Abstract

How do parents facilitate early vocal development of infants? The role of optimising postural stability and locomotor activity during social interactions

Research objectives

In this project we will investigate how parental activity during social interactions facilitates the development of infant vocalisations by organising the infant's postural and locomotor activity.

As adults we consider acts of speech to be simple actions that do not require any effort or monitoring when our speech is being produced. Yet, for infants, producing a set of articulated sounds is a challenging action. In real-world situations producing speech-like vocalisations is even more difficult because it occurs predominantly in the course of social exchanges with the caregiver. Vocalisations are produced in response to parental speech and need to be timed appropriately Yet, within a couple of years infants and toddlers learn to coordinate their complicated motor machinery to consistently produce entire comprehensible phrases and short sentences, adding prosody, gestures, simultaneous object manipulation and coordinated gaze behaviour.

Past research has addressed several crucial questions, identifying changes in the complexity of speech-like vocalisations, the overall role of motor development for speech, the turn-taking structure and parental feedback mechanisms that drive the development of speech-like vocalisations. However, the acts of speaking depend on complex biomechanics of the body, requiring the coordination of breathing, stable body posture and the activity of the vocal tract. These aspects of the developing capacity for speech production have gained less attention in research to date, while the parent plays the key role in organising the infant's activity during interactions adjusting posture, bringing toys and books to the line of sight and soliciting or reducing locomotor activity to perform joint actions. The significance of this spontaneous parental activity for the biomechanics of infant vocalising has not been frequently recognised and, even less so, researched.

Hence, in this project we seek to investigate how parental activity during social interactions facilitates vocalisations by adjusting postural stability and locomotor activity. We will also investigate whether parental adjustments of infants' postural stability predict long-term language development.

Project methodology

To address our questions, we will conduct a longitudinal analysis of infant-parent interactions in the lab with the use of an existing dataset (n=74 infant-mother dyads, collect in our Babylab) involving wearable motion sensors and video-recordings of behaviour and vocalisations at 4, 6, 9 and 12 months of age. We will use both manual coding and Machine Learning algorithms to annotate body postures and infant vocalisations. We will then use data from multiple movement sensors to estimate the postural stability. For analysing parental adjustments of infant posture and locomotor activity we will develop a new coding scheme. We will conduct both dynamic analyses (looking at rates of specific vocalisation types pre-/post-adjustment) and global analyses that will relate the number of adjustments per child at a give timepoint to vocal production. Finally, we will use measures of postural stability and parental adjustments to predict standardised language outcomes, which are measured in the same participants at 24 months of age.

Expected outcomes

To our knowledge, the has been very little research on how parental activity related to infant postural stability (both in real-time and in the long run) may influence the development of infant vocal production. This project will address an important aspect of early social interactions by better explaining the postural and motor mechanisms, through which caregivers drive infant vocal development during day-to-day social exchanges. It will also better ground research on the role of dyadic social interactions in biological reality of development and biomechanics of early vocal and motor development. Our project will also likely contribute new measures of postural stability from wearable motion sensors and test their use in predicting long-term language outcomes of young children.