

## WHAT CAN SOUND SYMBOLISM TELL US ABOUT THE EVOLUTION OF LANGUAGE? A COMPARATIVE STUDY IN HUMANS AND GREAT APES

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There has been a long debate in the literature of semantics between the arbitrariness of language proposed by Saussure (1959) and the non-arbitrary associations, known as sound symbolism. Sound symbolism is a form of iconicity based on similarity between a linguistic form and the sensory-motor properties of its referent (Perniss & Vigliocco, 2014). A classic example of sound symbolism is the sound-shape correspondence, as described by Köhler (1929), where the non-word “maluma” was judged to be a good match with a round shape whereas the non-word “takete” matched better to a spiky shape.

Recent theories have highlighted the relevant role of sound symbolism and that of iconicity for the evolution of language (Ramachandran & Hubbard, 2001; Arbib, 2005; Imai & Kita, 2014; Perniss & Vigliocco 2014).

In other words, iconic signals are proposed as the starting point for the evolution of language. Sound symbolic mimicking of the external word with the movement of lips and tongue is another form of iconicity that would fit these theories.

Moreover linked to theories on embodied cognition (Barsalou et al., 2003), language processing is proposed to be based on distributed neural circuits grounded in the action and perception system of the brain and mind (Pulvermüller, 2018). Sound symbolism has been proposed as the linkage between language and human sensory-motor experience, playing a determinant role on the evolution of language (Perniss & Vigliocco, 2014).

Despite this theoretical interest on the phylogenetic origins of sound

symbolism, as far as we are concerned there have been no comparative studies in testing sound symbolic associations in humans and great apes. In addition, considering the new evidence on the perception of iconic gestures in chimpanzees (Bohn et al., 2016), the present study aims to explore whether our closest living relatives are able of perceiving vocal iconic mappings between shapes and sounds.

For that purpose, we ran a two-alternative forced choice (2AFC) audiovisual task, the classic “maluma”-“takete” paradigm (Köhler, 1929). 24 healthy human subjects, four chimpanzees (*Pan troglodytes*) and two gorillas (*Gorilla gorilla gorilla*) took part in the study. During the task the subjects listened to a word co-presented with two shapes, one edgy and one round, and they had to choose one of the two co-presented shapes. In order to avoid any habituation effect, we generated disyllabic non-words that sounded more “round” or “edgy” based on combination of vowels and consonants that sound more “round” or “edgy” in accordance with the literature (Nielsen & Rendall, 2013; McCormick et al., 2015).

We also generated shapes that looked edgy or round. Both sounds and shapes were rated with an online questionnaire in order to select those that have the higher degree of “edginess” or “roundness”. The human subjects were tested in a behavioral booth by responding with a button box and choosing one of the two shapes that matched the aurally simultaneously presented non-word.

In accordance with previous studies, humans preferred to associate round shapes to words that consisted of round vowels, voiced plosives and sonorants. In contrast, disyllabic words that consisted of edgy vowels and voiceless plosives or fricatives were associated more with edgy shapes.

Based on the findings from humans we are currently conducting an analogous study in great apes at the Wolfgang Kohler Primate Research Center, Zoo Leipzig, Germany. Specifically six chimpanzees (*Pan troglodytes*, 3 males) and two gorillas (*Gorilla gorilla gorilla*, 2 females) that were touch screen trained, are tested with the same stimuli in a comparable task. We modified the initial task by increasing the number of trials, in order to have data comparable to the human ones, and by rewarding with food 50 % of the trials in order to keep them engaged to the task.

Based on the results of this study, we will shed light to different hypothesis regarding the role of iconicity and that of sound symbolism in the phylogenetic origins of language. Moreover, new questions will raise regarding the mechanisms that boost the evolution of language. Perhaps the different characteristics of the articulatory system (Fitch, 2000) or differences in the

brain's neuroanatomical structure for spoken language and verbal working memory between human and non human primates (Schomers & Pulvermüller, 2016) may have limited the role of verbal iconic communication in the evolution of language, so that apes would not show evidence of sound symbolic processing.

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