The use of prosody and gestures for the production of contrastive focus in French-speaking 4 and 5 year olds

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Information structure: narrow focus

• Highlighting an element that is new in the discourse to distinguish it from possible alternatives

Narrow-focus: “Take a purple SUITCASE [Which purple object?]”

Broad-focus: “Take a purple suitcase” [What should I take?]

Broad-focus vs. Narrow-focus

[la valise vioLETTÉ]_{AP/IP}  vs.  [[la vaLISE]_{AP} [vioLETTÉ]]_{AP/IP}

the suitcase purple

the suitcase purple
Contrastive focus in children

• **Late** production of adult-like intonation patterns of focus (7-8 years of age) (Chen, 2011; De Ruiter, 2009)

• **Earlier** use of other prosodic cues to mark new/given (at 4-5 years of age) (Romoren & Chen, 2015; Wonnacot & Watson, 2008)

• **Existing results:**
  • From Germanic languages
  • Using either imitation games or story-telling tasks
  • Only acoustic correlates of focus (no multimodal analyses)
Interaction prosody ↔ body gestures in production

Esteve-Gibert, Borràs-Comes, Asor, Swerts, & Prieto, in press; Krahmer & Swerts, 2007; Leonard & Cummins, 2011; Rochet-Capellan et al., 2008; Roustan & Dohen, 2010; Yasinnick et al., 2004

Look at the CROcodile!

Prosodic heads attract the prominent intervals of body gestures.

Prosodic edges determine the specific alignment of gesture apex with respect of the prosodic head.
In development...

• Early temporal synchronization of prosodic heads and pointing gestures in infants (Butcher & Goldin-Meadow, 2000; Esteve-Gibert & Prieto, 2014).

• Beat gestures seem to accompany child’s speech only much later, at around 5-6 years of age (Colletta et al., 2015; Mathew et al., 2014)
Aims & research questions
How prosody and body gestures interact in the development of focus marking in first language acquisition

1. Do preschool children mark focus with adult-like prosodic cues?
   > H1: Children might be better at using some prosodic cues like phrasing, while adults use both phrasing and intonation.

2. Do preschool children use gestures to signal focus, and are these gestures temporally aligned with speech in an adult-like way?
   > H2: Children will align gestures with the focused element, as adults do.

3. Do prosodic and gesture strategies interact to mark focus in development?
   > H3: If children produce a gesture to signal focus, they will also prosodically mark that element.
Methods
Participants

4-year-old French-speaking children (N = 10) [N=20 tested]

5-year-old French-speaking children (N = 10) [N=20 tested]

French-speaking adults (N = 6) [N=18 tested]
## Materials

<table>
<thead>
<tr>
<th>article + disyllabic noun + disyllabic adjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prends la valise violette</td>
</tr>
<tr>
<td>Take the suitcase purple</td>
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</tbody>
</table>

## Variables:

- **Position of focus:**
  1. article + NOUN + Adjective
  2. article + noun + ADJECTIVE

- **Focus type:**
  1. Broad-focus
  2. Contrastive narrow-focus
  3. Corrective narrow-focus
Production task

Help Claire finding the right object inside the big bag!
Possible visual displays

broad focus

contrastive focus on the adjective

contrastive focus on the noun

corrective focus on the adjective

corrective focus on the noun

12 trials per condition (children)

16 trials per condition (adults)
Data recordings

Children

Video recording (1 camera)
Audio recording (1 microphone)

Adults

Video recording (1 camera)
Audio recording (1 microphone)
EMA sensors for head gestures

- Head movements
- References
- Articulatory gestures
Example, child recordings
Example, adult recordings
Data analysis, prosody

Praat:

- Duration (words, syllables) → automatic segmentation with SPPAS (Bigi, 2012)
- Pitch max (within the target NP)
- Pitch min (within the target NP)
- Intonation (ToBI)

![Waveform and spectrogram showing pitch and frequency over time]
Data analysis, gestures

ELAN annotation tool:

- Gesture during the NP: yes/no
- Type of gesture: head nod, head tilt, eyebrow raising, chin forward, body movement, finger pointing
- Gesture-speech alignment: gesture on the noun, gesture on the adjective, primary on the noun, primary on the adjective
Results
Prosodic cues for focus marking, expectations

BROAD-FOCUS

NOUN

VA-LISE

N_initial N_final

ADJECTIVE

violette

Adj_initial Adj_final

NARROW-FOCUS ON NOUN

Noun

va-lise

N_initial N_final

Adjective

violette

Adj_initial Adj_final

NARROW-FOCUS ON ADJECTIVE

Noun

va-lise

N_initial N_final

Adjective

VIO-LETTE

Adj_initial Adj_final
Prosodic cues for focus marking

adults

[Box plot diagram showing the distribution of log duration across different positions (N1, N2, A1, A2) and positions in syllable (initial, final) for various contexts (Broad, Contrastive on N, Contrastive on A, Corrective on N, Corrective on A).]
Prosodic cues for focus marking

lmer(log(duration_msec) ~ position_syllable * condition + (1|participant) + (1|trial), df)
Prosodic cues for focus marking

No effect of condition nor age

lm\( \log(\text{duration\_msec}) \sim \text{position\_syllable} \times \text{condition} \times \text{age} + (1|\text{participant}) + (1|\text{trial}), \text{df} \)
Gestures for focus marking

**Children**

- Broad: 20%
- Contrastive: 40%
- Corrective: 60%

**Adults**

- Broad: 50%
- Contrastive: 70%
- Corrective: 70%
Interaction of prosodic and gesture cues, adults
Interaction of prosodic and gesture cues, children

No effect of condition

No effect of presence of speech-aligned gesture
Discussion & Conclusion
## Summary of the results

<table>
<thead>
<tr>
<th></th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of prosody focus</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>(syllable duration)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of body gestures</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Interaction prosody-gestures</td>
<td>✔️</td>
<td>❌</td>
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• Appropriate task to elicit spontaneous (but controlled) production of the broad/narrow focus distinction.

• Both adults and children use body gestures to focus narrowly one element in the discourse:
  – Children: corrective narrow-focus > contrastive narrow-focus > broad-focus
  – Adults: corrective and contrastive narrow-focus > broad-focus

• Adults mark focus prosodically through differential syllable duration, but preschool children do not master this cue yet.

• Prosodic and gestures cues do not seem to interact in the preschool children’s marking of focus, while they do in adults.

Preschool children can produce focus but they use visual strategies to do so.
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Pauline Welby, Praat script

Thanks for your attention!