Why vocal production of atypical sounds in apes and its cerebral correlates have a lot to say about the origin of language

doi:10.1017/S0140525X13004135

Adrien Meguerditchian,a Jared P. Taglialatela,b,c David A. Leavens,d and William D. Hopkins,e,a

*Laboratory of Cognitive Psychology, UMR7290, Aix-Marseille University – CNRS, Brain and Language Research Institute, 13331 Marseille, France;
only showed that (i) it was possible to explicitly train them to do so using operant conditioning, but also (ii) that those subjects would further use these novel vocalizations in a communicative context for getting the attention of a human (Russell et al. 2013).

Finally, the investigation of lateralization of those atypical sounds and its functional cerebral correlates show some continuity with the language system. Indeed, most of the language functions involve a left-hemispheric dominance (Knecht et al. 2000). Interestingly, it turns out that these chimpanzee auditory signals, when produced simultaneously with food-begging pointing gestures, induce a stronger right-hand preference than when the gesture is produced alone (Hopkins & Cantero 2003), indicating that the left hemisphere may be more activated when producing both gestures and these atypical vocal and lip sounds simultaneously. Moreover, measures of orofacial asymmetries for vocal production in chimpanzees have shown that species-typical vocalizations—such as food barks or pant-hoot—elicited a left-sided orofacial asymmetry (i.e., right-hemispheric dominance), whereas atypical attention-getting sounds elicited an asymmetry toward the right side of the mouth, indicating that, as for right-handedness for communicative clapping gestures (Meguerditchian et al. 2012), a left-hemispheric dominance might be involved for producing those acoustical signals (Losin et al. 2008). More impressively, brain imaging studies (PET [positive emission tomography]) conducted in three captive individuals have found that communicative signaling for begging food from a human by using either gestures, atypical attention-getting sounds, or both of these modalities simultaneously, activated a homologous region of Broca’s area (IFG) predominantly in the left hemisphere (Tagliatela et al. 2008), a pattern of activation which is enhanced in subjects who used both gestural and vocal signals simultaneously (Tagliatela et al. 2011).

These collective findings support the idea that the atypical orofacial and vocal sounds in chimpanzees are a good illustration of the potential existence of a multimodal intentional system that integrates gestures, orofacial, and atypical vocal sounds into the same lateralized system. This multimodal communicative system not only shares some features of social cognition and social learning with human language, but also seems to be ultimately related to brain specialization for language (Meguerditchian et al. 2011). This theory is consistent with the evidence that in humans, a single integrated communication system in the left cerebral hemisphere might be in charge of both vocal and gestural linguistic communication (e.g., Gentilucci & Dalla Volta 2008). For all of these reasons, and their implications for the precursors of human language and its brain specialization, we believe that Ackermann et al. should better consider these voluntary laryngeal sound-production mechanisms in chimpanzees and the related multimodal communicative system, in their theoretical model.

ACKNOWLEDGMENT
This research was supported by a grant from Agence National de la Recherche ANR-12-PDOC-0014-01 (LangPrimate).