

Effects of Sound Symbolism on Shape-Based Ambiguity

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A growing collection of work on sound symbolism has challenged strict interpretations of Saussurian arbitrariness (e.g. Dingemanse, 2015). Notably, the Bouba-Kiki effect shows that speakers associate words like *bouba* with round objects and words like *kiki* with sharp objects (Köhler, 1929). Further investigation has shown that these associations stem from specific phonemic properties: e.g., bilabial = round (e.g., D’Onofrio, 2014). Much of the literature on sound symbolism relies on unambiguous exemplars for a given shape property (*round or sharp*). However, how speakers use sound symbolism with ambiguous visual stimuli (*round and sharp*) is uninvestigated. To test more directly how sound-symbolic associations interact with visual ambiguity, we used a shape-categorization task that included both ambiguous and unambiguous shapes. Our results suggest that ambiguous shapes are interpreted as either *round or sharp* given the respective acoustic cues. This study provides evidence that sound symbolism extends to ambiguous shapes, guiding visual categorization.

Norming: A shape-rating task was first used to determine which shapes participants consider unambiguously round or sharp and which are perceived as ambiguous. We constructed 24 shape candidates that contained both round and sharp properties (e.g., curved lines and jagged points). We constructed another 24 shape candidates that could be judged as unambiguously round or sharp (i.e., containing only one of these properties). See Figure 1. Adult English speakers (n=51) rated the 48 total shapes on both their roundness and their sharpness. The three proposed shape types differed significantly in both their round ratings (lmer, $p < 0.001$) and their sharp ratings ($p < 0.001$). The 12 ambiguous candidates with the most similar roundness and sharpness ratings are used in the main experiment.

Methods: In the main experiment, adult English speakers (n=99) categorized the three established shape types as either *round or sharp* (two-alternative forced choice task). Participants saw each shape and heard it labeled with a nonce word (e.g., [teki]). These auditory labels were constructed using phonemes with either *round or sharp* associations as identified in D’Onofrio (2014). We test four conditions: (i) the label contains only round-associated phonemes, (ii) the label contains only sharp-associated phonemes, (iii) the label contains a mix of round- and sharp-associated phonemes (combination condition; a control), or (iv) there is no auditory label (no label condition), see Table 1. Image-label pairs were counterbalanced across conditions. Proportion of *round* selections is reported.

Predictions: If a shape is visually ambiguous, the sound symbolic properties of a label are the only cue available to speakers when asked to categorize the shape as *round or sharp*. As ambiguous shapes are neither uniformly round nor sharp, we predict that participants will then utilize sound symbolism to guide their categorization in the shape-associated conditions.

Results: Ambiguous shapes are categorized differently dependent on the linguistic label (Fig.2): compared to no label controls, ambiguous shapes are categorized as round *more often* when their label contains *round-associated phonemes* (glmer, $p = 0.017$) and as round *less often* when their label contains *sharp-associated phonemes* ($p = 0.047$). When comparing the sound-symbolic label conditions, this effect strengthens: ambiguous shapes with round-associated phonemes are more often categorized as round while those same shapes are more often categorized as sharp when presented with sharp-associated phonemes ($p = 0.01$). In other words, participants use the sound-symbolic properties of the label when visually categorizing shapes that, in the norming task, were judged to be ambiguous between round and sharp. As expected, we find no effect of label-type on the categorization of *unambiguous* shapes. We also find no difference between the *no label* and *combination* conditions.

Our results indicate that sound symbolic associations can resolve visual ambiguity. In the absence of uniform shape properties, sound symbolism can be used by speakers to perform categorization tasks, guiding the offline interpretation of ambiguous shapes. **Ongoing work:** Data collection is underway for a follow-up (planned n=99) that tests for these same effects using a Likert-scale rather than a forced-choice task. By allowing granularity in responses, we can further probe the role of sound symbolism as a cue for visual categorization.

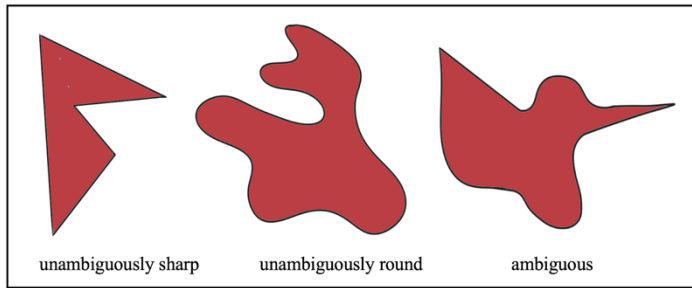


Figure 1. Shape condition examples

<i>Word</i>	<i>Label</i>
---	No label
[kuka]	Combination
[buba]	Round-associated
[keki]	Sharp-associated

Table 1. Label condition examples

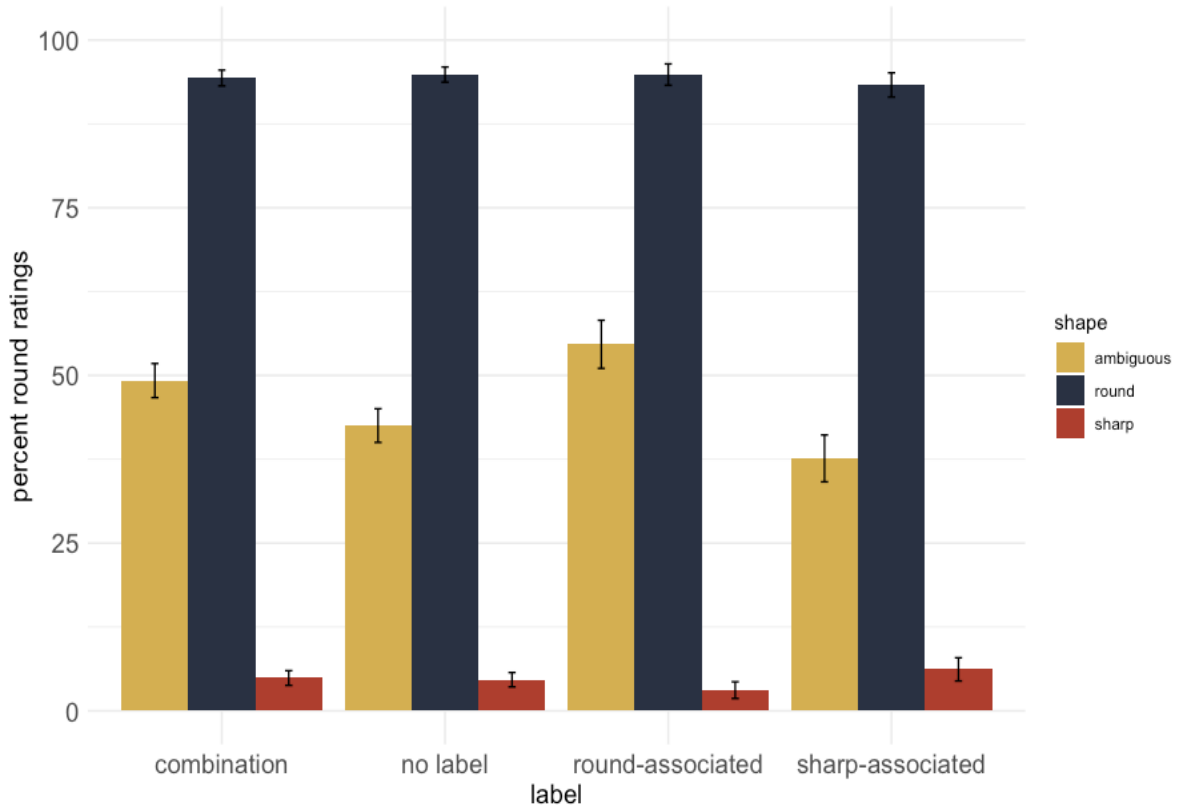


Figure 2. Proportion of Round categorizations by shape and label conditions

References:

- Dingemanse, M., Blasi, D. E., Lupyan, G., Christiansen, M. H., & Monaghan, P. (2015). Arbitrariness, iconicity, and systematicity in language. *Trends in cognitive sciences*, 19(10), 603-615.
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