

## QUESTION: Do nonsense words orient attention to abstract visual shapes?

Associations between abstract shapes and non-sense words, e.g., round shapes and /bouba/ sounds, have been observed across cultures and early in development. Yet, how automatic is this association and does attention influence such crossmodal correspondence? More specifically, does attending a sound enhance representation of the corresponding (congruent) shape feature naturally associated with this sound? We investigated the role of attention in sound-shape correspondence using steady state visual evoked potentials (SSVEPs) recorded by electroencephalography.



## METHOD

### Procedure and Stimuli

One round and one spikey half-shape was presented in each hemifield, both contrast-modulated from 0 to 100% at either 5.45Hz (slow flicker) or 7.5Hz (fast flicker).

Participants either heard no sound (baseline, for distinguishing good and poor activators), /ba/ or /ki/ sounds. The syllables were repeated at 3Hz.

Participants performed either tasks:  
 (1) attend **fixation**: Participants monitored the color of central fixation and made a key press, as fast as possible, when fixation turned red.  
 (2) attend **shapes/sounds**: Participants monitored the border of the shapes and the volume of the sound and made a key press, as fast as possible, when any of these three stimuli changed in either volume or border thickness.

TIME: 60s/trial x 8 trials x 5 blocks

Counterbalance across trials: the side the shape is presented on  
 Counterbalance across participants: the frequency associated with each shape; the order of auditory and attention conditions

### EEG data pre-processing

EEG recorded by BioSemi ActiveTwo (32+8 channels) and processed by Letswave 6.0

Time-domain

Frequency-domain

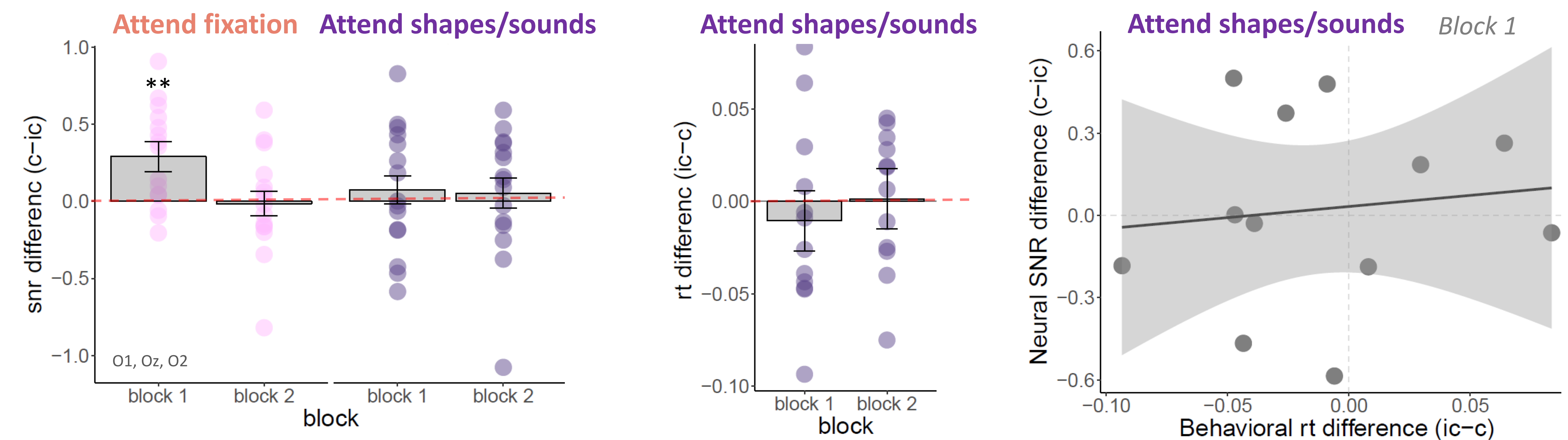
1. Re-referencing (average of ear lobes)
2. Butterworth bandpass filter (0.1-100Hz, filter order = 4)
3. Downsampling
4. Epoching
5. Averaging
6. Fast Fourier Transformation
7. Signal-to-Noise (SNR) computation

Attend fixation

Attend shapes/sounds

## RESULTS (Fundamental frequencies)

Inclusion criteria: (1) baseline SNR > 2.5 for at least one visual frequency, and (2) hit rate >= 0.8 when attending fixation and hit rate >= 0.5 for shape border changes and sound volume changes respectively (n=15)



Neural processing of visual shapes was enhanced when a congruent sound was presented, relative to when an incongruent sound was presented. This effect was transient (occurred in the first four trials only) and diminished when participants were asked to attend across sounds and shapes.

Participants did not respond faster to changes on the visual shape congruent to the concurrent sound.

There was no systematic relationship between behavioral (reaction time difference) and neural (SNR difference) effects when participants were asked to attend across sounds and shapes.

## CONCLUSION: Nonsense words can orient attention to congruent abstract visual shapes but not when endogenous attention is employed.

Further research is needed to understand the following:  
 1) Why do neural orienting effects dissipate (quickly)?  
 2) Why does endogenous attention impair the orienting effect of sound-shape correspondence?  
 3) What explains individual differences in the entrainment, direction and magnitude of neural/behavioral orienting effects?

References:  
 Boremanse, A., Norcia, A.M., & Rossion, B. (2013). An objective signature for visual binding of face parts in human brain. *Journal of Vision*, 13(11), 1-18.  
 Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception and Psychophysics*, 73, 971-995.  
 Others: Letswave 6.0 ([www.nociions.org/letswave](http://www.nociions.org/letswave))

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