Speech perception slopes across the first year of life: Maturation of consonant perception,







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Introduction

- Consonants and vowels differentially contribute to lexical acquisition [e.g., 1]
- From 8 months of age, infants mainly rely on consonants to recognize words [2, 3]
- Infants' differential reliance on consonants versus vowels in word recognition predicts later vocabulary [4, 5]
- This predictive value has not been evaluated for infants' longitudinal trajectories of consonant and vowel perception early in development

Methods

Participants:

58 full-term, healthy, and monolingual German infants (30 girls) were tested at the ages of 2.28 months (SD = 0.26), 6.71 months (SD = 0.32), 10.54 months (SD = 0.27) and 12.03 months (SD = 1.29)

Speech perception:

- Measured by the event-related potential Mismatch Negativity (MMN) [6] or Mismatch Response (MMR)
 - Valid indicator for development of central auditory system [e.g., 7, 8]
 - Difference between standard stimulus and deviant
- Multi-feature paradigm [9] with semi-synthesized phoneme stimuli at 2, 6 and 10 months

/ba/ /ga/ /ba/ /ba+/ /ba/ /baa/ /ba/ /bu/

- To measure consonant and vowel perception, the electrophysiological Mismatch Response (MMR) can be used
- The MMR allows measuring consonant and vowel perception already in young infants

Research Aims

- To analyze infant consonant and vowel perception at 2, 6 and 10 months by means of infant MMR
- To analyze the maturational slope of consonant and vowel perception as predictors of productive and receptive vocabulary scores at 12 months

Consona	nt Frequency	Length	Vowel
Deviant	t Deviant	deviant	Deviant
(170 ms)	; (170 ms;	(270 ms;	(170 ms;
F0=198 H	z) F0=214 Hz)	F0=198 Hz)	F0=198 Hz)

- Each deviant stimulus (i.e., /bu/, /ga/, /baa/, /ba+/) was presented 100 times, the standard stimulus (/ba/) was presented 400 times, and the experiment lasted for about 13 minutes
 - For the purpose of this study, only responses to vowel and consonant deviants were analyzed

Vocabulary Scores:

- Parents filled out the German version of the MacArthur-Bates Communicative Development Inventories when infants were 12 months old (ELFRA [10])
- We here used the subscales productive vocabulary (results: M= 4.08, SD = 6.47) and receptive vocabulary (results: M = 52.15, SD = 44.90)

Statistical Analysis:

- Separate second-order latent growth curve models for both deviants: Estimation of starting points (intercepts), change from 2 to 6 months (2-6-month slope) and from 6 to 10 months (6-10-month slope) of MMR amplitudes
- Multiple regression models of productive and receptive vocabulary on 2-6-month slope, 6-10-month slope and



Figure 2: Regression with maturational consonant slopes (upper two panels) and vowel slope (lower two panels) as predictors of vocabulary scores at 12 months (controlled for 2-month-MMR amplitudes). *P*-values are corrected for multiple comparisons.

Summary and Conclusion

- Positive MMRs across all assessment points
 - Amplitude decrease across age to be less positive (i.e., more adult-like)

• Consonant MMR :

- Consonant MMR amplitude at 2 months predicts receptive vocabulary
- Additional prediction of receptive vocabulary by change in MMR amplitude (slope) from 2 to 6 months and 6 to 10 months

• Vowel MMR:

- No predictive effect of vowel slopes or 2-month-MMR
- amplitude for productive or receptive vocabulary

- Stronger maturation from positive to more negative amplitude of consonant MMR between 2 and 10 months is associated with higher receptive vocabulary at 12 months
- Prominent role of consonant perception for word learning before behavioral onset of consonant preference in word recognition at around 8 months
- Longitudinal maturation of consonant perception needs to be considered when investigating lexical acquisition

References

6-10-month slope of vowel MMR amplitude

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