

Defining Language

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“Now we can also determine the difference between men and animals by these two means. For it is a very remarkable fact that there are no men so dull-witted and stupid, not even madmen, that they are incapable of stringing together different words, and composing them into utterances, through which they let their thoughts be known; and, conversely, there is no other animal, no matter how perfect and well endowed by birth it may be, that can do anything similar.” (Descartes)¹

1 Introduction: The Question

Descartes is right that language is a defining characteristic of humans. Without language, we could not have evolved into selves. Yet his simple dichotomy is hard to defend nowadays when, on the one hand, we have come to know of various pathologies of language that leave some humans with serious linguistic deficits and, on the other hand, we have research attributing language to other animals (and maybe even to trees!)

In a recent article in *Scientific American*, Kenneally, for instance, points out:

The list of abilities that were formerly thought to be a unique part of human language is actually quite long. It includes parts of language, such as words. Vervet monkeys use wordlike alarm calls to signal a specific kind of danger. Another crucial aspect is structure. Because we have syntax, we can produce an infinite number of novel sentences and meanings, and we can understand sentences that we have never heard before. Yet zebra finches have complicated structures in their songs, dolphins can understand differences in word order and even some monkeys in the wild seem to use one type of call to modify another. The list extends to types of cognition, such as theory of mind, which is the ability to infer others' mental states. Dolphins and chimpanzees are excellent at guessing what an interlocutor wants.²

Such findings make Descartes's simple dichotomy questionable. Remember that Descartes in 1637 had never seen a non-human primate!

Chamberlin claims that trackers do not simply see the tracks of animals; they "read" them and "interpret them" as representations of the animal which is absent. Should such reading be included in what we mean by "language?" And how about gestures, which some think are common to all humans, and maybe to chimps? Should they too be included under the rubric "language?"³

Against the backdrop of this continuum of similar activities from animals (and maybe plants) to humans, we need to figure out precisely what it is about language that makes it distinctively human. The position I defend in this paper is that language should be defined as a culturally normative mode of communication.

2 Communication

Communication is a transfer of information, but not all transfers qualify as communication. Tides on the earth contain information about the moon; but the moon does not *communicate* with the tides. Light from one ancient galaxy will have reached some other galaxy billions of years ago, but while these photons carried information, I do not count such a purely accidental, causal transfers as *communication*. Perhaps we might label it a "signal."

I will reserve the term "communication" for information transfers that are "functional", that is, that are designed for the *function* of transferring information. Humans might place a sensor on the moon that is designed to communicate data about the moon, such as its temperature, to researchers on the earth. Such a sensor does not just incidentally transfer information; transferring information is what the sensor is *for*; that is, its *function*.

Not all functions, however, require an intelligent designer. Biological evolution may, over generations, confer a function onto organic entities. A mammal's heart, for instance, not only actually pumps blood; its *function* is to pump blood. Whether a heart is actively engaged in pumping blood or is still, that is, not pumping, is irrelevant from the viewpoint of physics: physical laws explain the situation equally well in either case. From the viewpoint of biology, however, the state of not pumping is a case of heart failure: the heart has failed to fulfill the function for which it evolved over millions of years. A process has a biological function in so far as its existence is due to its having conferred evolutionary fitness on the ancestors of the current organism.

I want to use this biological sense of "function" to give a technical definition of "communication" and distinguish it from other, more general forms of information transfer. "Communication" is any process that not only transfers information, but whose function it is to transfer information. This is a normative point: a communication that fails to transfer information is a failure; it has not fulfilled its function.

Consider, for example, the claim by Suzanne Simard and her colleagues that they have discovered that some trees "really do communicate." When attacked by some pathogens, such a tree stimulates fungi that travel through the soil and get picked up by other trees in the vicinity. This gives the other trees advance warning of the pathogen and results in their immune system preparing a defence in advance of becoming infected. Is calling this communication simply a metaphoric mode of expression, a kind of anthropomorphic projection onto trees, or should we consider it "real" communication? As I am defining the term, this is an empirical issue: we have to investigate whether in fact the current existence of this mechanism of information transfer has evolved because it increased the fitness of ancestral trees. Since the indications from Simard are that this is indeed the case, then this transfer of information is indeed functional, and so the process qualifies as "communication" in the way I have defined it.⁴

3 Language

"Language," as I propose to use the term, is one subspecies of communication, but I think it is unwise to use the term for all forms of communication. To do so, is to confuse phenomena that we should differentiate. (Simard, wisely, does not describe the communication of trees as language.) Calling all communication language obscures one of the most distinctive features of humans.

So what is it that differentiates language from other modes of communication? Let me outline two wrong answers to this question - Chomsky's, Descartes'. Then I will offer the account that I think is correct.

3.1 Syntax

3.1.1 Chomsky's Position

Noam Chomsky's holds that the essence of language is syntax. Since the 1950s, Chomsky has sharply dichotomized semantics and syntax. Semantics is the meaning that an expression has. "The cat caught the mouse" and "the mouse was caught by the cat" are semantically identical -- they express the same meaning -- but their syntax, their grammatical structure, is different. "The dog chased the rat" and "The wolf caught the deer" have the same syntax, but carry different meanings, that is, they have different semantics. Semantics refers to meaning; syntax refers to the grammatical structure.

It is humans' syntactical capacity that allows us to speak and understand an infinity of expressions. Once we've grasped "The dog chased the cat" we can immediately understand "The wolf caught the deer" or "The elephant killed the tiger" or any number of other substitutions, provided we know what elephants, tigers, deer, etc. are. Syntax is infinitely generative of new meanings.

Syntax also gives us recursion. We understand "The dog chased (the cat that caught the mouse (that ate the cheese.))" Animals cannot do this; they lack recursion. Indeed, they lack all syntax, according to Chomsky.

Since syntax is universal in all languages, and since it is impossible for children to obtain enough information to learn it -- the "poverty of the stimulus argument -- Chomsky claims that there is a Universal Grammar that is innate in all human brains. As recently as 2014, he, and some of his followers, claim that there is a genetic mutation that enables these features and which occurs only once in human evolutionary history. "According to the[ir] 'Strong Minimalist Thesis,' the key distinguishing feature of language (and what evolutionary theory must explain) is hierarchical syntactic structure. The faculty of language is likely to have emerged quite recently in evolutionary terms, some 70,000-100,000 years ago, and does not seem to have undergone modification since then."⁵

3.1.2 Theoretical critique of Chomsky

Chomsky devised his theory at a time -- the 1950s and 60s -- when the paradigm for computing was based largely on the manipulation of discrete symbols, and he modelled his conception of the brain's cognitive processes on this paradigm. The subsequent discovery of the learning capacities of distributed processing systems -- of neural networks -- cast some doubt on the appropriateness of discrete symbolic manipulation, that is, syntactical processing, as an adequate account of brain processing. In a further blow to the theory, current Artificial Intelligence speech recognition technology has advanced rapidly, but only after it dropped the rule-based, syntactic approach in favour of statistical probability correlations.⁶ Given these newer advances, the poverty of the stimulus argument is weakened: if AI programs can manage without innate syntax, it is possible that children's brains can too, so the assumption that language is universally supported by one, unique rule-governed cognitive process is no longer theoretically necessary.

3.1.3 Empirical critique of Chomsky

Linguistic empirical studies challenging the universality of syntactical structures has also been accumulating. Evidence -- contested -- that the songs of some birds rely on syntactical structures, and the discovery that some monkeys communicate with cries that have inflectional endings suggest that syntax is not the exclusive privilege of human language.⁷ Other linguists claim to have found languages, most notably in the Amazon, that lack "essential" features such as recursion. Again the evidence is disputed. In addition, some studies of how children actually master language suggest that the poverty of the stimulus argument must be wrong.

3.2 Semantics

Chomsky's focus on the syntactical aspect of language results in him neglecting semantics, about which he has less to say. But from my functional point of view, it is semantics that is the main function of language; the function for which language evolved and continues to exist is to communicate meaning.

What, then, is linguistic meaning? How can we account for the semantics of language? I will first outline and reject an internalist approach, and then take inspiration from Brandom for my own, externalist position.

A Cartesian, dualist approach accounts for the meaning of a linguistic utterance by appealing to an internal mental "idea," present to the individual's mind, that accompanies the utterance and is expressed by it. The meaning of language is derivative -- it is derived from the mind's intuition of an internal, primordial meaning-in-itself. The mind "grasps" an idea present before it, analogously to how the eye sees an object, and then secondarily attempts to express this internal idea externally in language in order to communicate it to others. Language itself, being merely physical, has no meaning; it is simply a passive instrument, a vehicle, to get meanings from one private interior to another. Meaning is like a mental ghost that gets carried along by intervening causal mechanisms, themselves meaningless.

This dualist approach has a problem. Since I have no access to your internal, private ideas, how could I know what you mean by an expression? In *Alice in Wonderland*, Humpty-Dumpty says, "There's glory for you." ⁸ Alice can only find out that by "glory" Humpty-Dumpty is expressing his idea "a knock-down argument" when Humpty-Dumpty *tells* her that's what he means. But how can he tell her unless she already knows what he means by "knock-down argument?" I cannot tell you what an expression means except by using other expressions that you already understand. So we are faced with a vicious regress: unless we know the meaning of words we cannot discover what words mean.

Building on Wittgenstein's criticism of this private, internal, and mentalistic account of language, Brandom offers an externalist theory of meaning.⁹ A linguistic community holds its members responsible for the inferences of any utterance.¹⁰ If a speaker utters the sounds "It is raining," then the community assumes she is committed to also asserting that the streets are wet, to wearing a raincoat or carrying an umbrella, and so on and on. If instead, she asserts that, since it is raining, there is a large grey mammal with a trunk in the street, then those around her may come to believe that by the sounds "It is raining" the speaker is mistakenly expressing the meaning that is correctly expressed by "There is an elephant." "There is an elephant" has the inferences that there is a solid object, that it is an animal, a mammal, that it is grey and so on. The different set of inferences is what gives "It is raining" a different meaning than "It is an elephant." What internal idea or image the speaker may have in her mind is not the point. Even if the speaker is thinking of an elephant when she says, "It's raining," her utterance means that it is raining. Unlike Humpty Dumpty, she does not have control of the meaning of her utterance; the linguistic community does. The meaning of an assertion is the set of inferences the speaker *should* be committed to according to the norms of the community's language.¹¹

This account distinguishes norms from facts. The fact that a speaker has an idea of rain in her mind when she says, "There is an elephant" is irrelevant to the meaning of her linguistic expression. Even if as a matter of fact she had an idea of an elephant in her mind, it is not that idea that constitutes the meaning of her expression. Even if she utters the expression while pointing to an elephant that is in fact in front of her, it is not this fact that determines the meaning of her assertion. Meaning cannot be understood as a factual matter, as the association or co-presence of mental objects and physical sounds. Meaning is a normative phenomenon.

The community sets the norms for what an assertion *should* mean and it "enforces" its norms by treating violators as unintelligible. Meaning is not an individual matter, but a communal norm. Someone who says it is raining but doesn't accept there is water falling from the sky, or who speaks of rain as a mammal, is excluding herself from the linguistic community. She is talking gibberish, cannot be relied upon for further information and will have to be excluded from any social project coordinated by language.¹²

Brandom's externalism offers an alternative theory of the nature of linguistic meaning, one not based on the internal presence of an idea to a subject. It is *not* that the community holds speakers committed to certain

inferences because of the meaning that words already have; it is the inferences that the community holds one committed to that constitute the meaning of the words in the first place. Linguistic meaning -- semantics -- is not based on facts about individual minds: it is constituted by communal norms.

3.2.1 Normative Communication

My own position, building on Brandom's externalist account of meaning, is that language is that subspecies of communication that is based on cultural norms. Recall that I have defined communication as functional transfer of information. Non-linguistic communication is governed by biological norms. The lion's roar has a meaning, a warning to others to *stay away*, but the meaning is genetically based. As a biological function, of course, it could go wrong. If the lion has rabies, it might roar at a tree -- which is not what it *should* do. Its behaviour is dysfunctional. The norm the rabid lion has violated, however, is a biological one. What distinguishes language from other modes of communication, I am proposing, is that it is governed by cultural, not biological, norms. It is a cultural norm that "It is raining" means that the streets are wet, I should take an umbrella, and all the other inferences others will hold me to. Using "There is an elephant" to mean "It is raining" violates the norms of English; it is dysfunctional, but not in the biological sense. The correct use, the meaningful use, of an expression is constituted by each specific linguistic community. In my account of language, sounds are linguistically meaningful in so far as they are governed by the norms laid down by a particular cultural tradition and that have been learned by speakers and listeners within that community.

Vocal chords are not the only bodily activity that can be governed by cultural communicative norms. Gestures can also convey meaning. While the focus of this paper is on verbal language, the definition of language I am proposing is wide enough to include non-verbal language. Human bodily behaviour is based on biology, but it is significantly patterned by culture. Indeed, it is possible that human language originated in gesture. Contemporary sign languages clearly qualify as "language." Even without the structures of a recognized sign language, informal "body language" should not be taken as a metaphor: even posture communicates meaning. Some bodily behaviours express purely biological meanings, but behaviours that are governed by the norms of a group's tradition qualify as "language."

3.2.2 Evolution

But how does such a tradition come about?

Such traditions are set up by evolution. If the mechanism of evolution is "the survival of the fittest" (a limited view as we will see) then we should ask what features made hominins fit. While there have been many proposals, recent discussion has focused on cooperation. Early humans, perhaps as early as two million years ago, formed groups that could fend off predators, hunt large animals, and use team-work for gathering. Humans in such groups were better at these tasks than individuals living alone. That is, cooperation conferred comparative fitness.

Simple cooperative tasks could be coordinated by emotional contagion. When some chimps get restless and feel like hunting, others do too and soon a party sets off together. Imitation may lead one individual to copy the use of a stick as a tool. But more complicated tasks, such as hunting large mammals, require more complex communication. Cooperation in a group of, say, 100 would need some standardized gestures or sounds to assign roles, indicate where the prey is, who is to lead, and so on. Such techniques of communication would be common to all members of the group and could be passed on to younger members. In this way a local tradition would be established within the group. Groups that come up with such techniques would do better than others in the competition between groups for resources. It is the set of such group-defined ways of communicating that I am calling a "language."

Language in this sense is a crucial tool in the hominin evolutionary strategy of cooperation within the group. But language does not only enhance cooperation; it is, as Tomasello points out, itself a cooperative enterprise.¹³ The speaker does whatever she can to encourage the hearer's correct interpretation of the speaker's utterance. The hearer, in turn, takes the speaker's sounds or gestures to be carrying information of value, and in interpreting them, assumes that the speaker is trying to pass on information valuable to the hearer. Such communication is likely to be more effective if both speaker and hearer follow common norms for the exchange, that is, if they speak the same language.

3.2.3 Meaning without syntax

Since the evidence is that the human strategy of cooperative groups is at least a million years old, perhaps even two million, some form of communication based on communal norms likely existed from this very early period. Syntax may well be a recent evolutionary development, as Chomsky maintains. My claim is that, even if this is true, language -- in the way I am defining it as communication governed by cultural norms -- has been around for much longer. It could transmit meaning, that is, it would have semantics, but, contrary to Chomsky, it should be described as a non-syntactical language. What could that look like?

In a non-syntactical language, each different expression would have to be governed by its own norms, more or less independently of the norms of other expressions. Individuals would have to learn what commitments each particular expression involved. Knowing the meaning of one piece of language would be no help in figuring out the meaning of any other. Such a language would not be parsable. This may be the case in learned animal communication. Dogs, for example, must be trained separately for each specific command. Even if a dog responds correctly to "Your bone is in the garden" and also obeys the command "Bring me my slippers," it may be unable to respond to "Bring me your bone." That is, it doesn't grasp the syntactical structure, "Bring me xxxx," in which various nouns can be substituted for xxxx. Similarly, an early hominin without syntax might learn how to respond correctly to the sounds, "Bring-me-my-spear," but would have to learn from scratch what to do with the sounds, "Bring-me-my-axe." Mastering one would not help in mastering the other. Yet

each sequence of sounds could have a meaning within the cultural tradition. That is, language can have semantics, even if it has no syntax.

Because, in its advanced stages, human language is syntactical, it is tempting to suppose that there was syntax from the origin and to make it an essential, defining feature of language, as Chomsky does. My claim is that, important as syntax is to current language, it is anachronistic to project it back into early language. That later linguistic communities can set up, as one of their norms, that language should follow syntactical rules -- and due to its superior efficiency, most if not all languages have eventually done so -- should not overshadow the essential feature of human language: its power to constitute and convey meaning, that is, its semantics.

Syntax has many advantages. Nevertheless, evolving the cognitive capacities to master syntax is costly. Nowak presents a mathematical model to argue that once the number of speakers and number of objects to be spoken about exceed certain thresholds, the fitness of syntactic language outweighs that of non-syntactical language and so it has a selective advantage. If he is right, then the Chomskian insistence that syntax is the essence of language can be replaced by a simple pragmatic approach: at some point in hominin evolution, communities whose language came to rely on syntax gained a fitness advantage. This probably happened slowly, in a gradual, stepwise process, like most evolutionary changes. We don't have to think of syntax as a giant step, as if it were an all or nothing phenomenon explainable by a sudden, single, chance genetic mutation. That some monkeys add inflections to their calls, or that some song birds recognize some syntactical errors, does not imply that they have full access to recursion or infinite substitutability.^{14 15}

3.2.4 Evolution of syntax

Mutations alone cannot drive evolution. A mutation contributes to evolution only if there is selective pressure to preserve it. Three million years ago, if an individual had undergone a mutation that enabled syntax in a context in which human cooperation was not yet significant, there would have been little selective pressure for its replication, so it would likely have died out. Only when the hominin lifeway had already become cooperative and already relied on culturally normative communication -- what I am labelling "language" -- would mutations for syntax have a selective advantage. It is not syntax that explains the evolution of language; language must already have existed for syntax to evolve.

Arbitrarily defining language as syntax, as Chomsky does, obscures this relationship. Not surprisingly, therefore, Chomsky downplays communication. He says, "Externalized language may be used for communication, but that particular function is largely irrelevant in this context. Thus, the origin of the language faculty does not generally seem to be informed by considerations of the evolution of communication."¹⁶ I think this position is mistaken. Conceding that "externalized" language can be used for communication misses the point that linguistic meaning is external from the get-go. Language does not originate in the mind or the in the brain's cognitive abilities and secondarily get externalized. The primary function of language, that for which it has evolved, is the communication of meaning which occurs in the external, communal environment. It is communication that defines language. Cognitive changes in the brain, such as syntactical abilities, facilitate language, but communication is what defines it.

4 Conclusion

Language defines human existence. Yet defining language is a fraught project. I use the term "language" to refer to a specific mode of information transfer. First, it is a communicative mode. By communication I mean the information transfer serves a *function*, that is, an activity that occurs because it has increased the evolutionary fitness of ancestors. Secondly, while all communication is governed by norms, human communication, as opposed to biological communication, is governed by norms that have evolved within the learned traditions of individual cultures. The meaning of an assertion in a culture's language is the set of commitments to which that culture holds its speakers when they utter that assertion. Syntax has appeared in recent evolution to facilitate and enrich the communicative function, but it is a secondary aspect of language. The defining characteristic of human communication, of "language," -- is its capacity to constitute meaning.

ENDNOTES

1 René Descartes, Ian Maclean. *Discourse Method of Correctly Conducting One's Reason and Seeking Truth in the Sciences*. (Oxford University Press, USA) 2006. 57.

2 Christine Kenneally, "What makes language distinctively human," *Scientific American*, 319:3, September 2018. 55-59. 58

3 J. Edward Chamberlin, *Living Language and Dead Reckoning: Navigating Oral and Written Traditions*. Ronsdale Press, Vancouver, B.C. 2006. p 19

4 <http://www.ecology.com/2012/10/08/trees-communicate/>

5 Bolhuis JJ, Tattersall I, Chomsky N, Berwick RC "How Could Language Have Evolved?" *PLoS Biol* 12(8) (2014) doi:10.1371/journal.pbio.1001934

6 "Early speech recognition systems tried to apply a set of grammatical and syntactical rules to speech. If the words spoken fit into a certain set of rules, the program could determine what the words were. However, human language has numerous exceptions to its own rules, even when it's spoken consistently. Accents, dialects and mannerisms can vastly change the way certain words or phrases are spoken. Imagine someone from Boston saying the word "barn." He wouldn't pronounce the "r" at all, and the word comes out rhyming with "John." Or consider the sentence, "I'm going to see the ocean." Most people don't enunciate their words very carefully. The result might come out as "I'm goin' da see tha ocean." They run several of the words together with no noticeable break, such as "I'm goin'" and "the ocean." Rules-based systems were unsuccessful because they couldn't handle these variations. This also explains why earlier systems could not handle continuous speech -- you had to speak each word separately, with a brief pause in between them.

Today's speech recognition systems use powerful and complicated statistical modelling systems. These systems use probability and mathematical functions to determine the most likely outcome. According to John Garofolo, Speech Group Manager at the Information Technology Laboratory of the National Institute of Standards and Technology, the two models that dominate the field today are the Hidden Markov Model and neural networks. These methods involve complex mathematical functions, but essentially, they take the information known to the system to figure out the information hidden from it." (<http://electronics.howstuffworks.com/gadgets/high-tech-gadgets/speech-recognition2.htm>)

7 "As our findings indicate that songbirds have the ability to discriminate the grammatical rules of context-free languages, a cognitive ability previously supposed to be unique to humans, our results cast doubts on what is currently considered to be a unique characteristic of human language." (Kentaro Abe & Dai Watanabe, "Songbirds possess the spontaneous ability to discriminate syntactic rules." *Nature Neuroscience* 14, 1067-1074 (2011). doi:10.1038/nn.2869)

8 “ - 'There's glory for you!'

- 'I don't know what you mean by "glory",' Alice said.

Humpty Dumpty smiled contemptuously. 'Of course you don't — till I tell you. I meant "there's a nice knock-down argument for you!"'

- 'But "glory" doesn't mean "a nice knock-down argument",' Alice objected.

- 'When I use a word,' Humpty Dumpty said, in rather a scornful tone, 'it means just what I choose it to mean — neither more nor less.'

- 'The question is,' said Alice, 'whether you can make words mean so many things.'

- 'The question is,' said Humpty Dumpty, 'which is to be master — that's all.' “ (Lewis Carroll, *Alice in Wonderland*, 1865)

9 Wittgenstein, in arguing against the possibility of a private language, already rejects the Cartesian appeal to an internal process to explain linguistic meaning. "While we sometimes call it "thinking" to accompany a sentence by a mental process, that accompaniment is not what we mean by a "thought"." (*Philosophical Investigations*, para. 332) One cannot know, he argues, whether a repeated thought has the same meaning as the original thought. His image is of someone reading a second copy of the morning newspaper to confirm the news in the first copy. (*PI* 256). Without any external check, the self-identity of a mental idea is unverifiable. The stability or permanence of a thought depends on a rule that is unenforceable internally. Rules require an external, public standard; there is no way that one can follow a private rule within an internal mind. Language is rule-governed, so there can be no private language because governance by rules is essentially social.

10 This paragraph is a summary of one of the most central claims of Robert Brandom's *Making it Explicit* (Harvard 1994). The meaning of an assertion is the set of material inferences it commits one to. He makes it clear that he is not talking about *material implication* as defined in formal symbolic logic. In a section entitled "Material Proprieties of Inference and the Dogma of Formalism" he says:

"The kind of inference whose correctnesses essentially involve the conceptual contents of its premises and conclusions may be called, following Sellars, 'material inference.'" (p 48) Later, he offers examples of what he means by material inference. Consider the inferences from

"Pittsburgh is to the West of Philadelphia" to "Philadelphia is to the East of Pittsburgh," the inference from "Today is Wednesday" to "Tomorrow will be Thursday," and that from "Lightning is seen now" to "Thunder will be heard soon." It is the contents of the concepts West and East that make the first a good inference, the contents of the concepts Wednesday, Thursday, today, and tomorrow that make the second inference correct, and the contents of the concepts lightning and thunder, as well as the temporal concepts, that underwrite the third. Endorsing these inferences is part of grasping or mastering those concepts, quite apart from any specifically logical competence. (*Making It Explicit* 97-98)

11 “Understanding can be understood, not as the turning on of a Cartesian light, but as practical mastery of a certain kind of inferentially articulated doing, responding differentially according to the circumstances of proper application of a concept, and distinguishing the proper inferential consequences of such application.” (Brandom, *Making It Explicit* 120)

12 Unlike Wittgenstein's explicit rules, which lead to a vicious regress -- we would need rules for how to apply rules -- Brandom's norms are implicit: they are the normative patterns of a community's practices and need not be conscious or articulated. Philosophers, linguists and others may, of course, make them explicit -- hence the title of his book -- but the community's practices of keeping score of individuals' commitments operate unreflectively.

13 Michael Tomassello, *A Natural History of Human Thinking*, Harvard University Press, 36.

14 Martin A. Nowak, Joshua B. Plotkin & Vincent A. A. Jansen, "The evolution of syntactic communication" April 2000. *Nature* 404(6777): 495-8
DOI:10.1038/35006635

15 For comparison, consider the genetic changes that led to Europeans producing lactase, which gave them the ability to digest milk. These changes replicated only because of the agricultural way of life within which they occurred. For all we know, the ability to digest milk may have already appeared many times in various individuals over millions of years, but, without the agricultural environment 5000 years ago, the ability was not selected for, and so went extinct.

16 Bolhuis JJ, Tattersall I, Chomsky N, Berwick RC “How Could Language Have Evolved?” *PLoS Biol* 12(8) (2014) doi:10.1371/journal.pbio.1001934 p.1