Development of Infant-Directed Speech Categorization: Effects of Facial-Vocal Synchrony

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Introduction

- Infant-directed speech (IDS) is a specialized speech register used by adults and children when speaking to infants
- IDS has higher mean fundamental frequency (F_0), broader F_0 range, repetition of phrases and prosodic patterns, hyper-articulated vowels and simpler syntax than adult-directed speech (ADS)
- Acoustic properties of IDS vary with pragmatic context, communicative intent, and affect
  - Approving IDS: High F_0, variable bell-shaped pitch contours
  - Comforting IDS: Low F_0 falling, flat pitch contours
- Functions of IDS for infants (Fernald, 1992)
  1) To modulate infant attention and affect
  2) To communicate caregiver intent and meaning
  3) To exaggerate phonetic and linguistic structure
- For IDS to communicate meaning, infants must categorize IDS utterances that convey distinct classes of communicative intent
  - Categorization: exemplars within a class are treated as functionally equivalent yet discriminated from exemplars of other classes (Rosch, Mervis, Gray, Johnson & Boyes-Braem, 1976).
    - If pre-verbal infants categorize IDS, they may begin to extract meaning from speech without word comprehension

Background and Aims

- Previous research of IDS categorization by preverbal infants has found different results as a function of age and stimulus infants view while hearing IDS.

	Checkerboard presented with IDS	Static Female Face presented with IDS
4-month-olds	✘	✔
6-month-olds	✔	✘

- What is the role of synchrony in categorization of IDS at 4 and 6 months of age?
  - Experiment 1: Natural synchronous IDS
  - Experiment 2: Nonsynchronous facial-vocal IDS
    - Mismatch in communicative intent and utterance (e.g., approval face, comfort vocal)
  - Experiment 3: Nonsynchronous facial-vocal IDS
    - Same communicative intent, different utterances in face and voice (e.g., comfort 1 vocal, comfort 2 face)

Experiment 1:

Natural Synchronous Video Infant-Directed Speech (IDS)

Methods:

Participants:
4-month-olds: *N = 20; M = 121.50 days old; Range = 105 – 138 days*
6-month-olds: *N = 20; M = 181.15 days old; Range = 173 – 193 days*

Stimuli:
40 videos taken from 10 female talkers, each producing 2 comforting and 2 approving utterances.

Approvals: Mean F_0 =311.72 (*SD* = 32.92) Comforts: Mean F_0 = 265.05 (*SD*= 40.80)

Procedure:
Each infant sat on parent's lap approximately 1 meter from 60" Sony HDTV

Infant-Controlled Procedure:
Control Event

Habituated to 6 videos of either approvals or comforts

Six test trials: 2 post-habituation, 2 within-category, and 2 between-category test trials

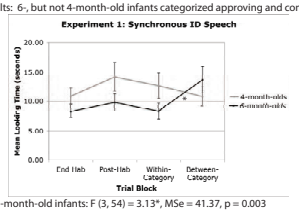
Post-Habituation Trials: Repeated stimuli from habituation

Within-Category Test Trials: New examples from habituation category, spoken by previously seen talkers

Between-Category Test Trials: New examples from novel category, spoken by previously seen talkers (order counterbalanced among within- and between category test trials)

Control Event

Results: 6-, but not 4-month-old infants categorized approving and comforting IDS



6-month-old infants: F (3, 54) = 3.13*, MSe = 41.37, p = 0.003
4-month-old infants: F (3, 54) = 1.01, MSe = 52.18, p = 0.40

Experiment 2:

Nonsynchronous: Mismatch in intent category and utterances

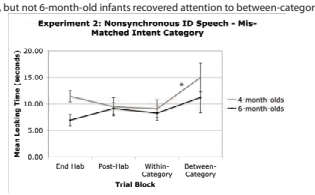
Methods:

Participants:
4-month-olds: *N = 20; M = 123.60 days old; Range = 104 – 138 days*
6-month-olds: *N = 20; M = 181.15 days old; Range = 165 – 192 days*

Stimuli:
Nonsynchronous stimuli were created by pairing similar-length approving audio tracks with comforting video tracks for each talker, and vice versa.

Procedure:
Identical to Experiment 1

Results: 4-, but not 6-month-old infants recovered attention to between-category test trials



6-month-old infants: F (3, 54) = 1.35, MSe = 47.60, p = 0.27
4-month-old infants: F (3, 54) = 3.01*, MSe = 48.39, p = 0.04

Experiment 3:

Nonsynchronous: Mismatch in utterance, but matched intent

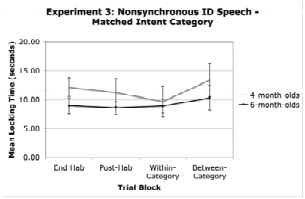
Methods:

Participants:
6-month-olds: *N = 17; M = 184.94 days old; Range = 170 – 195 days*
4- month-olds: *N = 18; M = 120.50 days old; Range = 103 – 132 days*

Stimuli:
Nonsynchronous stimuli were created by pairing the audio of one utterance with the video of a different, but same-category utterance of each talker. For example, the audio of stimulus "Good boy!" was presented with the video of stimulus "Great job!"

Procedure:
Identical to Experiment 1 & 2

Results: No support for categorization was found.



6-month-old infants: F (3, 45) = .33, MSe = 31.17, p = 0.81
4-month-old infants: F (3, 48) =.79, MSe = 55.47, p = 0.51

Discussion

- Procedures for Experiments 1-3 were identical
  - Only stimuli differed
- 4-month-old Infants:
  - Only increased attention to test stimuli that were nonsynchronous in both intent category and utterance (Ex. 2)
    - Difficult to interpret
- 6-month-old Infants:
  - Only categorized natural synchronous IDS (Ex. 1)
  - Categorization of synchronous versus nonsynchronous IDS may be due to mis-match in facial and vocal speech
  - 6-month-olds "expect" synchrony between facial & vocal speech
- Different findings between 4- and 6-month-olds
  - Increased dependence on visual speech by 6 months of age

	Checkerboard (Spence & Moore, 2003)	Static Face (Spence, et al; 04, Atchison, et al '06 and '08)	Ex: 1 Synchronous	Ex 2: Nonsynchronous Intent and Utterance	Ex 3: Nonsynchronous Utterance
4-month-olds	✘	✔	✘	✔	✘
6-month-olds	✔	✘	✔	✘	✘

Conclusions

- Second function of IDS: Communicate caregiver intent and meaning (Fernald, 1992)
  - Categorization of IDS is a prerequisite for the communicative function of IDS (Fernald, 1992)
    - Corroborate previous findings that both 4- and 6-month-old infants can categorize IDS
    - Current research, combined with Kitamura and colleagues' findings, may support IDS function of communicating caregiver intent for preverbal infants
      - Mothers vary IDS as a function of infant age (Kitamura & Burnham, 2003)
      - Infants' preferences at different ages also mirror mothers' usage (Kitamura & Lam, 2009)

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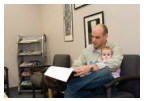

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