ACOUSTIC AND PERCEPTUAL EVIDENCE OF PROSODIC CORRELATES TO WORD MEANING

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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, bicket, 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 ($F_o$)
  - $F_o$ variation
  - Amplitude
  - Duration

- Analyzed both full sentence and novel word
Related to Valence?

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Nygaard, Herold, & Namy, 2009
Unique acoustic profiles differentiate meanings

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Nygaard, Herold, Namy, 2009
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

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Herold, Nygaard, & Namy, 2010
Mothers’ use of prosody to differentiate meaning

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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
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