

DID LANGUAGE EVOLVE FROM INDEXICAL SIGNALING?

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This paper discusses indexical signaling as a possible precursor of declarative sentences in the evolution of language. Such a proposal is based on two assumptions. The first is known as the social intelligence hypothesis. The second is the function-first approach to explaining the evolution of traits: before a prototype of a new trait develops and the adaptation process begins, something already existing is used for a new purpose. Applied to the emergence of declarative sentences, this suggests that for language evolution to begin, something already existing was used for a declarative function (expressing a proposition). Thus, the evolutionary hypothesis presented here is that before human language began to develop, natural signs (such as indexical objects) were integrated into communication. I show that such a behavioral display can imply a conceptual structure similar to that informing the syntax of sentences: the displayer represents the thematic role of agent, while an indexical object (e.g. a hunting trophy) plays the role of patient.

1. Introduction

There are, roughly, two views on language which have dominated the debate about language evolution in the last few decades. (1) Traditionally, theorists of “generative grammar” conceptualized language as a productive system, in which a finite number of elements can generate a theoretically infinite number of sentences (Chomsky, 1965). (2) More recently, theories of embodied cognition claim that higher cognitive functions, including language, are rooted in lower cognitive functions, such as the sensory-motor system (Arbib, 2005).

Though both theories of language are valid and give valuable insights, they have their shortcomings regarding language evolution. The theory of generative grammar has resisted explanation in terms of evolution, mainly because it conceptualizes language as an internal symbolic machine that either works or does not (Hauser, Chomsky, & Fitch, 2002). The embodied cognition approach, on the other hand, succeeds in identifying some requirements of linguistic communication and gives many insights into the situatedness of linguistic communication; however, it has not yet explained the development of *syntax* and

the emergence of the truth value (as a binary cognitive structure underlying the interpretation of declarative sentences) in terms of evolution.

In this paper I show how the idea of embodiment can address the problem of the emergence of syntax by including natural (indexical) signals in communication, and how, as a second step, the display of an object with indexical meaning could spur the development of syntax-like conceptual structures in which fundamental thematic roles (such as agent and patient) are marked by the direction of a mimetic gesture signifying the verb. For the sake of simplicity, I shall propose my hypothesis in form of statements and refrain from hedging.

2. Three problems in language evolution

There are at least three problems concerning language evolution. The first two are fundamental to any evolutionary history and originally addressed by Tinbergen (1963)—questions about the two “ultimate causes,” function and evolutionary process.

(1) *The function*. What did the trait evolve for? Here the challenge is *to suggest the right kind of selective pressure*. Language, for instance, could not have evolved for transmitting valuable information, because this would give a reproductive advantage primarily to the receiver (and not to the sender). Also, language could not have evolved for better coordination, because this would give an advantage to the group, and no complex trait can evolve by group selection (Williams, 1966). In an ideal evolutionary scenario, a slightly better speaker would out-reproduce all others.

(2) *The evolutionary process*. How did the trait develop *gradually*? This relates to the challenge of *irreducible complexity*. Syntax needs a minimal complexity to fulfill its function, for instance to refer to an absent action. Also, typical declarations imply truth values, which suggests that declarative sentences and truth values emerged simultaneously.

(3) The third problem is specific to language. When we use language, we cooperate. For instance, we mostly speak the truth and assume that other people do so as well (Grice, 1975). If people didn't follow this *cooperative principle* linguistic communication would fail. Therefore, many researchers (Ferretti et al., 2017) have said that, before language could even begin to evolve, a kind of cooperative principle had to be in place. On the other hand, researchers who work on the problem of cooperative behavior suggest that human altruism is based on gossip (Barclay, 2010). If gossip is circulating in a group and reputation is based on what other people say about you, then it might be rational to develop cooperative behavior. This obviously creates a paradox.

3. The evolutionary turning point

We define the evolutionary turning point as the point at which a function is fulfilled for the first time, creating a reproductive advantage. The idea is that, before a trait can develop, something already existing is used for a new purpose (the function the trait will later develop to fulfill). This can be illustrated by the development of tetrapods. Walking on four feet developed successfully only once. All land animals—including reptiles, birds, and mammals—descended from one kind of bony fish. The crucial point in the evolutionary development of four-footed ambulation was not the movement from water to land but the point at which an individual could improve its reproductive success by using its fins as legs in the water to walk on the bottom of the ocean. After this turning point, the trait developed depending on various factors including selective pressures, genetic variation in the population, the frequency of occurrence of mutations beneficial for the trait and the size of the population. However, we should remember that this process began with some individuals out-producing all others by being better walkers. Here, previously existing structures (the fins) are used for a new function (walking).

4. What is the evolutionary function of language?

The evolutionary function of a trait is the function it evolves for. Textbooks often classify sentences by function: exclamations, imperatives, declarations and questions. We find the exclamative function in most mammals and birds, while the gestures of chimpanzees fulfill an imperative function (Hobaiter & Byrne, 2014). Questions imply declarations as answers. This might suggest that language developed, primarily, for the function declarations can fulfill. Most theorists agree that declarative sentences fulfill the function of transmitting propositions (Akmajian, 1984). If this is true, the original evolutionary function of language can be specified as the simplest form of such transmission.

5. What is the cognitively simplest declaration?

Cognitive simplicity is a relation between a cognitive system and a structure to be understood; this makes it sometimes distinct from technical or logical simplicity. The technically simplest syntactic structure that can transmit declarative content, including the representation of displaced action, consists of one verb and one argument, representing the subject. However, the mirror neuron system of primates encodes only *transitive* actions (actions with objects; Rizzolatti & Arbib, 1998). Therefore, the cognitively simplest syntactic structure corresponding to a

pre-linguistic primate conceptual structure includes not only a verb and an actor, but also a *patient* (or *theme*).

Accepting this argument suggests: (1) that the simplest transitive verbs are *bivalent* with two semantic argument slots (agent, patient).

(2) Verbs that express *observable actions* are cognitively simpler than abstract verbs. “Jill hits Jack” is simpler than “Jill despises Jack.” The simplest propositions describing observable actions also always use *singular terms* (terms referring to concrete objects).

(3) The simplest *aspect* (how actions, states or events extend over time) is a *single* event that happened at one particular point in time.

(4) The simplest and easiest kind of non-present action to represent is one still fresh in memory. In contrast, to draw attention to an overlooked present would require only an indexical call (such as an alarm or food call), which are part of animal communication. In other words, only reference to some non-present actions requires the essential features of human language (such as syntax and symbols), and therefore these constitute the simplest relevant scenarios.

(5) The simplest grammatical person to express seems to be the first-person singular, which is always present and often implied. In sign languages first-person singular sentences can be expressed without role-taking (while other grammatical persons require perspective switches between the verb—signed by the speaker—and the grammatical person; Janzen, 2017).

(6) Mimetic gestures are less demanding than conventional ones.

(7) In most sign languages, a sentence can be expressed by including the sender and the receiver and other present objects. “I give you the book” can be expressed with only one gesture directed from *me* (the speaker) to *you* (the receiver). The *giver* and the *receiver* are marked by the *direction* of the gesture.

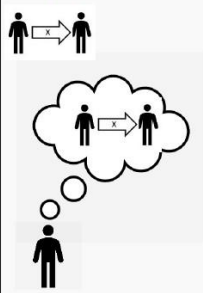
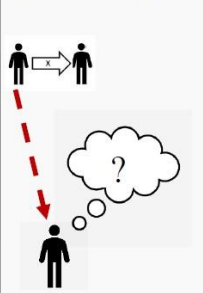
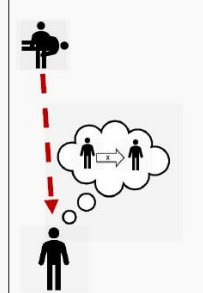
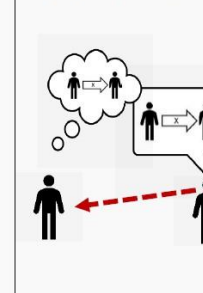
Arguments 1–7 can be brought together in the following way: The simplest declarative sentence refers to a single concrete past transitive action consisting of three elements: a) the sender as the agent, b) a present object as the patient, c) a directed mimetic sign—representing the action—that marks the agent and the patient in their semantic roles.

6. Declarations before language

The question arises of what could be used to refer one’s own past action, when there is no language: no symbol use, no understanding mimetic objects or gestures? At the turning point of language evolution, something which already existed must have been used for transmitting information about a concrete past action of the sender, with results beneficial to the reproduction of the sender’s

genes. Anything purposely used to refer to a non-present action must be considered some kind of sign. There are two classes of signs: natural and non-natural signs (Grice, 1957). The latter include mimetic or conventional symbols and are expressed intentionally. Natural signs, in contrast, are causally related to what they designate. All natural signs are indexical. Consequently, anything that can refer to the past of the sender in a non-linguistic world is an indexical sign. For an evolutionary process to begin, the transmission of this information needs to be beneficial to the sender. Following the function-first approach to explaining evolution (von Heiseler, 2019), these natural indexes referring to past actions of the sender would be integrated into communication and this communication would develop into language.

Table 1: *The three stages of transmitting information about one's past.* A = sender, B = patient, C = receiver. The interrupted arrow signifies the transmission of the declarative content. Left column: primate cognition; the two middle columns show two different scenarios of indexical signaling; in column 2 the patient is a living creature, in column 3 an inanimate object.

(1) Action comprehension	(2) Demonstrative behavior	(3) Trophy presentation	(4) Linguistic utterance
			
Inner representation of transitive actions. C understands what A does to B when (s)he sees it.	A shows C what (s)he did to B by restarting action x when C appears. The information (not necessarily the understanding) transmitted from A to C has what A did to B as content.	A displays B as a war trophy to C. C <i>might develop the understanding</i> of what A did to B. Displaying a war trophy is comparable to saying "I killed B."	Linguistic utterances which can represent non-present actions: A makes a statement to C about what (s)he did to B. C understands what A did to B.
Some primates (Pellegrino, et al., 1992).	Some monkeys, apes and hominins*** (Cheney & Seyfarth, 2008).	Some apes; carrying trophies without display (Carvalho, et al., 2010; Hirata, et al., 2001); hominins developing display behavior.	Some humans (such as sapiens and Neanderthals, probably Homo erectus; Everett, 2017).

One possible categorization of indexical signaling follows the classification of the patients: the indexical sign can be either another animal, for instance a conspecific (see table 1, column 2) or an indexical object, including but not limited to war or hunting trophies (see table 1, column 3). We define *a trophy as any object that*

transmits information about the past of the displayer which is beneficial to the displayer.

The elementary semantic function—the distinction between representation and reality—is a necessary prerequisite for full interpretation of a declaration. The simplest, and almost surely the first, way that our ancestors came to understand the distinction between representation and reality must be in situations where another individual expresses a contradictory belief. For this a belief has to be deniable. This rarely is the case in situations in which the indexical object of the action is a living creature: if, for instance, A defeats B, C arrives, and A hits B again to inform C, B can react in two ways: either (s)he can retreat, in which case it is true that A has defeated B, or (s)he can fight back, in which case the fight is not yet settled. This is to say: the reaction of the patient of the action is a reliable truthmaker.

Furthermore, a threatening gesture directed at one individual with a communicative function to another individual is a behavior we find in apes and monkeys (Cheney & Seyfarth, 2008), without them developing language-like behavior. All these objections make it unlikely that language evolved from this kind of demonstrative behavior. Let us therefore look again at the trophy display behavior.

7. From trophy display to simple language

Trophy display has a syntax-like structure (figure 1a). When individual A presents the head of a lion, this can be interpreted as the declaration “I killed this lion.” The displayer signifies the agent, the trophy incorporates the patient, and the state of the trophy implies the concept of “killing.”

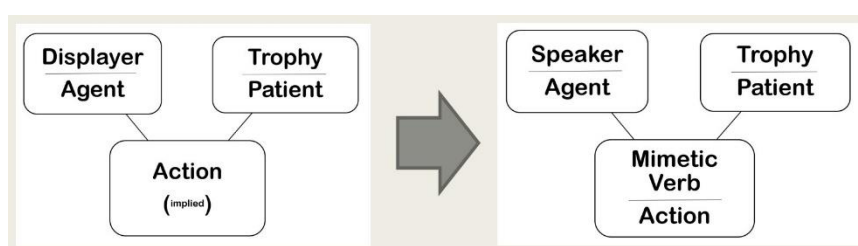


Figure 1: *The transition to language*. Left: the structure of trophy display (1a); right: the structure of the simplest sentence (1b; cf. section 5).

If, now, A adds a directed mimetic gesture—signifying the verb (“killing”)—this makes the trophy display behavior convey the same kind of information as a cognitively simplest sentence (as argued earlier). Here the syntax is expressed as the relation between present objects marked by the direction of the mimetic

gesture. The gesture signifying the verb is in this case directed from the agent to the patient.

8. Solving the three problems

(1) We presented a scenario in which the speaker gains a reproductive advantage. Since speakers talk about themselves, they could influence the mental states of others in a beneficial way, which might influence social hierarchy or sexual selection.

(2) Irreducible complexity is not a problem. The step from the trophy display to a simple declarative sentence is rather small: You only need to add one directed mimetic gesture as a verb.

(3) The *cooperative principle* does not need to be in place. The trophy indicates the past action of the speaker; though it can be doubted, declarations including trophies bear costs.

It might be rewarding to further explore in what kind of contexts the mimetic gesture could have first emerged. One possibility is that the mimetic gesture could be made as a reaction to a sign on the part of the receiver that they do not believe the implications of the trophy display (e.g. that A made the kill). This would make the first declaration a negation of a negation of an implicit statement of the trophy display. I suggest that the understanding of binary truth-values underlying any declaration is of social origin, founded on disagreements based on conflicts of implicit interests. I therefore deny that the concept of truth could have emerged through self-questioning about what one ought to believe, without any social interactions. In the latter case, the propositional attitude would develop as self-reflection. To attack this Cartesian view is the main target of this essay.

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