difficulties, I briefly re-introduce some of Peirce's terminological distinctions.

I reproduce only the relevant parts of his much more extensive taxonomic hierarchy in Figure 43.1.

In this taxonomy Peirce distinguishes those properties that characterize a sign vehicle irrespective of any reference from those properties linking a sign vehicle to its reference. A sign vehicle which exemplifies a general type of sign vehicle by virtue of convention or rule of design is called a 'legisign'. This conventional property is distinguishable irrespective of whether these signs refer iconically, indexically, or symbolically. For example, stick figure drawings representing male and female bodies on restroom doors are iconic legisigns. However, a portrait of a famous person is iconic but not a legisign. Peirce would describe it as an 'iconic sinsign'. A sinsign is a singular instance taken as a sign, such as the individual portrait. A smoke alarm's sound is an indexical legisign because of its conventional creation and its physical linkage to smoke detection, whereas a particular smell of smoke is an indexical sinsign. The arrangement of furniture in a room indicating that a meeting recently took place is also an indexical sinsign, but for it to invoke this indexical reference it must first be recognized as an iconic sinsign due to its similarity to arrangements recalled from previous meetings. Written words are symbolic legisigns, since both the typographical sign vehicle and its reference to a general concept or type of object, property, etc., are conventionally determined. Notice, however, that a written word is first recognized as an iconic sinsign (an instance of a familiar form), then an indexical legisign (a type of sign vehicle contiguous with other related types), and then as a

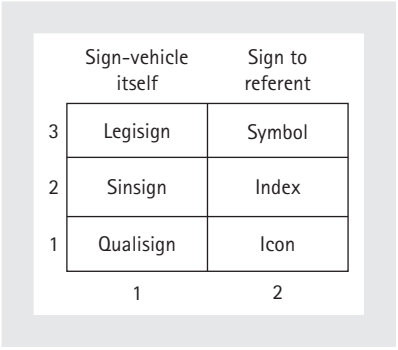

Figure 43.1. C. S. Peirce's categorical scheme for a taxonomy of sign forms. Each sign relation is characterized by a combination of features involving the sign vehicle itself (left column) and the relation of sign features to features of the referent (middle column). There is an asymmetric dependency in both the vertical and horizontal dimensions of the chart, with positions designated by a 1 being more basic and 3 being most derived. The features of the sign vehicle must always be of an equal or higher rank than features of the sign-to-referent relationship. This chart omits a third column in Peirce's taxonomy consisting of a 'rheme' (1), a 'dicent' sign (2), and a 'delome' (3), which identify the relationship of the sign to its interpretant (essentially the semiotic context of a sign's interpretation).

symbolic legisign (a conventional type of sign referring to a conventional type of referent). Peirce's taxonomy also includes the possibility that the sign vehicle itself may only be an abstract quality, a possibility or a potentiality, and calls these qualisigns.

In making this distinction between the way sign vehicles are determined and the way their referential relationships are determined, Peirce demonstrates an important and little-recognized constraint on this relationship. A qualisign can only be an icon. For example, the whiteness of snow (a qualisign) can be iconic of purity, but an instance of white snow (a sinsign), when contrasted to previous instances of dirty snow, can indicate that new snow has just fallen. Sinsigns can be either icons or indices. A face discerned in the clouds is an iconic sinsign, and dark clouds presaging an impending storm are an indexical sinsign. Finally, legisigns can represent in all three ways. A diagram is an iconic legisign, the position of a needle on a pressure gauge is an indexical legisign, and a military insignia is a symbolic legisign. This means that symbolic reference can only be supported by legisigns, which has almost certainly motivated the tendency to collapse these two facets of the symbol concept.

43.4 Hierarchic construction of interpretations

This asymmetric dependency is a consequence of necessary stages of constructing an interpretation. Consider the interpretation of the chevron insignia on a military jacket. Initially, it appears just a coloured shape, an iconic sinsign. As similar shapes are seen on other shoulders, it develops from an iconic sinsign to an iconic legisign (shapes of the same type). As it is understood to distinguish the individual wearing it, it becomes interpreted as an indexical legisign (pointing to something about this person). When its particular configuration is understood to designate that person's military rank it becomes interpreted as a symbolic legisign. The same sign vehicle thus is the locus for a sequence of interpretive phases in which both the relationship of the sign vehicle to other sign vehicles and the relationship of the sign vehicle to its reference are progressively developed.

The asymmetric relationship between features of the sign vehicle and features of the referential relationship explains why conventional typographical characters can refer both symbolically and non-symbolically. Consider for example, the text message use of the sideways 'smiley face' :-) created by punctuation marks. It is a combination of conventionalized sign vehicles that refers iconically. The combination of punctuation marks may be arbitrary in shape with respect to their canonical

textual functions, but in this combination they refer to smiling faces by similarity. Thus, calling an alphanumeric character a symbol is shorthand for saying that it is the sort of sign vehicle *designed for* conveying its reference symbolically. But calling these marks 'symbols' confuses what they were created for with how they actually refer in a given context.

Even in this case, the interpretation can be layered. A smiling human face is a symptom of a happy state of mind—an index. Placed in a text field, this icon enjoins the reader to interpret it in two distinct framings. Its inclusion as a text entry *indicates* that it is to be interpreted as text (typically producing symbolic reference), but its non-phonetic function and its atypical combinatorial form deny this interpretation. It is also implicitly embedded in a larger, equally relevant, cultural context: a similar cartoon caricature of a smiling face is a popular contemporary sign. Since the character combinations of a text message are intended to convey thoughts and attitude, the initial iconic reference invokes an indexical reference prompting a symbolic interpretation—something like 'that thought makes me happy'.

Aristotle describes a related, classic example of a symbol (*On soul*, 1984): the impression of a signet ring in wax, to seal a note and verify the sender's identity. Aristotle argues that mental ideas need only capture the forms of things, not any other feature of their physical composition. Only the form of the ring transfers to the wax, not its material composition. Reconstructing the cognitive steps necessary to interpret a wax impression also demonstrates that symbolic function depends on more than a simple arbitrary correspondence. First, as Aristotle notes, the formal similarity between the impression and the ring is primary. This is *iconic*. But without the physical action of the ring-bearer pressing the ring into hot wax to produce this likeness, it would not *indicate* that this message, thus sealed, was produced by the bearer of that specific ring. The presumed connection between ring and bearer further *indicates* that a particular individual actually sealed the note. Typically, possession of such a ring is a mark of royalty, etc., this status being a mere social convention. To interpret the wax impression as a symbol of social position, one must also understand social conventions, because nothing intrinsic to the form or its physical creation supplies this information. The symbolic reference is dependent on already knowing something beyond any features embodied in this sign vehicle.

This dependency on an external system of relations within which the formal similarities and correlative aspects of the wax impression are embedded is a critical property of its symbolic reference. But without familiarity with this entire system of relationships, these non-symbolic components remain merely icons and indices. Indeed, if any link in this chain of referential inferences is broken, symbolic reference fails. So while the features comprising the sign vehicle are not necessarily similar in form or physically linked to what is symbolized, this superficial independence is supported by a less obvious network of other modes of reference, involving both iconism and indexicality.

Interestingly, Peirce's hierarchic analysis doesn't stop at one level of simple symbolism. A complex sign vehicle such as the diagram of an electronic circuit can serve as an icon even though it is composed of symbols. Once the many symbolic legisign components are interpreted, their collective configuration is seen as iconic of the organization of the physical circuit. This is relevant to language. Thus the combinatorial organization of symbolic legisigns comprising a phrase, sentence, or narrative may constitute a higher order iconic, indexical, or symbolic referential function. In this sense the logic of this constructive semiotic hierarchy is critically relevant to understanding the constraints of grammar and syntax, and the complexities of discourse or narrative. The same hierarchic dependencies underlying and supporting the interpretation of symbolic reference in the examples above, impose analogous compositional constraints on word combination in sentence structure.

43.5 Semiosis and language structure

if this semiotic embeddedness of symbolic reference is relevant for language, then ignoring it will prevent access to a significant domain of explanatory principles. As we saw earlier, relationships between icons can generate indexical reference, and relations between indices can generate symbolic reference. So, do the combinatorial relationships between the symbolic units of language also function iconically, indexically, and even symbolically? We take for granted the way that combinatorial relationships among linguistic units affect language reference, but seldom consider this in semiotic terms. Nevertheless, relationships among sign vehicles and forms of reference are semiotic relationships, and this can generate higher order semiotic relationships. Let us consider to what extent the grammatical and syntactic regularities of language reflect and constitute these diverse semiotic functions.

Iconism is, of course, fundamental to writing using a phonetic alphabet or syllabary, and is essentially of the form of a diagram. Simple word repetition also has a syntactic function. Phrases like *very very difficult* or *millions and millions* utilize this, and repetitive superlatives are common in pidgins and child language. Literary use of repeated metaphoric images is a significant source of thematic complexity. Subtler forms of iconism are recruited for higher order structural organization. Agreement relationships (e.g. number or gender agreement) also link co-referring items not immediately adjacent (more below).

The effects of indexicality play a more elaborate, but often unrecognized, role in sentence structure. The importance of indexicality derives from the dependency of symbolic reference on indexical reference. As the examples above show, specific

interrelationships between indices can prompt one to interpret their collective relationship symbolically. But whereas these indices each have specific referents, the symbolic reference that emerges from their reflexive relations to one another is abstract and general. This is another critical distinguishing feature of symbolic reference that is entirely absent from the code model: symbols refer to general types, not specific instances.

A *type* of thing is not something as neatly bounded and singular as a given occurrence of a word. Consider some extended uses of the word 'shadow'. Besides the particular light/dark phenomena that we term shadows, metaphorical usage in phrases like *shadow of a doubt, shadow of his former self*, and *living in his father's shadow* suggests that neither this thing in the mind nor its object of reference are simple singular *signifieds*. Yet when used in a sentence like *We watched the shadow cast by the Eiffel Tower as the sun set*, the same word has a precise, concrete, and singular physical reference. This is inherited from its relational locus in a higher-order unit—a sentence—which itself inherits further reference-fixing information from the larger context of the narrative it occurs within. A linguistic communication (along with its context of salient physical and social relationships) is also a composite sign vehicle that constructs specific symbolic reference from the iconic and indexical relationships of its ambiguous symbolic components.

Unlike the simple examples described earlier, however, the construction of symbolic reference in language is made possible by a vast network of inter-referring indices, rather than just a few. The thousands of symbolic units comprising the lexicon of a language (e.g. words and morphemes) effectively 'point' to one another as though comprising a complex interconnected network. This symbol-symbol indexicality is exemplified by the structure of a thesaurus, a network of one-to-many vectors. Thus, we can positively define symbolic reference as reference mediated by a closed system of indexical relations which, taken together, refer holistically to a system of relations in the world. Because of this holism, reference to anything specific outside this network of relations is necessarily ambiguous. This is why, except for the degenerate case of proper names, individual words cannot be mapped to any specific referents. They only map directly to specific positions in this implicit network. Moreover, these indicated positions are entirely relative to others, so their imprecise loci, which serve as something like category centres, are circularly defined.

This exemplifies an important difference between the symbolic reference in non-linguistic examples of symbolic reference above, and linguistic symbolic reference. The military insignia and the signet ring mark each stand on their own. Although embedded in a larger semiotic network, they are not components in the construction of higher order signs (whereas the smiley face text is). The systematic iconic and indexical relationships in each define a kind of reflexivity (by in effect pointing to each other and their opposites) that is critical to invoking the symbolic

interpretation in each, but their relationship to some specific reference requires placing each in context that indicates its place.

The primary meaningful units of language (e.g. words and morphological markers) have multivalent referential possibilities too (as the example of the word *shadow* demonstrates), but these are used in combinations that often provide highly specific reference. The basis of the symbolic reference of words is the systematicity that unifies the network of indexical relationships that they constitute and depend upon. But this network of indexical relationships is also reflexively closed and ultimately self-referential. Consequently, the use of symbolic legisigns to refer to specific objects, events, or properties of things inevitably requires indexical mediation. Indeed, in the absence of an additional indexical relationship, symbolic legisigns only mark a relationship to other symbolic legisigns, and thus only refer to an ambiguously defined locus in this lexical system, not to anything in the world or even to a specific abstract referent.

This requirement of indexical mediation imposes a significant constraint, because indexical reference depends on immediate physical correlation: physical contiguity (adjacency), containment, temporal immediacy, and so on. The physical attributes of an indexical legisign are what matter. I postulate the following semiotic rule of thumb: every symbolic legisign must be immediately coupled with an indexical sign or else there is no specific symbolic reference (Deacon 2003). This index must itself refer to something in the immediate context, and is also subject to these strictures on indexicality. This coupling to another sign vehicle creates a transitive indexicality linking the symbolic legisign to something specific and particular in its context. So, uttering an isolated descriptive term like *smooth* offers ambiguous reference, but if uttered while running one's hand over a polished surface it refers specifically to this surface and that tactile experience by virtue of this indexical linkage. Substituting such phrases as *This table is . . .* or *The surface of the water is . . .* show that these noun phrases also indirectly provide indexical support for interpreting *smooth*. Without some immediate indexical linkage, explicit or implicit, the symbolic reference of *smooth* is unspecified.

The clausal structure of languages with constrained word order also reflects this limitation. An index refers by virtue of correlation, contiguity, and part-whole linkage. This means that temporal or physical separation undermines indexical reference. This proximity constraint is exhibited in certain syntactic rules. Consider the necessary immediate proximity of the quantifiers (e.g. *a, the, this, some, all*, etc.) to non-mass nouns and noun phrases. In English these quantifiers must immediately precede what they modify. Separation breaks the indexical link and renders their function ambiguous. This constraint is also reflected in *wh*-constructions in English, which respect the constraint of containment within the same clausal level. Even the agreement requirements of pronominal reference, which can span many sentences, reflect the constraints of immediacy to maintain indexical reference, because gendered pronouns point to the most recently mentioned gender-agreeing

noun or noun phrase. All can be understood as reflections of the necessary constraints of indexicality. In highly inflected languages, where many of these indexical functions are incorporated into word morphology (and thus not splittable), word order within a sentence is comparatively free.

Peirce's analysis even suggests that we can attribute the dyadic structure of well-formed sentences (e.g. noun phrase/verb phrase, topic/comment, function/argument structure, etc.) to the dependency of symbolic reference on indexicality. The ability to replace noun phrases by pointing or other indicative gestures, or by indexical terms like *this* or *that*, demonstrates that noun phrases serve an indexical role, linking the predicate (as a symbolic core of the sentence) to some specific instance of reference. Even isolated expletives or commands, which lack explicit indexicality, implicitly indicate something immediately salient in the context. So uttering *Incredible!* in an appropriate context indicates a particularly salient and probably surprising feature of that context.

These indexical constraints are rigid, general, and universally required for explicit reference. Failure to respect them risks equivocal reference. They are not so much rules that must be learned, as constraints that can be discovered.

43.6 The evolution of language adaptations

The above examples barely scratch the surface of the ways that the semiotic infrastructure of symbolic reference is integrated into the constraints affecting language structure. But they demonstrate how ignoring the non-symbolic basis for symbolic reference and assuming a code analogy can obscure functional principles relevant to explaining certain structural features of language. Additionally, ignoring this semiotic infrastructure impedes exploration of the neurological basis for the rapid acquisition of language in childhood, its inaccessibility to other species, and its evolutionary origin.

Despite its inadequacy, the code analogy has largely been assimilated into theories of language origins as an unquestioned fact. Thus, word reference has been analogized to the referential function of alarm calls for distinct predators, once thought special to vervet monkeys, but now recognized as widespread among birds and mammals. From this perspective the evolution of language is imagined to involve merely multiplying the number of distinct calls and referents and then superimposing combinatorial rules. It has also been argued that since many species (from pigeons to rats) can learn arbitrary associations, for instance between randomly chosen experimental stimuli, the capacity to learn the arbitrary referents of words

cannot be in any way special. From this perspective what is in need of an evolutionary explanation is only grammar and syntax.

However, since the code model of reference assumes that there are no constraints on the referential correspondences of the morphological units of language (e.g. words, prefixes, inflections) or on their combinatorial usage (i.e. grammar and syntax), the identification of nearly universal grammatical regularities demands an explanation that is independent of referential functions. But the categories of grammatical functions only make sense in symbolic terms. They do not correspond to natural or social categories, and make no sense applied to non-symbolic communication such as facial expressions or non-linguistic manual gestures. We would thus seem to require a separate evolutionary explanation for grammatical and lexical categories as well as the syntactic rules for coordinating them. The question is whether these explanatory challenges are being posed by language or by the assumptions upon which our theories of language are based.

With respect to the neurology of language processing, the code model makes assumptions about specialized brain processes, structures, or modules, which are the presumed loci of language-specific grammatical functions. But though formal linguistic theories based on the code model have made predictions about dedicated language algorithms and their neurological substrates, they have produced little by way of novel neurological findings. For example, no evidence has emerged that the brain structures involved in language are phylogenetically novel. Indeed, it is clear that those brain regions most critical for language processes have direct homological counterparts in other species (see review in Deacon 1997). Moreover, the number of brain systems involved in language is surprisingly extensive, and the way that diverse brain systems can be recruited to support language under pathological or atypical task conditions indicates considerable plasticity. These attributes don't easily fit with claims about language-unique brain processes unrelated to other forms of cognition.

If the symbolic reference of language is not, however, based on arbitrary correlation and a collection of human-unique mental algorithms, but is instead dependent on a higher order interdependency between iconic and indexical relationships, then we should not expect there to be an absolute boundary excluding non-human species from acquiring some aspects of language. Iconic and indexical functions are quite generic, and relevant to many sensory, mnemonic, and cognitive capacities. The challenge of understanding language origins thus becomes one of understanding why the critical juxtapositions and combinatorial analyses of non-symbolic relationships required to invoke symbolic interpretation are difficult for most non-humans to mentally construct. Similarly, the challenge of understanding which different brain systems contribute to the production and comprehension of language becomes one of understanding how the phylogenetically prior iconic and indexical analytic functions of those systems were recruited and modified to better suit this higher order synergistic use. Decomposing language functions into their contributing

semiotic bases may also help explain how atypical brain regions can take on language functions and how supernormal symbolic processes, like lightning-fast calculation, can result from developmental abnormalities of brain function, such as autism.

By taking into account the semiotic infrastructure of language, the human neurological adaptation for language need no longer be viewed as a disconnected, anomalous cognitive module. It is just a special (though probably highly demanding and atypical) re-use of previously evolved mental capacities. If semiotic constraints can account for many of the robust regularities of grammar and syntax, we should not expect evolution to have produced any genetically specified neural instantiation of natural language grammar. Instead, the critical barrier crossed in human evolution must involve support for the special processing demands of symbolic interpretation. This suggests that an analysis of the cognitive operations and brain processes required to construct symbolic reference from systems of indexical relationships might yield important clues to the nature of the human language adaptation.

In conclusion, what at first appears merely a terminological difference in the definition of the word 'symbol' has profound consequences for explaining the production and origins of the distinctive features of language. Although formal descriptions of language structure may ignore this difference without loss of descriptive precision, efforts to explain how and why these language structures arise may lead to quite unrealistic predictions unless this semiotic complexity of language reference is taken into account.