

A closer look at pronoun comprehension

Comparing different methods

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Background

Children start producing pronouns correctly from the age of two to three years onwards, whereas at the same time experiments found their comprehension to be at chance level. This asymmetry has led to the formulation of various linguistic theories with the objective of explaining these observations.

Before firm conclusions can be based on the comparison of results from comprehension and production tasks, we need to ensure that the results are not due to differences in the tasks. Methods employed in the investigation of pronoun comprehension so far are based on children's responses. Generating a reaction presumes processes beyond mere comprehension. This implies that **offline** methods measure **additional factors**, as they also pose demands on memory and attention. These factors can be avoided by means of **online** methods such as eye tracking.

Eye movements are **automatic**, they require no secondary task or superimposed processes. Furthermore, eye tracking has previously been used successfully to monitor adults' and children's online comprehension processes.

This study aims to compare online and offline methods for investigating pronoun comprehension. We carried out two comprehension experiments:

Eye Tracking

Methods

Simultaneous presentation of a picture and prerecorded sentences:

12 trials pronoun condition (*Meneer Kikker is hem aan het wassen.*)

12 trials reflexive condition (*Meneer Kikker is zich aan het wassen.*)

24 matching baseline trials (*Kijk! Wat lief!*)

Counterbalanced for sequence, agent, patient and verb

Results

Modulation by linguistic input:

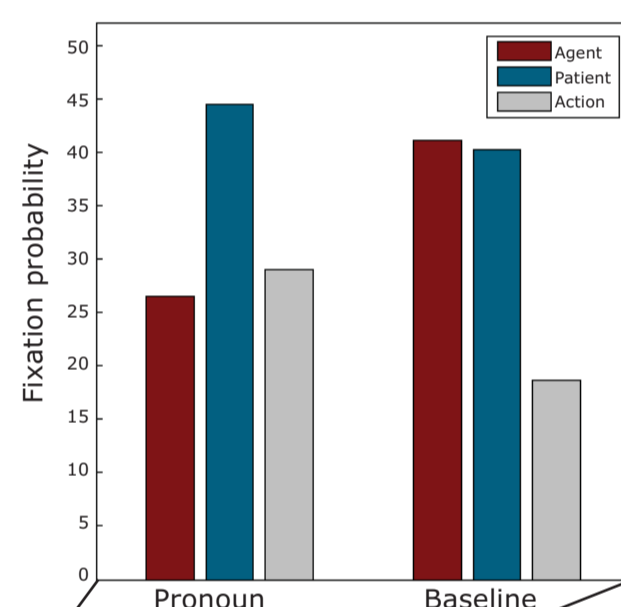
Compared to the baseline, peaks are higher, longer and time-locked to the auditory stimuli that describe the scene.

Following the onset of the pronoun at 2550 ms:

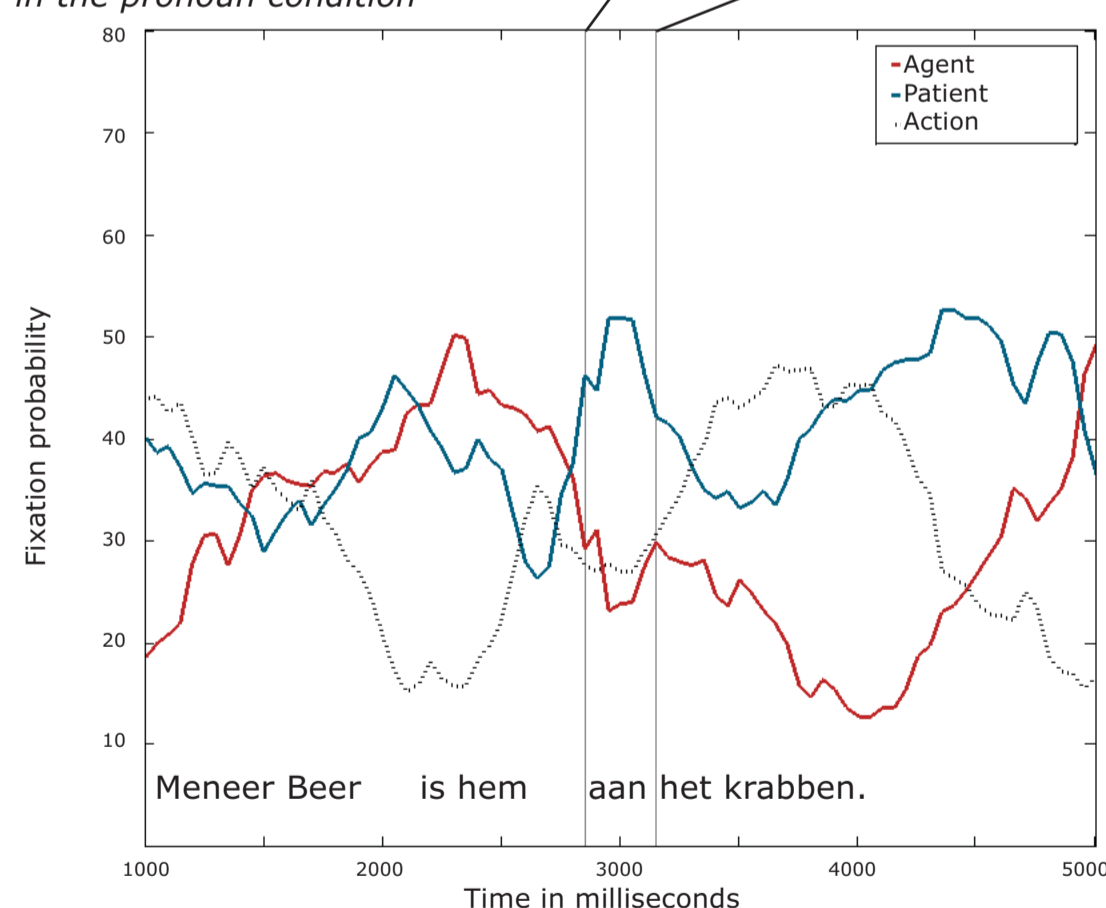
Increase in fixation probability on the patient.

The difference in fixation probability on agent vs. patient is significant (compared to the baseline; two-dimensional KS test: $p < 0.05$).

Fixation behaviour following the pronoun (2850-3150 ms)



Time course of fixations in the pronoun condition



Picture Selection Task

Methods

The stimuli in the picture selection task are the same as used in the eye tracking experiment:

12 trials pronoun condition (*Mevrouw Koe is haar aan het afdrogen.*)

12 trials reflexive condition (*Mevrouw Koe is zich aan het afdrogen.*)

No baseline

Counterbalanced for sequence, agent, patient and verb

Example stimuli in the picture selection task



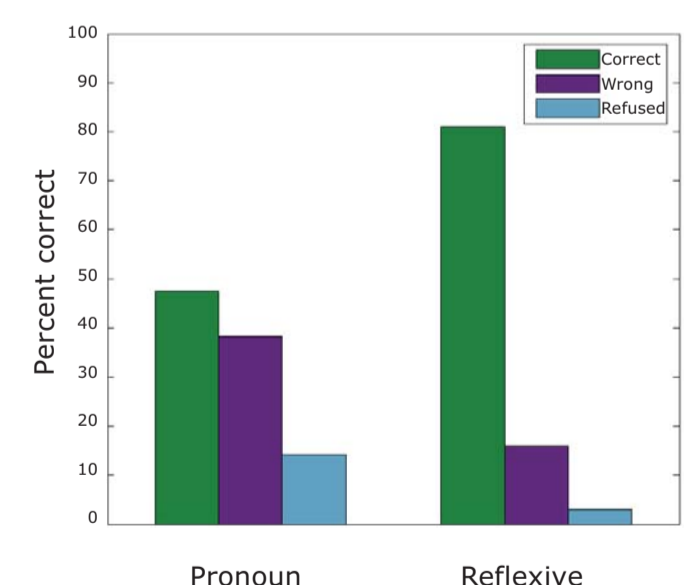
Results

Responses fell into 3 categories:

- > Pointing to the correct picture
- > Indicating the wrong picture
- > Refusal to choose

Significant difference of correct choices in the reflexive and pronoun condition (two-dimensional KS test: $p < 0.05$).

Performance in the picture selection task



Discussion

The picture selection task replicates the results of previous studies and suggest that children have problems understanding pronouns.

On the other hand, the eye tracking results suggest that children do **correctly comprehend pronouns**: The observed fixation behaviour points to a time locked identification of the correct referent and therefore a successful resolution of pronominal anaphora. Online studies are reflecting the processing of grammatical structure more directly than offline studies, such as the picture selection task. Hence, we conclude that there may be less of an asymmetry between production and comprehension than previously assumed.

The difference in behaviour in the online eye tracking task and the offline picture selection task may be due to **extralinguistic factors**: In the latter the perceived linguistic information needs to be mapped on and compared to two pictures, a decision has to be reached and subsequently transformed into the appropriate action (such as pointing to the correct picture). This palpably is a much more demanding task.

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