SPEAKER GENDER, CHILD AGE, SYNTAX, & THE PROSODY OF PARENTESE

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Dr. Corthals has no relevant financial or nonfinancial relationships to disclose.

with acknowledgements to dr. F. Loncke & students from the University of Virginia and Ghent University
Outline

PARENTESE
- What is parentese?
- Linguistic & phonetic features
- This contribution

METHOD
- Participants & recordings
- Praat software
- Analyses & indices

RESULTS
- Male & female substyles
- Child age & language effect
- Syntax transparency
Outline

**PARENTESE**
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What is parentese?

- you too use it
- speech-language register
  adults switch to when talking to children
- “motherese”
  “fatherese”
  “maidese”
  “child directed speech”
- regulates infant arousal and attention and communicates affect
Parentese linguistics

- limited vocabulary, short repeated utterances, and referents that are concrete and present
- Grammar complexity tuned to children’s language development
- thought to facilitate language learning
Parentese phonetics

- hyper-articulated vowels
- slower speech and articulation rate
- raised voice pitch
- exaggerated sing-song intonation
- segment-marking, “didactic” prosody
Parentese

- This contribution will focus on...

- "motherese" "fatherese" "maidese" "child directed speech"
- "didactic" prosody
- "child directed speech" regulates infant arousal and attention and communicates affect

- "didactic" speech and articulation rate
- "raised voice pitch"
- Exaggerated sing-song intonation
- Segment-marking, "didactic" prosody

Are these phonetical aspects of parentese evolving as a function of child age?

Is there a male and a female sub-style...

- Tuned to children’s language development
- Thought to facilitate language learning
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Partipants

- native speakers of Flemish Dutch
- most often, but not always son or daughter
- typically developing children

<table>
<thead>
<tr>
<th>Flemish Dutch</th>
<th>ADULTS</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>57</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>(23 up to 61 yrs)</td>
<td>av. age 35 years</td>
<td>av. age 33 years</td>
<td></td>
</tr>
</tbody>
</table>

speaking to children of (mean age):

- 25 months
- 26 months

Average recording:
306 seconds (i.e. 5 mins.)
440 words
Participants

- smaller sample: native speakers of American English

<table>
<thead>
<tr>
<th></th>
<th>American English</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADULTS</strong></td>
<td></td>
<td><strong>MALE</strong></td>
<td><strong>FEMALE</strong></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>(25 up to 42 yrs)</td>
<td></td>
<td>av. age 33 yrs</td>
<td>av. age 33 yrs</td>
</tr>
<tr>
<td><strong>speaking to children of (mean age):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td></td>
<td>11 months</td>
<td></td>
</tr>
</tbody>
</table>

These children are younger!
Recordings

- 2 digital recordings per person: adult directed \textbf{AD} and child directed \textbf{CD}
- Of \textit{dyadic} sessions in subjects’ home

\textbf{Praat software} (Boersma & Weeninck 2009)

\textbf{CD} - \textbf{AD} = \textit{Change} = \textit{extra effort in parentese register}
Analyses

- identify & describe relevant fragments
- run script

Analyses & indices

- Number of words
- Number of syllables
- Transcript (Dutch only)

Syntax boundary + pitch jump (Dutch samples only)
Analyses & indices

1) Speech rate changes CD vs. AD
(words & syllables per unit of time)

2) Voice pitch changes CD vs. AD
(median $F_0$, extent & speed of intonation maneuvers)

3) Voice intensity changes CD vs. AD
(extent & speed of voice stress maneuvers)

- purpose-built scripts in Praat software
Statistics

- two independent variables (factors)
- more than one dependent variable
- possible covariate

MANCOVA!
multivariate analysis of covariance
Statistics

- **conditions not met** for 2x2 factorial MAN(C)OVA

**ASSUMPTIONS:**
- normal distributions
- independent observations
- **equal covariance matrices** (Box’s test)
- **homogeneous variances** (Levene’s test)
- homogeneous dependent-covariate regression slopes

Effect of **two factors** separately!
Exploring factor **interactions**!
**Partialling out** the effect of the covariate!
Detect whether groups differ along **combination** of dependent variables!!
Statistics

- one independent variable (factor)
- each dependent variable
- possible covariate

Ind. var.: ADULT GENDER

Covar: CHILD AGE

Each Dep. var.: PROSODY effort

One way AN(C)OVA!
Statistics

- one independent variable
- one dependent variable
- conditions for ANCOVA not met (effect of child age covariate not partialled out!)

ONE-WAY ANOVA!
Statistics

- one predictor variable
- for several dependent variables
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  - Syntax transparency
Results

Male and female substyles

- **Dep. var.**: PROSODY effort
- **ind. var.**: ADULT GENDER
- **covar**: CHILD AGE

one way AN(C)OVA!
Results

- Gender effects
  - extent of intonation maneuvers
- pause length & voice pitch jump to mark syntactic boundaries

<table>
<thead>
<tr>
<th>Male and female substyles</th>
</tr>
</thead>
</table>

Robust Tests of Equality of Means

<table>
<thead>
<tr>
<th></th>
<th>Statistic(^a)</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech Rate Change</td>
<td>3,872</td>
<td>1</td>
<td>66,242</td>
<td>.053</td>
</tr>
<tr>
<td>(WRDS p/min)</td>
<td>Brown-Forsythe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitch Modulation Depth</td>
<td>11,073</td>
<td>1</td>
<td>64,953</td>
<td>.001</td>
</tr>
<tr>
<td>Change (Hz)</td>
<td>Brown-Forsythe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice Pitch Shift (Hz)</td>
<td>.405</td>
<td>1</td>
<td>64,135</td>
<td>.527</td>
</tr>
<tr>
<td>Pitch Modulation Speed</td>
<td>.143</td>
<td>1</td>
<td>67,824</td>
<td>.707</td>
</tr>
<tr>
<td>Change (Hz/sec)</td>
<td>Brown-Forsythe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice Intensity Modulation Change (dB)</td>
<td>.002</td>
<td>1</td>
<td>67,044</td>
<td>.968</td>
</tr>
<tr>
<td>Voice Intensity Modulation Speed Change (dB/sec)</td>
<td>1,680</td>
<td>1</td>
<td>52,259</td>
<td>.201</td>
</tr>
<tr>
<td>Articulation Rate Change (SyllSec)</td>
<td>.799</td>
<td>1</td>
<td>46,734</td>
<td>.376</td>
</tr>
</tbody>
</table>

\(^a\) Asymptotically F distributed.
Results

- Gender effects on the extent of intonation maneuvers still significant when effect of covariate (child age) is partialled out.

**Table: ANCOVA**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>13868,470a</td>
<td>2</td>
<td>6934,235</td>
<td>8,579</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>45920,521</td>
<td>1</td>
<td>45920,521</td>
<td>56,814</td>
<td>.000</td>
</tr>
<tr>
<td>agechildmonths</td>
<td>4985,719</td>
<td>1</td>
<td>4985,719</td>
<td>6,168</td>
<td>.015</td>
</tr>
<tr>
<td>GenderAdult</td>
<td>8293,734</td>
<td>1</td>
<td>8293,734</td>
<td>10,261</td>
<td>.002</td>
</tr>
<tr>
<td>Error</td>
<td>54961,896</td>
<td>68</td>
<td>808,263</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>164555,000</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>68830,366</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .201 (Adjusted R Squared = .178)
Results

- Gender effects of pause and voice pitch jump to mark syntactic boundary still significant when effect of child age is partialled out.

**Tests of Between-Subjects Effects**

**Dependent Variable: pausesACminusAD**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>1,235 (^{a})</td>
<td>2</td>
<td>.617</td>
<td>3.377</td>
<td>.049</td>
</tr>
<tr>
<td>Intercept</td>
<td>.474</td>
<td>1</td>
<td>.474</td>
<td>2.590</td>
<td>.119</td>
</tr>
<tr>
<td>agechildmonths</td>
<td>.267</td>
<td>1</td>
<td>.267</td>
<td>1.458</td>
<td>.238</td>
</tr>
<tr>
<td><strong>GenderAdult</strong></td>
<td>1,082</td>
<td>1</td>
<td>1,082</td>
<td>5.918</td>
<td>.022</td>
</tr>
<tr>
<td>Error</td>
<td>4,937</td>
<td>27</td>
<td>.183</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>11,790</td>
<td>30</td>
<td></td>
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<td></td>
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<tr>
<td>Corrected Total</td>
<td>6,172</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{a}\) R Squared = .200 (Adjusted R Squared = .141)

**Tests of Between-Subjects Effects**

**Dependent Variable: pitch jumps ACminusAD**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>10938,199 (^{a})</td>
<td>2</td>
<td>5469,099</td>
<td>8.855</td>
<td>.001</td>
</tr>
<tr>
<td>Intercept</td>
<td>23988,678</td>
<td>1</td>
<td>23988,678</td>
<td>38.842</td>
<td>.000</td>
</tr>
<tr>
<td>agechildmonths</td>
<td>5140,198</td>
<td>1</td>
<td>5140,198</td>
<td>8.323</td>
<td>.008</td>
</tr>
<tr>
<td><strong>GenderAdult</strong></td>
<td>4450,755</td>
<td>1</td>
<td>4450,755</td>
<td>7.207</td>
<td>.012</td>
</tr>
<tr>
<td>Error</td>
<td>16675,123</td>
<td>27</td>
<td>617,597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>64749,330</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>27613,322</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{a}\) R Squared = .396 (Adjusted R Squared = .351)
Results

- Gender effect on extent of intonation maneuvers

![Graph showing mean pitch modulation depth change (Hz) between male and female adults.](chart.png)

change re: adult directed level

- Female: Mean pitch modulation depth change (Hz)
- Male: Mean pitch modulation depth change (Hz)

**p < 0.005**
Results

- Gender effect
- Pause length to mark syntactic boundaries

Male and female substyles

\[ p < 0.05 \]
Results

- Gender effect on voice pitch jump to mark syntactic boundaries.
Results

Language effect

ind. var.: LANGUAGE

each
Dep. var.: PROSODY effort

one way ANOVA
Results

- **Language effect**: speech rate reduced more in Flemish

---

### Robust Tests of Equality of Means

<table>
<thead>
<tr>
<th>Metric Description</th>
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<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech Rate Change (WRDS p.min)</td>
<td>Brown-Forsythe</td>
<td>6.023</td>
<td>1</td>
<td>23,872</td>
<td>.022</td>
</tr>
<tr>
<td>Articulation Rate Change (Syll/Sec)</td>
<td>Brown-Forsythe</td>
<td>.318</td>
<td>1</td>
<td>30,519</td>
<td>.577</td>
</tr>
<tr>
<td>Pitch Modulation Depth Change (Hz)</td>
<td>Brown-Forsythe</td>
<td>1.007</td>
<td>1</td>
<td>15,686</td>
<td>.331</td>
</tr>
<tr>
<td>Voice Pitch Shift (Hz)</td>
<td>Brown-Forsythe</td>
<td>1.041</td>
<td>1</td>
<td>14,432</td>
<td>.324</td>
</tr>
<tr>
<td>Pitch Modulation Speed Change (Hz/sec)</td>
<td>Brown-Forsythe</td>
<td>.000</td>
<td>1</td>
<td>16,536</td>
<td>.998</td>
</tr>
<tr>
<td>Voice Intensity Modulation Change (dB)</td>
<td>Brown-Forsythe</td>
<td>.053</td>
<td>1</td>
<td>36,404</td>
<td>.820</td>
</tr>
<tr>
<td>Voice Intensity Modulation Speed Change (dB/sec)</td>
<td>Brown-Forsythe</td>
<td>1.962</td>
<td>1</td>
<td>17,880</td>
<td>.178</td>
</tr>
</tbody>
</table>

a. Asymptotically F distributed.
Results

• **Language effect**: speech rate reduced more in Flemish ($p < 0.05$ one way ANOVA)

• **conditions not met** for ANCOVA to partial out child age in language effect

Remember
These children were younger! One would expect the opposite!
Results
(group differences overview)

- **Language effect**: speech rate reduced more in Flemish (p < 0.05 one way ANOVA)
- **conditions not met** for ANCOVA to partial out child age in language effect

- **Gender effects**: extent of intonation maneuvers still significant when effect of covariate (child age) is partialled out
- **Gender effects**: pause and voice pitch jump to mark syntactic boundary still significant when effect of child age is partialled out
Results

(St)Age tuning

CHILD AGE

Dep.var.: PROSODY

effort

REGRESSIONs!
Results

- **(St)Age tuning**: the younger the child, the more speech rate (words per minute) is lowered (no gender difference)

Language effect; tuning in to (development st)age

Flemish Dutch only

linear regression $r = 0.58 \quad R^2 = 0.34 \quad p < 0.001$
Results

- **Language effect**: speech rate lowered, exception: American English speakers addressing youngest children *(before/after one word stage?)*

Language effect; tuning in to (development stage)

Loess regression lines fitting 90% of cases *(Am. English, Flem. Dutch)*
Results

- **(St)Age tuning:** the younger the child, the more articulation rate (syll./sec.) is lowered (in female parentese users)
Results

- **(St)Age tuning**: the younger the child, the higher the median voice pitch.

- Male speakers raise pitch but do not tune to age.

- (Some female speakers go lower: creaky voice/vocal fry?)

Female speakers: Spearman’s Rho = -0.35 p < 0.05
Results

- Age tuning in turn (developmental stage)

Gender effect:

- Tuning in to (developmental stage)

Female speakers:

- $p > 0.001$
- $\rho = 0.53$ Spearman's

Gender difference:

- Tuning more to age
- But do not tune to age
- Male speakers intonate more
- Tunes more to (developmental stage)
Results

(St)Age tuning:

- The younger the child, the better the child adjusts.

- Syntactical boundaries are marked by pitch jumps, particularly in female parentese; both genders tune to age.

- Both genders, Dutch samples: Pearson r = -0.49, p < 0.01.

- The younger the child, the better (St)Age tuning.
1. The prosody of parentese is segment-marking and tuned to child age, hence this prosody is “didactic”

2. Didactic prosody: female speakers do it better (but perhaps men compensate otherwise?)

3. Boost for language development? Ramifications for child directed multimedia?

Conclusions & ramifications

“didactic” prosody

PARSING

INFER, LEARN MEANING

ACTOR+ ACTION+ PATIENT sentence template
Self test questions

1. True or false?
   - The prosody of parentese is characterized by (among other features) larger intonation maneuvers, but these changes are more pronounced in female parentese users.

2. True or false?
   - Prosodic changes disappear by the time the child reaches the age of 2 yrs.

3. True or false?
   - Syntactic structure is made transparent (according to evidence from Flemish-Dutch samples) by longer pauses between constituents.
1. The prosody of parentese is characterized (among other features) by larger intonation maneuvers, but these changes are more pronounced in female parentese users.
1. The prosody of parentese is characterized by (among other features) larger intonation maneuvers, but these changes are more pronounced in female parentese users.

2. Prosodic changes disappear by the time the child reaches the age of 2 yrs.

3. True or false?
1. The prosody of parentese is characterized by (among other features) by larger intonation maneuvers, but these changes are more pronounced in female parentese users.

2. Prosodic changes disappear by the time the child reaches the age of 2 yrs.

3. Syntactic structure is made more transparent by longer pauses between constituents. True, but also voice pitch changes are larger.
Acknowledgements


Thank you for your attention