

ACOUSTIC AND PERCEPTUAL EVIDENCE OF PROSODIC CORRELATES TO WORD MEANING

Laura L. Namy, Emory University

Collaborators:

Lynne C. Nygaard (Emory University)

Debora Sasso Herold (Indiana University-Purdue
University at Indianapolis)

Kelly Chicos (former Emory Honors Student)

Sumarga (Umay) Suanda (Emory University)

Prosody

- Intonation, Stress, Loudness, and Timing
- Provides information about
 - ▣ Linguistic Structure
 - ▣ Emotional State of Speaker
- Indexical overlay
- Not integrated with meaning

Evidence for integration

- Emotional TOV and lexical processing (e.g., Nygaard & Lunders, 2002)
- Facilitation of semantic processing outside of emotion (e.g., Shintel, Okrent, & Nusbaum, 2006)

Kunihira (1971)

- Japanese antonym pairs (e.g., strong/weak, walk/run)
- Native English speaking participants
- 3 conditions
 - Orthographic
 - Neutral
 - Expressive
- Assign meanings to each word in pair

Prosodic correlates to word meaning?

- Acoustic properties that differentiate meanings
- Unique correlates for individual meanings
 - ▣ beyond valence
- Functional significance for novel word interpretation?
 - ▣ Adults
 - ▣ Children
- Mechanism

Acoustic Analysis

- Are there prosodic features that differentiate meanings within antonym pairs?
- Are these features consistent across speakers?
- Are there unique acoustic profiles that characterize each dimension of meaning?

Stimuli

- 12 dimensional adjectives (6 antonym pairs)
 - ▣ Happy/sad, hot/cold, big/small, yummy/yucky, tall/short, strong/weak
- 6 bi-syllabic nonsense words
 - ▣ Riffel, blicket, seebow, tillen, foppick, daxen
- 3 female speakers using novel words in IDS
 - ▣ “Can you get the *daxen* one?”
 - ▣ Neutral and meaningful prosody



Valence ratings

- Each of the 12 meanings (and 8 fillers)
- Positive *and* negative ratings
 - Likert scale: 1(not at all positive/negative) to 7 (extremely positive/negative)

Acoustic measures

- Four measures differentiated meanings:
 - Fundamental Frequency (F_0)
 - F_0 variation
 - Amplitude
 - Duration
- Analyzed both full sentence and novel word

Related to Valence?

	Positive Rating	Negative Rating
F ₀	.54 [^]	-.51 [^]
F ₀ variation	.70 [*]	-.71 [*]
Amplitude	.71 [*]	-.62 [*]
Duration	--	--

Nygaard, Herold, & Namy, 2009

Unique acoustic profiles differentiate meanings

	F ₀	F ₀ variation	Amplitude	Duration
Happy/sad	↑	↑	↑	↓
Hot/cold	↓	---	↓	---
Big/small	↓	---	↑	↑
Tall/short	---	↑	↑	↑
Yummy/yucky	↑	---	---	---
Strong/weak	---	---	↑	---

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Acoustic analysis -Conclusions

- Prosodic cues that differentiate meanings on both valence and semantic basis
- Consistent across speakers
- Similar prosodic features for related domains of meaning

Do parents spontaneously employ prosodic cues to word meaning?

- 14 mothers and their 2-year-old children
- Read picture book –encouraged to interact ‘naturally’
- Read target sentence (e.g., “Look at the tall one!”)
- Blind to purpose of study

Mothers' spontaneous use of prosodic cues to word meaning



Mothers' use of prosody to differentiate meaning

	F _o	F _o variation	Amplitude	Duration
Happy/sad	---	---		
Hot/cold	---	---		
Big/small	---	---		
Tall/short	---	---		
Yummy/yucky	---	---		
Strong/weak	---	---		

Herold, Nygaard, & Namy, 2010

Mothers' use of prosody to differentiate meaning

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Hot/cold	---	---	---	↓
Big/small	---	---	---	↓
Tall/short	---	---	↑	↑
Yummy/yucky	---	---	---	↑
Strong/weak	---	---	↑	↑

Herold, Nygaard, & Namy, 2010

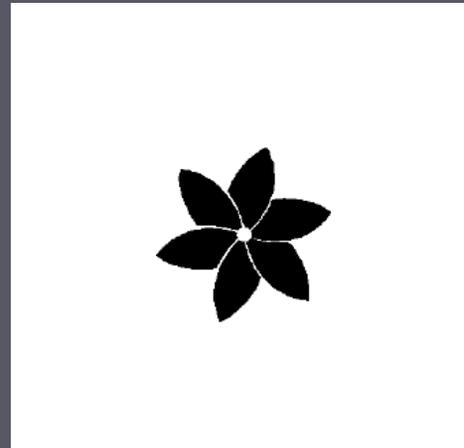
Mothers' use of prosody -Conclusions

- Preliminary evidence is suggestive
 - ▣ Parents spontaneously employ prosodic cues to meaning
 - ▣ Even in constrained task
 - ▣ Spontaneous utterances in naturalistic contexts required

Can children and adults recruit prosodic cues in the service of novel word interpretation?

- To accommodate use with children, used a 2-alternative forced choice with picture pairs
- Listened to recorded sentences
- Selected picture they believed corresponded to novel word

Sample trial



Adult Study

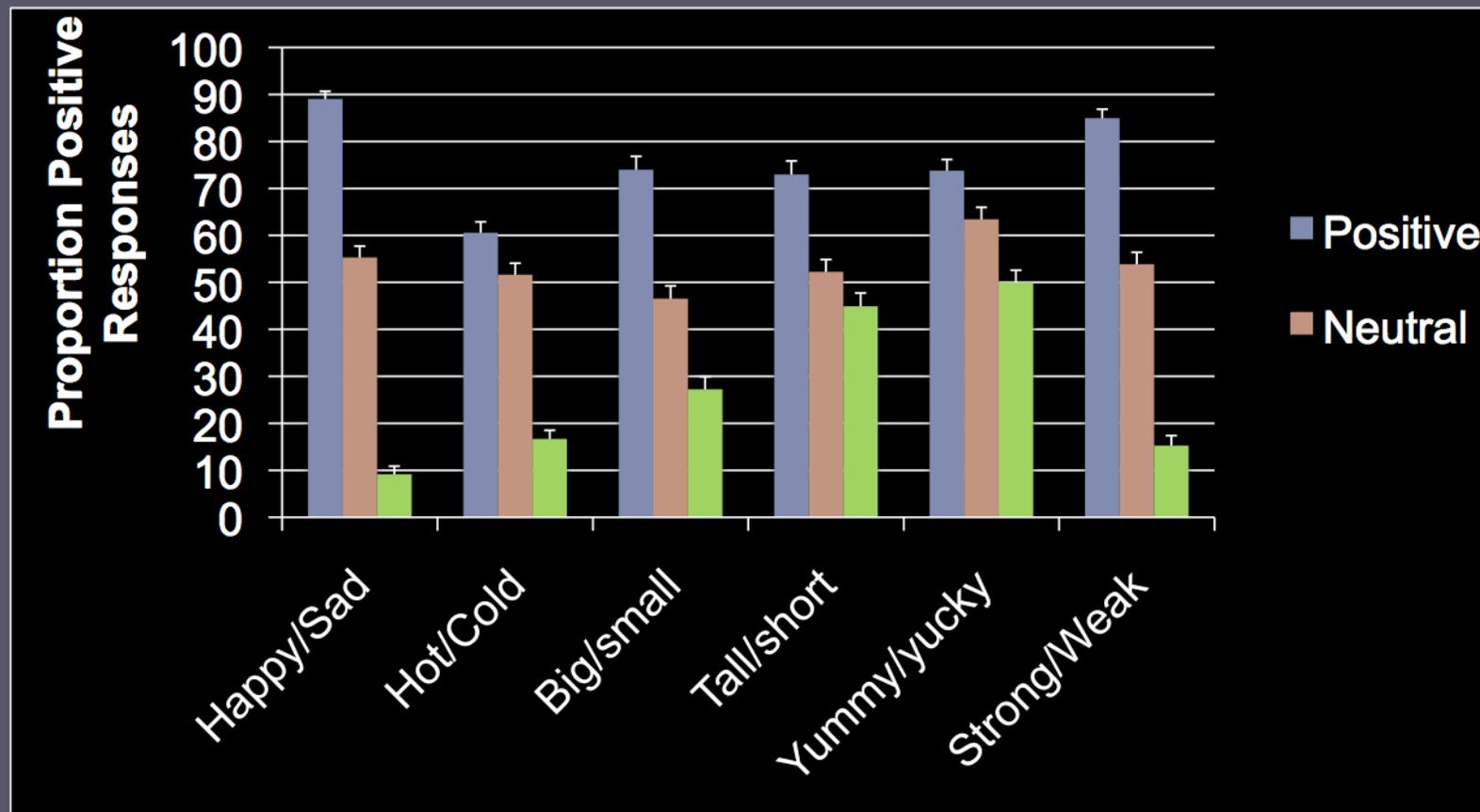
- Heard all sentences
 - ▣ neutral and meaningful
 - ▣ all three speakers
- Saw two picture pairs for each sentence

Adults use prosody to infer meaning



Nygaard, Herold, & Namy, 2009

Adults use prosody to infer meaning

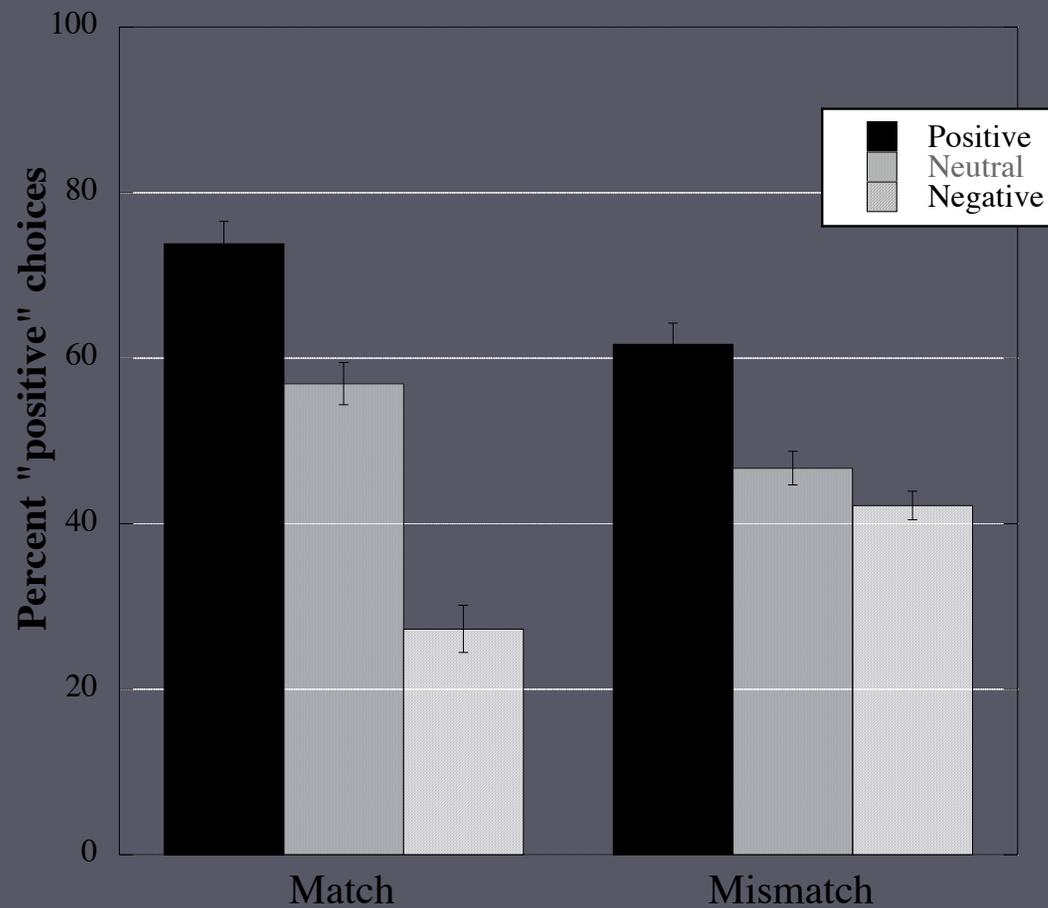


Nygaard, Herold, & Namy, 2009

Explained by Valence?

- If so, scrambling the pairings of sentences and pictures (e.g., play “hot” and “cold” words with big/small picture pairs) should yield similar performance
- Compared performance when sentences matched v. mismatched meanings

Matched pairings yield more robust effects



Adult Study -Conclusions

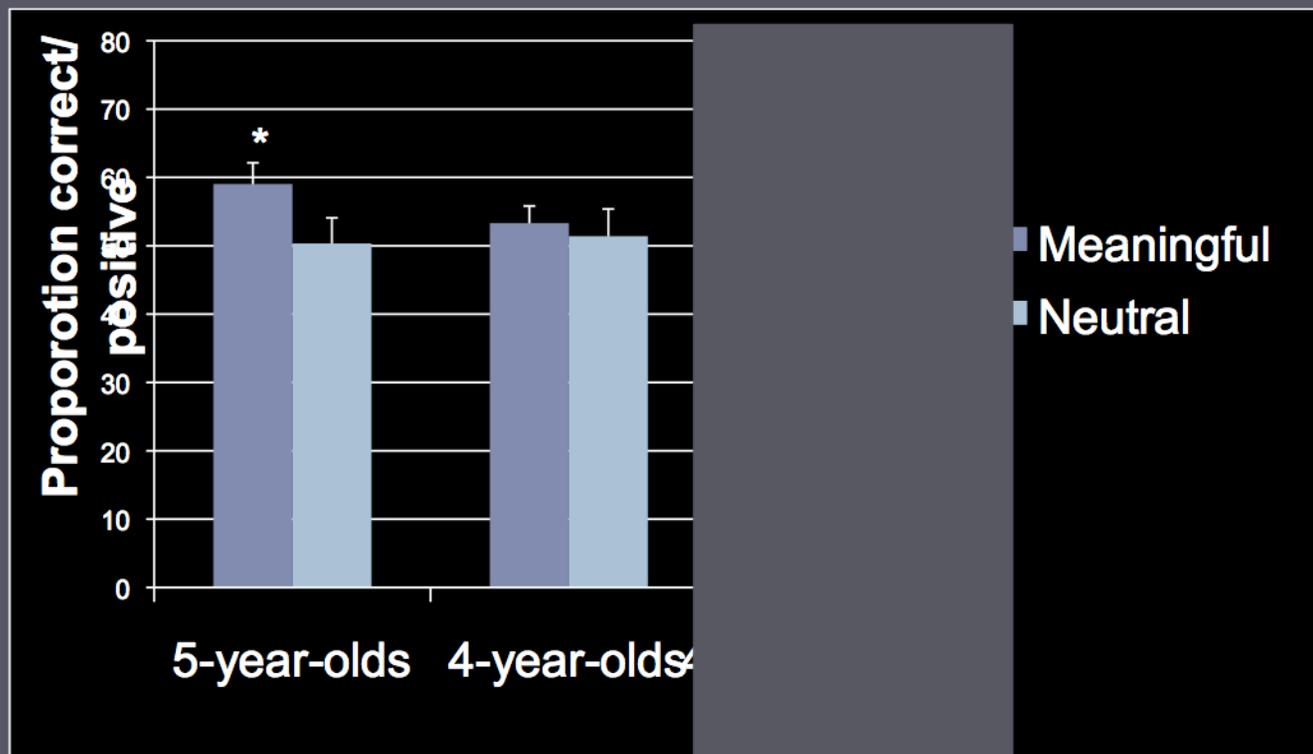
- Adult listeners reliability differentiated meanings based on prosodic cues alone
- Partly due to prosodic cues to valence
- Clear “value added” for correct mappings
 - ▣ Unique prosodic cues to specific domains

Can children recruit prosody to infer word meaning?

- 4- and 5-year-olds
- Single speaker
- Meaningful or Neutral (between subject)
- Learned Francine the Frog's special names for things



Children's use of prosody to infer word meaning



Herold, Nygaard, Chicos, & Namy, 2010

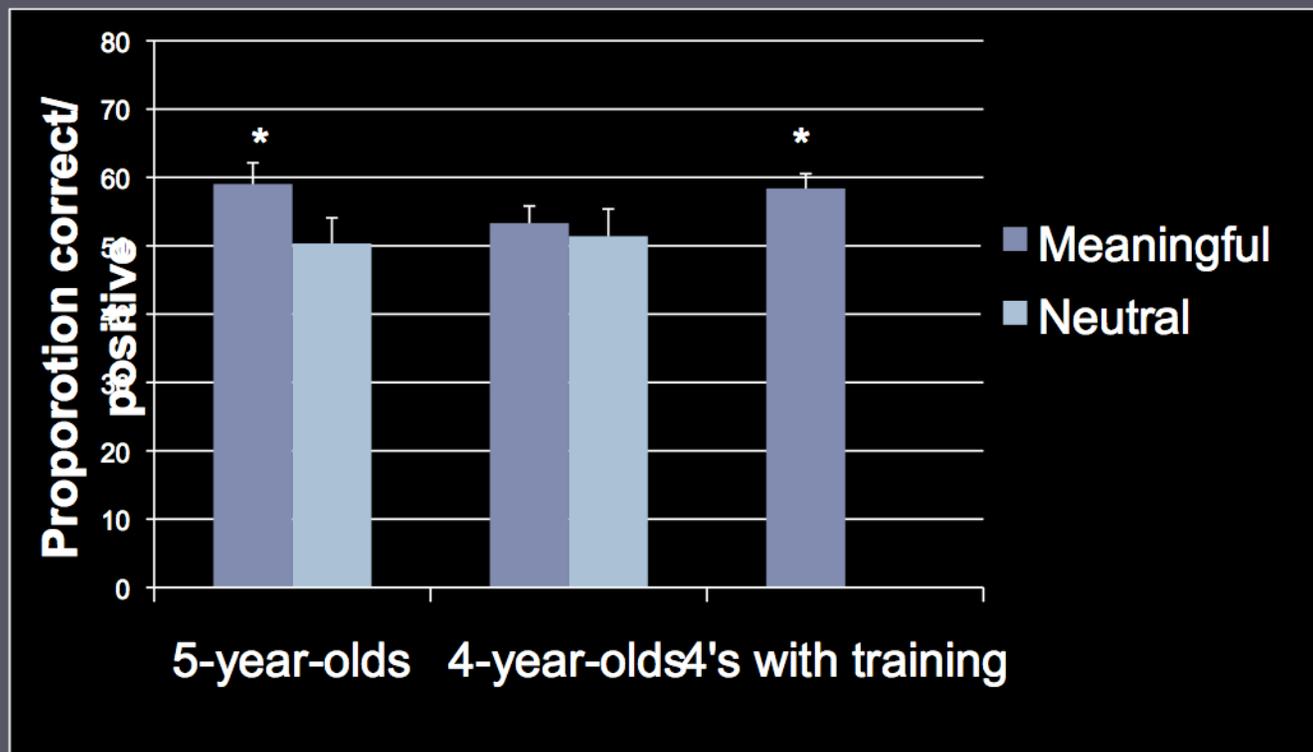
Do 4-year-olds lack understanding of prosodic cues or inhibit attention to prosody?

- 4-year-olds children selectively attended to propositional over prosodic cues to emotion (Morton & Trehub, 2001)
- Relative weighting of emotional prosody over propositional content increased with development.
- Ability to use prosodic cues to emotion was not impaired when propositional content was masked.

4-year-old training study

- Meaningful prosody condition
- Training period –exposed to happy/sad stimuli
 - ▣ Heard same novel word with both types of prosody
 - ▣ Asked children to identify emotion
 - ▣ Provided corrective feedback/reinforcement
- Training is non-specific

Impact of training on use of prosody



Herold, Nygaard, Chicos, & Namy, 2010

Child Studies -Conclusions

- Both 4- and 5-year-olds can recruit prosodic information in the service of interpreting novel words
- 5-year-olds do so spontaneously, 4's when encouraged to attend to prosody
- Earlier sensitivity?

Overall Conclusions

- Prosodic correlates to meaning beyond valence
- Spontaneously produced
- Consistent across speakers
- Both children and adults can recruit prosodic cues in the service of novel word interpretation

Current and Future Steps

- Prelinguistic infants?
- More naturalistic measures of spontaneous use
- Extend beyond antonyms and dimensional adjectives
- Disambiguating Mechanisms
 - ▣ Iconicity
 - ▣ Simulation
 - ▣ Conventionalization