Processing of Ambiguous Degree Constructions in German

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Research Goals

General:

- Test predictions arising from standard degree analysis empirically
- Test whether complexity predictions from semantic theory can be seen in processing

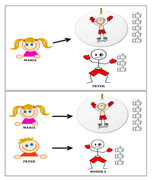
Concrete:

- Test processing of ambiguous attributive comparisons
- See whether movement distance matters in case of degree quantifiers (QR at work!)

Two Readings of Attributive Comparatives in German

- The sentence in (1) is **ambiguous** between the attributive **DP-internal** (INT) and **DP-external** reading (EXT) (cf. Lerner & Pinkal 1995):

(1) *Maria kennt* [*einen besseren Boxer*] *als Peter.*
Maria knows [a better boxer]-ACC than Peter

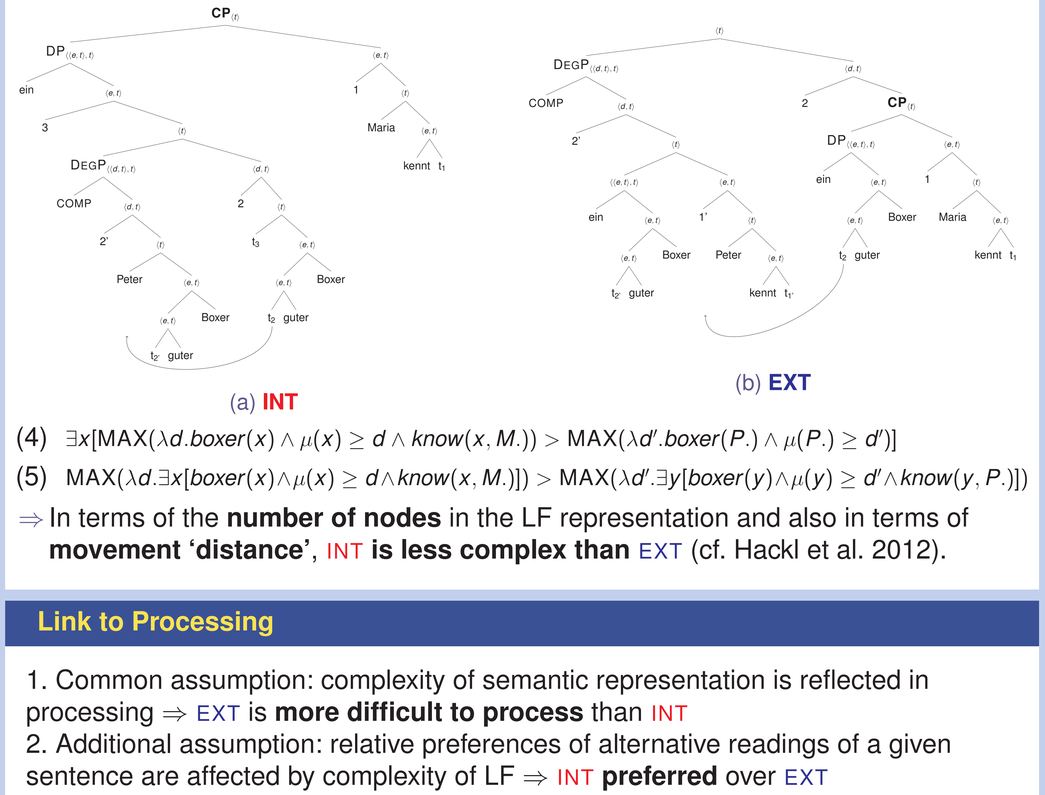


INT: 'Maria knows a boxer who is a better boxer than Peter.'
EXT: 'Maria knows a boxer who is better than any boxer Peter knows.'

Theoretical Background

- The standard degree analysis (cf. e.g. Heim 2001) treats the comparative operator, COMP in (2), as a generalized quantifier over degrees (type $\langle\langle d,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$).

(2) $[\![\text{COMP}]\!] = \lambda D.\ \lambda D'.\ \text{MAX}(D') > \text{MAX}(D)$ (3) $[\![\textit{tall}]\!] = \lambda d.\lambda x.\mu_{\textit{quality}}(x) \geq d$



(a) **INT** (b) **EXT**

(4) $\exists x[\text{MAX}(\lambda d.\textit{boxer}(x) \wedge \mu(x) \geq d \wedge \textit{know}(x, M.)) > \text{MAX}(\lambda d'.\textit{boxer}(P.) \wedge \mu(P.) \geq d')]$

(5) $\text{MAX}(\lambda d.\exists x[\textit{boxer}(x) \wedge \mu(x) \geq d \wedge \textit{know}(x, M.)]) > \text{MAX}(\lambda d'.\exists y[\textit{boxer}(y) \wedge \mu(y) \geq d' \wedge \textit{know}(y, P.)])$

⇒ In terms of the **number of nodes** in the LF representation and also in terms of **movement 'distance'**, INT **is less complex than** EXT (cf. Hackl et al. 2012).

Link to Processing

1. Common assumption: complexity of semantic representation is reflected in processing ⇒ EXT is **more difficult to process** than INT
2. Additional assumption: relative preferences of alternative readings of a given sentence are affected by complexity of LF ⇒ INT **preferred** over EXT

Pilot Study (Forced Choice Sentence Completion, N=24)

- Participants were asked to choose the most natural continuation for 24 sentences like:

(6) *Maria kennt* [*einen besseren Boxer*] *als Peter*... (a) *...einer ist.* (b) *...einen kennt.*
Maria knows [a better boxer]-ACC than Peter... (a) ...a-NOM is (b) ...a-ACC knows

Results:

INT	EXT
66%	34%

⇒ In line with our complexity considerations, the INT continuation is preferred over the EXT continuation ($p < .001$)

Eye Tracking Experiment (N=32)

- **Question**: Does the semantic complexity of attributive comparatives affect online comprehension?
- 24 comparatives were disambiguated towards INT (7-a) and EXT (7-b) and compared to controls like (8).
- All four sentence conditions were continued by the same spill-over regions, e.g. (9).

(7) *Fabian befragte* [*einen lustigeren Berater*] *als*| *Leon*|$_{\#1}$ (a) *einer ist.*|$_{\#2}$ (b) *einen befragte.*|$_{\#2}$
Fabian questioned [a funnier consultant]-ACC than Leon (a) a-NOM is (b) a-ACC questioned
'Fabian questioned a consultant who is funnier (a) than Leon. (b) any consultant that Leon questioned.'

ROIs:
- #1 preview: Leon / auch
- #2 critical: einer ist / einen befragte
- #3 spill-over: Fabians

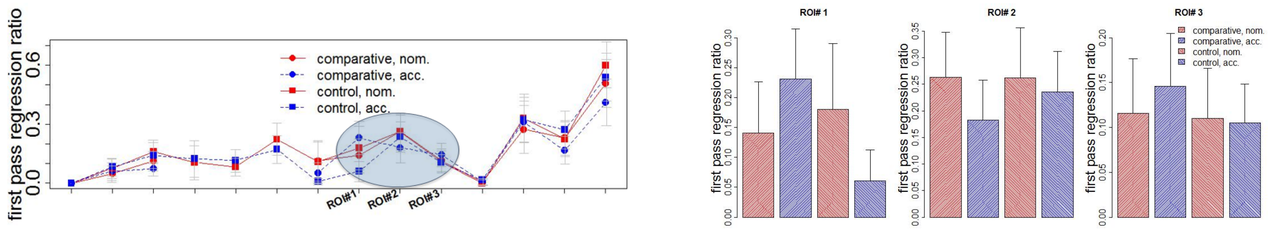
(8) *Fabian befragte* [*einen lustigen Berater*] *und erzählte es sogleich Leon, der*| *auch*|$_{\#1}$ (a) *einer ist.*|$_{\#2}$ (b) *einen befragte.*|$_{\#2}$
Fabian questioned [a funny consultant]-ACC and told it immediately Leon who also (a) a-NOM is (b) a-ACC questioned
'Fabian questioned a funny consultant and presently told it to Leon who (a) is one, too. (b) questioned one, too.'

(9) *Fabians*|$_{\#3}$ *Berater hatte* [*einen sehr guten Sinn*] *für Humor.*
Fabian's consultant had [a very good sense]-ACC for humor
'Fabian's consultant had a very good sense of humor. '

Prediction: Larger complexity difference between nom. and acc. case within the comparatives (INT vs. EXT) than within the controls.

Results

- **Eye tracking measures**: First-pass durations, second-pass durations, regression-path durations and first-pass regression ratios in the three mentioned ROIs; **Statistical Analysis**: GLMMs, α-level Bonferroni corrected to a value of .004
- Only significant interaction: first-pass regression-ratios in the spill-over region, ROI#1 ($\chi^2(1) = 9.1; p = .0025$).



⇒ In line with our predictions, comparatives with accusative case (EXT) led to more first-pass regressions than comparatives with nominative case (INT) whereas the opposite pattern was observed in the control conditions.

Discussion

- Our results indicate that complexity of compositional semantic representations affects how comparatives are processed.
- The more complex external reading is dispreferred offline; and upon disambiguation it leads to disruption during reading.
- Unexpected: The effect of semantic complexity on eye movements showed up extremely early and was extremely local.
- Is full semantic interpretation plausible when ROI#1 is fixated and the disambiguating case marking is merely in preview?

⇒ We **plan** to test this in a **self-paced reading study** in which readers have no preview on the critical region.

Selected References

Hackl, M., J. Koster-Hale, & J. Varvoutis (2012). Quantification and ACD: Evidence from Real-Time Sentence Processing. *J. Semant.* 29(2), 145-206. ::: Heim, I. (2001). Degree Operators and Scope. In C. Fery and W. Sternefeld (eds.), *Audiatur Vox Sapientiae. A Festschrift for Arnim von Stechow*, 214-239. ::: Lerner, J. & W. Pinkal (1995). Comparative Ellipsis and Variable Binding. *SALT* V, 222-236.

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