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# Phoneme categorization depends on production abilities during the first year of life

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## Introduction

### Phoneme categorization

- Infants show discrimination of syllables as soon as 1 month of age (Eimas et al., 1971; Eimas, 1974).
- **Problem of invariance:** ability to detect a consonant in ≠ syllable contexts despite acoustic variations: argument for the Motor Theory (Liberman et al., 1967).
- A recent study claimed that 6-month olds solve the invariance problem (Hochmann et al., 2014) and argue against a motor interpretation since babbling occurs later.

• Standard: (baseline) *bead-bad-boat* (target) *boo*

• Deviant: (baseline) *bead-bad-boat* (target) *due*

### However

- Are infants detecting invariance or just acoustic differences between stimuli?
- Does babbling only start at 6 months?

### Goals of the present study

- Assess the ability to detect invariants and the role of motor knowledge in 6-to 12-month old infants.

## Methods

### Exp1

31 6 month and 31 9 month-old infants  
Intersensory matching procedure: /b/ - /d/  
Parental questionnaire : infants' production abilities (46 infants)

### Exp 2: control study

35 6month-old and 47 9month-old infants  
Same procedure with contrast /v/-/z/

### Analysis: Intersensory matching.

- % Looking Time (LT) for Baseline (1&2) and for Test (4&6)
- **Difference score** = %LT Test – %LT Baseline.

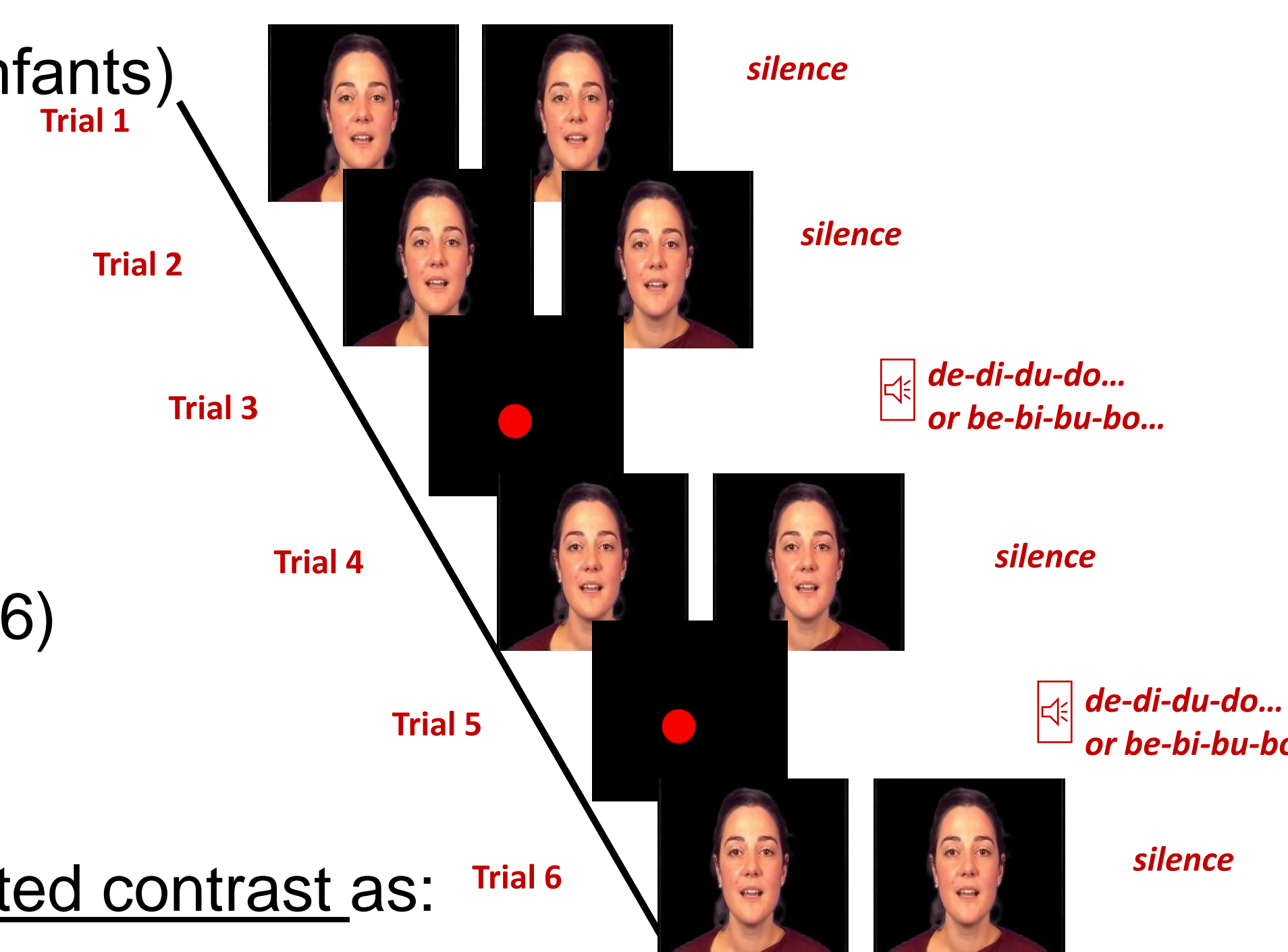
**Analysis: production.** Infants were classified on the tested contrast as:

- **Non Babbling:** no production
- **Canonical Babbling:** reduplicated CVCVCV with /a/ for one or both consonants
- **Variegated Babbling:** CVCVCV with ≠ vowels for one or both consonants

### Hypotheses

- If infants have plosive categories they should associate the sound in one vocalic context with the visual gesture in another vocalic context: preference for **familiar** stimulus
- If motor knowledge plays a role this should vary according to babbling abilities
- **AV association for /b/ - /d/ contrast in babbling infants**

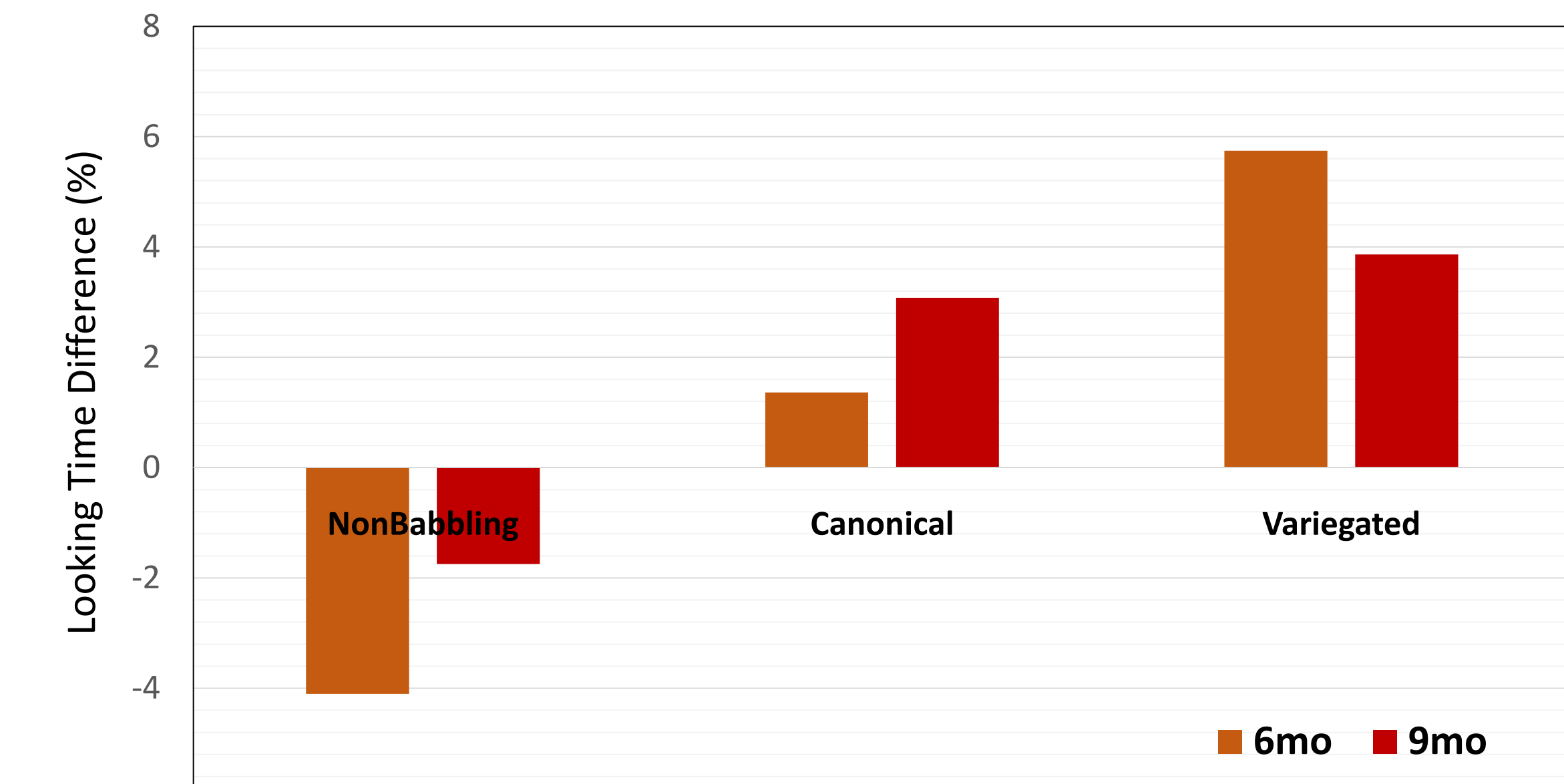
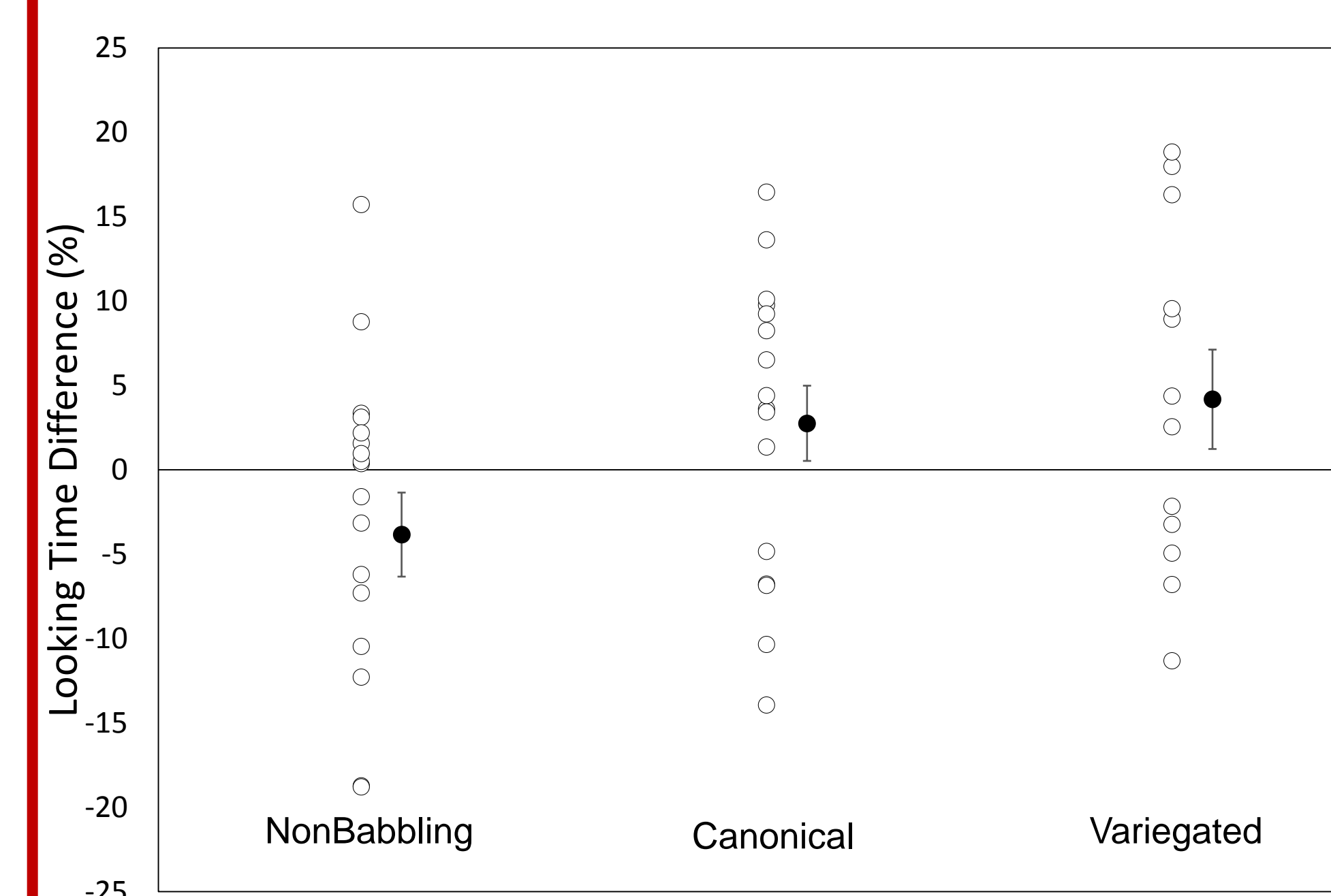
### Intersensory matching procedure (Pons et al., 2009)



## Results

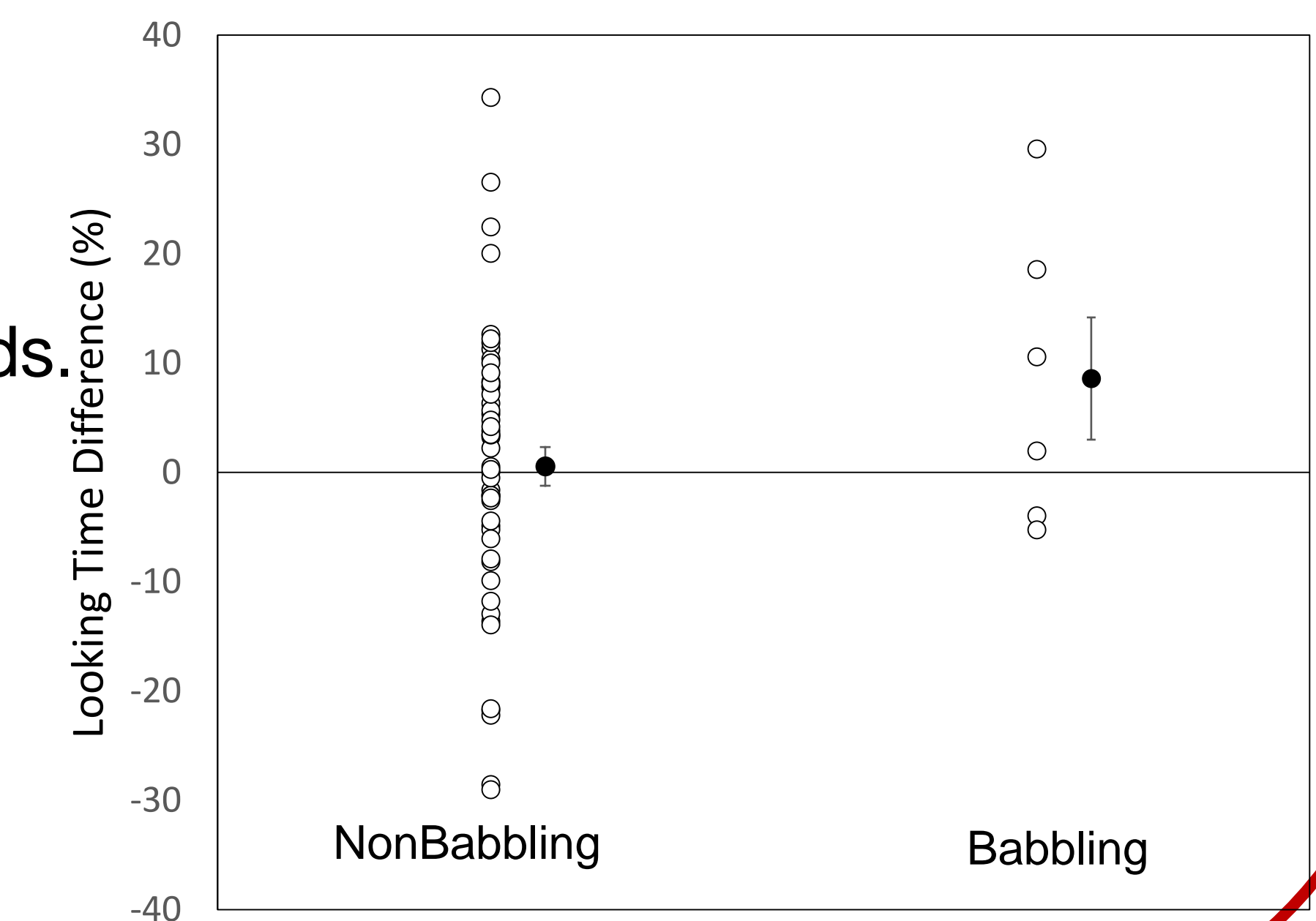
### Exp.1

- Effect of Age ( $p < 0.001$ ): preference for familiar stimulus in 9mo olds, not in 6mo olds.
- Production: 18 NonBabbling, 16 Canonical, 12 Variegated
- Effect of Production Stage ( $p = 0.06$ ): better scores in infants who are in the Canonical and Variegated phase than NonBabbling infants.



### Exp.2

- No significant preference, for 6-mo olds or for 9-mo olds.
- 52 infants did not produce the /v/-/z/ contrast
- Infants who did not produce the /v/-/z/ contrast did not show any preference (t-test vs 0:  $p = 0.42$ )
- Infants who produced the contrast showed a non significant preference for the familiar stimulus



## Conclusion

- For a contrast that they produce, infants showed a preference for videos pronouncing the consonant with which they had been familiarized.  
**They performed intersensory matching in spite of the varying vowel context** (invariance for plosive place of articulation?)
- For an unknown contrast (/v/ - /z/) visually identical, there is no matching in infants  
**Role of the perceptuo-motor link in categorization?**

### References

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