



# Conjunction meaning can modulate parallelism facilitation: Eye-tracking evidence from German clausal coordination



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## ARTICLE INFO

### Article history:

Received 1 September 2010  
revision received 7 May 2014  
Available online 23 June 2014

### Keywords:

Clausal parallelism  
Coordinating conjunction  
Eye tracking  
Sentence comprehension  
Priming

## ABSTRACT

In *and*-coordinated clauses, the second conjunct elicits faster reading times when it parallels (vs. does not parallel) the first in constituent order. This paper examined whether such parallelism facilitation results from simple constituent order priming from the first to the second clause, or whether it can be modulated through the linguistic context (the conjunction and clausal relations). Three eye-tracking experiments on German assessed this issue by manipulating conjunction meaning and type within subjects (resemblance: ‘and’ vs. adversative: ‘but’ or ‘while’; coordinating: ‘and’ and ‘but’; subordinating: ‘while’), and by varying the clausal relations between experiments. Clausal parallelism facilitation was reduced when syntactic dependence of the clauses from a superordinate verb reinforced their coherence, and semantic expectations for ‘but’ and ‘while’ were violated through the parallel constituent order and thematic role relations of noun phrases. By contrast, it was not reduced when the same expectations were satisfied through other sentence constituents (temporally contrastive adverbs) and when the coordination involved matrix clauses. The contextual modulation of parallelism facilitation rules out simple priming as the only underlying mechanism. The observed facilitation rather reflects compositional processing of the coordinands and the conjunction in the linguistic context.

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## Introduction

An increasing number of studies is beginning to examine sentence comprehension mechanisms by looking at how recently interpreted linguistic structure influences ensuing comprehension. Some of these studies have examined what has been dubbed structural ‘priming’ effects (e.g., Arai, Gompel, & Scheepers, 2007; Branigan, Pickering, & McLean, 2005; Scheepers & Crocker, 2004; Traxler, 2008), that is the “tendency to [...] better process

a current sentence because of its structural similarity to a previously experienced (‘prime’) sentence” (Pickering & Ferreira, 2008, p. 427).

Other studies have examined ‘parallelism effects’, by which we mean processing facilitation *within* a given sentence when two conjuncts are similar in their structure. Not unlike priming, the structure of the second conjunct is processed with greater ease when it resembles the structure of the first conjunct (active–active coordination, (1a)) than when it doesn’t (active–passive coordination, (1b)), e.g., Frazier, Taft, Roeper, & Clifton, 1984).

- (1)
- (a) The tall gangster hit John and the short thug hit Sam.
  - (b) The tall gangster was hit by John and the short thug hit Sam.

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At first blush, these two kinds of repetition appear related through the facilitative effect that they procure and through the pervasiveness of their effects beyond the structural level. Priming during sentence comprehension also emerged for semantic similarity and lexical repetition (e.g., Kutas, 1993), and parallelism effects for phonology, definiteness (Carlson, 2001; Frazier et al., 1984), and animacy (Carlson, 2001; Frazier et al., 1984) amongst others. Both of these phenomena also occur with and without verb repetition. Verb repetition between a prime and target sentence was essential in eliciting priming effects when the primed structure was part of the verb's lexical entry (e.g., arguments, Arai et al., 2007) while priming of non-argument structure (adjuncts) did not depend upon verb repetition (Traxler, 2008). For parallelism, facilitation has likewise been observed with (e.g., Frazier et al., 1984) and without verb repetition (e.g., Knoeferle & Crocker, 2009).

Based on these similarities, it would seem parsimonious to assume that priming and parallelism effects implicate the same (priming) mechanism (of which more below). However, an argument in favor of a distinct parallelism mechanism would appear justified if – unlike priming – parallelism effects depended upon the linguistic context (e.g., coordination). Parallelism effects originally emerged in a specific syntactic environment (*and*-coordination), prompting speculation that their emergence might depend upon that context and involve more than just repetition. Initial empirical results seemed to corroborate this view. In *and*-coordination, facilitation manifested itself through faster reading times for the second conjunct of structurally parallel (e.g., *a strange man and a tall woman*) than non-parallel noun phrases (*a man and a tall woman*). By contrast, when the same two noun phrases filled verb argument slots, no parallelism effects emerged (*a tall woman* was no faster after *A strange man noticed* than after *A man noticed*; Apel, Knoeferle, & Crocker, 2007; see Frazier, Munn, & Clifton, 2000). This finding was taken to suggest that parallelism effects depend upon the presence of *and*, and cannot be accommodated by a priming mechanism alone.

One concern, however, was that the non-coordinate construction involved grammatical function changes in the critical noun phrases (subject vs. object of the verb), and that this could have eliminated parallelism facilitation. When Sturt, Keller, and Dubey (2010) controlled for grammatical function and noun phrase meaning differences, participants' first pass, regression path, and total reading times were shorter when two noun phrases were parallel relative to non-parallel in their structure, independent of whether these noun phrases were coordinated by *and* (*a difficult to read book and a risky to cross street*) or not (e.g., *A demanding boss said that a lazy worker...*). Their findings showed that – at least for noun phrase coordination – parallelism facilitation can occur outside of *and*-coordination, suggesting a priming mechanism is sufficient to accommodate these effects. However, it remains an open issue whether this is also the case for other (e.g., clause-level) parallelism effects.

A related question is whether the meaning and type of the coordinating conjunction modulates parallelism facilitation. Staub and Clifton (2006), for instance, have shown that readers integrate conjunctions incrementally

into the emerging sentence interpretation. When or coordinated either two clauses or noun phrases, participants' post-conjunction reading times were faster if they had previously read the word *either*. Thus, the presence of *either* led readers to predict the upcoming coordination structure. Against this background, we can assume that the interpretation of the first clause in a coordinate structure together with the ensuing conjunction affects comprehenders' expectations about the second conjunct. What we do not yet know is whether parallelism effects are sensitive to such contextual modulation. For clausal coordination in particular, compositional semantic interpretation of the conjuncts in their linguistic context might play a crucial role, a view espoused by a recent account of parallelism effects (Knoeferle & Crocker, 2009, of which more below). If parallelism effects were indeed modulated by conjunction meaning this would seem to implicate more than just priming through (structural) repetition.

The present paper examined this issue in three sentence-completion and three eye-tracking experiments by manipulating the meaning and type of the conjunction for sentences such as those in (2). These examples are from a study by Knoeferle and Crocker (2009). For sentence (2a) the two clauses are non-parallel and for (2b) they are parallel in constituent order (object–subject-and-object–subject). Parallelism facilitation emerged in total times on *den Ringer* ('the wrestler') and in regression path times during the next noun phrase *der Erzfeind* ('arch-enemy', see (2) and Exp. 2 in Knoeferle & Crocker, 2009). The study also manipulated structural markedness and found elevated reading times when the second conjunct was in marked (object–subject) compared with unmarked (subject–object) order (Knoeferle & Crocker, 2009). There was no strong evidence that parallelism effects varied by structural markedness although descriptively, parallelism facilitation was apparent for unmarked structures while for the marked ones, reading times were longer for parallel than non-parallel constituent order ( $F_s < 2$ ).

(2)

- (a) Vor einer Stunde bezwang der Fechter (subj) den Gegner (obj) und gerade besiegt den Ringer (obj) der Erzfeind (subj), wie der Journalist schreibt.  
'An hour ago defeated the fencer (subj) the adversary (obj) and currently overwhelms the wrestler (obj) the arch-enemy (subj), as the journalist writes.'
- (b) Vor einer Stunde bezwang den Fechter (obj) der Gegner (subj) und gerade besiegt den Ringer (obj) der Erzfeind (subj), wie der Journalist schreibt.  
'An hour ago defeated the fencer (obj) the adversary (subj) and currently overwhelms the wrestler (obj) the arch-enemy (subj), as the journalist writes.'

Does simple priming alone bring about these constituent order parallelism effects or are they sensitive to the meaning and type of the conjunction? In what follows, I first discuss a 'simple' priming account according to which

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