A computational cognitive model of pronoun resolution

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Background

Pronouns are referential expressions that have to be resolved. Contextual factors play an important role in the processing of subject pronouns (e.g., Arnold, Eisenband, Brown-Schmidt & Trueswell, 2000; Sorace & Filiaci, 2006) and object pronouns (Spaneder, Smits & Hendriks, 2009; Clackson, Felser & Clahsen, 2011; Van Rij, 2012).

Although the interpretation of subject and object pronouns is typically studied in isolation, the sentential subject might contribute to the local context in which an object pronoun is interpreted. Therefore, the resolution of subject pronouns might influence the resolution of object pronouns, or vice versa.

Does subject pronoun resolution influence object pronoun resolution, and vice versa?

Experiment

The effect of subject form on the processing of object pronouns

• Eyetracking experiment with 40 Dutch adults
• Audio stories with two characters
• Subject: Full NP vs. Pronoun
• Object: Reflexive vs. Pronoun
• Pupillary responses measured as an indication of processing load

Clause

1. De egel heeft een boomhut gebouwd.
The hedgehog has a tree-house built.
2. Afgelopen dinsdag liep de egel met de muis door het bos naar huis.
Last Tuesday walked the hedgehog with the mouse through the forest to home,
3a. terwijl de egel hem volgde over een donker pad.
while the hedgehog him followed along a dark trail.
3b. terwijl hij hem volgde over een donker pad.
while he him followed along a dark trail.
3c. terwijl de egel zich haastte over een donker pad.
while the hedgehog himself hurried along a dark trail.
3d. terwijl hij zich haastte over een donker pad.
while he himself hurried along a dark trail.

Model design

Goal to develop a model of pronoun resolution that can resolve subject and object pronouns occurring in the same sentence.

The model design will be loosely based on the subject processing model of Van Rij, Van Rijn & Hendriks (2013) and the object processing model of Van Rij, Van Rijn & Hendriks (2010), which can simulate both adult and child processing.

These models will have to be incorporated into one model that can handle both subject and object pronouns. Because the state of the model is based on the previously encountered context, the state will be different after a subject pronoun than after a subject NP; the activations of the sentence elements in the declarative memory are different. This model state will influence the processing of the following object pronoun.

What is cognitive modelling?

A computational cognitive model is a computational simulation of human cognitive processes, which can provide insight into processes such as memory storage, learning and decision making (Anderson et al., 2004).

In ACT-R, chunks (facts) are stored in the Declarative Memory. Chunks have Activations that reflect how active they are in memory and how easily they can be retrieved (remembered). Processing speed as well as Working memory capacity can be adjusted in ACT-R in order to simulate the differences between child and adult processing.


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