Scaffolding vocal development: maternal responsiveness to infant speechlike vocalizations at three, six and eight months

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Introduction

Parental responsiveness is an important feature of parent-infant interactions for infant's development and learning, including language. Responsiveness is also a part of a social feedback loop between parents and children (Warlamount, Richards, Gilkerson &Oller, 2014) and might have consequences for their later language development (Tamis-LeMonda, Bornstein & Baumwell, 2001; Wu & Gros-Louis, 2014). Yet, most studies concerned with responsiveness to infants' vocalizations have investigated infants from 8 months on.

Parents are prompt to contingently respond to speech-related vocalizations of 8-48 months old children (Warlamount et al., 2014). In the present work we checked if parents promote spontaneous, speech-related sounds by timed responses even earlier in development.

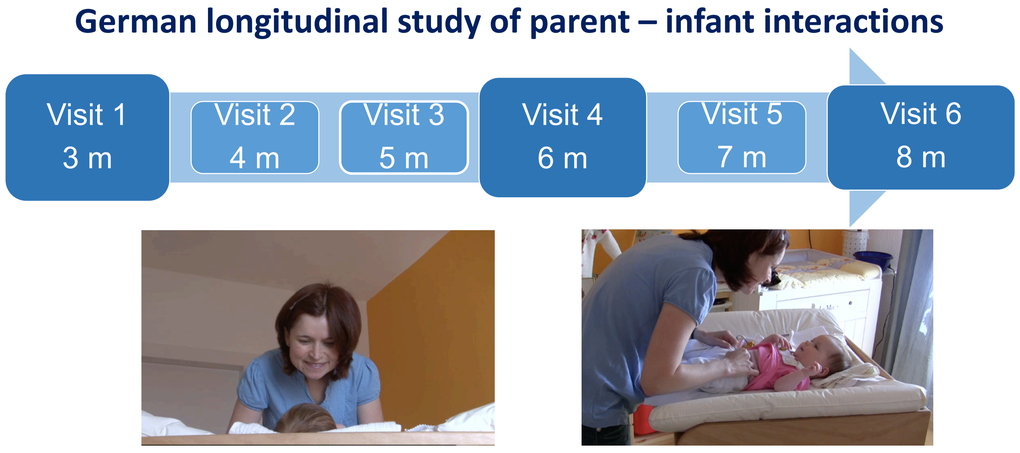
We aimed to investigate longitudinally differences in parental responsiveness to early speech-related and non-speech-related infants' vocalizations when infants were 3, 6 and 8 months old. Furthermore, the temporal characteristic of responses to those two types of vocalizations was explored.

Hypotheses

- In comparison to non-speech-related vocalization, infant's amount of speech-related vocalization will increase with age.
- Mothers will respond more to speech-related vocalizations regardless of infants' age (in comparison to non-speech-related ones).
- Mothers reactions to speech-related vocalizations will be quicker regardless of infants' age (in comparison to non-speech-related ones).

Study design

German longitudinal study of parent – infant interactions



Measures

- **Vocalization type**: speech-related (SL) per minute, non-speech-related (NS) per minute
- **Mother responsiveness to vocalization type within 2 sec window** – proportion: responses to SL/SL vocalizations; proportion: responses to NS/NS vocalizations;
- **Mean time of mother response (MRT) to vocalization type**: MRT to SL, MRT to NS
- **ELFRA 2** – Overall productive vocabulary at 24 months reported by parents via a report

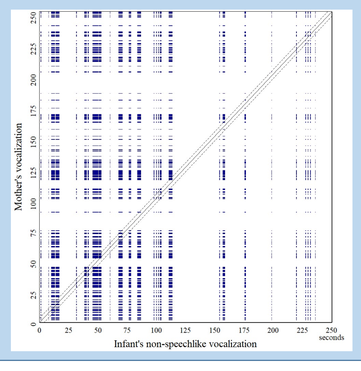
Participants

- 16 German dyads (9 boys, 7 girls)
- Age: 1st visit M = 3,44; SD = 0,18 ;
  Age 4th visit M = 6,24; SD = 0,26;
  Age 6th visit M = 8,06, SD = 0,14

Analysis

- repeated measures ANOVA
- Cross-recurrence quantification analysis (Dale, Warlamount & Richardson, 2011)
  - the level of recurrence rate (% REC) was extracted from recurrence plots
  - plotted diagonal-wise recurrence profiles (%REC as a function of the lag in a window of ± 5 seconds)

Sample cross-recurrence plot



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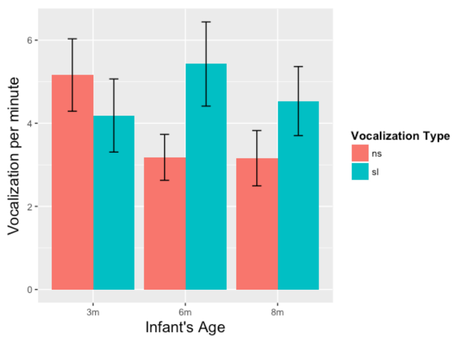
Results – repeated measures ANOVA

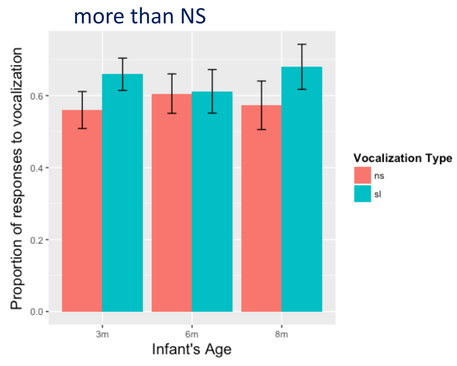
❖ Vocalization type per min

- **n.s.**



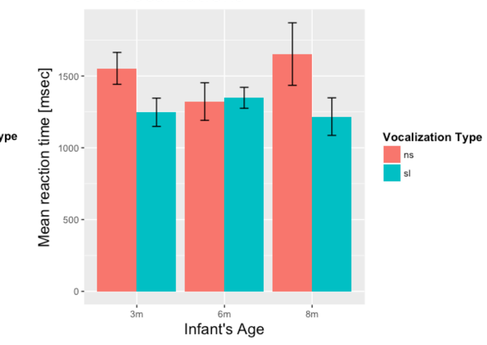
❖ Maternal responsiveness to type of vocalization

- trend for main effect of type
  $F(1, 14) = 4,18$; $p = 0,06$; $\eta^2 = 0,23$
  - ➢ SL vocalizations responded to more than NS



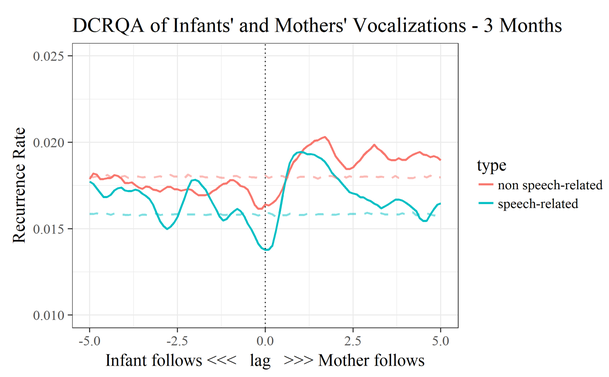
❖ Mean reaction times to vocalization type

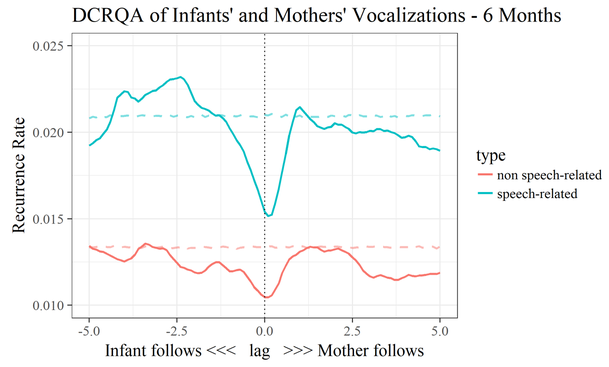
- main effect of type
  $F(1, 13) = 4,9$; $p < 0,05$; $\eta^2 = 0,27$
  - ➢ MRT shorter for SL than NS vocalizations

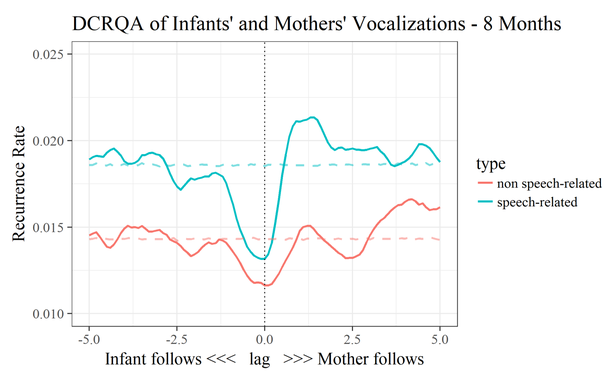


Results – Cross-Recurrence Analysis: Diagonal Profiles

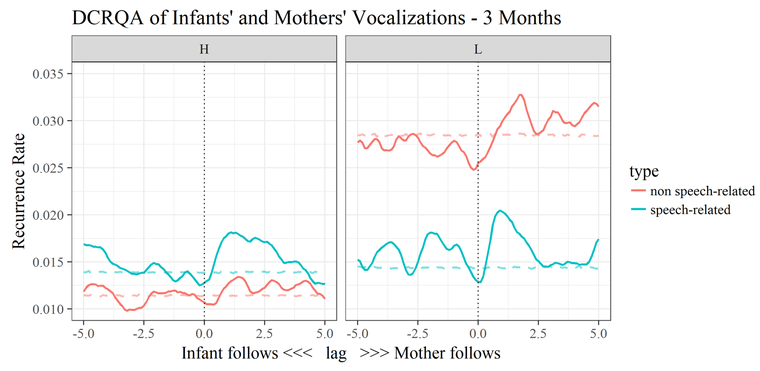
Whole group

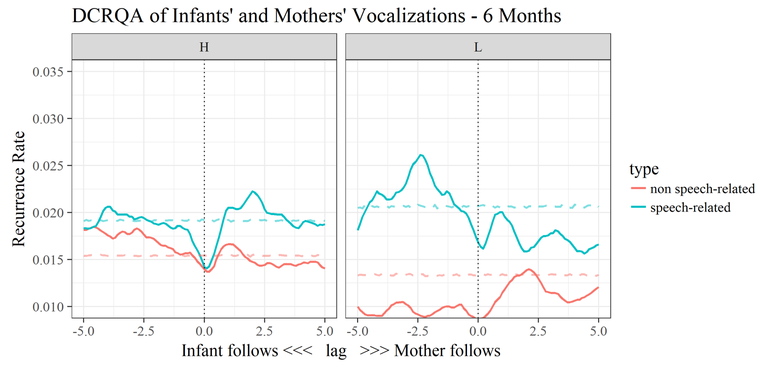


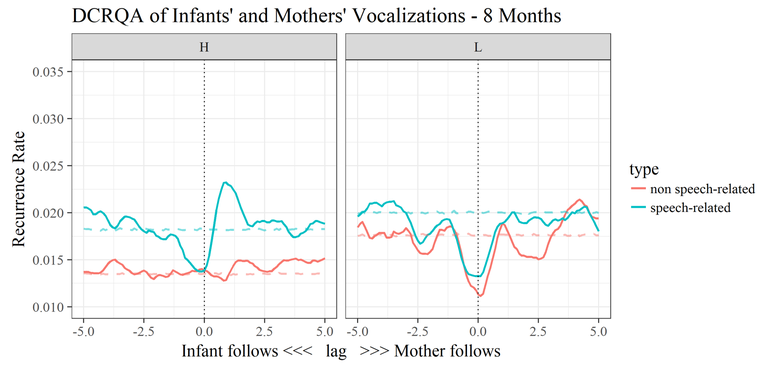




Groups: scoring high (left) or low (right) in ELFRA2 Overall productive vocabulary







Results – Cross-Recurrence Analysis: Diagonal Profiles

- **For 3 month olds:** the 'peak' for SL in diagonal profile for whole group is present in both, high and low ELFRA2 groups.
- **For 6 month olds:** the 'peak' for SL in the profile for high ELFRA2 group (albeit small) which is not present in low ELFRA2 group;
- **For 8 month olds:** the 'peak' for SL observable in profile for whole group is present in profile for high ELFRA2 group, but not in low ELFRA2. Mothers of infants in low ELFRA2 group seemed to not distinguish their reactions between SL and NS vocalizations.

Conclusions

- In the 3-8 months age window infants tended to produce more speech-related vocalizations with age in comparison to non-speech-related, but differences didn't reach significance.
- Mothers showed higher responsiveness to speech-related vocalizations in comparison to non-speech-related regardless of infants' age.
- Duration of mean reaction times of maternal responses to speech-related vocalizations was shorter than MRT to non-speech-related vocalizations, regardless of the age of the infant. Taken together, these results suggest that mothers early in development start to support emerging vocal communicational skills by selective and timed responses.
- Diagonal profiles from CRQA might be a robust method for characterization of temporal dynamics of maternal responses to infant vocalizations.
- Early differences in maternal responses to different types of infants' vocalizations may contribute to trajectories of development and later language outcomes.