Perceptual connectivity influences toddlers' attention to known objects and subsequent label processing

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Does a toddler's knowledge of and attention to subcomponents of word meanings impact lexico-semantic processing? Adult research suggests the answer is "yes". Different aspects of word meanings influence a range of adult psycholinguistic processes, including categorization, word/concept learning, and semantic priming. Meanwhile, recent work exploring effects of portions of word meanings on toddlers' normative vocabulary development have revealed not all types of meaning are equally important: perceptual features matter most (Engelthaler & Hills, 2017; Peters & Borovsky, 2019). However, less is known about whether and how perceptual aspects of word meanings influence lexical processing in early language development.

One possibility is increased perceptual connectivity (i.e., having more words in a child's lexicon that share perceptual features with the item) facilitates processing for familiar words. This option is supported by evidence that 2-year-old toddlers' processing is facilitated for words that are members of categories they are more knowledgeable of (Borovsky et al., 2016), and likely to share many perceptual features with (Hills et al., 2009). A second possibility is that increased perceptual connectivity facilitates attention to objects pre-labeling, with cascading effects on subsequent label processing. This option is supported by evidence linking children's speed of visual object processing and sensitivity to holistic shape to word knowledge (Pereira & Smith, 2009; Smith, 2003) and experience with same category items (Quinn, 2004).

Thus, in the current study, we explored whether and how building a lexicon with perceptual connectivity supports either *pre-labeling* attention to and/or *post-labeling* recognition of word meanings. We explored this question in 24-30-month-olds (N=60) in relation to other individual differences, including age, vocabulary size, and temperamental tendencies to maintain focused attention. Participants' looking to item pairs with high vs low perceptual connectivity (Figure 1A) was measured before and after target item labeling (Figure 1B).

Results from a permutation cluster analysis revealed pre-labeling attention to novel items is biased to both high and low connectivity items: first to high, and second, but more robustly to low connectivity items (Figure 1C). Exploratory analyses of first looks showed the initial bias towards high-connectivity items mainly resulted from a greater likelihood for first looks to land on high connectivity items according to an exact binomial test (*probability* = 0.47, *95% confidence interval* = [0.44, 0.5], p = .029), while the later bias towards low connectivity items was driven by longer durations for first looks that landed on low-connectivity items according to a linear mixed effects model (*coefficient* = -0.123, *95%CI*=[-0.238, -0.008], p=.035).

Subsequent object-label processing was also marginally facilitated for high connectivity items (Figure 1D), and connectivity significantly interacted with temperamental tendency to maintain focused attention according to a linear mixed effects model (*coefficient*=0.098, *95%CI*=[0.02, 0.176], p=.013), even while considering significant cascading effects of pre-labeling attentional biases (*coefficient*=0.08, *95%CI*=[0.04, 0.122], p<.001). This result suggests that a tendency for maintaining focused attention during learning opportunities may provide crucial support for the recognition of shared perceptual features between objects.

This work provides the *first empirical evidence* that patterns of shared perceptual features within children's known vocabularies influences both visual and lexical processing, highlighting the potential for a newfound set of developmental dependencies based on the perceptual/sensory structure of early vocabularies.

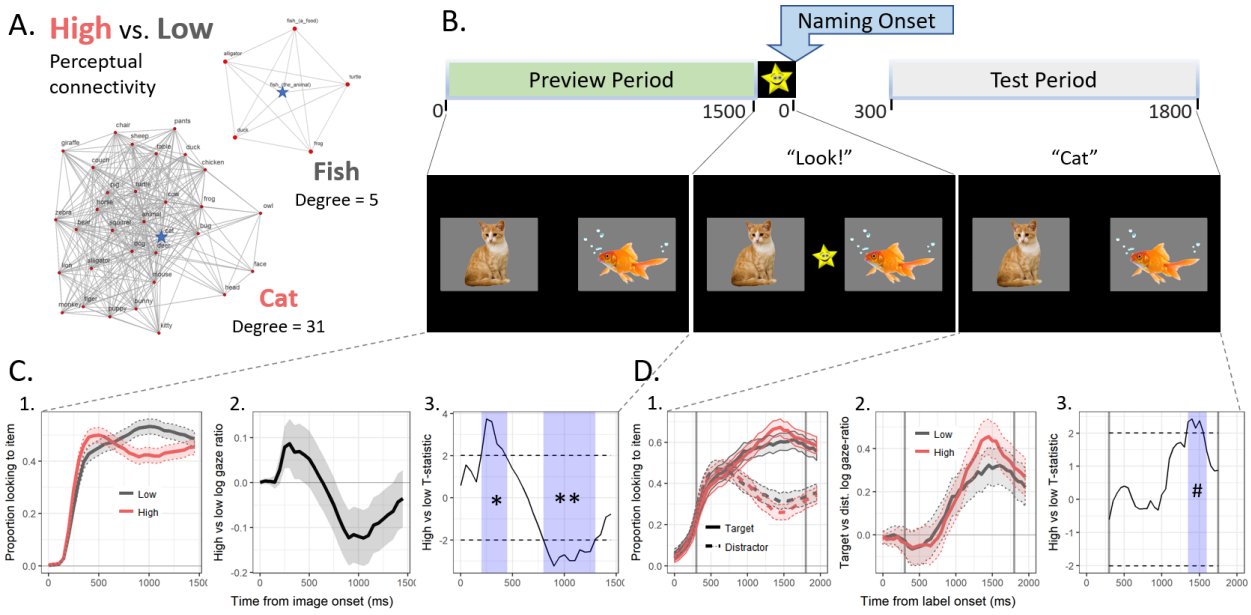

Figure 1. (A) Networks showing words connected to CAT and FISH via shared perceptual features according to a recently developed extension of the McRae et al. (2005) feature production norms, (B) an example of visual stimuli in an experimental trial, and timecourse plots—for both the (C) pre-labeling Preview Period and (D) post-labeling Test Period—of the 1. proportion of fixations, 2. log gaze-ratios, and 3. pointwise comparisons with periods of consecutive significant differences identified by cluster analyses (light blue).
** p < .01. * p < .05. # p < .1.

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