Non-expert abstract in English

From birth, humans pay special attention to faces and human voice and our brains seem especially attuned to rapidly learn about these aspects of interacting humans during infancy. Our daily experience of people involves speech and is typically multisensory, yet, over the last few decades research on language and communication development in infancy was focused primarily on speech as an auditory phenomenon. Thus, various aspects of infant knowledge about speech, for example knowledge of speech sounds, were considered predominantly as belonging to one sensory modality – the auditory modality.

In contrast to that it has been known for a relatively long time that newborns show surprisingly advanced capacities to integrate auditory and visual information from social stimuli. Yet, the idea that visual information about speech may play an important role in shaping infant knowledge of speech sounds has only recently attracted more attention. New research on the perception of audiovisual speech (speaking faces) showed the importance of visual information about speech (mouth movements) not only for the infant's developing knowledge of speech sounds, but also for language comprehension and production throughout subsequent years of life. Moreover, there is growing evidence that in the human brain representations of speech may be inherently multimodal in nature and that they include visual speech cues. These findings indicate that in order to better understand how infants learn about speech, we need to investigate how they process visual speech information and how they integrate the visual and auditory aspects together.

The main goal of our project is to investigate the development of visual and audiovisual speech processing in infants during the second half of the first year of life. This is a period of rapid changes in infant perception of faces and speech and changes in its organisation at the brain level. For this reason we plan to use modern non-invasive and infant-friendly methods for imaging brain activity: electroencephalography (EEG) and near-infrared spectroscopy (NIRS). We will also use eye-tracking methods to measure visual attention while infants watch speaking faces.

We will conduct four experiments to provide answers for two main questions:
1) are there any areas in the frontal and temporal lobe of the infant brain that selectively respond to: (A) visual speech – speaking faces in comparison with facial gestures not related to speech and auditory-only speech, as well as (B) audiovisually congruent speech in comparison with incongruent speech (where the auditory and visual parts do not match, e.g. visual /ba/–auditory /ga/).
2) Are the changes in audiovisual speech processing between the ages of 5 and 10 months (e.g. in detection of audiovisual mismatch) related to developmental changes in face processing that are described in the scientific literature?

The results of the project, especially new data on the development of brain mechanisms for visual speech processing may influence the way we think about specialisation of different areas of the social brain (e.g. some areas processing only speech sounds, or facial gestures not related to speech). Moreover, the project may help to better understand the associations between the development of speech perception and face perception in infancy.

Although the project involves basic research questions, in the long term its results may have impact on our understanding of different factors that affect language development from early age. This encompasses information about both protective and risk factors for language difficulties. Hence the project may contribute to the development of new methods for diagnosing speech and language disorders in children, as well as suggest new avenues for early intervention in this domain.