

# Expectation and Memory in Processing of German Verb-final Clauses: Relativization Matters

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## Introduction

- Konieczny (2000) shows that the presence of additional preverbal material can facilitate the processing of clause-final verbs.
- This is an example of an anti-locality effect (e.g., Vasishth & Lewis, 2006); it contradicts standard results showing that pre-verbal dependents increase processing difficulty (e.g., Gibson, 1998).
- Levy (2006) argued that this type of anti-locality result arises as a result of *probabilistic expectations* (Hale, 2001).
- To reconcile these results, we posit that the cost of memory retrieval varies across language and constructions.
- **Hypothesis:** relativization (unbounded dependency construction) involve more resources than clause-local constructions.

## Experiment 1

- This experiment investigated processing difficulty at German clause-final verbs, controlling for the potential confounds present in Konieczny (2000).
- We varied the *type* and *amount* of preverbal material in the matrix clause.
- For our materials, a DATIVE argument serves as a strong indicator for the upcoming verb; an ADJUNCT is a weaker indicator.
- Lexicalization, immediately preverbal material, and sentence position at the critical verb (V\*) are completely controlled.

### Method

- We used a 2 × 2 design crossing the factors, as in (1):
  - a DATIVE phrase appears in the matrix clause (a & b) or the subordinate clause (c & d);
  - an ADJUNCT phrase appears in the matrix clause (a & c) or the subordinate clause (b & d).

(1) a.	As NP <sub>nom</sub>	NP <sub>acc</sub> V	, has NP <sub>nom</sub> (who) PP <sub>adj</sub>	NP <sub>dat</sub> NP <sub>acc</sub> V*	, ...
b.	As NP <sub>nom</sub> PP <sub>adj</sub>	NP <sub>acc</sub> V	, has NP <sub>nom</sub> (who)	NP <sub>dat</sub> NP <sub>acc</sub> V*	, ...
c.	As NP <sub>nom</sub>	NP <sub>dat</sub> NP <sub>acc</sub> V	, has NP <sub>nom</sub> (who) PP <sub>adj</sub>	NP <sub>acc</sub> V*	, ...
d.	As NP <sub>nom</sub> PP <sub>adj</sub>	NP <sub>dat</sub> NP <sub>acc</sub> V	, has NP <sub>nom</sub> (who)	NP <sub>acc</sub> V*	, ...
	subordinate clause		matrix clause (relative clause)		

- There were 24 items instantiating the template in (1). Four lists were constructed using a Latin square.
- Each subjects was assigned one of the lists; the items in the list were presented in random order together with 24 fillers.
- The eye-movements of 28 native speakers were recorded using an Eyelink-II video-based tracker.

### Results and Discussion

- The total reading times for the four conditions are graphed in Figure 1.
- There was a significant main effect of DATIVE in total time ( $F_1(1,27) = 7.287, p = 0.012; F_2(1,23) = 4.532, p = 0.044$ ). This effect was marginal for second pass time and absent in the other measures.
- There was no significant effect of ADJUNCT and no interaction.
- The mere presence of additional material does not have an effect. The constituent has to impose additional constraints on the verb (e.g., dative NP) to facilitate processing.
- Critical-verb reading time was uncorrelated with plausibility (pretest).

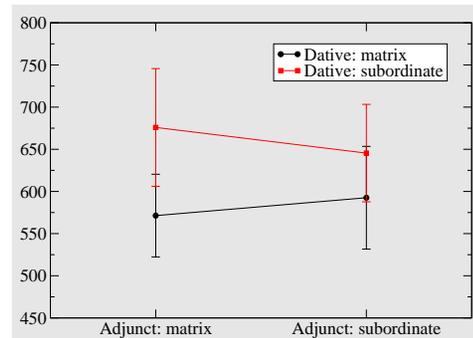


Fig. 1: Total reading time on the final verb in Experiment 1.

## Experiment 2

### Method

- This experiment tested if embedding the critical verb into a relative clause increases memory load.
- The matrix clause in (1) was replaced by a relative clause (insertion of *who*).
- Otherwise, materials and procedure as in Experiment 1.

### Results and Discussion

- The total reading times for the four conditions are graphed in Figure 2.
- Again significant main effect of DATIVE in total time ( $F_1(1,27) = 5.688, p = 0.024; F_2(1,23) = 4.282, p = 0.050$ ). This effect was marginal for second pass time and absent in the other measures.
- No significant effect of ADJUNCT, but interaction DATIVE/ADJUNCT significant in second pass ( $F_1(1,27) = 6.446, p = 0.017; F_2(1,23) = 8.769, p = 0.007$ ) and in total time (significant  $F_1$ , marginal  $F_2$ ).

- There is an anti-locality effect for datives, modulated by a locality effect for adjuncts, but only in relative clauses.
- This suggests that relativization involves a higher memory cost than clause-local dependencies.

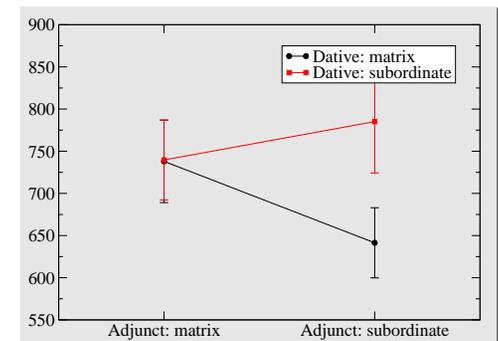


Fig. 2: Total reading time on the final verb in Experiment 2.

## Conclusions

- The anti-locality effects found by Konieczny and others are unlikely to be due to confounds of sentence position, lexicalization, plausibility.
- The facilitative effect of preverbal datives appears in late but not early measures; expectation effects may be similar to Cloze-type predictability effects.
- Preverbal adjuncts have an effect only under conditions of increased memory load, e.g., in relative clauses.
- Then they can show a locality effect that modulates the anti-locality effects of preverbal datives.
- This indicates that memory-based theories of processing complexity (e.g., Gibson, 1998) need to posit differential retrieval costs for constructions.

## References

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