Monolingual and multilingual children's word learning from consistent vs. variable labels

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Background

Lab-based studies of word learning primarily test children's ability to learn one-to-one mappings.[1]

This tendency contrasts with the reality of natural word learning environments, which feature multiple labels for the same referent, including:

- variable labels across languages (i.e., translation equivalents)[2]
- variable labels within languages (e.g., register-specific variants)[3,4]

Experience with multiple languages reduces children's bias toward one-to-one mappings.[5,6]

Over development, both monolingual and multilingual children come to understand and produce multiple labels for the same referent.[2,3,7]

How do consistent vs. variable labels influence monolingual and multilingual toddlers' word learning over short timescales?

Method

Participants (18-36 months)

Study 1 (Monolingual)	Study 2 (Multilingual)
$N = 58$	$N = 53$
$M_{age} = 27.6$ months	$M_{age} = 26.7$ months
>80% English	20-80% English + any other language(s) (cumulative and current exposure measured using structured interview (MAPLE))[8]

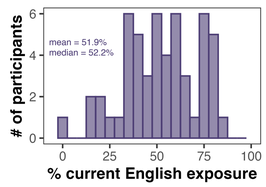


Figure 1: Distribution of current English exposure for multilingual participants.

33 additional languages represented

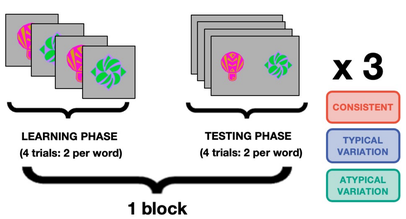
- Spanish: 41.5% of participants
- Mandarin/Chinese: 18.9%
- Arabic: 9.4%
- Hindi: 7.5%
- Cantonese: 5.7%
- French: 5.7%
- Hebrew: 5.7%
- Tamil: 5.7%
- All other languages: <5%

Eye-tracking + Pupillometry Design

6 isoluminant novel objects presented with English labels in three labeling conditions:

CONSISTENT	TYPICAL VARIATION	ATYPICAL VARIATION
Look, **tanzer**!	Look, **tanzer**!	Look, **tanzer**!
That's a **tanzer**…**tanzer**.	That's a **tan-tan**.	That's a **zer-zer**.
Do you see the **tanzer**?	Do you see the **tanny**?	Do you see the **y-zer**?
Yes! That's a **tanzer**.	Yes! That's a **tanzer**.	Yes! That's a **tanzer**.

3 blocks counterbalanced across participants:



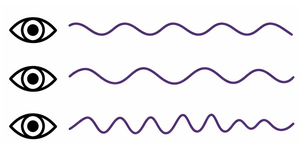
We tested real-time recognition of the standard label using the LWL procedure, measuring children's accuracy of looking to the target object following the label.[9]

Children's fixations and pupil sizes were recorded using an EyeLink 1000 Plus eye-tracker.

Pre-Registered Analyses

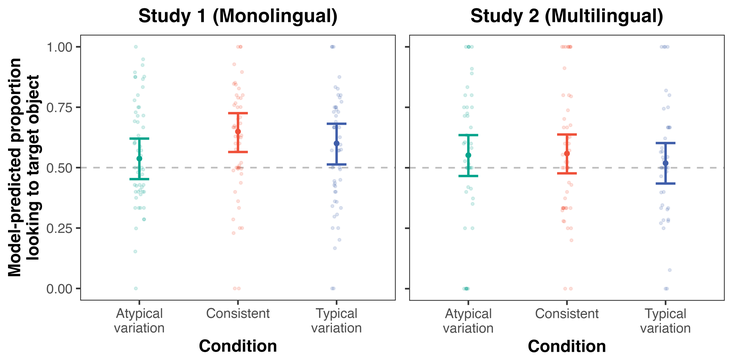
We tested for effects of labeling condition and % of English exposure on:

(1) LWL accuracy (proportion looking to target object)
(2) Pupil size synchrony (between-participant correlations of pupil size fluctuations during learning)[10]



LWL Accuracy

Figure 2: LWL accuracy across conditions.
*Error bars show means with 95% CIs. Points show means for individual participants.



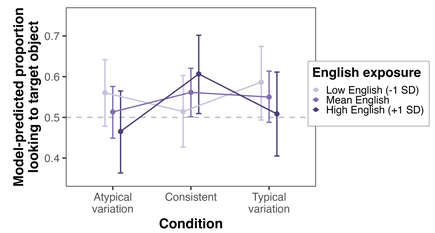
Monolingual children showed above-chance word-recognition accuracy for the **consistent** condition ($M = 0.65$, $SE = 0.04$, 95% CI [0.56, 0.73]) and the **typical variation** condition ($M = 0.60$, $SE = 0.04$, 95% CI [0.51, 0.68])

Multilingual performed at chance across all conditions.

Significant main effect of current **English exposure** on word-recognition accuracy
(β = -0.20, 89% CrI: [-0.38, -0.02])

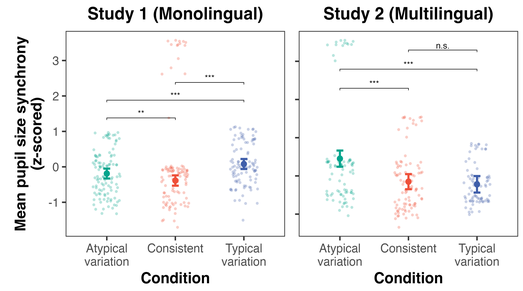
Significant interaction between current **English exposure** and condition
(β = 0.30, 89% CrI: [0.01, 0.59])

Figure 3: Multilingual participants' LWL accuracy across levels of English exposure.
*Error bars show means with 95% CIs. Points show means for individual participants.



Pupil Size Synchrony

Figure 4: Pupil size synchrony across conditions.
*Error bars show means with 95% CIs. Points show means for individual trials for each participant.



Higher pupil size synchrony ≈ Greater shared engagement

When toddlers attend to stimuli in similar ways at the same time, their pupil size fluctuations become more synchronized.[10,11]

Monolingual toddlers showed the highest engagement for the **typical variation** condition (Tukey-corrected *p*s for pairwise comparisons < 0.05).

Multilingual toddlers showed the highest engagement for the **atypical variation** condition (Tukey-corrected *p*s for pairwise comparisons < 0.05).

Discussion

Monolingual toddlers learned from consistent labels and variable labels when the variation matched common child-directed English word forms (e.g., reduplicated or diminutivized variants).

Multilingual toddlers showed chance-level learning overall, possibly due to the smaller sample with more variable language exposure. However, *less* current English exposure was associated with *better* word-recognition accuracy, suggesting a better ability to 'listen through' variability.

Exploratory pupil size synchrony analyses revealed different patterns of real-time engagement for monolingual and multilingual toddlers during word learning.

Future research is needed to better understand the consequences of variable labels for real-time word recognition for both monolingual and multilingual children.

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