CUMULATIVE VOCAL CULTURES IN ORANGUTANS AND THEIR ONTOGENETIC ORIGIN

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Recently, several lines of evidence indicate that orangutans (*Pongo* sp.) – the earliest diverging great ape lineage – are capable of expanding their species-specific vocal repertoire with new (voiced and voiceless) calls. These calls are shared and learned between individuals of the same cultural community. Orangutans represent, thus, a desirable model species for the study of language and speech precursors within the human lineage, since human spoken languages are fundamentally characterized by being learned. In the first section of this talk, based on the largest and most comprehensive call database ever assembled in orangutans (currently comprising 9 wild populations across Sumatra and Borneo), and perhaps among any great ape species, we show that orangutan vocal repertoires across populations show a nested structure – a signature of cultural build up that indicates that orangutan vocal cultural repertoires emerge and culturally evolve through a process of "sound upon sound". The identification of these orangutan vocal cultures raises, however, questions about their ontogenetic origins. In the second section of this talk, we present a case of extreme vocal malleability in a wild Sumatran orangutan infant (approximately 5 years old), who exhibits a repertoire 2 to 4-fold the size of that of adults. A modest dataset of less that 150 recordings collected from this young individual increased the known orangutan vocal repertoire hitherto described by more than 20%. This flexibility verifies that assemblages of cultural calls may be indeed acquired by infant orangutans and subsequently passed on through generations. Altogether, our findings indicate that vocal

cultures in orangutans are real and may ontogenetically emerge through similar mechanisms as human vocal cultures. Like children, orangutan infants exhibit a latent degree of vocal malleability that expressively surpasses that of adults, and they experience a process of cultural trimming within their "linguistic" community in the process of development of the adult repertoire. Once present in our last great ape common ancestor, similar vocal skills would have allowed the rise and preservation of vocal cultures comparable at a basic level with modern human spoken languages.

1. Background

Language evolution is a scientific puzzle. As far as our understanding of language evolution goes, many puzzle pieces remain yet unrevealed. One of the most critical pieces that have proven particularly elusive is the identification of a vocal cultural system among our closest relatives, the great apes. Unlike humans, virtually no primate species shows the capacity to culturally transmit and preserve vocal cultures. A growing number of studies of great ape vocal behavior indicate, however, that orangutans may indeed be capable of learning new call types and expanding their vocal repertoire beyond the species-specific repertoire [1–4]. How these cultural call repertoires ontogenetically develop, and whether they exhibit the potential to evolve cumulatively as human cultures, remains to be investigated.

1.1. *Methods*

Nestedness analyses were conducted based on vocal repertoire assemblages across orangutan populations as part of the largest database ever assembled of orangutan calls, and results have been replicated resorting to computer simulations.

Infant data were collected opportunistically in the wild (Sikundur Research Station) and analysed via automated cluster analyses based on acoustic similarity as measured through pairwise comparisons using dynamic time warping.

1.2. *References and Citations*

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3 Wich, S.A. *et al.* (2012) Call cultures in orang-utans? *PLoS One* 7, e36180
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