doi 10.4436/JASS.91013

JASs *forum*

Journal of Anthropological Sciences
Vol. 91 (2013), pp. 245-247

Language and hybrids: too many answers for too few questions

Emiliano Bruner

Centro Nacional de Investigacíon sobre la Evolución Humana, Paseo Sierra de Atapuerca s/n, 09002 Burgos, Spain
e-mail: emiliano.bruner@cenieh.es

"Where any answer is possible, all answers are meaningless"
Isaac Asimov

Language and species interbreeding in human evolution have one thing in common: the lack of agreement despite so many years of debate. Both topics are indeed complex issues, and probably this makes conclusive and robust statements more difficult. Nonetheless, I believe the primary reason for such a patent lack of any decisive result in spite of so many studies and discussions is the fact that both issues are debated following a principle of *possibility*. Science should be firmly based, instead, on the principle of *probability*. In science, we collect data to give a percentage of probability regarding whether hypotheses can be true or false. Following a sane Popperian instructive approach, sometimes we can even demonstrate that a hypothesis is false and prune it according to a process of cultural selection. However, it is definitely more difficult (or even impossible) to demonstrate that a hypothesis is true. Debates on language evolution and species interbreeding, on the other hand, have been largely based on *possibility* (rather than on *probability*) for a hypothesis to be true. This approach, frequently used and abused in paleontology, is not the most proper one in science, being more traditional in fields like politics or religion. The reason why we should avoid *possibility* in science is because, theoretically, every hypothesis is formally *possible*. This does not help the process of cultural selection: no hypothesis can be pruned and, consequently, all hypotheses remain in circulation for decades with no actual advance in the debate.

The interbreeding issue represents a strange case in evolutionary anthropology (see Bruner, 2013). After one century of disagreements based on morphological evidence, in the last decade also the genetic approaches, frequently put forward as a final solution, have not always been so coherent in clarifying the actual molecular contribution of the extinct taxa to the extant human groups. This is, in my opinion, probably due to an excessive reductionism associated with unnecessary firm statements. The longstanding debate on hybrids and hybridization sounds excessive when considered from a zoological perspective. In fact, we know that in nature species and even genera can interbreed, with many examples in living primates. Therefore, the real interest should be not if two groups can interbreed or even if they did or not, but better whether and to what extent this might have influenced the evolutionary course and changed phylogenetic relationships. The debate is further complicated by the fact that in paleoanthropology we are used to naming groups from single and fragmented pieces of fossil bones, and now even from isolated molecular cues.

The issue of language has similar problems, with an additional speculative component associated with the complexity of cultural and cognitive processes. If reductionism has negatively influenced the biological aspects of the debate, the same approach regarding cognitive levels can be even more dangerous. It is curious how we are used to criticizing reductionist approaches in

the morphology of one century ago (such as the excesses of phrenology and physiognomy), but we make exactly the same errors nowadays with molecules and genes, mostly when dealing with cognitive perspectives. After so much unfruitful research, it is unlikely that a magic gene can explain such a complex function like language. Regardless of a fast or more gradual evolution, poligeny, pleiothropy, genetic integration, phenotypic integration, social factors, and cultural autocatalytic processes make a linear solution to language at least improbable.

Also when dealing with the hard evidence of fossils, which provide the only actual anatomical remnants of such hypothetical biological processes, we must recognize that perspectives on cognition are generally speculative. In this context, anatomy can only suggest "compatibility" with a given biological aspect, but such potentiality leaves many doors open, and opposite conclusions cannot be discarded. Paleoneurology has probably already uncovered all the scarce information available from endocasts on this topic. According to endocranial morphology, the appearance of the cortical gyri and sulci involved in language has been "modern-like" in every human species for two million years (Tobias, 1987, 1995). In terms of general proportions, the Broca's area displays a specific lateral enlargement in both modern humans and Neandertals (Bruner & Holloway, 2010). This change can be associated with a functional reorganization of the cortical networks, or alternatively it could just be a secondary structural rearrangement with no functional consequences. Endocranial form differences between human species are facts, but they cannot say more than what they say. There is no firm association between brain morphology and functions, as evidenced by the fact that no agreement exists even on many basic aspects of these cortical areas in modern humans and living apes (e.g. Amunts *et al.,*1999; Keller *et al.,* 2009a,b; Amunts & Ziller, 2012; Sherwood & Smaers, 2013).

In their article on paleogenomics and Neandertals' cognitive capabilities, Benítez-Burraco and Barceló-Coblijn advise against excessively associating hypotheses on hybridization with hypotheses on language (Benítez-Burraco & Barceló-Coblijn, this Forum). I think we should even go beyond their reasonable prudence, and present such caution as a necessary requirement to keep the topic within a proper scientific and professional debate. Both issues are largely based on speculative perspectives and rooted in the concept of *possibility*, which hampers any selective approach organized on the available proof. On the one hand we should not discard or reject the information from genetics and morphology, while on the other we must recognize that such evidence cannot be clear or conclusive. In paleobiology, we are more and more used to associating any single study or analysis with a firm conclusion. Maybe this is a bad habit aimed at attracting the attention of media and journals. Scientific hypotheses should be, in contrast, provided on the basis of multiple evidence and according to a probabilistic approach. The temptation to provide firm statements and general solutions in any single article, for every single fossil, or for any single gene, should be inhibited for the sake and promotion of a proper professional attitude in our field.

Language is one of the most complex human cognitive processes, and it is strictly linked to all human cultural aspects. Therefore, it is likely that culture itself may be the most informative witness of language evolution, more than genes, bones, or circumvolutions (e.g. Wynn & Coolidge, 2004, 2010; Coolidge & Wynn, 2007; Langbroek, 2012). Only the integration of all biological and archaeological aspects can provide a general perspective on this issue, which anyway will never arrive at final solutions. One reasonable probability is better, at least in science, than hundreds of justifiable possibilities.

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Associate Editor, Rita Vargiu