Novel word learning and repair through the lifespan

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For novel words such as ‘panana', listeners have two logical interpretation choices. Following noisy-channel correction (Gibson et al., 2013) they could interpret it as a mispronunciation of a familiar target (‘banana'). However, following disjunctive reasoning (Halberda, 2006) they could interpret it as a label for an unfamiliar novel item which can then be learned via fast-mapping (Carey & Bartlett, 1978). Examining which referent is selected and the patterns of attention to candidate referents during the interpretation process provides insight into how learning and repair trade off and how they are predicted by properties of participants and items. Previous work has shown college-aged adults to have a general repair preference (Brehm et al., HSP 2023). However, both noisy-channel correction and disjunctive reasoning are supported by inferences from pre-existing linguistic knowledge. As such, learning is likely to occur less in adults than children because their lexicon is denser (e.g., Storkel, 2006), to be affected by a variety of individual differences (e.g., Kidd et al., 2018; Kukona et al., 2016), and to be adaptable trial-to-trial depending on the sentence context (e.g., Altmann & Kamide, 1999).

We tested these questions in a large-scale lifespan study conducted in American English at a science museum (N=92, recruiting ages 5 through 60, target N=168) and in a university campus site (N=14, ages 18-30, target N=48). Participants listened to sentences containing a known word (‘banana’) or a novel word differing in onset by one phonetic feature (‘panana’), paired with a scene containing a known item, a novel item, and a distractor item (see Figure 1. We tracked participants’ eyes while they listened to the audio and collected a button-press judgement on each trial about which visual object was the referent of the sentence. Science museum participants got 12 trials and in-lab participants got 24. We examined (1) how interpretations change by participant age, (2) when visual attention is directed to novel items across age, and (3) how much diversity appears in the sample on language-related demographic characteristics. Future analyses with the full sample will also examine (4) differences in repair/learning by age as predicted by the valence/arousal (e.g., Fernandes et al., 2011) of adjectives preceding the noun (see Figure 1 for adjectives used), and (5) the role of foreign language experience in repair/learning.

First, while the most common interpretation across all trials was repair (β=-3.69, $p<0.001$), all participants made more learning judgments to novel than known words (β=-1.94, $p<0.001$). Children learned more than adults (β=-1.23, $p<0.01$) and learning judgments formed a qualitative u-shaped function by age (Figure 2): repair and learning trade off over development.

Second, more fixations were made to novel objects by adults than children, and particularly in the post-noun onset time window (β= -0.04, $p<0.001$, see Figure 3). This shows both adults and children attended to the novel object when a candidate referent was available, but adults spent more time deliberating on both objects before ultimately performing a repair.

Finally, demographic diversity was fairly good in this sample (see Table 1 A-C). Science museum participants ranged in age from 5 to 54 and came from our town and from up to 5200 miles away. About half of the participants were monolingual L1 English speakers, about 20% learned another language before learning English, and 24 unique languages were spoken by our participants. This highlights non-university testing locations as a good way of collecting data from diverse participants varying in background.

Figure 1: Sample trial

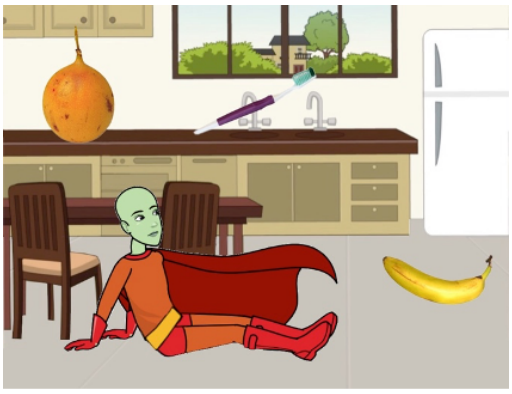
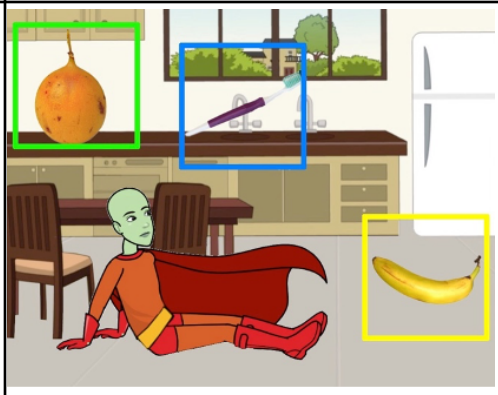
Audio	Sam goes to the kitchen. She finds a [familiar/strange/ nice/weird/old/new] kind of food. Hey, it's a [banana/panana]!	Which one is it?
Visual		
Measure	Looking-while-listening	Choice of object (button box)

Figure 2: Proportion of learning interpretations (novel item selected in novel noun trials) by age

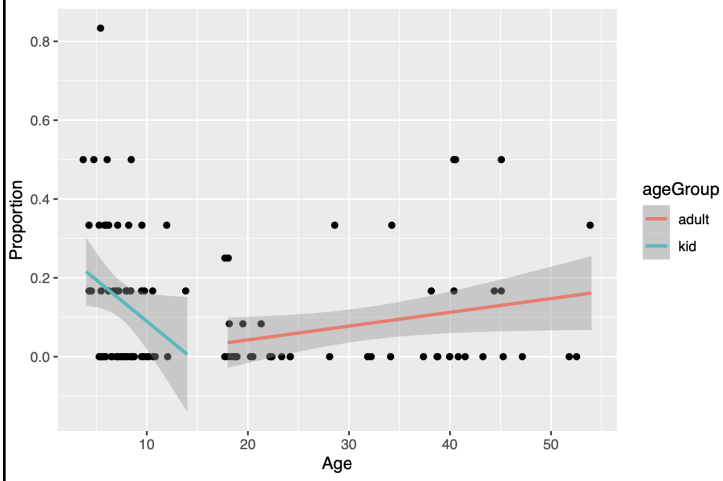


Figure 3. Proportion of fixations to novel item by noun condition (known=pink, novel=blue) and age group (adult=solid, kid=dashed), time-locked to noun onset

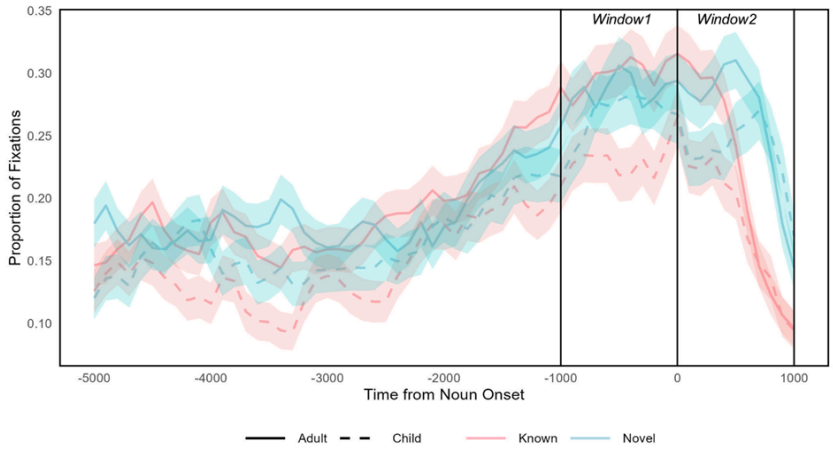


Table 1: Museum participant demographics (participant counts by sub-table row)

A. Language Background	N	B. Distance travelled (miles)	N
Monolingual L1 English	47	0-10	33
		11-50	22
L2 English	15	51-100	18
Other multilinguals	22	100+	11

C. Languages Spoken	N
Spanish	28
Mandarin	8
French	7
Greek, German, Swedish, Cantonese, Hebrew, Hindi, Korean, Portuguese, Arabic, ASL, Chinese, Italian, Japanese, Polish, Punjabi, Russian,Samoan, Tagalog, Telugu, Vietnamese	4 or less

References: [1] Altmann & Kamide (1999) *Cognition*. [2] Brehm, Kennis, & Bergmann, (2023) *HSP Conference*. [3] Carey & Bartlett (1978) *Monograph*. [4] Fernandes, Koji, Dixon, & Aquino, (2011) *Visual Cognition*. [5] Gibson, Bergen, & Piantadosi, (2013) *PNAS*. [6] Halberda, (2006) *Cog Psych*. [7] Storkel, Armbrüster & Hogan (2006) *JSLHR*. [8] Kidd, Donnelly & Christiansen (2018) *TICS*. [9] Kukona, Braze, ... & Tabor. (2016). *Acta Psychologia*.