DECODING SOUND-SYMBOLIC WORDS IN VISUAL CORTEX

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Background: Sound symbolism, also called the "bouba-kiki" effect, is a non-arbitrary association between meaningless speech sounds and visual shapes. For example, participants routinely associate rounded shapes with the word "bouba" and spiky shapes with the word "kiki", suggesting a cross-modal association between certain speech sounds and specific visual features. However, despite a long tradition of behavioral experiments manifesting the effect of sound symbolism, evidence for its neural correlates in the human brain is still sparse.

Aims: Given that early visual cortex has been shown to represent auditory stimuli in a selective and content-specific way (Vetter et al., 2014; 2020), we aimed to assess whether early and shape-selective visual cortices show distinguishable neural activity patterns for the implicit shapes conveyed by sound symbolic speech sounds.

Method: We acquired 3T fMRI BOLD signals from 8 healthy adult participants while they were blindfolded and listened to a set of sound symbolic words (rounded, spiky and mixed). Participants' task was to categorize the associated visual shape of words (more spiky or more round on a 4-point scale). After standard fMRI pre-processing, we extracted beta weights from anatomically defined visual regions of interest (V1, V2, V3 and LOC) and applied a within-subject multi-variate pattern classification analysis (MVPA).

Preliminary results: Behavioral results showed that we could replicate the "bouba-kiki" effect inside the MRI scanner, i.e. "rounded" words were associated more often with rounded shapes than "spiky" words, and vice versa. Preliminary MVPA analyses indicate that it is possible to successfully decode sounds judged as "round" or "spiky" based on fMRI activity within visual cortical regions of interest (particularly V3 and LOC) in 5 out of 8 participants.

Conclusions: Our preliminary results show that sound symbolic words entailing a visual shape association can be decoded from fMRI activity patterns in early visual and shape selective cortical regions, even in the absence of visual stimulation. This suggests that visual cortex can represent information from speech, even when it consists of meaningless non-words with a visual shape association. This supports the notion that sound symbolism may be a true effect of sensory and cross-modal association in the human brain and that visual brain regions do not just process visual feed-forward information but also top-down, high-level auditory information.

Keywords: Sound symbolism, Bouba-kiki effect, Visual cortex, fMRI, Multivariate pattern analysis

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