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An integrative constraint-based account of constituent linearization in the German midfield

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1. Introduction

1.1. Flexible constituent ordering in the German midfield

- The ordering of constituents is relatively flexible in the German midfield (all variants in (1) are grammatical and truth-conditionally equivalent, cf. Frey 2015).

- (1) a. *Zu Weihnachten wird der Mitarbeiter der Chefin eine Opernkarte schenken.*
for Christmas will the.NOM employee the.DAT.F boss a.ACC opera.ticket give
b. *Zu Weihnachten wird der Mitarbeiter eine Opernkarte der Chefin schenken.*
c. *Zu Weihnachten wird eine Opernkarte der Mitarbeiter der Chefin schenken.*
d. *Zu Weihnachten wird der Chefin der Mitarbeiter eine Opernkarte schenken.*
e. *Zu Weihnachten wird der Chefin eine Opernkarte der Mitarbeiter schenken.*
f. *Zu Weihnachten wird eine Opernkarte der Chefin der Mitarbeiter schenken.*
'The employee will give the boss an opera ticket for Christmas.'

- Holds for arguments as well as for adverbials:

- (2) *Ich habe gehört, dass er*
I have heard that he
a. *mit einer Pinzette einem Jungen einen Splitter aus der Hand gezogen hat.*
with a pair.of.tweezers a.DAT boy a.ACC splinter out.of the hand removed has
b. *einem Jungen mit einer Pinzette einen Splitter aus der Hand gezogen hat.*
c. *einem Jungen einen Splitter mit einer Pinzette aus der Hand gezogen hat.*
'I have heard that he removed a splinter from a boy's hand using a pair of tweezers.'

- Changes in linearization may have reflexes in e.g. information structure, scope interpretation and binding possibilities (see a.o. Frey 2015).
- *normal order*: contextually least restricted (among sentences differing only in constituent order and/or intonation) (Höhle 2019/1982)

1.2. Accounts of argument linearization

Base generation (a.o. Fanselow 2001; 2003)

- arguments of a head can be realized in (almost) any order $\Rightarrow$ no fixed base order

Base order & movement (a.o. Frey 1993; Müller 1999; Haider & Rosengren 2003; Hinterhölzl 2004; Struckmeier 2017)

- arguments must be combined with the verbal projection in a specific order
- many differences between accounts: base order predicate-dependent? base order = normal order? Landing site? Triggered (if yes: which feature)? ...

Factors influencing linearization descriptively:

- long research tradition (a.o. Lenerz 1977; Hoberg 1997; Kempen & Harbusch 2003)

- taken up as triggers for scrambling, but also in optimality theoretic work (a.o. Müller 1999; Keller 2000) which is in principle compatible with base-generation (e.g. Choi 1999), as well as with base-order approaches (e.g. Müller 1999)
 - one or more unmarked order(s), and several suboptimal orders (varying in degree)
- Recent experimental work on constraint hierarchy (Ellsiepen & Bader 2018):¹
NOMINATIVE < ACCUSATIVE >
ANIMATE < INANIMATE >
DEFINITE < INDEFINITE >
AGENT < NON-AGENT >
NOMINATIVE < DATIVE >
DATIVE < ACCUSATIVE >
RECIPIENT/GOAL/BENEFACTIVE < THEME

1.3. Accounts of adverbial linearization

Base generation (Hetland 1992):

- The positioning of adverbials is completely unconstrained.

Semantic accounts (Haider 2000; Ernst 2001):

- constrained base-generation: Adverbials can be freely base-generated in relation to arguments, but there are linearization restrictions among adverbials of different classes.

Base order & scrambling (Frey & Pittner 1998; Maienborn 2001; 2003; Frey 2003; Pittner 2004):

- (Classes of) adverbials occupy base positions relative to the hierarchically ordered argument slots.
- Base positions are formulated in terms of class-specific properties.

Basic assumptions:

- adverbial classes: adverbials relate to different semantic domains
- adverbial hierarchy : SPEECH ACT > PROPOSITION > EVENT > INTERNAL > PROCESS

1.4. Our proposal

The positional flexibility of arguments and adverbials in German should be accounted for in terms of a unified account. Frey (2015): unified approach to constituent ordering in terms of base positions & scrambling

Proposed alternative account:

- base generation of both arguments and adjuncts
- base generated orders are subject to violable linear precedence (LP) constraints
- model of constraint interaction: Maximum Entropy Grammar (Goldwater & Johnson 2003; Hayes 2022)

Empirical evidence: experimental data from two offline studies

- event-internal adverbials (some adverbial types adhere to the same constraints as arguments).
- experiencer-object (EO) verbs (some dative EO-verbs with animate subjects show no preference for a specific order, animacy of subject makes a difference)

2. Experimental studies

2.1. Forced Choice study on event-internal adverbials

Study from Kiss, Pieper and Börner (under review)

¹ Ordering based on constraint weights (Ellsiepen & Bader 2018: 28). Constraint names slightly adapted.

Event-internal adverbials:

- event-internal adverbials relate to a participant in an event (variable orientation: SUBJ vs. OBJ).
- encode additional thematic roles

Focus on two adverbial types (both subject-oriented)

- instrumentals (INSTR): concrete entities used intentionally as means for an end (role: instrument)

(3) *Der Häftling hat einen Wärter mit einer Axt verletzt.*
 the.NOM inmate has a.ACC jailor with a.DAT axe harmed
 ‘The inmate harmed the jailor with an axe.’

- subject-oriented comitatives (COM(S)): co-presence and co-involvement in an action (role: co-agent (here))

(4) *Er verreist zusammen mit einem Freund.*
 he travels together with a.DAT friend
 ‘He and a friend go on a journey.’

Design: ANSWER(PP<OBJ, OBJ<PP) ~ ADVERBIAL_TYPE(COM(S), INSTR) × SENSE(affirmative, privative)

Test environment: existential *wh*-indefinites (scrambling resistant, Diesing 1992; Haider 2010)

Minimal pair for affirmative COM(S):

- (5) a. *Ich habe gehört, dass ein Minister zusammen mit einem General was unterschrieben hat.*
 I have heard that a minister together with a general something signed has
Was es war, weiß ich aber nicht.
 what it was know I but not
 ‘I have heard that a minister signed something together with a general. But I don’t know what it was exactly.’
- b. *Ich habe gehört, dass ein Minister was zusammen mit einem General unterschrieben hat. Was es war, weiß ich aber nicht.*

Minimal pair for privative COM(S):

- (6) a. *Ich habe gehört, dass ein Offizier ganz ohne einen Berater was entschieden hat.*
 I have heard that a officer entirely without a counsellor something decided has
Was es war, weiß ich aber nicht.
 what it was know I but not
 ‘I have heard that an officer decided something without a counsellor. But I don’t know what it was exactly.’
- b. *Ich habe gehört, dass ein Offizier was ganz ohne einen Berater entschieden hat. Was es war, weiß ich aber nicht.*

72 items (1 list: 24 test pairs, 48 filler pairs), 33 participants (Prolific)

Predictions:

- Frey & Pittner (1998), Frey (2003): general preference for PP<OBJ (minimal c-command condition)
- Maienborn (2001): general preference OBJ<PP
- Haider (2000): no preference

Results:

- Affirmative COM(S) prefer PP<OBJ
- All other conditions: preference OBJ<PP

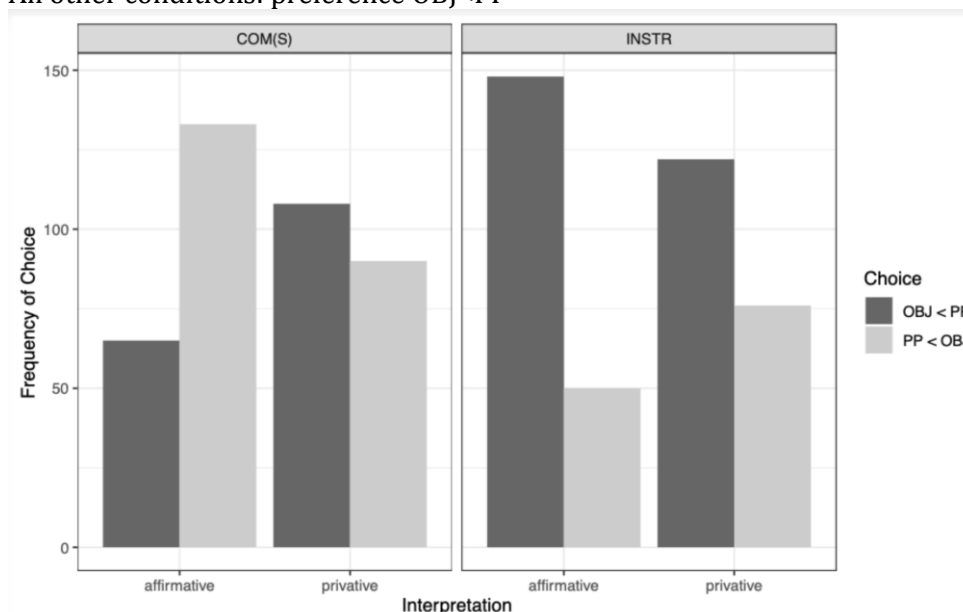


Figure 1: Frequency of choices Forced Choice study adverbials

Discussion:

- subject-oriented event-internal modifiers neither behave uniformly across types, nor across senses
- no evidence for base-positions (contra base-position accounts)
- ordering is not fully unconstrained (contra semantic accounts)
- type/sense-specific results suggest the influence of violable LP-constraints
 - OBJ < INSTR (affirmative & privative): NP < PP
 - OBJ < privative COM(S): NP < PP, *ANIMATE < INANIMATE
 - affirmative COM(S) < OBJ: ACTOR < NON-ACTOR, ANIMATE < INANIMATE, *NP < PP
assumption: affirmative COM take over the thematic role of a c-commanding argument

2.2. The normal argument order of EO verbs

Studies from Masloch, Poppek and Kiss (under review)

- psych verb: characterized by an entailment about the mental state of an experiencer
- experiencer-object (EO) verbs: psych verbs that realize the experiencer as their object: *to frighten, to please, to annoy,...*
- subdivided according to case of object: Accusative / dative EO (Belletti & Rizzi 1988)
- normal order:
 - Dative: object before subject (OS) (near consensus: see a.o. Lenerz 1977; Fanselow 1992; Wegener 1999; Haider & Rosengren 2003; Temme & Verhoeven 2016; but see Lötscher 1981; Barðdal et al. 2014)
 - (non-agentive) accusative: disputed. Theoretical literature often assumes OS (a.o. Lenerz 1977; Haider & Rosengren 2003), experimental literature favours subject before object (SO) (a.o. Scheepers et al. 2000; Temme & Verhoeven 2016; Ellsiepen & Bader 2018)

Common features of studies:

- Forced Choice studies, choices vary in order of subject and object
- target clauses embedded in a matrix clause ($\Rightarrow$ verb-last clauses to avoid possible prefield effects) and presented together with an introductory question (designed to make the context as neutral as possible information-structure-wise)
- example (from study A):

(7) *Was hat Marek berichtet?*

‘What did Marek report?’

(8) a. *Marek hat berichtet, dass ein Resultat einen Forscher verblüfft hat.*

Marek has reported that a.NOM result a.ACC researcher baffled has

b. *Marek hat berichtet, dass einen Forscher ein Resultat verblüfft hat.*

‘Marek reported that a result baffled a researcher.’

Study A

- inanimate subjects
- FC(ORDER) ~ CASE
- 8 lexicalizations per condition: 16 test items (+ 66 fillers), one list
- 40 participants recruited via Prolific (11 excluded following pre-specified exclusion criteria)
- Predicted preferences (based on literature, mainly Temme & Verhoeven’s 2016 similar study):
 - accusative: SO (perhaps only mild preference)
 - dative: OS

Study B

- Animate subjects
- FC(ORDER) ~ AGENTIVITY $\times$ CASE
- 8 lexicalizations per condition: 32 test items (+ 64 fillers), one list
- Each verb used twice (for lack of suitable verbs)
- 33 participants recruited via Prolific (8 excluded following pre-specified exclusion criteria)
- Predicted preferences:
 - action verbs, accusative EO: SO
 - dative EO: OS

Results:

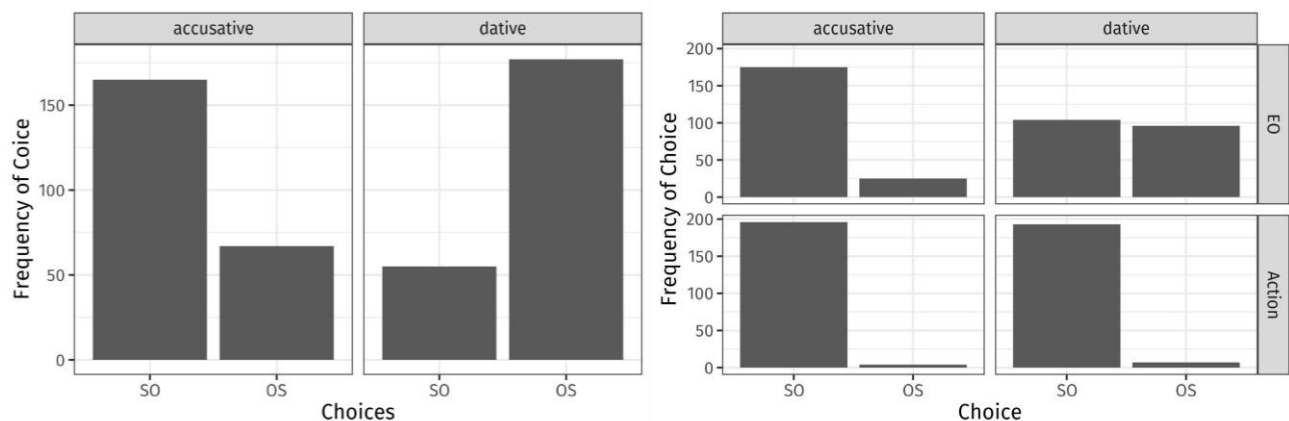


Figure 2: Frequencies of choice Forced Choice studies experiencer-object/action verbs. Left: study A, right: study B.

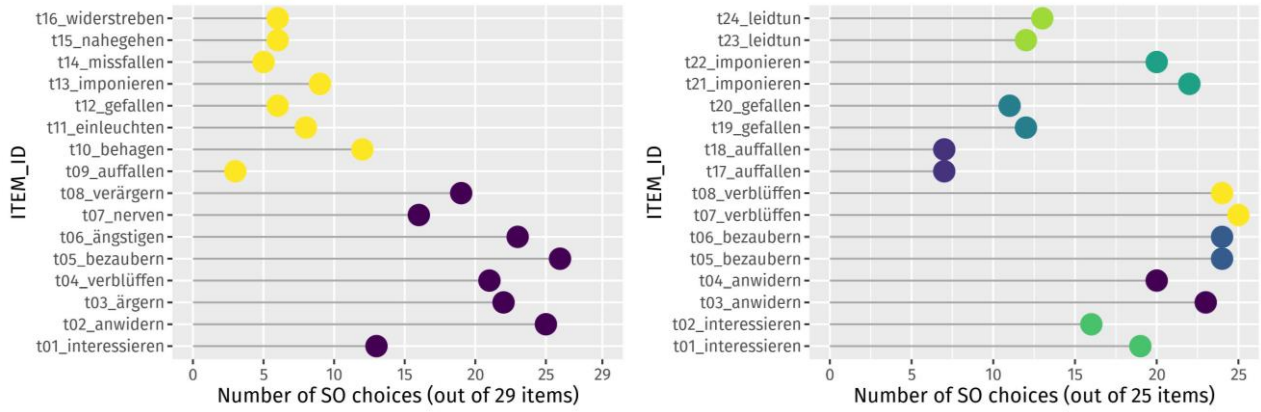


Figure 3: Frequencies of choice individual items studies on experiencer-object/action verbs. Left: study A (yellow dots: dative EO, mauve dots: accusative EO), right: study B (Dots have identical colour if items contained the same verb. t01–t07: accusative EO, t17–t24: dative EO. only data for experiencer-object verbs shown. With action verbs, SO is chosen almost always.)

Discussion

- At least some verbs have more than one normal order (not impossible to implement, but *prima facie* unexpected on base-order theories equating base and normal order)
- Animacy seems to be a crucial factor, but the strategy to reduce apparent animacy effects to ambiguity of the verb and different thematic roles (cf. e.g. Haider & Rosengren 2003: 218 sqq.; Frey 2015: 531) seems inviable here
- differences between classes: accusative EO causative, dative EO not (see e.g. Rothmayr 2009; Marelj 2013; Hirsch 2018). Rather, their object is an object of emotion in Pesetsky's (1995) terms.
- There seem to be exceptions (*interessieren* 'to interest', *imponieren* 'to impress')

3. Modelling the data

Basic assumptions

- Binary-branching verbal projection, no functional projections between C and maximal verbal projection, which contains the subject (Haider 2010)
- Arguments and adjuncts may combine with the verb in any order in principle
- Ordering subject to violable and interacting constraints

To model constraint interactions, we will use Maximum Entropy Grammar (Goldwater & Johnson 2003), a probabilistic variant of Optimality Theory / Harmonic Grammar assuming weighted constraints

(10) (Goldwater & Johnson 2003: 114)

$$P(y|x) = \frac{1}{Z(x)} \exp \left(\sum_{i=1}^m w_i f_i(y, x) \right), \text{ where}$$

$$Z(x) = \sum_{y \in Y(x)} \exp \left(\sum_{i=1}^m w_i f_i(y, x) \right)$$

$f_i(y, x)$: number of times candidate y violates constraint number i in context x ; w_i : weight of constraint number i ; m : total number of constraints; $Y(x)$: set of candidates

(Probability of candidate = exponentiated sum of weighted constraint violations divided by sum of exponentiated sums of weighted constraint violations for all candidates.)

We assume the following constraints to be among the linear precedence constraints of German:

- ACTOR < NON-ACTOR (ACT)
- CAUSER < NON-CAUSER (CAUS)
- ANIMATE < INANIMATE (ANIM)
- NP < PP (NPPP)
- (OBJECT OF UNACCUSATIVE VERB < SUBJECT OF UNACCUSATIVE VERB (UNACC))

Weights:

- EO argument order studies: participants could choose between all relevant alternatives, factors influencing argument order not inherent to the design controlled for $\Rightarrow$ We can use data to compute constraint weights: ACT: 3.4, CAUS: 2.4, ANIM: 1.1, UNACC: 0.8
- Adverbial modification: some possible (but clearly unacceptable) options not presented to the participants. Computing weights from the missing values is only possible by stipulating values. Ranking is possible: ACT (+CAUSE) > NPPP > ANIM

4. Conclusion

4.1. Summary

Motivated by the observations that...

- the linearization of adverbials is not completely free and adverbials do not have fixed base positions: if an adverbial takes over a thematic role, this influences its linearization,
- animacy influences linearization even where postulating polysemy of the predicate seems implausible,
- some verbs do not have a preferred argument order in a neutral setting,

we argued for a model in which clause-level constituents are freely base-generated, but orders are subject to violable linearization constraints and compete with each other.

4.2. Open Questions

- Where does optimization take place? Each node, each full phrase, sentence,...?
- Full list of factors
- Scope, variable binding
- Focus

Abbreviations

ACT: ACTOR < NON-ACTOR, ANIM: ANIMATE < INANIMATE, CAUS: CAUSER < NON-CAUSER, COM(S): subject-oriented comitative, EO: experiencer-object, INSTR: instrumental, LP: linear precedence, NPPP: NP < PP, OBJ: object, OBJ<PP: object before PP, OS: object before subject, PP<OBJ: PP before object, SO: subject before object, SUBJ: subject, UNACC: OBJECT OF UNACCUSATIVE VERB < SUBJECT OF UNACCUSATIVE VERB

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