Interference effects in the processing of control structures in German healthy adults

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Aims of the study

In our project, we investigate how different sentence structures are processed by people of different ages and people with aphasia, focusing on variability between and within participants.

content of the poster

Here, we use control structures to investigate how dependency length and the similarity of dependent and non-dependent elements influence sentence processing.

- ▷ We investigate how control structures are processed in healthy German adults.
- ▷ We test the assumptions of the cue-based retrieval model of Lewis & Vasishth (2005).
- ▷ We investigate interference effects with a self-paced listening task with sentence-picture matching.

Control structures

In control structures, the subclause subject (*controllee*) is identified with a noun of the main clause (*controller*). The controllee can be covert (PRO, see (1)) or overt (pronoun, see (2)). The controller can be the subject (1a) or the object (1b).

We investigate two factors:

Peter *erlaubt / verspricht* nun Lisa, das kleine Huhn zu jagen und zu fangen.

(1) control type
- ▷ subject control (a) vs. object control (b)

a. Peter promises Lisa PRO to catch the chicken.
b. Peter allows Lisa PRO to catch the chicken.

Peter verspricht nun *Lisa / Thomas*, dass er das kleine Huhn jagt und fängt.

(2) argument similarity
- ▷ referents' genders match (a) vs. mismatch (b)

a. Peter promises Tom that he will catch the chicken.
b. Peter promises Lisa that he will catch the chicken.

Cue-based retrieval model

When the controllee of a control structure is heard, the controller has to be retrieved from memory to understand the sentence. However, two nouns (e.g. Peter & Tom) are encoded in memory. The distractor noun can slow down the controller's retrieval, which is called interference. The cue-based retrieval model predicts these interferences:

1. **control type**
   - ▷ greater interference when the distractor is close to the controllee (1a) vs. precedes the controller (1b):
   - ▷ interference should occur at the retrieval point:

   ⇒ critical region: PRO (*the chicken*)

2. **argument similarity**
   - ▷ greater interference when the main clause nouns bear same gender (2a) vs. different gender (2b):
   - ▷ interference should occur at the retrieval point:

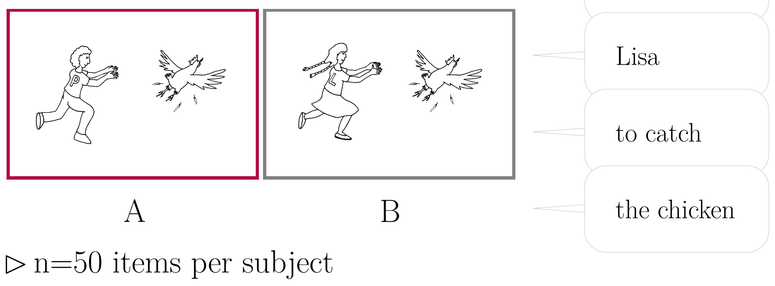
   ⇒ critical region: pronoun (*that he*)

Methods & Design

participants: n=48 German-speaking healthy adults (18 ♂, age: 19–83 years, M=49 years)

self-paced listening with sentence-picture matching:

Who interacts with the animal?

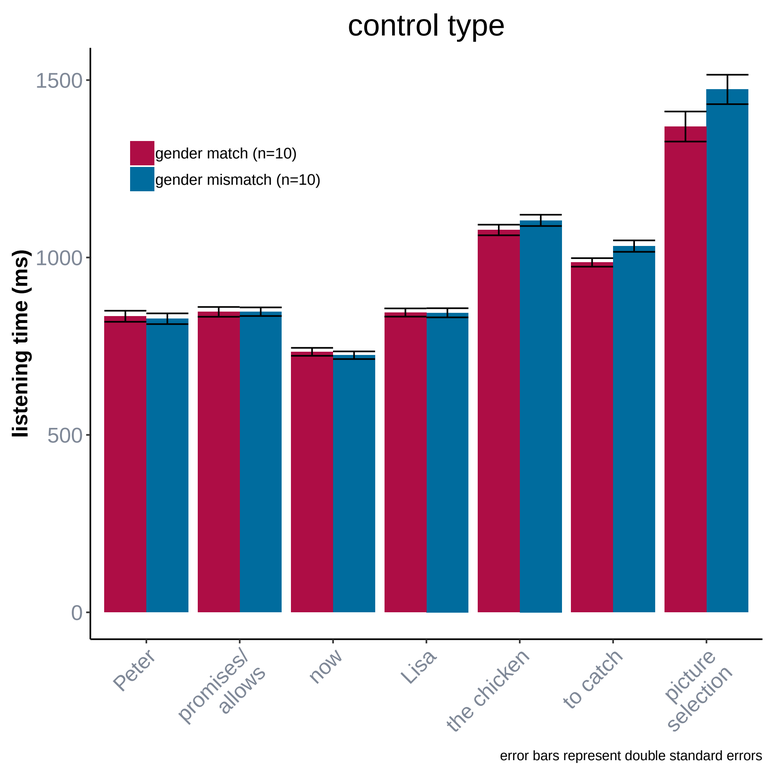


- ▷ n=50 items per subject

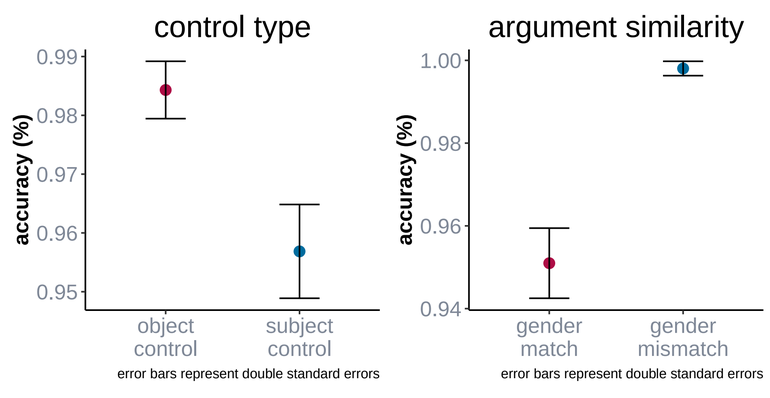
outcome measures & statistical analyses:

- ▷ listening times & RT for picture selection: linear model (individual intercepts & slopes for subjects & items)
- ▷ accuracy (correct/incorrect picture): generalized linear model (individual intercepts for subjects & items)

Results: Listening times



Results: Accuracy



Summary of the results

control type

- ▷ listening time at the critical region *the chicken*: 27ms faster for object control ($t = 1.28, SE^1 = 0.016$)
- ▷ listening time at the critical region+1 *to catch*: 45ms faster for object control ($t = 2.05, SE^1 = 0.014$)
- ▷ picture selection, reaction time: 104ms faster for object control ($t = 1.71, SE^1 = 0.033$)
- ▷ picture selection, accuracy: 2.7% higher for object control ($z = 2.57, SE = 0.43$)

argument similarity

- ▷ listening time at the critical region *that he*: 5ms faster for gender match ($t = 0.2, SE^1 = 0.016$)
- ▷ listening time at the critical region+1 *the chicken*: 17ms faster for gender match ($t = 1.2, SE^1 = 0.015$)
- ▷ listening time at the critical region+2 *will catch*: 5ms slower for gender match ($t = 0.65, SE^1 = 0.015$)
- ▷ picture selection, reaction time: 269ms slower for gender match ($t = 4.1, SE^1 = 0.03$)
- ▷ picture selection, accuracy: 4.7% higher for gender match ($z = 3.2, SE = 1.02$)

[1] SE for reaction times on the log scale

Discussion

control type

- ▷ The direction of the effect in line with the cue-based parsing model.
- ▷ Interference effects were reflected in higher listening times and lower accuracies in the subject control condition.
- ▷ Interference effects were manifested in the post-critical region. This is different from the eye-tracking studies of Betancort et al. (2005) and Kwon & Sturt (2016) in which interferences occurred directly at PRO.
- ▷ We found that the control type influenced comprehension accuracy.

argument similarity

- ▷ The direction of the effect is in line with the cue-based parsing model.
- ▷ Interference effects were reflected in higher reaction times and lower accuracies in the gender match condition.
- ▷ We found no early interference effect at the pronoun.
- ▷ Effects occurred only in the question region. This speaks for a late integration effect (Schroeder, 2007): Referents are easier to integrate into discourse if they are more distinct.

References

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