

## Introduction

I find no scope ambiguity with comparative operators. (Kennedy, 1997)

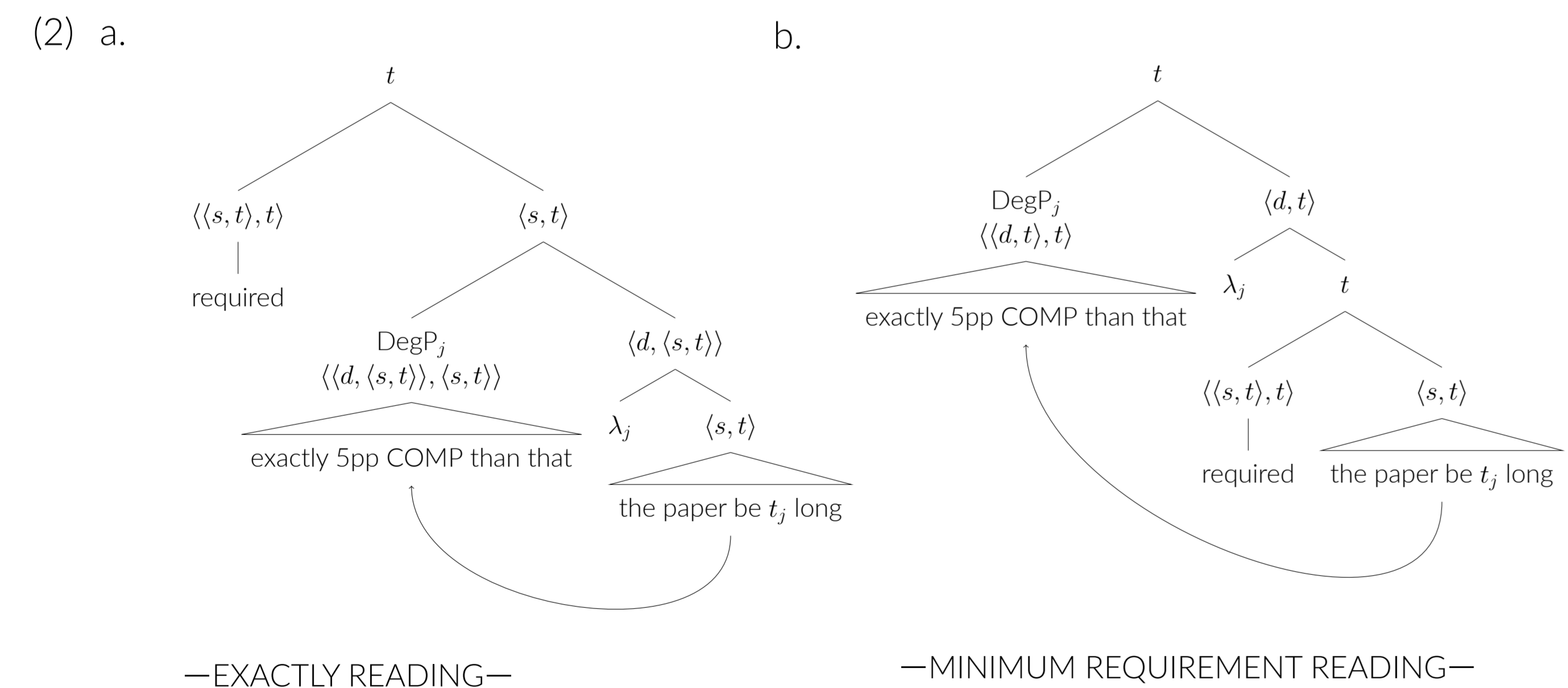
But I do in specific cases with intensional verbs and exactly-differentials or less-comparatives. (Heim, 2000)

Are these subtle ambiguities real?

- (1) (This draft is 10 pages.) The paper is required to be exactly 5 pages longer than that.
- linear scope:  $\forall w \in Acc : \max\{d : long_w(p, d)\} = 15pp$  —EXACTLY READING—  
'It is required of the paper that it is exactly 15pp long.'
  - inverse scope:  $\max\{d : \forall w \in Acc : long_w(p, d)\} = 15pp$  —MIN. REQUIRE. READING—  
'The minimum length required for the paper is exactly 15 pages.'

## Theoretical Background & Relevance

The comparative operator (COMP) is commonly treated as a degree quantifier (e.g. Stechow 1984 a.m.o. following Heim) interacting with other scope-bearing elements like modals.



Via Heim (2000), less-comparatives and exactly-differentials show the same ambiguity.

This ambiguity influenced subsequent analyses of comparatives (e.g. Bhatt et al. 2004; Breakstone et al. 2011; Lassiter 2012, a.m.o.) and was used as a diagnostics for scope mobility of the comparative operator in cross-linguistic studies, e.g. Beck et al. (2009).

## Goals and Methods

**Goal:** To test for availability of inverse readings in less-comparatives and exactly-differentials.

**Method:** In question answering tasks, we compare forced-choice judgments indicating linear or inverse scope readings to a baseline obtained from unambiguous control conditions.

## Experiment 1 (N=87): Targets, Controls & Questions in German

12 items+48 fillers; participants from prolific; blme analysis

Example item illustrating the basic design, 2 (MODIFIER) × 2 (±MODAL) × 2 (±MATCH)

- (3) Target sentences and post contexts
- Das Papier muss genau 10 Seiten länger sein als der Entwurf. So lautet die Vorgabe der Zeitschrift. the paper must exactly 10 pages longer be than the draft. So sounds the guideline of the journal 'The paper is required to be 10 pages longer than the draft. That's what the journal's guideline says.'
  - Das Papier ist genau 10 Seiten lang. Das haben die Autoren gesagt. The paper is exactly 10 pages long. That's what the authors said.
  - Der Entwurf muss weniger lang sein als das Papier. So lautet die Vorgabe der Zeitschrift. the draft must less long be than the paper. So sounds the guideline of the journal 'The draft is required to be less long than the paper. That's what the journal's guideline says.'
  - Der Entwurf ist weniger lang als das Papier. Das haben die Autoren gesagt. The draft is less long than the paper. That's what the authors said.

(4) Matching (m) and mismatching (mm) comprehension questions

- |   |   |
|---|---|
| a-m Soll das Papier 10 Seiten länger sein als der Entwurf? should the paper 10 pages longer be than the draft 'Should the paper be 10 pages longer than the draft?'                     | b-m Ist das Papier 10 Seiten lang? is the paper 10 pages long 'Is the paper 10 pages long?'                           |
| a-mm Darf das Papier auch 15 Seiten länger sein als der Entwurf? may the paper also 15 pages longer be than the draft 'Is the paper also allowed to be 15 pages longer than the draft?' | b-mm Ist das Papier 14 Seiten lang? is the paper 14 pages long 'Is the paper 14 pages long?'                          |
| c-m Soll der Entwurf kürzer sein als das Papier? should the draft shorter be than the paper 'Should the draft be shorter than the paper?'   | d-m Ist der Entwurf kürzer als das Papier? is the draft shorter than the paper 'Is the draft shorter than the paper?' |
| c-mm Darf der Entwurf auch länger sein als das Papier? may the draft also longer be than the paper 'Is the draft also allowed to be longer than the paper?'                             | d-mm Ist der Entwurf länger als das Papier? is the draft longer than the paper 'Is the draft longer than the paper?'  |

## Experiment 2 (N=87): Comparative Form Across the Board in German

Comparative form was used across the board to mitigate potential complexity gradient between positive and comparative forms in (4-b-m, b-mm) vs. (4-d-m, d-mm).

- |   |  |
|---|--|
| b. Das Papier ist genau 10 Seiten länger als der Entwurf. the paper is exactly 10 pages longer than the draft | b'-m Ist das Papier 10 Seiten länger als der Entwurf? is the paper 10 pages longer than the draft  |
|   | b'-mm Ist das Papier 14 Seiten länger als der Entwurf? is the paper 14 pages longer than the draft |

## Experiment 3 (N=199): Quasi-Replication with Contexts in English

12 items+20 fillers; participants from prolific; blme analysis

Translations embedded in supportive contexts intended to highlight the inverse reading.

- (5) Alex's company has been assembling motorbikes, scooters and mopeds for well-known manufacturers for years. After a major refurbishment of the main production facility, the machinery on the assembly line needs to be recalibrated. In order to ensure that the minimum height standards for different vehicle types are met, Alex and his engineers are consulting various designs provided by the manufacturers. ...
- The specifications from one particular manufacturer are especially puzzling. For instance, one of the mopeds is 90 cm high. The motorbike is required to be exactly 50 cm higher than that. That's what the manufacturer specified.
  - They are also trying to incorporate their customers' feedback. One of the customers indicated that their moped is 90 cm high. The motorbike is exactly 50 cm higher than that. That's what the motorcyclist said.
  - The specifications from one particular manufacturer are especially puzzling. For instance, one of the motorbikes is 140 cm high. The moped is required to be less high than that. That's what the manufacturer specified.
  - They are also trying to incorporate their customers' feedback. One of the customers indicated that their motorbike is 140 cm high. The moped is less high than that. That's what the motorcyclist said.
- (6) Comprehension questions
- |  |  |
|--|--|
| a-m Should the motorbike be 140 cm high?                   | b-m Is the motorbike 140 cm high?            |
| a-mm Is the motorbike allowed to be 160 cm high?           | b-mm Is the motorbike 160 cm high?           |
| c-m Should the moped be lower than the motorbike?          | d-m Is the moped lower than the motorbike?   |
| c-mm Is the moped allowed to be higher than the motorbike? | d-mm Is the moped higher than the motorbike? |

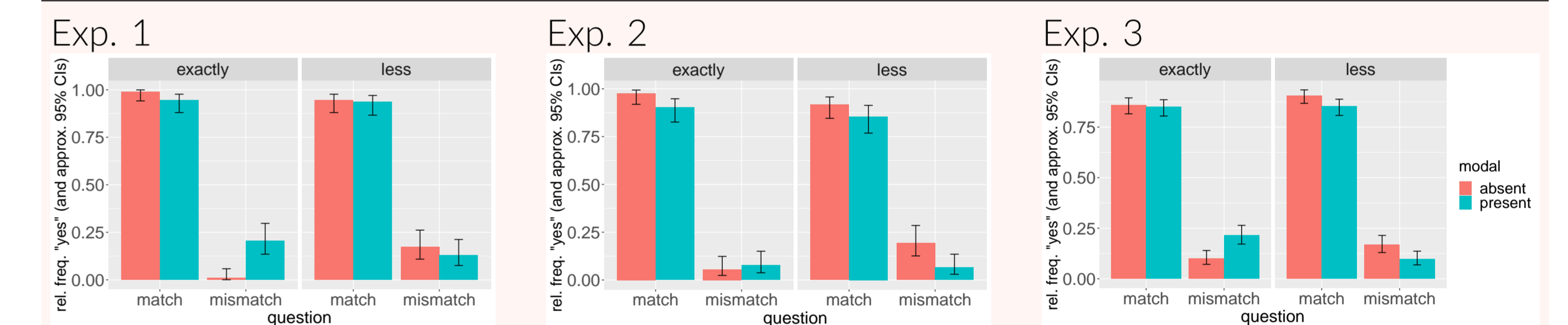
## Predictions

Assuming incongruent answers, i.e. "yes" to matching and "no" to mismatching questions indicate inverse scope with modals or errors, the following predictions can be made:

- Scope-mobility (Heim 2000) predicts modal × question interaction in response distributions. ⇒ Less clear separation of responses in potentially ambiguous targets vs. controls
- Theories without scope-mobility (Kennedy 1997) could, however, still explain interaction in terms of errors due to increased complexity in modal conditions. ⇒ Informative result: no divergence between modal and control conditions, challenging scopal flexibility of COMP

Prediction based on Heim (2000): The inverse scope reading should be available for both exactly-differentials and less-comparatives.

## Results: Ambiguity in exactly-differentials but not less-comparatives



Across all three experiments, predicted interaction was observed with exactly-differentials (Exp. 1:  $z = 3.36, p < .001$ ; Exp. 2:  $z = 1.86, p = .063$ ; Exp. 3:  $z = 2.94, p = .003$ ) but not less-comparatives (Exp. 1:  $z = -.32$ ; Exp. 2:  $z = -.88$ ; Exp. 3:  $z = -.33$ ), as reflected by significant 3-way interactions (Exp. 1:  $z = -3.05, p = .002$ ; Exp. 2:  $z = -2, p = .046$ ; Exp. 3:  $z = -2.2, p = .027$ ).

## Discussion

Across experiments, indication of the purported ambiguity was limited to exactly-differentials. ⇒ Empirical basis for scope mobility of COMP is even more restricted than previously assumed.

- We find parallel effects in German and English, even with contextual embedding for English, in line with Philipp et al. (2022).
- Potential explanation for the difference between less-comparatives and exactly-differentials: Oda (2008) accounts for the ambiguity in terms of scope mobility of exactly 5 pp rather than COMP (cf. also Penka 2021 in a response to Hohaus et al. 2020 for equatives)

## References

Beck, S. et al. (2009). In: *Linguistic Variation Yearbook* 9. Bhatt, R. et al. (2004). In: *Linguist Inquiry* 35.1. Breakstone, M. Y. et al. (2011). In: *Proceedings of SALT* 21. Heim, I. (2000). In: *Proceedings of SALT* 10. Hohaus, V. et al. (2020). In: *Journal of Semantics* 38.1. Kennedy, C. (1997). PhD thesis. University of California at Santa Cruz. Lassiter, D. (2012). In: *Proceedings of SALT* 22. Ed. by A. Chereches. Oda, T. (2008). University of Connecticut. Penka, D. (2021). Manuscript. Philipp, M. et al. (2022). In: *Linguistic Inquiry*. Stechow, A. v. (1984). In: *Journal of Semantics* 3.1-2.

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