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Can the asymmetric effect of implicit causality be explained through usage patterns?

Introduction

To understand complex utterances, people have to build a coherent mental representation of the described events. An essential part of such representations are causal relations that are typically constructed with the help of overt markers like conjunctions and covert properties like *implicit causality* (Garvey & Caramazza 1974; Garvey, Caramazza, & Yates 1975), which designates some verbs' propensity to impute the cause of an event to either subject or object. According to the respective causality bias, people will continue *Oskar annoyed Emma, because...* with *he* and *Oskar noticed Emma, because...* with *she*. This pattern is very consistent and has been observed in numerous studies (e.g., Au 1986; Brown & Fish 1983). Furthermore, causality-biased verbs like *annoy* and *notice* have been shown to influence online sentence comprehension. Bias-incongruent pronouns are harder to integrate, resulting in longer reaction and reading times (Garnham, Traxler, Oakhill, & Gernsbacher 1996; Stewart, Pickering, & Sanford 2000), more regressions and longer fixations (Featherstone & Sturt 2010; Koornneef & Van Berkum 2006; Metzner 2010) plus electrophysiological signs of syntactic integration problems (Van Berkum, Koornneef, Otten, & Nieuwland 2007). Consider sentences 1a (congruent) and 1b (incongruent) for clarification:

- (1) a. *Oskar noticed Emma, because she waved at him.*
b. *Oskar noticed Emma, because he looked up.*

Greene and McKoon (1995) and Long and De Ley (2000) report an effect of congruence only for NP2-biased verbs like *notice*. Whereas Greene and McKoon ascribe this to the recency of NP2, Long and De Ley assume that it is due to differences in everyday language. They hypothesize that NP2-biased verbs yield more useful predictions for upcoming anaphora and support this assumption with a corpus study. They find sentences with NP2-biased verbs to be congruent with the verb's implicit causality more often than sentences with NP1-biased verbs like *annoy*. However, Long and De Ley's (2000) corpus is a comparably small and regionally very constrained newspaper corpus that does not reflect verbal communication and thus might not enable sophisticated generalizations about language comprehension.

Method and Results

To validate Long and De Ley's (2000) results, sample sentences for strongly biased verbs (determined in a preliminary study and taken from Long & De Ley 2000, respectively) were randomly chosen from a corpus of written German and a corpus of spoken English. It was recorded whether a reference to subject or object of the main clause was present, and, given that one had occurred, if it was congruent with the verb's implicit causality bias. The investigation of *Tübingen's Partially Parsed Corpus of Written German* (TüPP-D/Z: Eberhard Karls Universität Tübingen 1986-1999) was supposed to substantiate Long and De Ley's findings with results from another

language. Moreover, the analysis of the spoken component of *BYU-BNC: The British National Corpus* (Davies 2004–) could have strengthened the usage-based account with results from a different modality. The patterns did, however, not resemble Long and De Ley's. First, NP1- and NP2-biased verbs were equally good predictors for upcoming anaphora in the German corpus ($\chi^2(1) = 0.003$; $p > .05$). Second, the data from the BNC revealed the exact opposite pattern to Long and De Ley (2000), with NP1-biased verbs being more reliable predictors than NP2-biased verbs ($\chi^2(1) = 7.71$; $p < .01$). Consequently, our results do not support a usage-based explanation of the diverging magnitudes of NP1- and NP2-based effects.

Discussion

The picture remains diffuse. Greene and McKoon (1995), Long and De Ley (2000), and Featherstone and Sturt (2010) found stronger effects for NP2-biased verbs in probe-recognition tasks and eye-tracking experiments in English. Koornneef and Van Berkum (2006) and Metzner (2010), however, report the opposite pattern in eye-tracking experiments on Dutch and German. Also, NP1-biased verbs were better predictors for future reference in a corpus of spoken English and NP2-biased verbs were better predictors in a corpus of written English, but there was no difference in a corpus of written German. If the asymmetric effects of NP1- and NP2-biased verbs were based on usage-based heuristics as proposed by Long and De Ley (2000), we would have expected to see a corresponding pattern in the German corpus, which we did not.

There are theoretical reasons why NP1-biased verbs would elicit a stronger effect. Incongruence with a bias towards NP1 always coincides with a violation of the first-mention advantage (Gernsbacher & Hargreaves 1988) and almost always with the assumptions of the parallel-function hypothesis (Grober, Beardsley, & Caramazza 1978), which posits that a discourse entity will preferably take the same grammatical role in both main and subordinate clause. This is not the case with verbs that are biased towards NP2.

An account for the difference between Dutch/German and English and between written and spoken English might highlight cross-linguistic and cross-modal variation. However, apart from the asymmetries, all experiments have brought roughly the same results for different languages. Also, we would rather expect NP2-biased verbs to play a more important role in verbal communication, where parsimony is instrumental. The most convincing explanation for Long and De Ley's (2000) and similar results thus appears to be recency, because their probe-recognition task is by design prone to capture memory effects. However, Featherstone and Sturt (2010) also report stronger effects for NP2-biased verbs in an eye-tracking experiment, so there must be more to it than just recency.

Obviously, different experimental sentences and methods were used across experiments.

Although they have in common that their verbs are biased towards NP1 or NP2, they differ in terms of overall meaning, bias strength, language, participants, and method.

Featherstone and Sturt (2010, p. 10) argue that there might not be a systematic difference between NP1- and NP2-biased verbs, but that the asymmetric effects might merely reflect the above-mentioned variation in the material and the different methods. Given the seemingly random pattern of results, we are very inclined to follow this reasoning.

Conclusions

The present study casts doubt on a usage-based explanation for implicit causality, but this doubt is mainly grounded in a null result from the German corpus. To confidently reject such an explanation, one would have to find diverging evidence from experimental and corpus data (e.g., NP2-biased verbs to be better predictors in the German corpus). Moreover, the present results come with a big caveat. They are based on very small samples, so an investigation of the topic with a larger corpus is certainly indicated. Also, sentences in the German preterite tense were extracted to grant comparability with Long and De Ley's (2000) results. Since this form is becoming more and more unusual in everyday German, another study with sentences in perfect or present tense appears like another useful extension.

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