A closer look at pronoun comprehension
Comparing different methods

Christina Bergmann
Markus Paulus
Paula Fikkert

Radboud University Nijmegen
A closer look at pronoun comprehension

Asymmetric Pronoun Acquisition

Delay in correct comprehension of pronouns in comparison to reflexives and in comparison to correct production (see Chien & Wexler, 1990; and a vast amount of subsequent studies in English, Dutch, German, etc.)
Asymmetric Pronoun Acquisition

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<thead>
<tr>
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Methods to Investigate Comprehension

Act-Out:
Make the cat touch her/herself.

Truth Value Judgement Task:
The bear touches him/himself.
Did Kermit get it right?

Picture Selection Task:
Choose the picture where the frog is touching him/himself.
Methods to Investigate Comprehension

Common factors of behavioural methods

- Response-based
- Secondary task
  - Attention to both the linguistic input and the appropriate response
  - Planning and executing the respective action

Results possibly influenced by children’s limits in attention span and memory capacity (as previously suggested by Bloom et al, 1994)
Eye Tracking

Implicit measurement
   No secondary task, hence no additional demands on memory and attention

Visually presenting several objects and naming one
   Time-locked increase in number of fixations and longer fixation time
   (Tanenhaus et al, 1995)

Allows for various dimensions of analysis
   Short, time-locked events
   Change of fixation behaviour over time
   Fixation dynamics
Experimental Approach

Compare automatic (eye tracking) and behavioural responses (picture selection task)

Measuring linguistic competence should yield similar results independent of the method
Experimental Approach

Two general conditions
  Object pronouns vs reflexives
  (In line of Chien & Wexler, 1990, Experiment 4)
  *Mama bear is touching her/herself.*

Participants
  Age group 4: 16 children between 3;08 and 3;11 (mean: 3;10;04)
  Age group 3: 22 children between 2;11 and 3;01 (mean: 3;0;21)
Part 1: Eye Tracking

12 Pronoun trials  
*Meneer Beer is hem aan het wassen.*  
*(Mister Bear is him washing.)*

12 Reflexive trials  
*Meneer Beer is zich aan het wassen.*  
*(Mister Bear is himself washing.)*

24 Baseline trials  
*Kijk, dat is lief!*  
*(Look, this is nice!)*

Baseline:
Account for visual saliency
Measure fixation behaviour without explicit reference to scene
Part 2: Picture Selection Task

Identical pictures and sentences as used in the eye tracking task, no distractor or baseline

Mevrouw koe is haar aan het uitkleden.
Op welk plaatje is mevrouw koe haar aan het uitkleden?
(Miss cow is her undressing.
In which picture is miss cow her undressing?)
Results: Picture Selection Task

Across age groups:

Improvement in the reflexive condition

From chance level to 79% correct
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Results: Picture Selection Task

No change in the pronoun condition

Both age groups at chance level
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Results: Picture Selection Task

3 year olds:
Performance on chance level in both conditions
Strategy: pick the picture on the left (32%)

4 year olds:
Effect of condition: $p<0.01$
Strategy: always choose reflexive (18%)
Results: Eye Tracking

**Agent**: Directly named subject of the sentence, actor

**Patient**: Correct referent in the pronoun condition

**Action**: Region around the action

Separate analysis of the most salient change across pictures
Results: Eye Tracking – Age 3

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Meneer beer is hem aan het wassen.

Pronoun condition
Time slot: 300-600 ms after onset of the pronoun
Baseline trials: Agent and patient at 33%

Fixation probability

Time in milliseconds

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Results: Eye Tracking – Age 4

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Meneer beer is hem aan het wassen.

Pronoun condition

Maximum fixations on the patient: 46% at 2950 ms

Fixations on the agent at 2950 ms: 27%

Baseline trials: Agent and patient at 30%

p<0.05
Discussion

Picture selection task replicates previous results and shows a developmental improvement for reflexives only.

Pronoun comprehension results do not change.

Eye tracking strongly suggests a correct, automatic interpretation of pronouns in 4 year olds.

This is not yet the case in the younger age group.
Conclusion

Eye tracking data shows *comprehension earlier* than the picture selection task and other behavioural methods.

Behavioural methods sensitive to *extralinguistic factors*.
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Additional Slide: Eye Tracking – Reflexive Condition: Age 3

Fixation probability vs. time in milliseconds for different conditions.
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Additional Slide: Eye Tracking – Reflexive Condition: Age 4

![Graph showing fixation probability over time for different conditions. The graph plots time in milliseconds on the x-axis and fixation probability on the y-axis. The legend indicates different conditions such as Agent, Patient, Action, Agent Baseline, Patient Baseline, and Action Baseline.]
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Additional Slide: Eye Tracking – Reflexive Condition: Adults

Fixation probability vs. Time in milliseconds

Graph showing the fixation probability over time for different conditions (Agent, Patient, Action, Agent Baseline, Patient Baseline, Action Baseline).
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Additional Slide: Eye Tracking – Pronoun Condition: Adults

Fixation probability vs. Time in milliseconds for different conditions:
- **Agent**
- **Patient**
- **Action**
- **Agent Baseline**
- **Patient Baseline**
- **Action Baseline**

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