

Locality and anti-locality effects in German: Insights from relative clauses

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Locality effects provide the prime evidence for working-memory constraints on sentence processing: Material intervening between two related elements (e.g., argument and verb) often increases processing difficulty. Yet, sometimes intervening material facilitates processing of the verb (anti-locality effect) (Konieczny, 2000). The present study contributes to the debate on the source and interpretation of locality and anti-locality effects by presenting further evidence from German showing that both effects can co-occur within the same language. Results from three self-paced reading experiments show that unambiguous sentences benefit from additional material and from familiarity of intervening NPs while garden-path strength increases with additional material.

Experiments 1 and 2 investigate the processing of German sentences like (1) which contain an unambiguous relative clause (RC). The two experiments show no penalty for object-extracted RCs (ORCs) as (1b) compared to subject-extracted relative-clauses (SRCs) as (1a). They do, however, show effects of NP-accessibility and length, both independent of RC type (SRC/ORC). Reading times in the second half of the RC are shorter when it contains a first-person pronoun rather than a non-pronominal and therefore less accessible NP (Experiment 1). Length had a positive effect as well: Reading times for the relative clause verb and the subsequent part of the matrix clause are shorter when the adverbial is present (Experiment 2). Experiment 3 concentrates on ORCs and compares unambiguous ORCs (2a) and locally ambiguous ORCs disambiguated by verb agreement (2b). As a second factor, an adverbial phrase is present or not. Reading times in unambiguous sentences replicate the anti-locality effect observed in Experiment 2. Ambiguous sentences, in contrast, show the opposite effect: Reading times in the matrix clause increase when the RC contains an adverbial phrase.

- (1) a. Ich weiß, dass der Patient, der {den Arzt | mich} (letzten Montag) fragte, den Pfleger kritisierte.
I know that the patient who.NOM the doctor me last Monday asked the nurse criticized
'I know that the patient who asked {the doctor|me} last Monday criticized the nurse.'
- b. Ich weiß, dass der Patient, den {den Arzt | ich} (letzten Montag) fragte, den Pfleger kritisierte.
I know that the patient who.ACC the doctor I last Monday asked the nurse criticized
'I know that the patient who {the doctor|I} asked last Monday criticized the nurse.'
- (2) a. Ich weiß, dass der Patient, den die Ärzte (letzten Montag) fragten, den Pfleger kritisierte
I know that the patient.M who.ACC the doctors last Monday asked.PL the nurse criticized
- b. Ich weiß, dass die Patientin, die die Ärzte (letzten Montag) fragten, den Pfleger kritisierte
I know that the patient.F who the doctors last Monday asked.PL the nurse criticized
'I know that the patient who the doctors asked (last Monday) criticized the nurse'

The absence of an SRC-ORC difference contrasts with studies showing a penalty for object-extraction in English (cf. Gibson, 2000) but is in line with previous results for unambiguous sentences in German (e.g., Friederici et al., 1998). This finding is compatible with memory-based accounts emphasizing the role of intervening material: in contrast to English counterparts, German SRCs and ORCs do not differ with respect to dependency lengths. The verb's clause-final position entails that the second argument always intervenes -- between subject and verb in SRCs and between relative pronoun and corresponding gap in ORCs. The anti-locality effect observed in Experiments 2 and unambiguous sentences in Experiment 3 -- additional adverbial phrases decrease reading times -- challenges working-memory accounts based on distance. Yet, the two instances of locality effects -- the pronoun-advantage in Experiment 1 and the stronger garden-path in long sentences in Experiment 3 -- argue in favor of such accounts. The facilitating effect of a pronoun replicates (Warren & Gibson, 2002) and also supports distance-based locality under the DLT's discourse-based definition of distance. The complicating effect of an adverbial in garden-path sentences corresponds to what Frazier & Clifton (1998) called 'visibility' and Tabor & Hutchins (2004) 'digging-in effects' (cf. Levy et al., 2009). Overall, our results argue for combining backward-looking, distance-based integration cost (cf. Gibson, 2000) and forward-looking, prediction-based facilitation (cf., Levy, 2008). Locality effects arise when the processing of the current item requires retrieval of an item processed earlier in the sentence. Retrieval is particularly hard when hampered by ambiguity, and therefore locality affects garden-path sentences in particular. Anti-locality effects, on the other hand, arise when intervening material narrows down the range of possible continuations.