Early eye gaze patterns to talking faces in European Portuguese

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EXCL/MHC-LIN/0688/2012
PTDC/MHCLIN/3901/2014
Selective Audiovisual Attention

- Although there can be exceptional circumstances, audiovisual speech is the natural modality of language acquisition;

- Visual contributions to speech perception are well documented in literature, suggesting a crucial role for visual information in typical speech development (e.g., Chandrasekaran et al., 2009; Rosenblum et al., 1996; Summerfield, 1979).

- Infants attend to speaking faces in order to extract visual information about speech, and prefer faces over non-face stimuli (Frank et al, 2009; Munhall & Johnson, 2012);

- Infants show increased attention to the eyes as compared to the mouth, but attend more to the mouth when the speech is unfamiliar or a speaker’s face movements are not in synchrony with the auditory vocal production (e.g., Boisferon et al., 2016; Wagner et al., 2013);
Selective Audiovisual Attention

- 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 6 and 8 months, regardless of the native language (Lewkowicz & Hansen-Tift, 2012);

- Therefore, infants might use visual attention to talking faces to assist language development.
Although the idea that infants attend to speaking faces to extract visual information about language is not new, the question of how infants' attention to audiovisual stimuli develops is still unexplored for European Portuguese.

Also, research has not explored the preferential looking at focal areas of a speaking face combined with social gestures.
Our goal is to address infants’ attention to audiovisual stimuli in European Portuguese (EP), characterizing infants’ eye gaze while watching a video of a talking movie character (Noddy), nodding and waving.

Using eye-tracking methodology, we examined the pattern of gaze to face and non-face regions in typical developing EP-learning infants with 5 – 6 months of age.

We hypothesized an advantage of the eye region over the mouth, and an advantage of the face over non-face stimuli, including social gestures (waving). In addition, we predicted a positive relation between attention to the eyes and measures of communicative development.
Participants

- 24 typical developing monolingual EP-learning infants (16 males; mean age: 5 months 26 days; age range: 5-6 months).
- Typical development assessed with the Communication and Symbolic Behavior Scales Developmental Profile between age 6 and 24 months, and the MacArthur-Bates Communicative Development Inventories between age 8 and 30 months.

Material & Procedure

- Using remote eye-tracking (SMI RED500), infants’ eye gaze was measured while watching a video with an animated toy with human properties (Noddy) talking and nodding and waving.
- The video was the last event of each experimental block in a speech perception experiment (Butler et al. submitted). It had a dual goal: to allow measurement of eye gaze to talking faces and social gestures, and to keep infants engaged in the speech perception task.
Method

Material & Procedure (cont.)

Four different exemplars of the video were created containing 4 different encouraging messages. Order of presentation was fixed within participants and randomized across participants.

The following areas of interest (AOIs) were considered:

(a) **face**: face, eyes, mouth

(b) **non-face**: arm

A total of 91 videos were 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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The different messages were shown not to impact on the results.

We observed that gaze was concentrated more on the face than on the non-face region (t (23) = 6.564, $p = \leq .0001$; mean face: 2097ms, mean arm: 298ms).

For the face regions, gaze was concentrated more on the eyes than on the mouth (t (23) = 4.397, $p = \leq .0001$; mean eyes: 1040ms, mean mouth: 211ms).
A significant **positive correlation** was found between attention to the eyes \( (r = .436, p < .05) \), attention to the face \( (r = .467, p < .05) \) and **communicative development** measured by the CSBS overall report recommendation (administered at **6 months** for all except 3 infants).

Large significant **negative correlation** between mouth viewing \( (r = -.761, p < .05) \) and attention to **non-face** stimuli \( (r = -.680, p < .05) \) and **receptive vocabulary** measured by the CDI-I at **12-18 months**.
Conclusions

- The gaze of typical developing European Portuguese-learning infants at 5-6 months follows a similar pattern as reported for other languages, by showing gaze fixations to the eye region before the onset of canonical babbling.
- Infants also look more to the face than to non-face stimuli, as predicted.
- Attention to the eyes and face is positively related to communicative development at 6 months of age.
- Increased attention to the mouth and non-face stimuli at 5-6 months seems to be an early marker of lower language comprehension at 12-18 months.
Future research should include other ages, as well as clinical populations to observe how visual attention supports communication and language development.

- Eye gaze of typical developing (TD) children has been compared to children with Autism Spectrum Disorders (ASD), because autism is a social-communicative disability characterized by atypical gaze to faces often accompanied by delays in language, and by deficits in audiovisual integration;

- Research has showed that ASD children look less to the mouth of the speaker and more to non-eyes and non-mouth areas than ASD children (Irwin & Brancazio, 2014; Johnels et al., 2014);

- In ongoing research we are examining how an atypical pattern of gaze to a speaking face can be an early marker of atypical development.
These results set an important foundation for studies of communication and language development, social interaction and clinical intervention.
Thank You!

Research supported by grants EXCL/MHC-LIN/0688/2012, PTDC/MHCLIN/3901/2014 and BPD/94695/2013, from FCT, Portugal