

AIMS OF THE STUDY

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

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

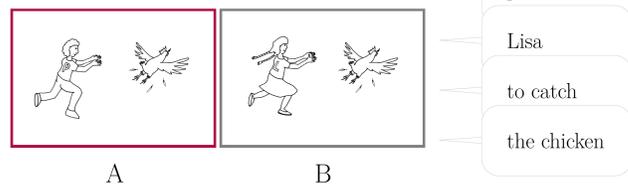
METHODS & DESIGN

participants:

- ▷ n=48 German-speaking healthy adults
- ▷ 18 male, age: 19–83 years, M=49 years

self-paced listening with sentence-picture matching:

Who interacts with the animal?



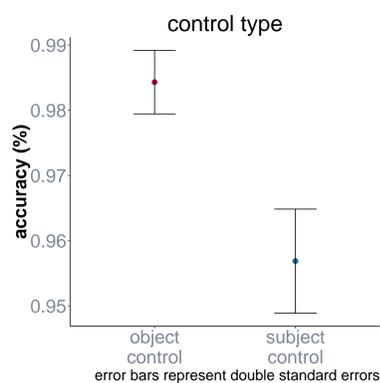
- ▷ n=10 items per condition

outcome measures & statistical analyses:

- ▷ listening times
- ▷ accuracy & RT for picture selection
- ▷ Bayesian linear mixed model (correlated varying intercepts & slopes for subjects & items)

This experiment is preregistered at: <https://osf.io/y28rg/>

RESULTS: ACCURACY



Discussion

control type

- ▷ The sign of the effect is in line with the cue-based parsing model.
- ▷ Interference effects are reflected in higher listening times and lower accuracies in the subject control condition.
- ▷ The estimate at the (post-)critical region is inside the 95% CrI [2, 28] of a meta-analysis on interference effects (Jäger et al., 2017)
- ▷ Interference effects appeared also in the post-critical region, thus differ from the results obtained by Betancort et al. (2005) and Kwon & Sturt (2016) in which interferences occurred directly at PRO.

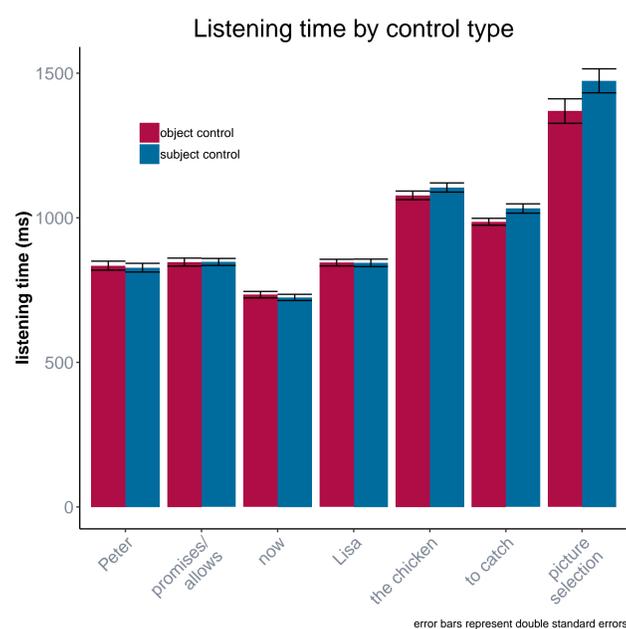
CONTROL STRUCTURES

In the control structures in (1) and (2), the covert subject (*PRO*) is co-indexed with a noun in the main clause (*controller*). The controller can be the subject (1) or the object (2) depending on the control type:

- subject control
Peter_i promises Lisa_j PRO_i to catch the chicken.
- object control
Peter_i allows Lisa_j PRO_j to catch the chicken.

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

RESULTS: LISTENING TIMES...



SUMMARY OF THE RESULTS

Bayesian analysis: reported are mean effect sizes, 95% credible intervals (CrI) and the posterior probability of a parameter being greater or smaller than zero ($P(\beta < 0)$).

listening times

- ▷ critical region *the chicken*:
22ms faster for object control
($\hat{\beta} = -22$, 95% CrI = [-63, 17], $P(\beta < 0) = 86\%$)
- ▷ post-critical region *to catch*:
28ms faster for object control
($\hat{\beta} = -28$, 95% CrI = [-62, 4], $P(\beta < 0) = 96\%$)

inter-individual variability

- ▷ The object control advantage is visible across participants (no participant with subject control advantage).
- ▷ Older participants show more variation in the effect size and the width of the distribution.
- ▷ We found no evidence for an interactive effect of age and control type on listening times or reaction times.

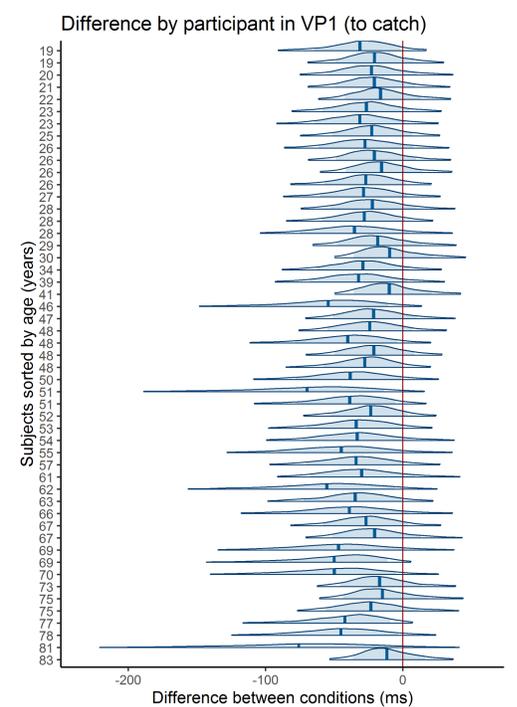
CUE-BASED RETRIEVAL MODEL

At PRO, the controller has to be retrieved from memory to understand the sentence. However, two nouns (e.g. Peter & Lisa) are encoded in memory. The distractor noun slows down the controller's retrieval. This *interference effect* is greater if the distractor is close to PRO.

predictions

- ▷ interference: object control < subject control
- ▷ critical region: PRO (*the chicken*)
- ▷ greater interference in people of higher age (greater influence of target decay on retrieval compared to younger people)

...AT THE POST-CRITICAL REGION



picture selection

- ▷ reaction time:
72ms faster for object control
($\hat{\beta} = -72$, 95% CrI = [-176, 26], $P(\beta < 0) = 86\%$)
- ▷ accuracy:
2.7% higher for object control
($\hat{\beta} = 2.7$, 95% CrI = [0.07, 4.8], $P(\beta > 0) = 99.7\%$)
- influence age**
- ▷ no evidence for age * control type interaction at the post-critical region
($\hat{\beta} = 0$, 95% CrI = [-3, 3], $P(\beta < 0) = 34\%$)
- ▷ no evidence for age * control type interaction in RT
($\hat{\beta} = 0$, 95% CrI = [-3, 3], $P(\beta < 0) = 44\%$)

References

- ▷ Betancort, M., Carreiras, M., & Acuña-Fariña, C. (2006). Processing controlled PROs in Spanish. *Cognition*, 100, 217-282.
- ▷ Jäger, L. A., Engelmann, F., & Vasishth, S. (2017). Similarity-based interference in sentence comprehension: Literature review and Bayesian meta-analysis. *Journal of Memory and Language*, 94, 316-339.
- ▷ Kwon, N., & Sturt, P. (2016). Processing control information in a nominal control construction: an eye-tracking study. *Journal of Psycholinguistic Research*, 45, 779-793.
- ▷ Lewis, R. L., & Vasishth, S. (2005). An activation-based model of sentence processing as skilled memory retrieval. *Cognitive Science*, 29, 375-419.

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