AGAINST USAGE-BASED APPROACHES TO RECURSION: THE GRAMMAR-PERFORMANCE DISTINCTION IN A BIOLINGUISTIC PERSPECTIVE

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THE GRAMMAR-PERFORMANCE DISTINCTION

... in a biolinguistic perspective
“To study actual linguistic performance, we must consider the interaction of a variety of factors, of which the underlying competence of the speaker-hearer is only one. [...] We thus make a fundamental distinction between competence (the speaker-hearer’s knowledge of his language) and performance (the actual use of language in concrete situations). [...] in the technical sense, linguistic theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior.” (Chomsky 1965: 4)

... in a usage-based perspective
“[...] grammar is the cognitive organization of experience with language. [...] Grammar cannot be thought of as pure abstract structure that underlies language use [...]. Grammar is built up from specific instances of use that marry lexical items with constructions; it is routinized and entrenched by repetition and schematized by the categorization of exemplars.” (Bybee 2006: 730)
THE GRAMMAR-PERFORMANCE DISTINCTION

A prominent argument in favor of the grammar-performance distinction:

Multiple center-embedding cannot successfully be interpreted despite being generable by the grammar.

(1) The rat the cat the dog chased killed ate the malt. (Chomsky & Miller 1963: 286)

Claim: Such sentences are quite incomprehensible, but this has no bearing on the possibility of generating them on the level of grammar.

Chomsky’s (1963: 327) analogy: “the inability of a person to multiply 18,674 times 26,521 in his head is no indication that he has failed to grasp the rules of multiplication.”
THE GRAMMAR-PERFORMANCE DISTINCTION

However, usage-based approaches do not accept this line of reasoning.

“[…] from the point of view of modeling psychological processes, we need not take the purported unbounded recursive structure of natural language as axiomatic. Nor need we take for granted the suggestion that a speaker/hearer’s knowledge of language captures such infinite recursive structure. Rather, the view that ‘unspeakable’ sentences which accord with recursive rules form a part of the knowledge of language is an assumption of the standard view of language developed by Chomsky.” (Christiansen & Chater 1999: 158)

We took up this issue by focusing on certain properties of the processing of multiple center-embeddings, thereby investigating some of the relevant ‘psychological processes’ Christiansen & Chater (1999) allude to.
PROCESSING GRAMMATICAL AND UNGRAMMATICAL CENTER-EMBEDDINGS

(Frazier 1985: 178)

(2) a. The patient the nurse the clinic had hired sent to the doctor met Jack.

   b. * The patient the nurse the clinic had hired __ met Jack.

Multiple center-embeddings missing the second VP are often accepted as grammatical.

This **missing-VP effect** is experimentally confirmed for English (Gibson & Thomas 1999; Vasisht et al. 2010) and for French (Gimenes et al. 2009). For English, Christiansen & MacDonald (2009) even found that cases like (2b) are rated better than cases such as (2a).
PROCESSING GRAMMATICAL AND UNGRAMMATICAL CENTER-EMBEDDINGS

However, for German, Vasishth et al. (2010) claim that the missing-VP effect does not exist.

Vasishth et al. (2010: 550)

(3) a. Der Anwalt, den der Zeuge, den der Spion betrachtete, schnitt, überzeugte
den Richter.
   the lawyer who the witness who the spy looked-at cut convinced
den Richter.
   the judge

b. * Der Anwalt, den der Zeuge, den der Spion betrachtete, __ überzeugte
den Richter.
   the lawyer who the witness who the spy looked-at convinced
den Richter.
   the judge
PROCESSING GRAMMATICAL AND UNGRAMMATICAL CENTER-EMBEDDINGS

Results from Vasishth et al.’s (2010) self-paced reading study:

**English**

Results from Vasishth et al.’s (2010) self-paced reading study:

**German**

Results from Vasishth et al.’s (2010) self-paced reading study:
A prominent explanation for the missing-VP effect

The working-memory overload account:
Forgetting the prediction of the second VP reduces working-memory load. The comprehender’s acceptance of (or even preference for) the ungrammatical structure is due to memory overload induced by distance (Gibson & Thomas 1999; Gibson 2000).

However, language-independent working-memory constraints seem to offer no explanation for the purported absence of the missing-VP effect in German.
A usage-based explanation for the missing-VP effect

The experience-based account:
“[…] constraints on recursive regularities do not follow from extrinsic limitations on memory or processing; rather they arise from interactions between linguistic experience and architectural constraints on learning and processing […], intrinsic to the system in which the knowledge of grammatical regularities is embedded.” (Christiansen & MacDonald 2009: 127)

Claim: Due to the head-finality of German relative clauses, German readers have a stronger expectation of a VP. The missing-VP effect is thus due to experience with language-specific structures.
THE MISSING-VP EFFECT IN GERMAN

The results of Vasishth et al. (2010) and the claim by Christiansen & MacDonald (2009) contrast with our own experimental results (Bader, Bayer & Häussler 2003).

However, Bader, Bayer & Häussler (2003) used different sentence structures (4) and a different experimental procedure (end-of-sentence speeded grammaticality judgments; cf. Warner & Glass 1987).

(4) Heute morgen ist das Programm, das den Programmierer, der die Dokumentation völlig ohne irgendeine Hilfe erstellen musste, abgestürzt.

We therefore run a new experiment with the same procedure as Christiansen & MacDonald (2009) and the same sentence structures as Vasishth et al. (2010).
THE MISSING-VP EFFECT IN GERMAN

Experiment

Procedure:
- Word-by-word self-paced reading with mid-screen presentation
- Word-by-word grammaticality judgments (go – no-go)
- End-of sentence rating task on a scale from 1 (very good) to 7 (very bad)

Materials:
10 sentences in two versions each: complete or missing-VP

Sentences with doubly center-embedded relative clauses in SpecCP
(5) a. Der Chef, den der Angestellte, den die Sekretärin liebt, betrügt, betritt den Raum.
   the boss who the criminal who the secretary likes betrays enters the room

   b. Der Chef, den der Angestellte, den die Sekretärin innig liebt, __ betritt den Raum.
   the boss who the criminal who the secretary devotedly likes enters the room
THE MISSING-VP EFFECT IN GERMAN

Results:
THE MISSING-VP EFFECT IN GERMAN

Results:

Mean end-of-sentence ratings (1=very good, 7=very bad)

<table>
<thead>
<tr>
<th></th>
<th>Accepted</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>3.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Missing VP</td>
<td>4.0</td>
<td>5.9</td>
</tr>
</tbody>
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COMPARISON OF ENGLISH AND GERMAN

**English**

![Cumulative Rejection Profile for Experiment 4](image)

**German**

![Percentage rejection](image)

(Christiansen & MacDonald 2009: 148)

**Results:**
- The rejection rates are substantially higher for English than for German.
- Missing-VP cases in German were not rejected significantly more than complete center-embeddings.
COMPARISON OF ENGLISH AND GERMAN

Grammatical prediction error (GPE; cf. Christiansen & Chater 1999):
- measure of processing difficulty used by simple recurrent networks
- ranges from 0 (very easy) to 1 (very difficult)

→ High predictability means low GPEs. For German, V1 is predictable. Thus, the missing-VP effect, according to these connectionist models, should not exist.

→ In contrast, we found that the missing-VP effect in German does exist (although processing center-embeddings in general seems to be easier in German than in English).

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>German</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>0.98</td>
<td>0.56</td>
</tr>
<tr>
<td>Missing</td>
<td>0.86</td>
<td>0.56</td>
</tr>
</tbody>
</table>

V1
COMPARISON OF ENGLISH AND GERMAN

Interim Conclusions:

- The missing-VP effect appears in both English and German. Thus, it is not a reaction to the particular configuration created by a language-specific word order.

- Language-independent working-memory constraints seem to offer an adequate explanation for the missing-VP effect; usage-based models do not provide us with a full picture of processing center-embeddings.

- Since constraints on multiple center-embedding can thus be explained by extrinsic limitations on processing (cf. Miller & Chomsky 1963), there is no reason to question the grammar-performance distinction.
According to Chomsky (2005: 6), three factors have to be explored when one aims at an explanation of language design:

- The genetic endowment (= UG)
- Linguistic experience
- Principles not specific to the language faculty

Third factor:
“[...] (a) principles of data analysis that might be used in language acquisition and other domains; (b) principles of structural architecture and developmental constraints [...] including principles of efficient computation.” Chomsky (2005: 6)
“[...] properties of the human brain that determine what cognitive systems can exist.” (Chomsky 2007: 3, fn. 4)

We argue in Trotzke, Bader & Frazier (2013) that systematic properties of performance systems provide third-factor explanations for crucial design features of human language.
The systematicity of the language processing system

The Missing-VP effect also occurs in language production.

Corpus study: deWaC corpus (cf. Baroni et al. 2009)
- Corpus of written German built by web crawling
- 1.600.000.000 tokens of text in roughly 92.000.000 sentences
- Size enhances the chance of obtaining quantitative information even for low-frequency constructions like multiple center-embeddings.

Result:
In the case of doubly center-embedded relative clauses contained within an embedded clause, VP2 was missing in about 15% of all cases.
THE PERFORMANCE INTERFACE IN LANGUAGE DESIGN

The systematicity of the language processing system

Missing-VP example

(6) Dieser Typ entsteht, wenn lin-3 oder ein Gen, das für die Induktion, die von der Ankerzelle
this type emerges when lin-3 or a gene that for the induction that from the anchor-cell
ausgeht, __ mutiert ist.
originates mutated is
‘This type emerges when lin-3 or a gene that for the induction that originates
from the anchor cell __ has mutated.’
(Dewac-1/95201, http://www.zum.de)

* The VP of the lower relative clause was almost never omitted (0,2%).
* The VP of the superordinate clause was missing only in a small number of cases (2,2%).

→ In accordance with Frazier (1985: 178-179), the missing-VP effect only arises
when the VP of the highest relative clause is missing.
CONCLUSION

- The regularities involved in the missing-VP effect are language-independent, since they are not a reaction to language-specific word order; there are no dramatically different processing systems in different languages.

- Since we presented converging data from language comprehension and language production, the extrinsic constraints on recursive center-embedding are deep and systematic.

- The performance systems, beside the grammar, constitute a distinct cognitive component of biolinguistic inquiry, since the constraints they impose on the grammar are not random but characteristic. Therefore, systematic properties of performance systems belong to the domain of third-factor effects.
THANK YOU!
REFERENCES


Bybee, Joan. 2006. From usage to grammar: The mind’s response to repetition. Language 82, 711–733.


REFERENCES


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