



Does polysemy assist in cross-situational word learning?

Comparing artificial visual similarities with natural polysemous pairs

Katinka Tangen (Mentors: Dr. John Trueswell, Victor Gomes, Alexander LaTourrette)

University of Pennsylvania



Background

- Many words have multiple meanings
- **Homophones** have meanings that are not semantically related (e.g. bat, the animal and baseball bat).
- **Polysemes** have meanings that are semantically related (e.g. book, the physical object, and its content)
- But how are these multiple meanings acquired?
 - Can learners use one meaning to infer other polysemous meanings?
 - If so, polysemes should be easier to learn than homophones
- Floyd & Goldberg (2021) found that children and adults learn polysemes more efficiently than homophones
 - However, they did not test learning cross-situationally
- So, how do polysemes assist in word learning cross-situationally?
 - Experiment 1 tested how Floyd & Goldberg's artificial polysemes, based on visual similarity, were learned cross-situationally
 - Experiment 2 tested how naturally occurring polysemous pairs (not present in English) were learned cross-situationally

Methods experiment 1

- 80 monolingual English-speaking adults from SONA completed an online experiment hosted on PCLbex. Participants randomly assigned to either polysemy condition (n = 40) or homophone condition (n = 40)
- **Design**
 - Polysemous pairs from Floyd & Goldberg (counterbalanced for similarities of shape and material) shown interleaved with another polysemous pair across 6 trials



Figure 1: sample polysemous pair with similarity in shape



Figure 2: sample homophonous pair (selected from across different polysemous pairs)

- Participants asked to click on the image they thought the word was referring
- Each trial had an ambiguous referent
- Same design for homophone condition

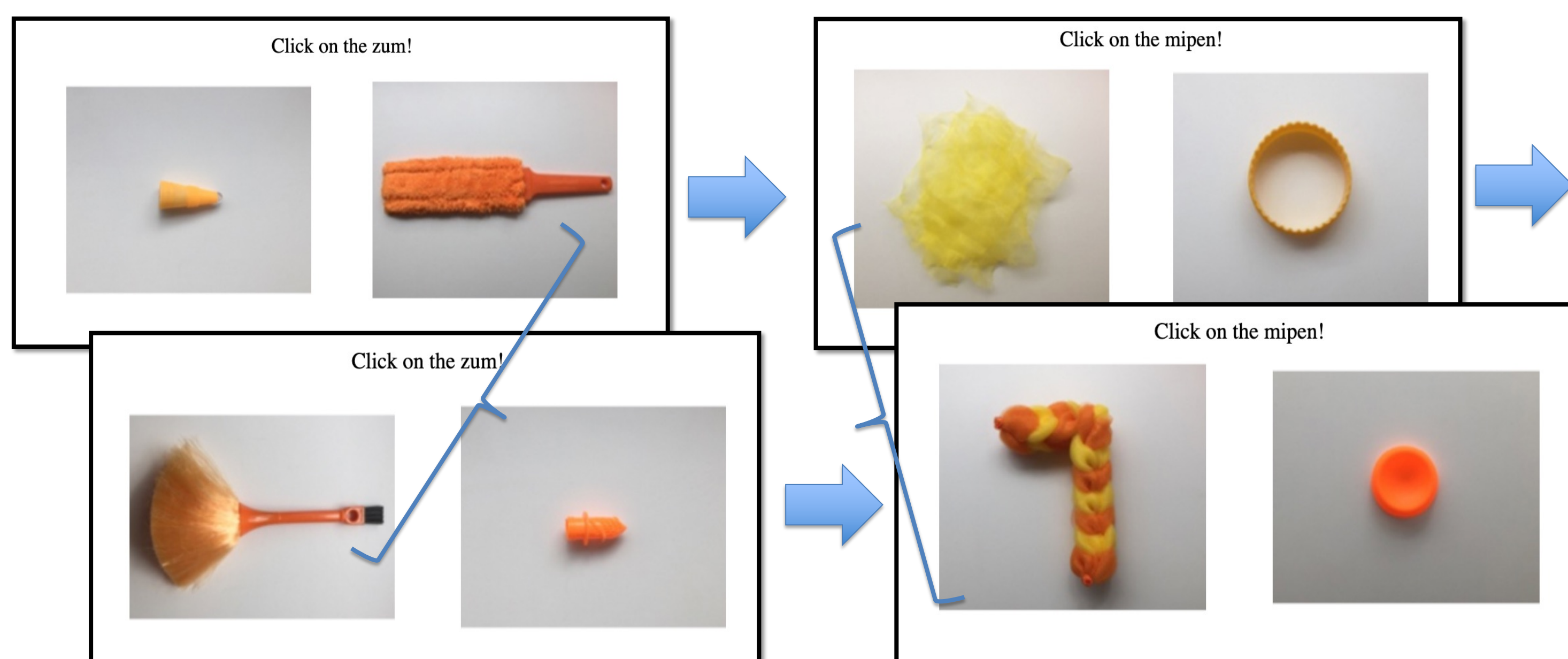


Figure 3: example of experiment 1 polysemy condition. "Zum" pair interleaved with "mipen" pair

Results experiment 1

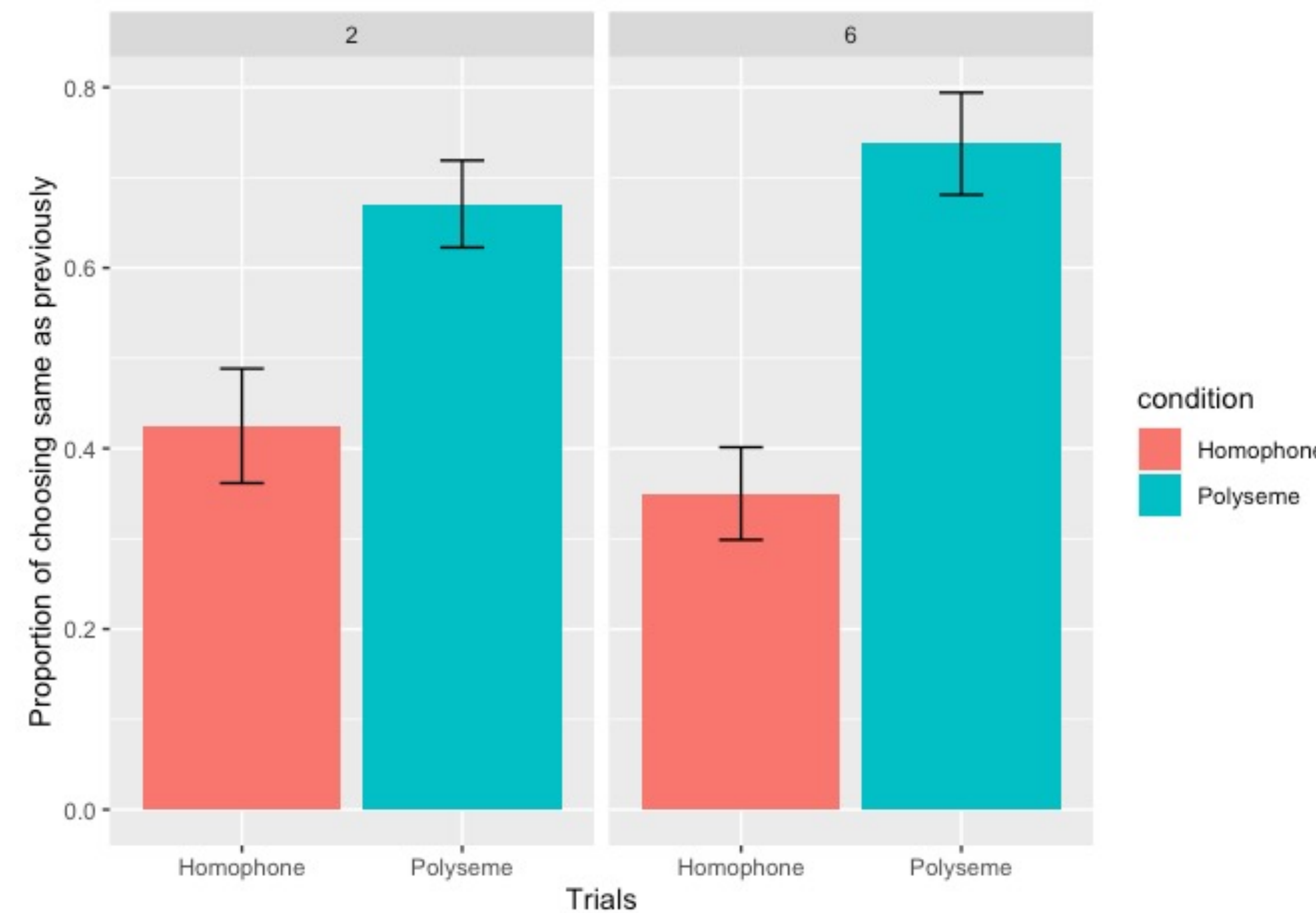


Figure 4: Trial 2: Mixed effects model using condition as predictor . Significantly more likely to pick same item as previously selected when shared polysemous relationship ($\beta = 1.059$, $SE = 0.36$, $z = 2.926$, $p < 0.01$). Trial 6: Mixed effects model using condition as predictor . Significantly more likely to pick same item as previously selected when shared polysemous relationship ($\beta = 1.757$, $SE = 0.426$, $z = 4.123$, $p < 0.01$)

Results experiment 2

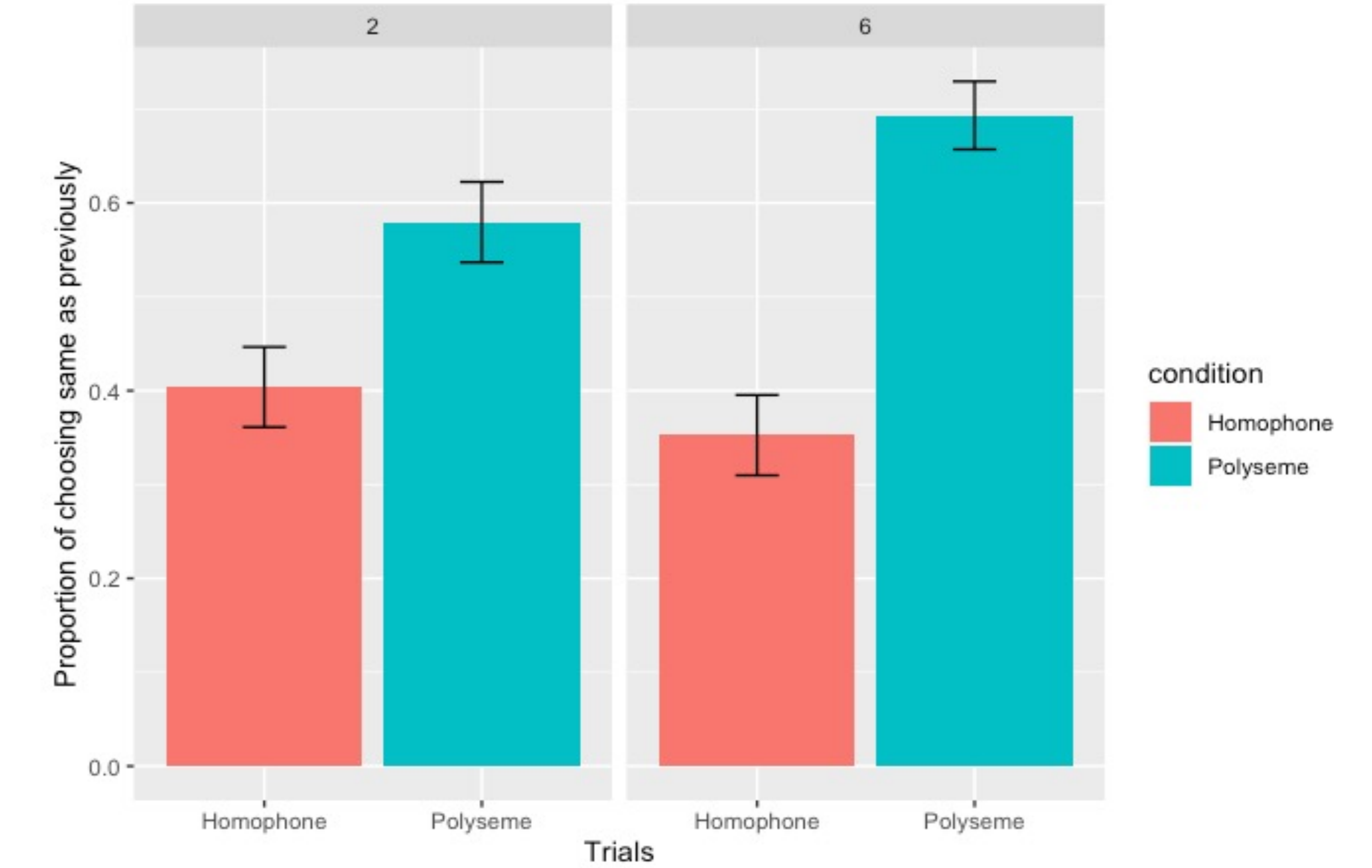


Figure 6: Trial 2: Mixed effects model using condition as predictor . Significantly more likely to pick same item as previously selected when shared polysemous relationship ($\beta = 0.712$, $SE = 0.309$, $z = 2.308$, $p < 0.01$). Trial 6: Mixed effects model using condition as predictor . Significantly more likely to pick same item as previously selected when shared polysemous relationship ($\beta = 1.58$, $SE = 0.045$, $z = 3.512$, $p < 0.01$)

Methods experiment 2

- 79 monolingual English-speaking adults from SONA completed an online experiment hosted on PCLbex. Participants randomly assigned to either polysemy condition (n = 42) or homophone condition (n = 37)
- **Design**
 - Naturally occurring polysemous and homophonous pairs were chosen (images normed) that were not present in the English language
 - Images were counterbalanced for order of exposure, mapping, and labelling (zum, mipen, heek, fendle)
 - Same design as experiment 1

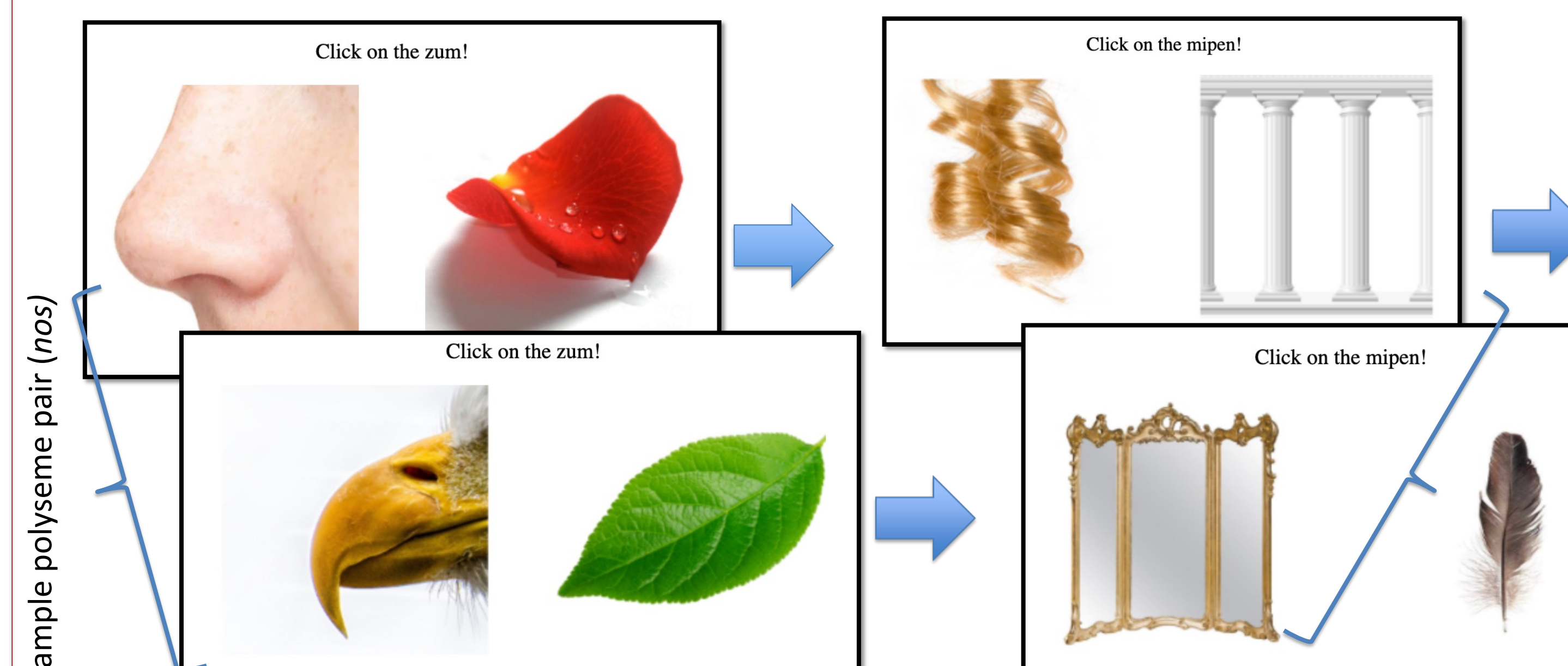


Figure 5: example of experiment 2 polysemy condition. "Zum" pair interleaved with "mipen" pair

Discussion

- Polysemy shows an advantage over homophones as early as trial 2 for both artificial and naturally occurring word pairs.
- Advantage is stronger for artificial visual similarities than for naturally occurring polysemes
- Participants improved from trial 2 to trial 6 in both experiments
 - Shows that they were able to make use of relationships across meanings in cross-situational word learning
- Proportion of correct responses for homophonous word meanings decreased from trial 2 to trial 6 in both experiments
 - Homophones may serve as a disadvantage for word learning cross-situationally

Direction for future studies

- Conduct experiment with children to confirm same pattern with young language learners
- To ensure participants were not just memorizing the images, we would want to increase diversity in images for experiment 2 to discourage memorization (e.g. a different image for "nose" for each exposure)

References

Floyd, S., & Goldberg, A. E. (2021). Children make use of relationships across meanings in word learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 47(1), 29.