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The origins of language: in search for the specificity of large-brained hominin languages

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Since the publication of the "Neandertal Genome" hominin interbreeding has become a renewed paradigm for the explanation of recent human evolution. In all fairness, a moderate genetic flow among archaic and anatomically modern humans (from now on AMH) –the so called "assimilation model"- had been largely defended by Erik Trinkaus and Fred H. Smith among others, on the basis of certain morphological similarities. Nevertheless, the new technologically powerful paleogenomic methods and results are placing the interbreeding model in the headlines of human evolution. The complete sequencing of the Neandertal and Denisova genomes has detected a moderate but significant coincidence of their DNA sequences with those of *H. sapiens* populations. In front of this new evidence, gene flow from Neandertal to modern humans is presently becoming largely accepted, although alternative interpretations for the genetic similarities are also possible. For instance, the presence of a deep African *H. sapiens* population structure at the end of the Middle-early Late Pleistocene, and assuming that a subpopulation genetically closer to the common root with Neandertals was the one who went involved in the Out-of-Africa process.

Accepting interbreeding as the most likely hypothesis, it has been discussed whether archaic gene variants could have affected the evolution of AMH. Specifically, among the potential effects that the archaic DNA introgressed into AMH chromosomes are those related to neuronal-brain development. In sort, it has been proposed that variants of genes such as MCPH1 (Microcephalin) or ASPM (Abnormal Spindle-like, Microcephaly-associated) may have positively affected the cognition capabilities of modern humans. More in particular, because language is so closely related to cognitive development, it has been even discussed whether archaic gene variants could have forced the capacity of modern humans to communicate by means of a complex articulated language. Benítez-Burraco and Barceló-Coblijn (this volume) review this topic for JASs "*paleogenomic, intebreending and language*" forum, finely exploring most of the sides of this polyedric and complex matter.

In their assessment, Benítez-Burraco & Barceló-Coblijn (this volume) differentiate two major points. On the one hand, the core of the subject: to what extend the available data support the hypothesis of introgression as the fuel for AMH language capabilities. And, on the other hand, they give a statement on the hypothetical basic makeup of the Neandertal language.

Regarding the possibility that DNA introgression may confer the genotypic background for a complex modern language, these authors discard it as very unlikely. After a careful revision of the evidence, they call for caution. I fully agree with them. I find very little foundation, if any, for supporting the introgression hypothesis. Personally, I feel this proposition just as an appealing intellectual entertainment, but without actual empirical foundation. By contrast, it seems to me that exploring the specificity of the languages that archaic human species could have developed (e.g. Neandertals) is a much more interesting enterprise for the time being.

Indeed, for archaic humans (e.g Neandertals) transferring the language genotype to AMH

it would imply that, in some way, Neandertals had already a well developed complex language. Nonetheless, Benítez-Burraco & Barceló-Coblijn conclude that "the languages they plausibly spoke would have lacked some defining properties of human languages, particularly, complex syntax…". Fine! This is an important statement, but I consider of prime interest to go further and clarifying what sort of language may have had archaic humans. Defining specific language capabilities in humans other than AMH is vital for understanding what we call "human". Language is at the core of our notion of humanity. Thus, exploring this (and other characteristics) on the Neandertals goes beyond the nostalgic interest for a "primitive" human species.

At first sight, there is a sort of contradiction when conceptualizing Neandertals as a human species. On the one side, Neandertal anatomy is well different from that of us. In fact, the more we analyze its morphology, the more we find differences in size and shape (e.g. divergence in brain growth and evolutionary trajectory could involve radical consequences). For many of us, phenotypes are sufficiently distinct as to consider them deriving from two different human "species". However, a series of analyses of behavioral and cultural attributes tend to united both human groups. The discovery of personal ornaments at chatelperronian sites, the non-functional use of feathers inferred from the analyses of bird bones (Peresani et al., 2011), or the well documented employ of pigments impinge on the Neandertals a human nature difficult to distinguish from our own sort of humanity. From this perspective, Neandertals had independently developed their own sophisticated symbolic world. Even plastic arts, perhaps one of the boundaries never crossed by Neandertals, are recently under discussion. Some authors have speculated that the earliest cave painting at the Iberian Cantabrian range could have been made by *Homo neanderthalensi*s individuals.

Within this tension, language plays, in a way, a kind of hinge between these two extreme sources of evidence. To my view, the more interesting point lays here. The challenge is not just to discuss whether Neandertals spoke or not, but to define the way they did it. I agree with those who think Neandertals had developed a complex social and cognitive system. Evidences for a Neandertal language come from several disciplines and a hunter-gatherer social organization demands a certain level of communication, personal ornament interpreted as proof of symbolic thinking. Following d'Errico *et al*. (2003), "it is difficult to imagine that a human group could excavate a grave, position the corpse in the pit, and offer funerary goods with no form of verbal exchange". However, to identify the possibly subtle, but fundamental differences between different human species, will represent a step further in the understanding of us. After decades of exploring gross similarities and differences we now face the challenge of characterizing those mechanisms which make a human to be a Sapiens, a Neandertal or a Denisovan. Our way of thinking the meaning of "humanity" remains certainly still in a "black and white" mode. At the most, we can distinguish a gamut of grays between two extremes: *to be or not to be human*. Indisputably, we need a step forward to appreciate a more colored world, and to perceive the diversity of human forms which have emerged possibly throughout the combination of a wealth of cognitive basic mechanisms. The pending challenge is to decipher the differences in internal organization between the same-sized brains of these taxa. I share Trinkaus (2003)'s perspective the emergence of modern human behavior (including language) must be understood within a complex interwoven matrix, with a variety of biological and behavioral components.

To this end, there are several potential research lines to be followed. Here I will briefly refer to two of them. The first is a comparative anatomy study of brain components with implications on social complexity. The other, a more technologically based paleogenetic study detecting fine genetic regulation differences with possible consequences on articulation of language.

Recently, Pearce *et al*. (2013) defended the idea that Neandertals had significantly larger visual systems as compared to AMH. This, together with their high lean body mass, led to conclude that they were a human variant with significantly smaller adjusted

endocranial capacities than contemporary AMH. The difference in the partitioning of brain tissue might have substantial implications for cognitive processing in Neandertals. In particular, Pearce *et al*. (2013) propose that Neandertal and modern human lineages followed different evolutionary strategies related to, among many other aspects, social complexity and bonded size group. Although not entangled at the moment, it seems obvious that language structure might have been involved in this divergent evolutionary process.

At a different biological scale, the discovery that two Neandertals shared the derived human alleles of the language-related FOXP2 gene was perceived as solid confirmation of the, for many presumed, Neandertals language (Trinkaus, 2003). However, in a new twist, Maricic *et al.,* (2012) proposed that AMH-specific changes in the FOXP2 regulation, via the transcription factor POU3F2, occurred after the divergence of Neandertals and modern humans. Even though it is presently unknown the exact effect of that mutation, a potentially direct influence of the language performance is implied.

These two examples may illustrate the assertion that Neandertal may have been a subtle but different kind of human being. As such, having a different –simpler- language system as compared to modern humans is something within the expectations. Any complex system does not emerge overnight. Even thought evolution of complex systems (e.g. language) is not necessarily gradual, they go through phases of increasing complexity. Presently, we only know the wide but limited range of modern human languages, which apparently share all of them a universal template. Therefore, it should be expected that hominins other than present *H. sapiens* would have essayed distinct ways of developing a verbal communication. The point would be to untangled their structures and specificities. Not just classifying them in the one single dimension of "more or less" simple than the ones from present humans.

In conclusion, I fully agree with Benítez-Burraco & Barceló-Coblijn as I find very little support, if any, for arguing that DNA introgression had influenced the evolution of AMH language. I claim, at the same time, for a linguistic expert endeavor in the elucidation of the evolutionary structural disparity of hominin languages.

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