How do we talk to children? Leveraging speech corpora to quantify how we simplify speech to children

Background

- Children learn from overhearing in lab, but are less likely to at home: why?
- The amount of child-directed—but not overheard—speech in children's homes between 18 and 30 months predicts vocabulary growth
- Infants preferentially attend to learnable stimuli of intermediate complexity
- Across, cultures, adults simplify their speech to children
- Early in development, might children initially fail to learn from naturalistic overheard speech, because it is too complex to capture their attention?
- We test the idea that overheard speech—which will often consist of speech between adults (ADS)—is too complex for children relative to child-directed speech, leading them to disattend from it until it is of equivalent complexity
- We apply empirically grounded text-based metrics of processing and semantic complexity to child-directed and conversational adult corpora.

Data Sources

**Child-directed Speech**

- **CHILDES**
  - exclusively single adult-child dyads
  - 46,234 tokens from 140 children
  - **CASE STUDIES**
  - Providence: 364 transcribed, 6 dyads
  - Manchester: 12 20-36 month-olds
- **Homebank**
  - 53 children (M_	ext{age} = 29.8 mos)
  - 159 5-minute transcribed excerpts of daylong recordings from the VanDam corpus
- **CALLHOME CORPUS**
  - 23,744 tokens
  - 9222 tokens from 363 adults

**Adult-directed Speech**

- **CHILDES**
  - adult utterances which precede other adult utterances
  - 36,807 tokens
- **Homebank**
  - 63,807 tokens
- **Santa Barbara Corpus**
  - 11 million spoken words

**NATURALISTIC**

British National Corpus

100 million written & spoken tokens
11 million spoken words

Preprocessing...

(Preprocessing... untranscribable fillers removed; tokens lemmatized)

Computing Complexity

**Lexical Complexity**

- How frequent are familiar words?
- surprisal (negative log probability) of words known by most same-age children on the M-CIDI
- speech contains fewer highly child-friendly words as children age (B = -4.35 [-6.51, -6.18])
- remains more complex at 30 mos

**Entropy**

- How unpredictable, or diverse, are the unfamiliar words?
- entropy decreases with age, but remains greater at 30 mos. (p < .001)

**Age of Acquisition (AoA)**

- AoA is associated with faster online processing; adult judgments may be proxies for subjective complexity
- Of the words with ratings, AoAs were reliably higher for the BNC (M = 5.78)

**Concreteness**

- How semantically complex is CDS?
- Concrete language may index here-and-now speech, & be easier to acquire?
- A concrete word refers to something you can immediately experience of through your senses (smelling, tasting, touching, hearing, seeing), and the actions you do. The easiest way to explain a word is by pointing to it or by demonstrating it, if you do not need other language?
- CDS is more concrete (difference in means: 0.612 [0.35, 0.48], p < 0.001), & higher valence
- but CDS decreases in concreteness alone (B = -0.412 [-0.438, -0.385])

**Speech Rate**

- Is speech between adults faster?
- 368,009 CDS utterances with times 1.28 [1.02, 1.54] wpm increase per month and 0.03 increase in syllables per second [0.02, 0.04]
- IN LAST 6 MONTHS: maternal speech rate 136 wpm [134.14, 137.88]

**Conclusions**

- Speech to children is reliably less complex & easier to process:
  - it contains higher proportions of words children are likely to know, & less diverse words they may not
- New words in child-directed speech are more likely to be learnable compared to those in adult-directed speech:
  - they are more likely to be about the here-and-now and/or object of the child’s attention, and easier to learn without other language, through demonstration
  - they are likely to be delivered more slowly and contingently
- If complexity-based attention is relevant for language-learning, overheard speech may not maintain children’s attention until at least three years of age.

**Limitations**

- Many aspects of complexity are missing, e.g., contextual support, syntax...
- Not all overheard speech is between adults!
- Data sparsity: little overheard speech (and labor-intensive to verify)
- CDS and ADS are from different adults, households: ideal corpus would allow analysis of comparative complexity from same speaker around vs. to the child.

**Future Directions**

- Can children learn from overheard speech equivalent in complexity to the child-directed speech they typically receive?
- What do the different trajectories for different complexity measures mean?
- Ongoing experiments test children’s attention to language stimuli of contrasting complexity, & qualitative variability in early overhearing environments.

**References**


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