Analyzing multimodal gesture usage and infants' vocabulary development in natural environments

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Introduction

When children learn new word-meaning mappings, they are thought to benefit from multimodal gestures that can provide cues as to what the words refer to. Various studies have shown that there are strong correlations between the frequencies with which such gestures occur and infants' vocabulary development (e.g., Iverson et al., 1999; Rowe & Goldin-Meadow, 2009).

In the CASA MILA project we investigate, among other things, the correlation between the frequencies with which multimodal gestures are used and infants' vocabulary development. Here we look at infant gestures and child directed gestures used by all communication partners - including (grand)parents, siblings, peers and other adults - during normal day-to-day activities in the home environment.

The aim of the project is to investigate these correlations cross-culturally, comparing the development of infants from two cultural groups in Mozambique (urban and rural) and one in the Netherlands (commencing in late 2011).

We investigate the following three research questions:

1. What are the frequency distributions of multimodal gesture usage in the different cultures?

2. How do the frequencies of different multimodal gestures correlate with vocabulary development?

3. Are there any cultural differences?

Methods

Participants: Per cultural group (urban and rural) 14 families with infants averaging 13-mo. at the start of the study.

Procedure: Longitudinal study with data-collection points at 13-, 17- and 25-mo. During each time period the infants were videotaped for 45-90 mins, after an accommodation session the week prior. Participants' families were asked to continue their daily routine as they had been prior to our arrival. Afterwards, the infants' vocabulary size was assessed using an adaptation of the Mac Arthur-Bates CDI (short version).

Coding: From the recordings, 30 mins of naturalistic data were coded for the following gestures, used during episodes of joint engagement:
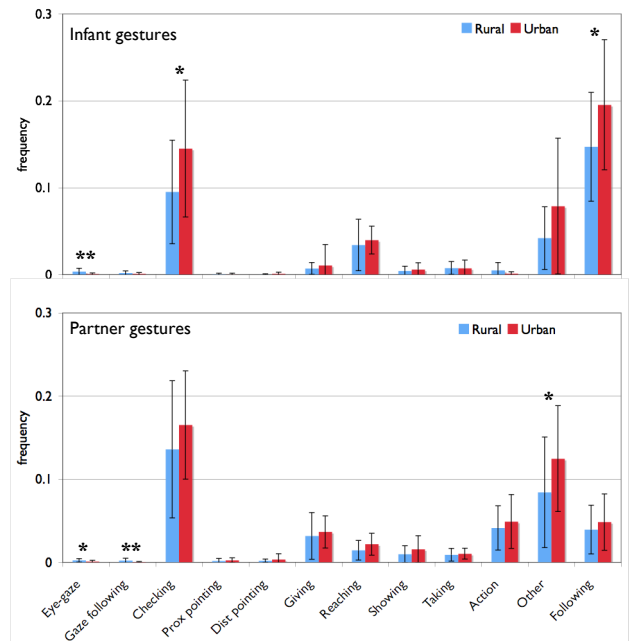
Eye-gaze	Giving
Eye-gaze following	Reaching
Checking*	Showing
Proximal pointing	Taking
Distal pointing	Other gestures
Action/Moving	Gesture following

*Checking the focus of attention of someone by looking at his/her eyes

Results

The following graphs show the frequency distributions for infant gestures and partner gestures in both the rural and urban communities.

(* p<0.05; ** p<0.01)

These graphs indicate that infants and communication partners rarely use *Eye-gaze* or *Pointing* to shift the other's focus of attention. Infants' *Checking* and *Gesture following* occur more frequently in the urban site than in the rural site. Otherwise, the graphs show few significant differences across both cultures regarding the frequency of gesture usage.

The following table shows the gestures that have (almost) significant correlations between infants' and partners' gesture frequencies at 13-mo. on the one hand and vocabulary development at 17-mo. and 25-mo. on the other.

	17 Months		25 Months	
	Positive	**Negative**	**Positive**	**Negative**
Infant gestures				
Rural	Eye gaze**	Checking* Prox pointing	Reaching* Action*	
Urban	Giving*		Gesture following**	
Partner gestures				
Rural		Checking* Gaze following** Giving* Reaching	Action	Giving
Urban	Other*		Checking** Other*	

p < 0.10; *p < 0.05; **p < 0.01

Conclusions

The frequency distributions of multimodal gestures in both cultures is highly similar. However, the most frequently used gestures tend to occur with significantly different amounts across these two cultures. Interestingly, these gestures also reveal significant correlations with the CDI scores: *Checking* the partner's focus of attention occurs less frequently in the rural area and has a negative correlation to vocabulary development, while the urban site reveals a positive correlation. Likewise, infant's *Gesture following* and partners' *Other gestures* occur more frequently among the urban families and show positive correlations with vocabulary development. These findings suggest that the amount of gesture usage has a positive relation to word learning, but only when the amount exceeds a certain threshold, which varies between types and classes of gestures. Further analysis of these findings is ongoing.

The infrequent use of *Eye-gaze* and *Pointing* is another interesting observation, and may be due to a reduced use of *Eye-gaze* and *Pointing* in child directed gesturing, causing a delay of their usage among infants, or because there are less objects to point to in these environments. Analysis of the use of these gestures at later data-collection points should provide more insights regarding this issue.