Max-Planck-Institut für Ornithologie

Max Planck Institute for Ornithology

Seewiesen Colloquia

Speaker invited by: Henrik Brumm

Thursday, November 29, 2012, 13h, House 4, Lecture

Behavioral and prefrontal representation of volitional vocal behavior in non-human primates

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Broca's area, in the ventrolateral prefrontal cortex is one of the key brain structures that allows humans to voluntarily produce sophisticated speech signals. Brain damage in this region causes dysfunctions or severe impairment of speech and language production, known as Broca's aphasia. In contrast, lesions in cortical brain structures of monkeys have no or only mild effects on spontaneous call behavior. This and other observations led to the assumption that vocalizations of nonhuman primates are exclusively affective utterances bond to specific motivational states processed by a sub-cortical neural network. In our studies, we demonstrate cognitive control of call production in rhesus monkeys and suggest a neuronal correlate of volitional call initiation in the monkey homologue of Broca's area. For this purposes, we first trained monkeys with operant conditioning techniques to vocalize reliably in response to visual cues. During recordings in the ventral prefrontal and premotor cortices, call-related neurons in the monkey homologue of Broca's area predicted the preparation of subsequent cued vocalizations. Call-related neurons showed significantly higher pre-vocal activity during cued vocalizations as compared to spontaneous calls, suggesting a specific involvement of these prefrontal areas in the initiation of volitional vocalizations. These findings suggest a cardinal role of this prefrontal area in vocal planning and call initiation, a putative cognitive precursor in nonhuman primates that may ultimately give rise to speech control in linguistic humans.

Who is Steffen R. Hage?

2005 PhD, University of Ulm
2007 Research fellowship of the German Primate Center, MPI Ornithology
2007 DFG research fellowship, University of California Los Angeles (UCLA), USA
2009 Group leader of Vocal Communication, Animal Physiology, University of Tübingen,

Selected publications:

- Kobayasi K*, Hage SR*, Berquist S, Feng J, Metzner W (2012) Behavioral and neurobiological implications of linear and non-linear features in larynx phonations of horseshoe bats. Nature Communications: in press (*equal contribution)
- Hage SR (2009) Neuronal networks involved in the generation of vocalization. In: Brudzynski SM (ed.) Handbook of mammalian vocalization (ed. Brudzynski SM), Academic Press, Oxford, pp. 339-349.
- Hage SR, Jürgens U (2006) On the role of the pontine brainstem in vocal pattern generation. A telemetric single-unit recording study in the squirrel monkey. Journal of Neuroscience 26: 7105-7115
- Hage SR, Jürgens U, Ehret G (2006) Audio-vocal interaction in the pontine brainstem during self-initiated vocalization in the squirrel monkey. European Journal of Neuroscience 23: 3297-3307

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