Book Review

The Recursive Mind. The Origins of Human Language, Thought and Civilization

Michael C. Corballis
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Language is perhaps the most common way to identify the source of humans' uniqueness within the animal kingdom. Its variety, creativity and flexibility make it hard to believe that our language is something that we could share with other species. It is mainly for this reason that the study of animal communication has long been – and still is - considered by some a useless activity to undertake, when the aim is to reveal the mechanisms underlying the human faculty of language. Among them, Noam Chomsky has claimed that studying animal communication is just a waste of time, since human language is based on an «entirely different principle» (Chomsky, 1966, p. 78). In his view, language is not an outcome of evolution, but rather a consequence of a sudden and fortuitous genetic mutation that occurred in some individual that he nicknamed "Prometheus".

Although Chomsky is owed enormous credit for his essential finding that language is an innate faculty in humans and that it cannot be explained in terms of learned sequences, his idea, however, of a sudden appearance of language in *Homo sapiens* has not had the same acceptance. Many scientists have in fact tried to reconcile Chomsky's idea of the innate nature of human language with Darwin's natural selection theory, that is crucial for any theory on the origins of language worthy of its name – any true naturalist will agree on this (see, for example, Pinker and Bloom's attempt, 1990).

Michael Corballis should be included among the true naturalists, as he clearly takes a stand against such "emergentist" approaches that, in his own words, «do smack of the miraculous» (2011, p. viii). In his book, *The*

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Recursive Mind Corballis claims that language did not appear suddenly in humans 50-100,000 years ago as Chomsky proposed, but instead evolved during the last 6 million years, arising from pre-existing cognitive systems that we share with other animals. The distinction of Corballis' proposal is that these systems share a characteristic that is critical for human language and mind, that is *recursion*. Recursion is a general property of our minds that allows us to embed elements into other elements of the same kind to form potentially infinite thoughts, behaviours, or linguistic sequences.

The Recursive Mind is divided into four main parts, explaining in a simple and informative style what it means for humans to have a recursive mind, how it has influenced the origin and the nature of our language, as well as the overall evolution of hominids, and why recursion is the primary characteristic that distinguishes the human mind from that of other animals.

The first part of the book deals with language and recursion. Recursion in language is the capacity to embed structures within structures to generate expressions such as "John, who's married to Mary, whom I've known for years, works at the airport". As long as our mind can stand it, sentences like this can expand unlimitedly – even though, realistically, we can get up to only four or five levels of embedding before losing the thread. The reason why language is recursive is most likely because it is used to express recursive thoughts, and indeed, in the author's view, it is in thought rather than in language that recursion originates. Against the view that language rests upon a "language of thought" (Fodor, 1975), Corballis claims that it depends on a set of other cognitive devices that are not specific for language and that are themselves recursive. Recursion seems to be a general principle that organizes very different spheres of human mental activity, such as mindreading and episodic memory. Thus, recursive speaking may well depend on the recursive nature of non-linguistic thought.

But is language exclusive to our species? Although Corballis affirms that «it remains highly likely that language itself is specific to humans» (2011, p. 35), the essential concern in order to establish a connection between humans and other species is to ascertain whether animals other than humans possess anything resembling human language. The author thus analyses animal communication and the several attempts which have been made to teach human language in all its forms to animals. Attempts have been made with birds, like the famous parrot Alex, who could answer questions he heard for the first time such as "how many green keys are there?" (Pepperberg, 2009). But the

experiments concentrated mainly on the so-called "human raised apes", like the chimpanzees Washoe (Gardner & Gardner, 1969) and Nim Chimpsky (Terrace et al., 1979) - the latter being a pun on Chomsky's name -, who learned American Signed language, and the bonobo Kanzi (Savage-Rumbaugh et al., 1998) who learned to communicate with humans using lexigrams on keyboards. The results of the research on Kanzi were particularly relevant: they showed that Kanzi is capable of carrying out tasks based on the understanding of quite long sentences, even when they are new and rather eccentric to him, such as "would you please put the soap in the refrigerator?". Such studies show at least an apparently simple but surprising ability, that is to discern the single words composing sentences. It is not a banal operation, as we could easily verify by listening to someone speaking a language completely strange for us.

It is up to the reader to decide whether Washoe or Kanzi succeeded or not in learning language, as there is no general consensus on the issue yet. Many insist that the language acquired by apes is not true language, as it does not manifest a true recursive grammar: «they just don't get it» (Pinker, 1994, p. 340). However, their language can actually be regarded as a form of what Derek Bickerton (1995) defined *protolanguage* a kind of symbolic communication that efficiently transmits information but lacks grammar. Protolanguage is probably what our ancestors hominins spoke, and it is often considered to be the precursor of modern language (see Tallerman, 2007).

Whatever opinion you may have on this, one thing remains certain: while all attempts to teach great apes how to speak have been fatally unsuccessful, significantly better results have been achieved when they have been taught to use written symbols or signed languages. The apes' difficulty to reproduce the articulated sounds of human language is due to the different physical structure of their vocal trait compared to the human one. But their failure can be also attributed to the common misconception that human language can be compared to animal vocalizations. The sounds emitted by animals, despite being sometimes very similar to our voice - as for some talking birds - have little in common with human speech. Firstly, they are mainly under emotional control, as in the case of the calls emitted involuntarily by chimpanzees who spot a source of food or a predator. Secondly, those sounds are genetically fixed, and, with only few exceptions, tied to the external environment. Moreover, they lack a real intention to inform others, as testified by the fact that chimps will make alarm calls in case of predators even if nobody is around.

This is because vocalizations are largely involuntary: in 1986 Jane Goodall recorded that a chimpanzee cannot help but make a call when she discovers food, even if she would prefer to keep it secret in order to eat it all by herself. In general, it seems that the production of a certain sound in absence of the corresponding stimulus is impossible even for animals as close to us as chimpanzees.

On the other hand, as Corballis points out, great apes' gestures - both the ones directed to humans and those observed in the wild between the same species - are intentional and sensitive to the receiver's attentional state. Apes are in fact capable of following gaze direction and of using it to understand where the agent's attention is directed. Such characteristics are significant, says Corballis, because they are fundamental prerequisites for language. Besides, gestures are more similar to language in that they are typically performed by one individual towards another, while vocal calls are usually directed to an entire group.

This similarity between human language and apes gestures has led Michael Corballis to formulate his theory on the origin of language, already explained in his 2002 book, *From Hand to Mouth.* His idea is that language as a complex and structured behaviour cannot plausibly have evolved recently in our species – with "recently" meaning some 50-100,000 years ago. The emergence of complex structures can only be gradual (Pinker, 1994; Pinker & Bloom, 1990), thus we must look at a time far earlier, that is to say from two to six million years ago, and at the ingredients of language that we share with our primate relatives.

A recent discovery supports the theories on the gestural origins of : this is the finding of the mirror system by Giocomo Rizzolatti and his colleagues at the University of Parma (e.g. Gallese et al., 1996; Rizzolatti et al., 2001). They found that an area in the macaques' brain - the area F5 - that is activated when they make hand movements intentionally, and also during the observation of the same movements performed by another individual. An homologous of this area was also later discovered in humans, located in the Broca's area, critical for language and complex hand movements. The significant difference between the chimps' and humans' mirror system is that in humans it responds not only to transitive acts, such as reaching for an actual object, but also to intransitive acts, in which the movement is mimed and there are no object within the field of view. This capacity could have led to an understanding of symbolic acts and thus to symbolic behaviour and communication. Moreover, mirror neurons in

humans are also activated when we hear or read about an action, suggesting that our mirror system involves language too. The discovery of the mirror system has been used to build a theory of action understanding, and speech perception in particular, by which we do not perceive speech in terms of acoustic patterns, but in terms of how we ourselves would articulate it (see Rizzolatti & Arbib, 1998; Arbib, 2012). So, according to Corballis, intentional communication could actually have originated from action understanding, and mirror neurons could be a suitable candidate for bridging a gap between human language and animal communication.

Since a number of great apes have been able to successfully learn different forms of language-like gestures, it is reasonable to suppose that hominins could also, and that they once used to communicate this way. Such communication maybe lacked grammar that gradually evolved later, «driven by practical concerns and not by biological predisposition» (Corballis, 2011, p. 29). This process goes by the name of *grammaticalization*, and can be seen even today, for example in second-generation users of sign languages or in creole speakers. Time was also critical for *conventionalization*, the process by which gestures lost their iconicity and thus their resemblance to real objects of the world. More arbitrariness meant higher difficulty at the moment of acquiring symbols, but also more variation and flexibility at the stage of production. The next step towards spoken language also meant greater economy of use and freedom to use the hands for other purposes.

But how come we switched from gestures to speech? Corballis' account highlights two main steps. The first is the incorporation of facial gestures, being the face the connection between hands and mouth. Even today, sign languages of the world make use of facial gestures as well as those of the body. Facial gestures increasingly involved invisible movements of the tongue, and in the second step the activation of the vocal cords made these movements perceivable by the ear.

Humans might then have passed through a brain evolution for language, and also undertaken genetic mutation that led to the development of "language genes" such as the FOXP2 (the last is a controversial point, see Fisher & Scharff, 2009 for a review). We also took advantage of anatomical changes that favoured the rise of language: first, the upright stance freed up our hands allowing us to transport and craft objects, and also to gesticulate. Second, the lowering of the larynx created a right-angled vocal trait which was able to articulate the range of vocals that characterizes speech. Even though

bipedalism brought disadvantages such as back pain, and increased birth pain, on the other hand the evolution of speech to which it led brought important advantages such as the possibility to communicate at long distances or in the dark, and a reduced penetrability due to the absence of an iconic component. Today the switch is complete, but we can still witness the remains of the gestural origins of language in our everyday verbal exchanges.

Corballis argues that once the progression from manual gestures to speech was complete, grammar was added to language. But how did recursion and generativity become the most remarkable characteristics of modern language?

Corballis claims that these properties came from the recursive nature of two other cognitive devices, from which language takes its roots: Mental Time Travel and Theory of Mind. These topics are respectively the second and third part of the book.

Mental Time Travel is a phenomenon that joins two different but related capacities: memorizing past events and imagining possible future events (see Suddendorf & Corballis, 2007). Memory is certainly a recursive phenomenon: when we remember or think about the future we are in fact inserting previous or future experiences into present consciousness. Memories and plans can also be inserted into other memories, like when we remember ourselves in the past planning for the future. Humans undoubtedly master such activities: we can remember countless episodes and memorize lots of concepts, but also project ourselves in the future to make plans for our lives or to predict situations to always be ahead of the game. Finally, we are most likely the only species that can use its memories and resolutions for the future to build a structured personal identity.

Corballis suggests that language is tightly linked to mental time travel, as its main purpose is to share our past and future events, and indeed it could actually have evolved for this reason. Humans, in fact, seem to be particularly interested in the lives of others – hence the existence of gossip, which someone has pointed to as the reason why we talk so much (see Dunbar, 1998).

The second element, the Theory of Mind, is the ability to gauge is in the mind of other individuals, whether they are thoughts, emotions, intentions or desires. It is a key ability for activities such as cooperation, deception and for what has been called Machiavellian intelligence (De Waal, 1982). Mind Reading is also a recursive activity: there are in fact several orders of intentionality that we can build, e.g. "I think that she suspects that he knows what I'm about to do" – a mere fourth grade intentionality. As Sperber and

Wilson (1986), and Grice before them (1975) have taught us, the role of intentionality in language is essential. True language is not a mere transmission of words and content, but rather a cooperative activity in which participants have to show their communicative intentions and recognize the same in others. The importance of mindreading for language catches the eye when we analyse language in individuals with deficits of Theory of Mind, such as autistic subjects, who cannot go beyond the literal meaning of sentences.

It is debated whether other animals are capable of some grade of episodic memory, future thinking and mindreading. The most explored field since Premack and Woodruff's 1978 article is that of Theory of Mind: there is some evidence that chimpanzee and bonobos, our nearest related species, show at least some grade of mindreading (see Call & Tomasello, 2008). Even if they may not come to understand false beliefs, they could actually be aware of the attentional states of others, and to effectively use this ability to implement behaviours such as tactical deception (Whiten &Byrne, 1988; for a sceptical view, see Povinelli & Wonk, 2003). As for Mental Time Travel, there is some evidence of future prediction in animals. To name, a few scrub jays who are used to store away the kind of food that they know will not be available later in time (Correia et al., 2007); or Santino, the chimpanzee who has the curious habit to stockpile stones in order to throw them later at unlucky visitors of the Furuvik Zoo in Sweden (Osvath, 2009). But in many cases it is more difficult to exclude some instinctive determinants for such behaviour. Even conceding a glimmer of future thinking capacity in animals, Corballis claims that humans are for sure the only ones who can deliberately measure time to guide intentional behaviour.[1] The author is actually sceptic about the animals' ability to reach a level of recursion higher than the first, in both mindreading and Mental Time Travel. Anyway, nothing prevents us from hypothesizing that our abilities are just refinements of basic capacities already present in other species.

The last part of the book is dedicated to human evolution: here Corballis takes a clear position against the Cartesian discontinuity, and in favour of a Darwinian gradualist continuity between human beings and the other species. He analyses the steps by which we became humans, the facultative and then obligate bipedalism, the evolution of tools manufacturing, the migration from Africa, and the building of a "cognitive niche", and how we evolved our unique

[1] Corballis has recently changed his opinion on this subject, arguing that some animals other than human beings can possess a form of MTT: see Corballis, 2013.

way of thinking from mental structures that were already present in other species. The journey towards modern human beings began yet before the appearance of hominins, even if Corballis points to the Pleistocene (starting about 2 million years ago) as the period in which the most radical changes happened. It is at this moment that language started its evolution, eventually shifting from manual gestures to articulated speech, maybe as a consequence to a gene mutation or simply as a result of a cultural invention. Recursion came later mainly under the pressure of complex social interaction and the inclination to storytelling (but, according to Corballis, only secondarily to the crafting of tools).

In conclusion, the main claim of *The Recursive Mind* is that recursion is that recursion is the key property of the huma mind that underlies our unique abilities, such as language, Mental Time Travel and Theory of Mind. But we could still abide with Darwin's postulate that such difference, «great as it is, certainly is one of degree and not of kind» (1871). Recursion is not a module, it did not evolve in some single, miraculous step, and different levels of recursion can be found in the behaviour of many non-human animals, even if they might not go beyond a first level of embedding. For these reasons, language and recursion could turn out to be the link between humans and other species, rather than the source of our uniqueness.

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