

# Quantifier Binding Across Sentence Borders

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## ABSTRACT

**Objective** Investigating the impact of discourse relations on the acceptability of cross-sentential quantifier-variable binding (*quantificational subordination*).

**Method** Online acceptability rating.

**Conclusion** Discourse relations play a crucial role for the acceptability of quantificational subordination. In particular, *causal* discourse relations allow for quantificational subordination, in contrast to non-causal discourse relations.

## BACKGROUND

It has traditionally been assumed that the scope of universal quantifiers such as ‘each’ and ‘every’ is sentence-bound, that is, that they may not bind pronouns in subsequent sentences. This is motivated by data such as in (1).

- (1) [Every dog]<sub>i</sub> came in. \*[It]<sub>i</sub> lay down under the table.

However, there are cases that show that this constraint seems to be too strong, as illustrated by the very natural sounding examples in (2) and (3), extracted from the BNC.

- (2) The menopause is a natural event in [every woman]<sub>i</sub> life. It marks the end of [her]<sub>i</sub> periods and [her]<sub>i</sub> capacity to bear children.
- (3) [Each machine]<sub>i</sub> is probably used by half a dozen different people every day. Some of them may be less careful with [it]<sub>i</sub> than others, so we need machines that can take a battering.

The contrast between (4a) and (4b) below indicates that the availability of the binding relation depends on the structure of the discourse.

- (4) a. [Every rice-grower]<sub>i</sub> owns a wooden cart. [He]<sub>i</sub> uses it when [he]<sub>i</sub> harvests the crop.  
b. [Every rice-grower]<sub>i</sub> owns a wooden cart. \*[He]<sub>i</sub> used it yesterday to harvest the crop.

In an eye tracking study by Carminati et al., no significant slowdown was found for conjoined sentence pairs for which a binding relation, but no c-command relation, was available, such as (5a) in relation to (5b).

- (5) a. [Every Midwestern farmer]<sub>i</sub> planted corn and then [he]<sub>i</sub> worried endlessly about the weather.  
b. [Every Midwestern farmer]<sub>i</sub> admitted that [he]<sub>i</sub> worried endlessly about the weather.

## CURRENT STUDY

The aim of this study is two-fold.

- First, the study is supposed to show whether quantifier-variable binding across a sentence boundary is equally available in German.
- Second, I want to argue that grammatical instances of quantificational subordination must satisfy specific discourse requirements. In particular, I’m investigating whether a causal discourse relation allows for a quantifier to bind a pronoun in a following sentence.

## MATERIALS

The materials used in this study were two-sentence discourses that differed with respect to two conditions: *causality* and *antecedent type*.

*Causality* described whether there was a causal connection between the first and second sentence. Discourse relations are not overtly encoded and have to be inferred from the discourse content and context. However adverbs such as ‘thus’ or ‘lately’ were used to indicate a particular discourse connection, e.g. causal or temporal respectively.

*Antecedent type* classifies the nominal phrases in the first sentence that serve as binders or antecedents for the pronouns in the second sentence. Antecedent NPs were either *referential* — for instance ‘my friend Chris’, or ‘the janitor in our school’ — or *quantificational* — for instance ‘every patient’ or ‘every janitor in the area’.

These conditions led to four types of two-sentence discourses that were constructed from sentences as illustrated in (6) below.

Context Sentences  
quantificational antecedent

- (6) Jeder unserer Patienten, /der sich im letzten Jahr ein Bein brach, / every our.GEN patients who self in.the.last year a leg broke hatte Ärger mit der Krankenversicherung. had trouble with the health.insurance  
‘Every patient of ours who broke a leg during the last year experienced trouble with his health insurance.’

referential antecedent

Mein Freund Christian, / ... my friend Christian ... (continued as above)

Continuation Sentences  
causal continuation

Er musste sich deswegen / mit viel Papierkram / herumschlagen. he needed self therefore with much paper.stuff beat.around  
‘For that reason, he needed to bother with a lot of paper work.’

non-causal continuation

Er hatte aber / auch schon vorher / viel Pech mit Versicherungen. he had but also already before much bad\_luck with insurances.  
‘In addition, he had already had lots of trouble with insurance companies.’

Both quantificational and referential context sentences were continued with either causal or non-causal continuation sentences. For instance, a referential / non-causal discourse from the examples above would for be

‘My friend Christian, who broke his leg last year, experienced trouble with his health insurance. In addition, he had already had lots of trouble with insurance companies.’

## METHOD

24 native speakers of German were presented 4 discourses of each type and 38 filler discourses in randomized order on a computer screen in a frame by frame fashion. Immediately following the last frame, the participants were asked to rate the naturalness of the discourse on a scale from 1 to 5, where a response of 1 indicated a fully natural sounding discourses and 5 an unacceptable one.

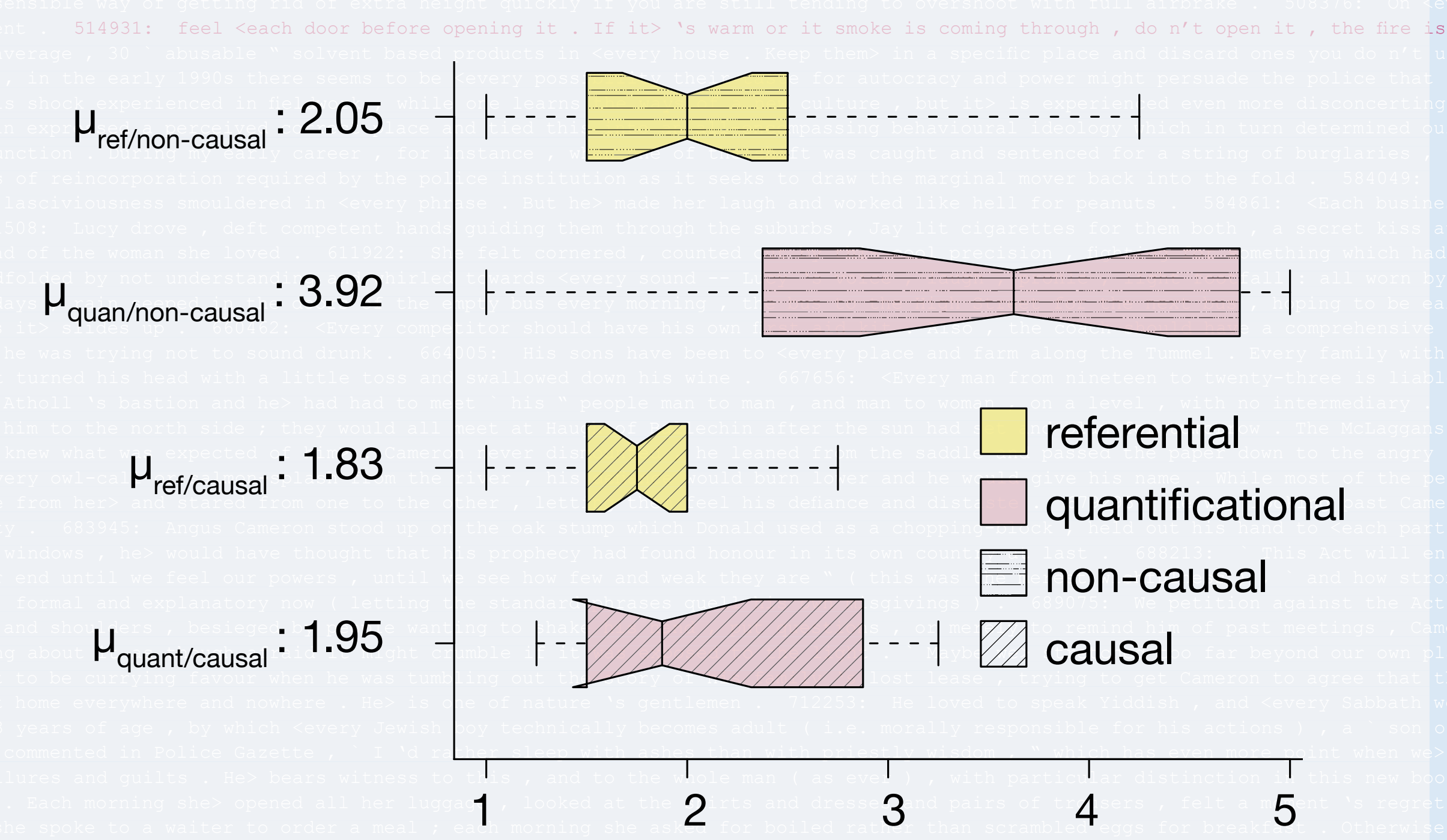
## RESULTS

ANOVA  
subject: F(1,94)=18.54, p<.001  
item: F(1,62)=26.75, p<.001  
subject: F(1,94)=17.43, p<.001  
item: F(1,62)=26.2, p<.001  
subject: F(1,94)=8.53, p<.005  
item: F(1,62)=12.95, p<0.001

T-TESTS  
p<.001  
p=.12

causal/non-causal for quantified antecedents:  
causal/non-causal for referential antecedents:

Main effects of both factors were found (2x2 ANOVA). However, while there was a highly significant effect of causality for the quantificational sentences, only a numeric effect of causality could be found for the referential items (t-tests). This difference is reflected in a highly significant interaction.



Average acceptability judgments for two-sentence discourses on a scale from 1 (very natural discourse) to 5 (totally unacceptable)

The graph illustrates the vast impact that non-causal discourse connections have on the acceptability of quantifier binding across sentence borders.

## DISCUSSION

That the unacceptability of the quantificational / non-causal sentences is due to a general inavailability of discourse relations has been proposed in Linton Wang, Eric McCready, Nicholas Asher (2003): Information Dependency in Quantificational Subordination, presented at: Where Semantics meets Pragmatics, First International Workshop on Current Research in the Semantics-Pragmatics Interface, UNMichigan, July 2003.

These results support the hypothesis that causality plays a role for inter-sentential quantifier-variable binding. The absence of a causal discourse relation does not affect the referential cases in the same way as it does affect the quantificational cases, which I will take as evidence that the effect is not due to a general incompatibility of the two sentences in the non-causal case.

Conclusions:

- Quantifiers have the potential to bind pronouns in the following sentence, both in German and English.
- Not just any discourse relation allows for cross-sentential binding — while non-causal discourse continuations are fully acceptable for context sentences with referential antecedents, they are almost ruled out for sentences that contain a quantificational antecedent.

Speculations:

- Causal discourse relations are only one type of discourse relations that allow for quantificational subordination. In order to account for examples of *telescoping*, I think the more general notion of a *non-accidental generalization* is needed.
- The notion of a non-accidental generalization might be related to a semantic account of quantificational subordination involving generic quantification over possible events.

Thank you.\*

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