

GESTURES REFLECTED – TRACING GESTURAL DEVELOPMENT FROM A CHILD’S EEG SIGNAL

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1. Introduction

The research on the way gesture and language intertwine in a child’s struggle for speech is still unfolding. There are many studies concerning acquisition and use of gestures by children at an early stage of their life (e.g. Capirci et al. 1998, Liebal et al. 2009, Kidd and Holler 2009). Infants and babies incorporate gestures in their expression from early stages of their lives. The use of nonverbal signals augments a child’s message and lends him or her possibilities for social contact and development (Tsao et al. 2004). Gestural expression is also a way in which the child manifests his or her temperament (Rothbart et al. 1992).

2. Theoretical Background

It has been established that both spoken and sign language development can be assessed by means of early gesture observation. For example, children who tend to point and name objects perform better in two-word stage production (e.g. Iverson and Goldin-Meadow 2005). Interestingly, in later development (3–5 years of age), children who utilize gestures along verbal narration tend to resolve lexical ambiguities better than those who do not incorporate gestures in their reasoning. An example comes from Kidd and Holler’s study, where they show that in 4-year-olds polysemous expressions are explained by gestures rather than speech (2009).

Gestural expression were shown to be useful in logical thinking and problem solving (as in mathematical equations) – schoolchildren who gesturally trace elements of equations provide better answers and can faster explain the task than children who do not use gestures (Goldin-Meadow et al. 2009). These examples show the importance of nonverbal communication throughout early linguistic development of the child – when the child copies parents’ behaviours (e.g. Özçalışkan and Dimitrova 2013), and later, when the child is ready to use gestural expressions to facilitate speech production and understanding of new phenomena.

The study, has been conducted as a spinoff of the Grant Project addressing phonemic awareness and hearing in newborns and infants. The main project has been carried out in the Baby Lab of the Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Torun, Poland. During the phonematic training, held in the facility, children had several meetings with a native speaker of French, who was interacting with them (reading stories, talking). The children were recorded throughout seven subsequent sessions, each lasting about 30 minutes. The recordings present the native speaker-child interactions. After preparations, the children underwent a repeated recorded EEG and Eye Tracking sessions the aim of which was to check whether they react to a stimulus containing sounds of French language.

After assessing the whole material, we elicited 10 children (8–12 months of age) whose videos met the requirements for being analysed in ELAN (angle, visibility, audibility, length) and lasted in total c.a. 40 hours. Additionally, to participate in the research, parents were obliged to fill in Mary Rothbart's Infant Behaviour Questionnaire at home, which enabled us to assess the children's temperament. Our hypotheses are encapsulated in three research questions:

1. Is the difference in the children's temperament visible in their gestural and motor behaviour? Bates et al.'s (1989) suggest that individual differences in gestural expression may stem from various temperaments of children. We expect to complement the research with that piece of information.
2. Are there temperament-dependent behavioural and nonverbal exploration patterns that a child manifests meeting-to-meeting as he or she is getting familiar with the new environment? Kuhn et al. (2014) show that gestures are a precursor of language development and executive functions (EF). We expect that the more the child uses gestures (depending on their temperament), the sooner he or she will show his or her preferences (EF) for the items and places in the room.
3. Do changes in a child's EEG signal (Mu signal) correspond to his or her gestural behaviour? Marshall and Meltzoff (2011) point out that a child's EEG reacts to action observation and action execution. We would like to see if the changes are visible month-to-month as children's attention develops and changes as they interact with live stimuli. We expect to see differences in the Mu signal in children presenting different temperaments, and would like to show that it is possible to see an increased/lowered gesture use in a child's EEG signal.

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