The role of technology and pedagogy in the evolution of language

Fabio Di Vincenzo[1], Laura Desirée Di Paolo[2], Giorgio Manzi[1]
[1]Sapienza, Rome; [2]University of Göttingen

All living beings are able to communicate, but only humans have language. The reason is that language requires that "symbolic" and "computational" mind co-occur: while the former gives specific meanings to gestures, sounds and signs, the latter (that is based on recursive thinking), generates and ordinates signs and symbols in grammatically correct sentences. Both these abilities - ultimately referred to semantics and syntax - are rooted in the sensory-motor organization of the brain.

From a biological point of view, language and social learning are closely related phenomena, since those cortical areas involved in social learning (emulation and imitation) in humans and other apes, are also anatomically associated with the areas controlling language in *Homo sapiens*.

Our proposal is that in early humans, social learning exhibits the first evidence of a functional combination of semantic and syntactic (hierarchical, recursive) aspects as can be evinced by the analysis of the productive chains of some Paleolithic artefacts. Therefore, in this association we can observe the same structural core of the linguistic communication adopted by modern humans.

Furthermore, the asymmetrical development of left perisylvian cortical areas observable in the endocasts of the "early *Homo*" fossil specimens, more than 2 millions years ago, is here interpreted together with the presence of a nonverbal imitative learning system, more efficient than that one owned by their ancestors or extant apes. Actually, the increased capabilities of social learning in Plio-Pleistocene hominins provided the key adaptation to obtain high quality nutrients essential to support the development of the brain (encephalization), through transmission of pivotal technical skills and, in our view, it is within this techno-pedagogical context that the cognitive complexity required for language might have been selectively promoted.