The neural substrates of word-learning in 14-20-month-olds: a replication and extension

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Background

- Phonetic representations improve over the first 2 years of life.
  - Behavioral evidence (switch task) & Neural (EEG)[1,2,3]
  - 14 mo.: difficulty learning similar sounding words (e.g., *bih* vs. *dih*)
  - By 20 mo.: this difficulty resolves[1,2]
- Neurocognitive work suggests a shift in word processing[3]
- Lots of behavioral follow-up and replication[2,], limited for neuro
- Here: preregistered replication and extension of Mills et al. (2004)
  - Substantive change: a continuous age-range, 14-20mo.
  - Greater EEG scalp coverage (32 channels)

How does phonetic representation change over developmental time?

Methods

- 14 14-20-month-old English-learning infants
  - Goal: N=48, with data collection paused for COVID
- Presented with 30 words from 3 categories
  - **Known words (*bear*)**
  - **Phonetically-similar nonwords (*gare*)**
  - **Phonetically dissimilar nonwords (*kobe*)**
- Used EEG to measure event-related potentials (ERPs)
  - 32-channel active electrode system

Known Words	Similar Nonwords	Dissimilar Nonwords
Bear	Gare	Kobe
Ball	Pall	Lif
Book	Dook	Neem
Bottle	Pottle	Fipe
Cup	Tup	Mon
Cat	Gat	Tek
Dog	Bog	Riss
Milk	Nilk	Keed
Nose	Mose	Jud
Shoe	Zhu	Zav

References:

1) Stager, C. L., & Werker, J. F. (1997).
2) Tsui, A. S. M., Byers-Heinlein, K., & Fennell, C. T. (2019).
3) Mills, D. L., Prat, C., Zangl, R., Stager, C. L., Neville, H. J., & Werker, J. F. (2004).

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Hypotheses

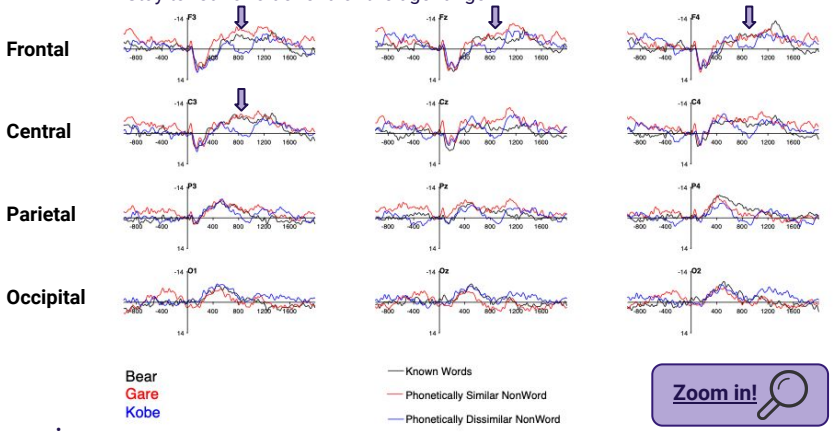
Replicating original study:

- ~14 months: larger N200-N400 for [**bear** and **gare**] vs. [**kobe**].
- ~20 months: larger N200-N400 for [**bear**] vs. [**gare** and **kobe**].

Initial Results (n=14)

Preliminary visual inspection:

- 14-16-month-olds: larger left frontal negativity ~600-1000 ms for [**bear** and **gare**] vs. [**kobe**]
  - Stay tuned for older end of the age range!



Discussion

- Initial results consistent with original results, but later time-window
- Broader age range (14-16-month-olds) looks similar to original 14-month results
- I.e., ERPs in 14-16mo's show differentiation of real words and their minimal pairs (e.g. ***bear*** and ***gare***) vs. other novel (phonotactically licit) words (e.g. ***kobe***),
  - this is expected to change by 20 mo., with similar ERP patterns for both nonwords types (e.g. ***kobe*** and ***gare***) vs. known words (e.g. ***bear***)
- More replication of infant language EEG results needed #OpenScience
- Read more!