

Eyes or mouth? Exploring eye gaze patterns and their relation with early stress perception in European Portuguese

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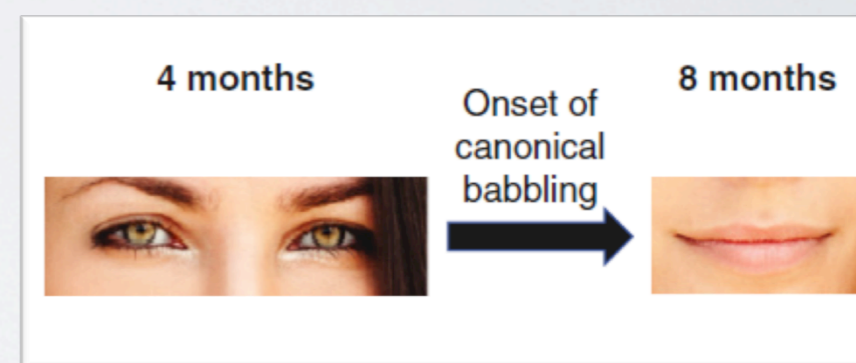
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Audiovisual speech processing

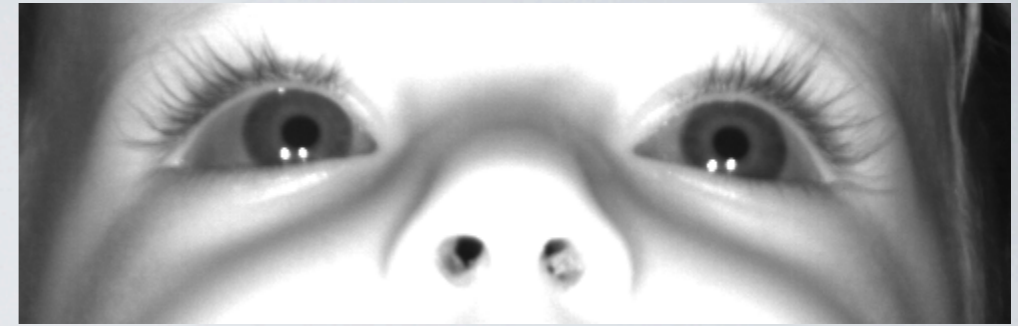
- ❖ It is known that **selective audiovisual attention changes with language development.**
- ❖ The location of infant visual attention varies depending on age and mastery of a language.
- ❖ Infants exposed to native audiovisual materials **shift** their attention **from the eyes to the mouth** between **4 and 8 months**, (Lewkowicz & Hansen-Tift, 2012).




Audiovisual speech processing

- ❖ **Bilingual** infants show **longer and earlier attention to the mouth** region as compared to monolinguals: increased support from audiovisual cues is needed (Pons, Bosch & Lewkowicz, 2015; Ayneto & Sebastian-Galles, 2017).
- ❖ These findings suggest that **eye gaze patterns relate to language development**, with more attention to the mouth signaling ongoing acquisition and less attention possibly relating to a more advanced stage, parallel to findings in motor brain responses to speech perception (Kuhl, Ramírez, Bosseler, Lin & Imada, 2014).
- ❖ In the current study we address this hypothesis by **exploring infants' eye gaze** in a **stress perception experiment**, in which **European Portuguese (EP)** learning infants showed a clear **preference** for the **iambic stress pattern** (Butler, Correia, Uysal, Vigário & Frota. Submitted).

Research question & Hypothesis



- ❖ Is there a **relation** between **eye gaze patterns** and the **preferred stress pattern**?
 - ❖ Assumptions:
 - the preferred stress pattern is acquired earlier (Jusczyk, Cutler & Redanz, 1993);
 - more attention to the mouth signals ongoing acquisition, i.e., increased support from audiovisual cues is required to acquire the language (Pons, Bosch & Lewkowicz, 2015; Ayneto & Sebastian-Galles, 2017; also Kuhl, Ramírez, Bosseler, Lin & Imada, 2014).
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- ❖ Prediction: **more attention to the mouth** in infants that **do not show** an **iambic preference**.

Method

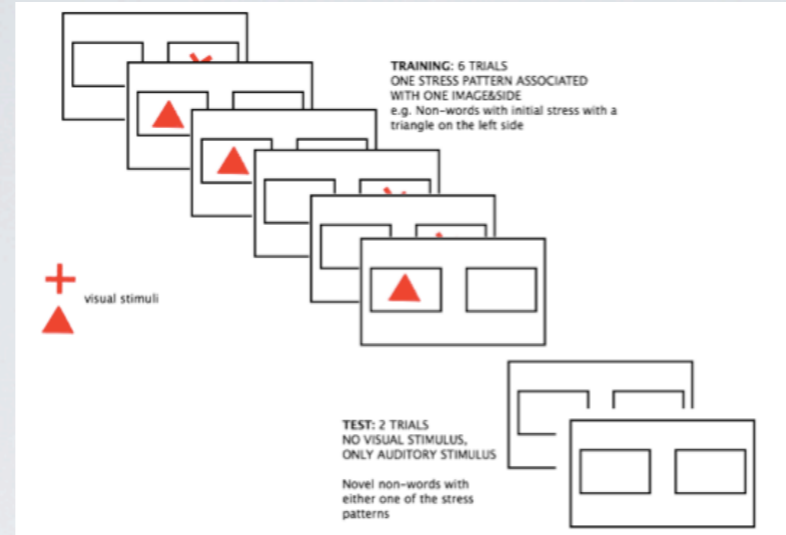
Participants

- ❖ 24 typical developing monolingual EP-learning infants (16 males; mean age: 5 months 26 days; age range: 5-6 months).

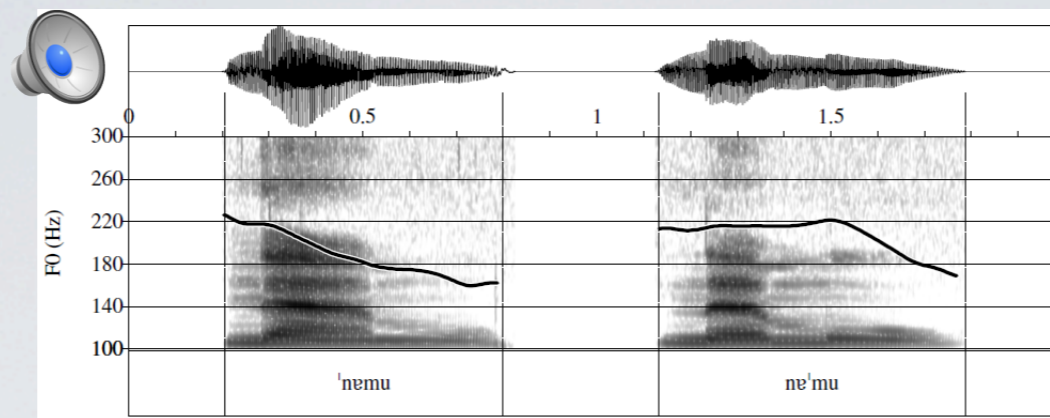
Materials & Procedure

Stress perception

- ❖ Infants' stress perception was examined using remote eye-tracking (SMI RED500) and a modified version of the Anticipatory Eye Movement paradigm.
- ❖ Infants were first exposed to **trials with two geometric images, each associated to a stress pattern** (iambic or trochaic). In the test phase, both stress patterns were played and infants were expected to look to the side of the screen where the image associated to the played pattern appeared in the training phase.



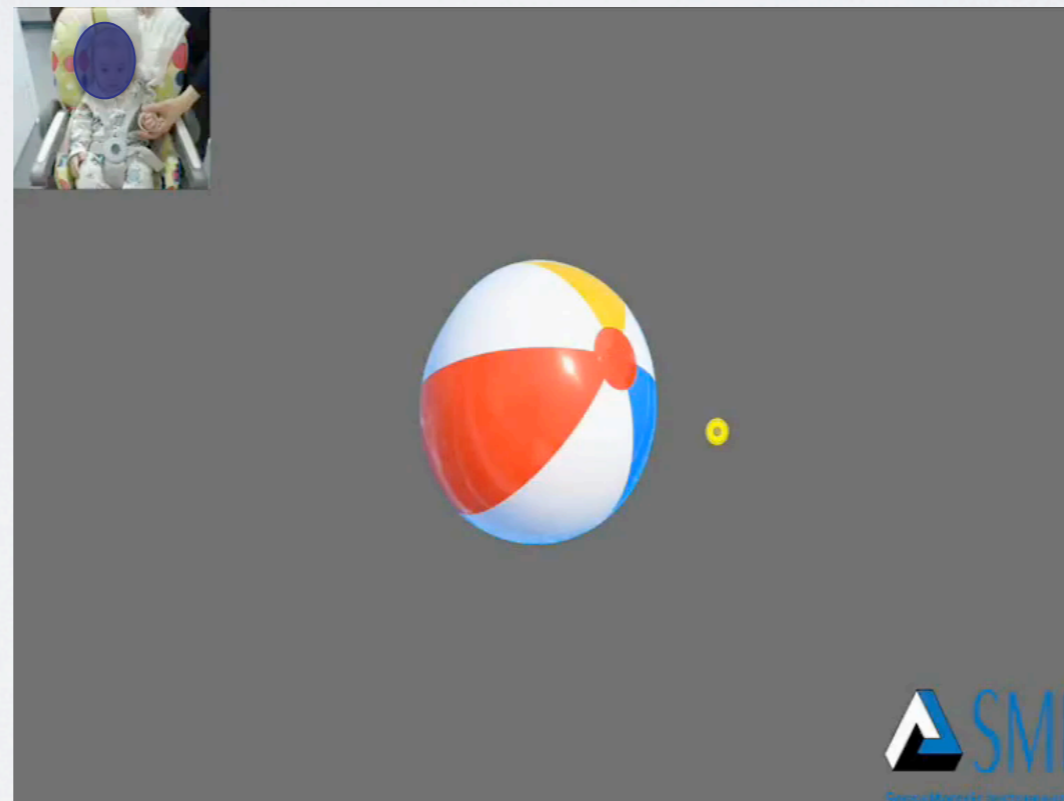
Method



Materials & Procedure

Stress perception

- ❖ Disyllabic segmentally varied nonsense words with penult and final stress, uttered by a female speaker in CDS were used.



Method



Materials & Procedure

Eye gaze pattern: eyes or mouth?

- ❖ A video with a talking movie character was used between blocks to keep infants engaged in the task, and to allow measurement of eye gaze to talking faces
- ❖ Four different exemplars of the video were created containing **4 different encouraging messages**. Order of presentation was fixed within participants and randomized across participants.
- ❖ Three **focal AOIs** (face, eyes, mouth) and one **non-focal region** (waving arm) were defined.
- ❖ Total of 91 videos analysed (mean 3,8 by infant). Net dwell time (in ms) for each AOI was used as the eye gaze measure.





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Results: eye gaze



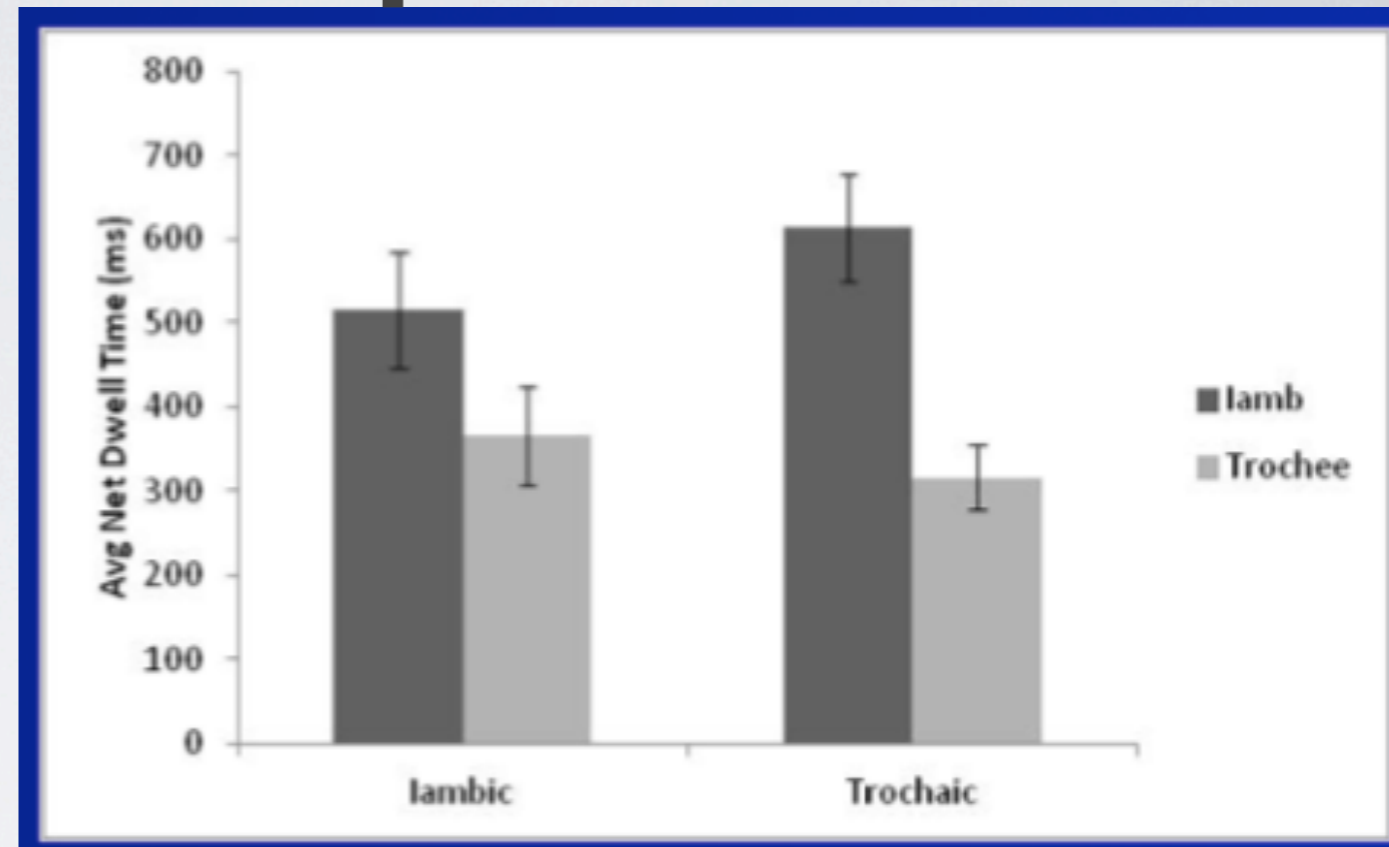
- ❖ The **different messages** were shown **not** to **impact** on the results.
- ❖ We observed that **eye gaze was concentrated more on the face** than on the arm ($t(23)=6.564, p=.000$; mean face: 2097ms, mean arm: 298ms).
- ❖ For the face regions, **eye gaze was concentrated more on the eyes** than on the mouth ($t(23)=4.397, p=.000$; mean eyes: 1040ms, mean mouth: 211ms).
- ❖ A similar pattern as reported for other languages, with a general preference for the **eye region** at this young age.

Results: eye gaze



- ❖ Significant negative correlation between **mouth viewing** ($r = -.761, p < .05$) and **receptive vocabulary** measured by the CDI-I at 12-18 months.

Results: eye gaze by stress pattern

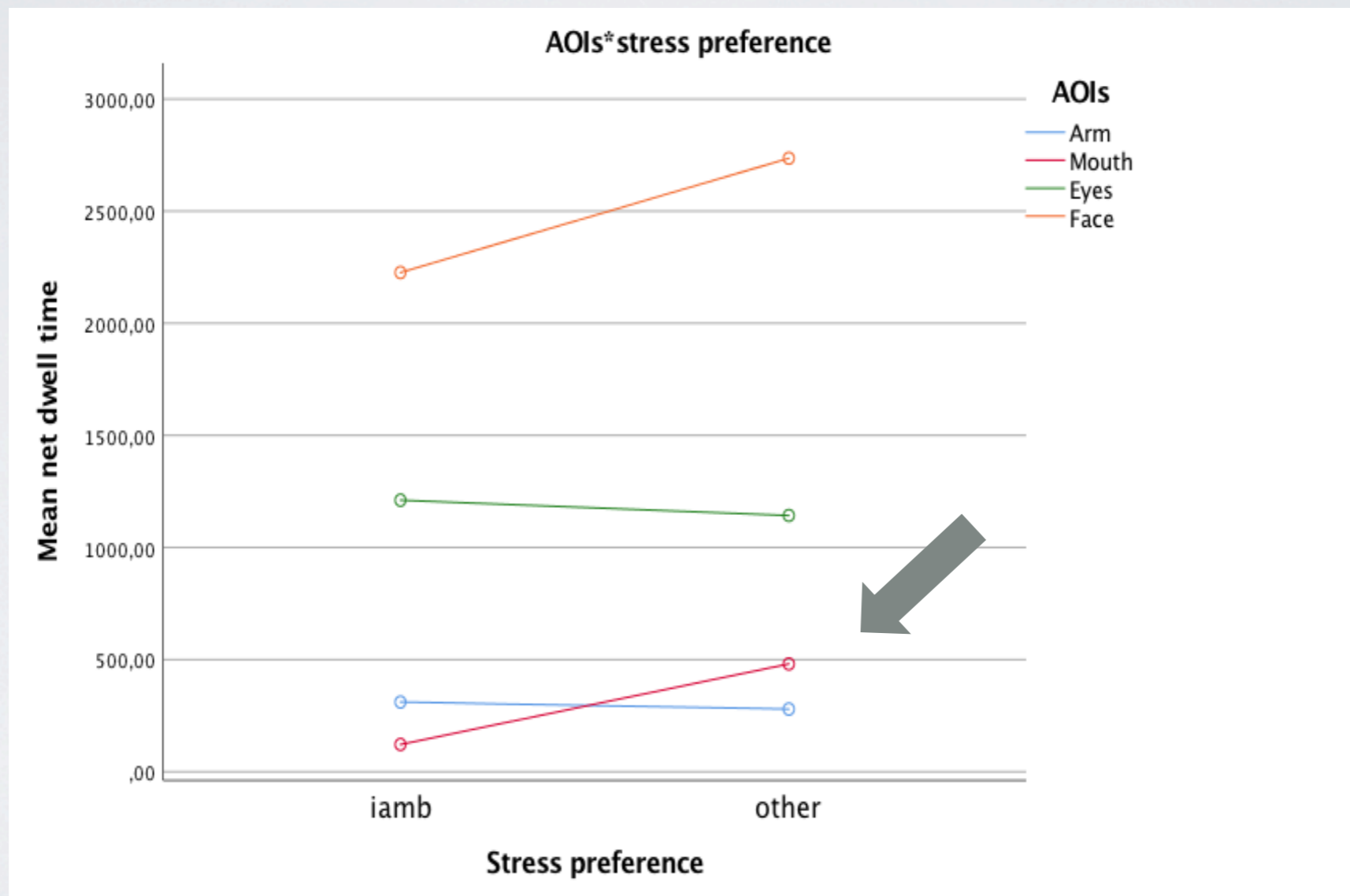


(Butler, Correia, Uysal, Vigário & Frota, Submitted)

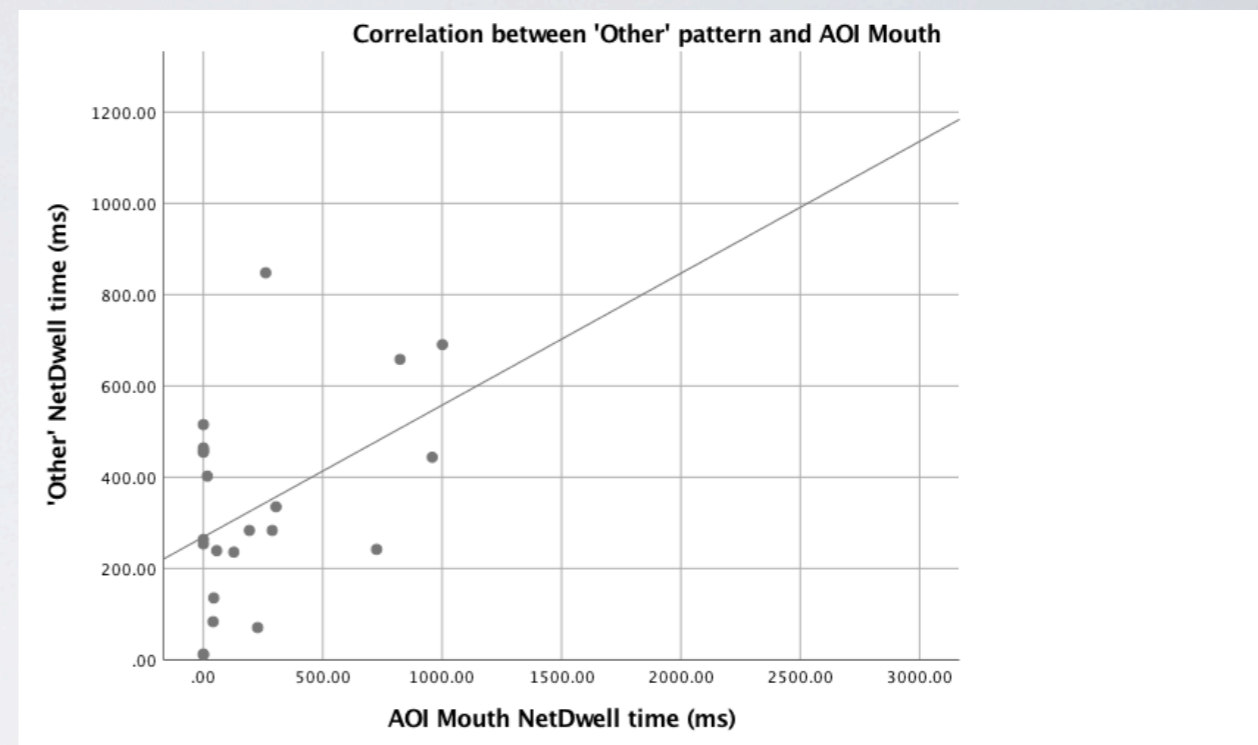
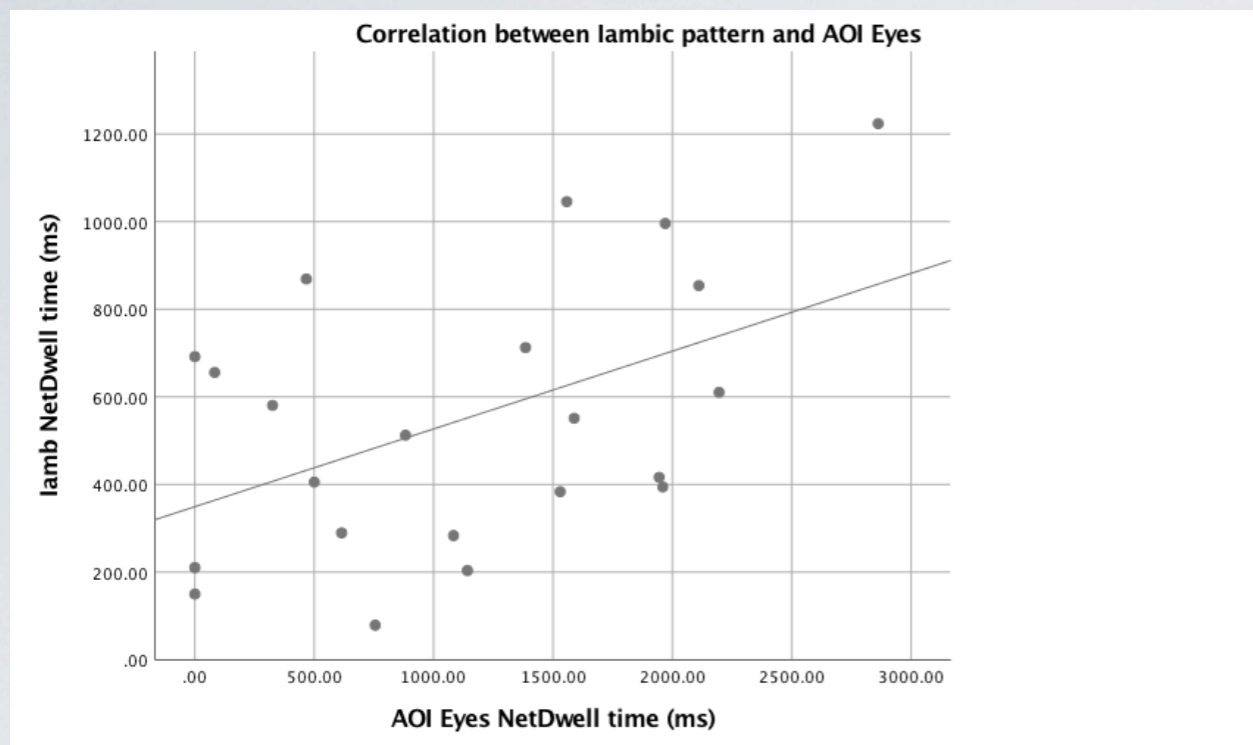
- ❖ The analysis of eye gaze according to the stress pattern preference (iambic vs. trochaic) showed a **main effect of the AOI** ($F(1,20)=54.215, p=.000$), and the interaction **AOI*stress preference** was not significant ($F(1,20) = 0.711, p = .409$), given the strong dominance of the face and eyes.

Results

❖ However, independent of this overall preference, we found that gaze to the mouth region (and face) is **modulated** by the stress pattern, as there is **more attention to the mouth** in **infants that do not show an iambic preference**.

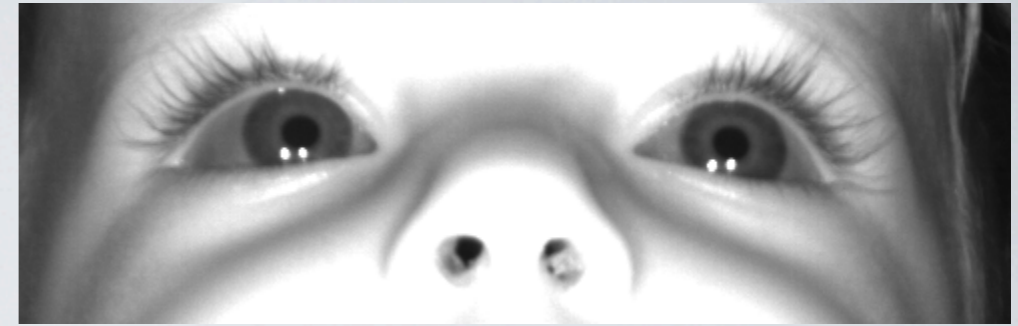


Results



- ❖ Correlation between stress pattern preference and gaze to the mouth region ($r=.527, p=.012$)
- ❖ Net dwell time on the mouth positively correlated with net dwell time for the other (trochaic, or no preference) pattern ($r=.436, p=.042$).
- ❖ Net dwell time on the eyes positively correlated with net dwell time for the iambic pattern ($r=.480, p=.024$).
- ❖ No other significant correlations were found.

Conclusions



- ❖ The gaze of EP-learning infants at 5-6 months, as expected, shows a similar pattern as reported for other languages at this young age, with a general preference for the eyes.
- ❖ Despite the overall dominance of gaze to the face and eyes, infants' gaze was found to be modulated by the stress pattern
 - ❖ More looks to the mouth correlated with increased attention to the trochaic pattern, whereas more looks to the eyes correlated with increased attention to the iambic pattern.

Our prediction that more attention to the mouth is found in infants that do not show an iambic preference was borne out.

Conclusion

- ❖ Our results add to previous findings suggesting that **increased support from audiovisual cues** signals ongoing acquisition (Pons, Bosch & Lewkowicz, 2015; Ayneto & Sebastian-Galles, 2017; also Kuhl, Ramírez, Bosseler, Lin & Imada, 2014)

We thus bring novel data relating early stress perception and **eye gaze exploration of talking faces** by 5-6 month-olds that provide further support for infants' use of eye gaze in early language development.



Thank You!



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