

I. Introduction

Abstract:

We present results from two word-by-word self-paced reading experiments in German showing that the complexity of *wh*-fillers vs. non-*wh*-fillers (topicalized phrases, or ‘TOP-fillers’) in long-distance dependencies has differential processing effects, although from a syntactic point of view the two extraction types should involve the same displacement operations.

Wh-extraction: Processing of filler-gap-dependencies with *wh*-fillers has been shown to be sensitive to the complexity of the *wh*-filler (bare *wh*-word / *which*-NP phrase).

▶ Type A findings:

In Dutch, complex *wh*-fillers incur longer reading times at the gap site than bare *wh*-words (Donkers, Hoeks, and Stowe, 2013).

In English, complex *wh*-fillers in object questions cause greater processing difficulties in various tasks for children and aphasics (Avrutin, 2000; Goodluck, 2005; Shapiro, 2000).

▶ Type B findings:

In English, bare *wh*-words incur longer reading times at the gap site than complex *wh*-fillers (Hofmeister and Sag, 2010).

Topicalization: Filler complexity has not been explored. Relevant related findings:

- ▶ *Wh*-and TOP-fillers of equal complexity in German: higher integration costs (P600) for *wh*-filler at the clause-final verb but no differences earlier in the clause (Felsler, Clahsen, and Münte, 2003).
- ▶ German object fronting: higher processing costs throughout the clause in comparison to subject-initial clauses → suggested to be effect of storage costs in working memory (Weskott, 2003; Matzke et al., 2002)
- ▶ Galician complex sentences with fronted objects: prolonged reading times → suggested to be reflecting active search for integration site (Pablos, 2006).

II. Method and Materials

Two word-by-word self-paced reading experiments 60 participants. Dependent variable: reading times. Conditions: SIMPLE/COMPLEX filler.

Exp 1: 40 item, 92 fillers. **SIMPLE:** bare *wh*-word; **COMPLEX:** *which*-phrase with adjective or with adjective + adverb

Wh-questions (preceded by a context sentence)

Wen/ Welchen schwer kranken Jungen hat Jim gesagt, dass der Fahrer [VP GAP mit einem Wagen abgeholt hat] und ...
 who.ACC which.ACC seriously ill.ACC boy.ACC has Jim said that the driver GAP with a car picked.up has and ...

Who/Which seriously ill boy did Jim say that the driver picked up in a car and ...

Exp 2: 42 items, 90 fillers. **SIMPLE:** indefinite NP without modifiers; **COMPLEX:** indefinite NP with adjective or with adjective + adverb

Topicalization

Einen Jungen/ Einen schwer kranken Jungen hat Jim gesagt, dass der Fahrer [VP GAP mit einem Wagen abgeholt hat] und ...
 a.ACC boy.ACC a.ACC seriously ill.ACC boy.ACC has Jim said that the driver GAP with a car picked.up has and ...

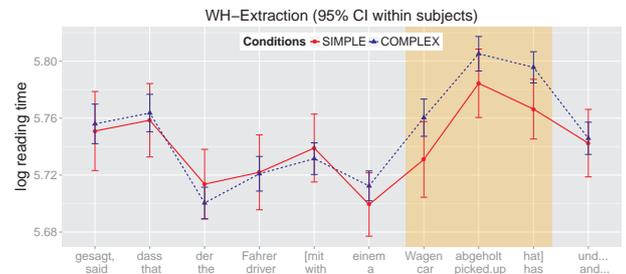
A boy/A seriously ill boy Jim said, that the driver picked up in a car and ...

In both experiments, a gap site can be postulated well before the subcategorizing verb: before the PP, at the VP boundary (cf. e.g. Felsler, Clahsen, and Münte, 2003).

III. Results and Discussion

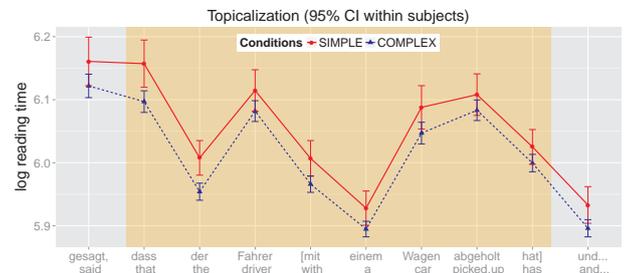
Wh-extraction: longer RTs for the complex *wh*-filler, spanning from the noun in the PP (*Wagen*) until the clause-final auxiliary (*hat*).

- ▶ Filler complexity effects arise when a gap can be postulated: from the VP boundary onwards.
- ▶ Filler complexity modulates filler reactivation/retrieval.
- ▶ Finding that higher complexity leads to longer RTs, groups with type A findings above: during reactivation the conceptual properties of the filler are re-accessed, which is more costly for more complex fillers.



Topicalization: complex fillers lead to shorter RTs than simple fillers from the beginning of the embedded clause (*dass*) until the clause-final auxiliary (*hat*).

- ▶ Filler complexity effects arise earlier than in *wh*-extraction.
- ▶ Filler complexity modulates processing dynamics of entire embedded clause → TOP-fillers are held actively in memory until they can be integrated rather than being reactivated at the gap site.
- ▶ Advantage of more complex fillers is expected by interference theory for memory representations: the more (unique) cues are provided to identify an element in memory the more robust that element is for incoming competitors (cf. e.g. Vasishth and Lewis, 2006).



IV. General Discussion

Two processing mechanisms

The observation that the modulation of filler complexity leads to different effects in the two structurally identical environments suggest that the semantics of the fillers (question word, indefinite NP) leads to different processing mechanisms.

Topicalization

We propose that an indefinite NP denotes a semantic object that corresponds to a discourse referent in memory in the sense of Gibson (1998).

- ▶ Discourse referents are actively held in memory until they are fully processed.
- ▶ Every incoming phrase interferes with this memory representation.
- ▶ A more specific element is more robust against interference.

Wh-questions

A *wh*-question word, in contrast, does not denote a semantic object that corresponds to a discourse referent but to a memory index.

- ▶ At the gap site the content of the index is reaccessed/reactivated.
- ▶ Reactivation of more complex information is more costly than reactivation of less complex information.

Filler complexity in filler-gap dependencies: wh-extraction vs. topicalization

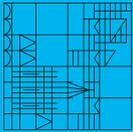
Constantin Freitag & Sophie Repp
Universität Konstanz
Humboldt-Universität zu Berlin

Presented at the 28th CUNY Conference
on Human Sentence Processing,
March 2015,
University of Southern California, Los Angeles

– constantin.freitag@uni-konstanz.de –



Universität
Konstanz



References

- Avrutin, Sergey (2000). “Comprehension of Discourse-Linked and Non-Discourse-Linked Questions by Children and Broca’s Aphasics”. In: *Language and the Brain. Representation and Processing*. Ed. by Yosef Grodzinsky, Lewis P. Shapiro, and David Swinney. San Diego: Academic Press, pp. 295–313.
- Donkers, Jantien, John C. J. Hoeks, and Laurie A. Stowe (2013). “D-Linking or Set-Restriction? Processing Which-Questions in Dutch”. In: *Language and Cognitive Processes* 28.1-2, pp. 9–28.
- Felser, Claudia, Harald Clahsen, and Thomas F. Münte (2003). “Storage and Integration in the Processing of Filler-Gap Dependencies: An ERP Study of Topicalization and Wh-Movement in German”. In: *Brain and Language* 87.3, pp. 345–354.
- Gibson, Edward (1998). “Linguistic Complexity: Locality of Syntactic Dependencies”. In: *Cognition* 68, pp. 1–76.
- Goodluck, Helen (2005). “D(iscourse)-Linking and Question Formation. Comprehension Effects in Children and Broca’s Aphasics”. In: *UG and External Systems. Language, Brain and Computation*. Ed. by Anna Maria Di Scullo. Amsterdam: John Benjamins, pp. 185–192.
- Hofmeister, Philip and Ivan Sag (2010). “Cognitive Constraints and Island Effects”. In: *Language* 86.2, pp. 366–415.
- Matzke, Mike et al. (2002). “The costs of freedom: an ERP – study of non-canonical sentences”. In: *Clinical Neurophysiology* 113.6, pp. 844–852.
- Pablos, Leticia (2006). “Pre-Verbal Structure Building in Romance Languages and Basque”. PhD thesis. College Park: University of Maryland.
- Shapiro, Lewis P. (2000). “Some Recent Investigations of Gap Filling in Normal Listeners: Implications for Normal and Disordered Language Processing”. In: *Language and the Brain. Representation and Processing*. Ed. by Yosef Grodzinsky, Lewis P. Shapiro, and David Swinney. San Diego: Academic Press, pp. 357–376.
- Vasishth, Shravan and Richard L. Lewis (2006). “Argument-Head Distance and Processing Complexity: Explaining Both Locality and Antilocality Effects”. In: *Language* 82.4, pp. 767–794.
- Weskott, Thomas (2003). “The Left Periphery of German Verb-Second Sentences and Its Interpretation in Context”. PhD thesis. Universität Leipzig.