

# The representation of lexical and syntactic information in bilinguals: Evidence from syntactic priming

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## Abstract

To what extent do bilinguals have a single, integrated representation of syntactic information? According to Hartsuiker et al. (2004) [Hartsuiker, R. J., Pickering, M. J., & Veltkamp, E. (2004). Is syntax separate or shared between languages? Cross-linguistic syntactic priming in Spanish–English bilinguals. *Psychological Science*, 15, 409–414.], bilinguals represent syntactic information in terms of links between lexical representations and combinatorial nodes that specify syntactic structure, in a single cross-linguistic network. We describe predictions of this account and test them in two pairs of syntactic priming experiments with Dutch–English bilinguals. In Experiments 1 and 2, we tested priming in English (L2) production. Experiment 1 showed priming within English, and found that this priming was boosted by lexical repetition. Experiment 2 showed priming from Dutch to English, and found that this priming was boosted when prime and target used translation-equivalent verbs. However, this boost was weaker than the lexical boost in Experiment 1. In Experiments 3 and 4, we tested priming in Dutch (L1) production. Experiment 3 showed priming within Dutch, again boosted by lexical repetition. Experiment 4 showed priming from English to Dutch, but found no boost when prime and target were translation-equivalent verbs. We interpret these results in terms of an integrated model of lexical-syntactic representation.

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## Introduction

Research on bilingualism focuses on the question of how the representations of the two languages are related in memory. Are they closely integrated, with information being shared as much as possible, or are they kept

largely separate? The answer may of course depend on the level of representation in question. Most research has been concerned with conceptual and lexical representations (Dijkstra, Van Heuven, & Grainger, 1998; Kroll & Stewart, 1994; Van Hell & De Groot, 1998). Recently, phonological representations in bilinguals have also received more attention (Colomé, 2001; Dijkstra & Van Heuven, 2002). The findings from both comprehension tasks (e.g., lexical decision) and production tasks (e.g., naming and translation) indicate that there is at least some overlap in the representation of

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the languages, and that the languages interact to at least some extent during processing (see also Scheutz & Eberhard, 2004).

The great majority of this research has investigated the comprehension and production of single words only. In contrast, there has been very little work on syntactic representations in bilinguals. This is surprising because there is a great deal of research into syntactic processing in monolinguals, both in production (e.g., Bock & Levelt, 1994) and comprehension (e.g., Mitchell, 1994). The present study considers syntactic processing in bilinguals, and specifically asks how syntactic and lexical information interact during language production in bilinguals, to help answer the question of whether syntactic information is shared across languages. In this paper, we follow recent accounts in assuming that both lexical and syntactic representations are situated at the *lemma* level (Hartsuiker, Pickering, & Veltkamp, 2004; Levelt, Roelofs, & Meyer, 1999; Pickering & Branigan, 1998). In these accounts, the lemma is treated as part of the lexical representation of a word which is connected to nodes specifying syntactic information (cf. Roelofs, 1992) and thus shared by different morphological variants. This syntactic information becomes highly relevant when the word is embedded in a sentence. Our specific interest is in the use of this information during speech production. We will turn to the theoretical accounts in more detail, after discussing some relevant findings of earlier research on syntactic representations in both monolingual and bilingual speech production. We then derive a number of predictions from these accounts and report four experiments that tested these predictions.

### Syntactic priming

A frequently used method to investigate the formulation of syntactic structures is *syntactic priming*. Syntactic priming (or syntactic persistence) occurs when speakers tend to repeat the syntactic structure they had recently encountered. In other words, it is the tendency to reuse previously activated syntactic information. Bock (1986) had participants repeat auditorily presented prime sentences and describe visually presented target pictures in English. In one manipulation, the syntactic structure of the prime sentences was either a passive or an active (e.g., *The building manager was mugged by a gang of teenagers* vs. *A gang of teenagers mugged the building manager*). Participants were more likely to describe the target picture with a passive after a passive prime than after an active prime. In another manipulation, Bock found a similar effect for prepositional object versus double object constructions in the description of dative target pictures (e.g., *The governess made a pot of tea for the princess* vs. *The governess made the princess a pot of tea*). Bock (1989) demonstrated that such effects occurred without any lexical repetition between prime

and target, thus ruling out a lexical explanation of the effects (cf. Levelt & Kelter, 1982).

Since Bock's (1986) original study, many researchers have found syntactic priming with different tasks (Branigan, Pickering, & Cleland, 2000; Pickering & Branigan, 1998; Potter & Lombardi, 1998), different types of constructions (Ferreira, 2003; Hartsuiker, Kolk, & Huiskamp, 1999; Hartsuiker & Westenberg, 2000; Scheepers, 2003), different languages (Hartsuiker & Kolk, 1998b) and different ages (Brooks & Tomasello, 1999; Huttenlocher, Vasilyeva, & Shimpi, 2004). Syntactic priming has also been found in studies with aphasics (Hartsuiker & Kolk, 1998a; Saffran & Martin, 1997). There is also some evidence for priming in language comprehension (e.g., Branigan, Pickering, & McLean, 2005; Noppeney & Price, 2004; cf. Frazier, Taft, Roeper, Clifton, & Ehrlich, 1984; Kaschak & Glenberg, 2004), and for extensive syntactic repetition in naturalistic corpora (e.g., Gries, 2005; Schenkein, 1980; Weiner & Labov, 1983). Additionally, syntactic priming occurs between production and comprehension in dialogue (Branigan et al., 2000), so that interlocutors appear to align their syntactic representations (Pickering & Garrod, 2004).

Although syntactic priming is not dependent on lexical repetition between prime and target, it can be greatly enhanced by such repetition. In Branigan et al. (2000), verb repetition roughly doubled the magnitude of the syntactic priming effect (*the lexical boost*); comparable effects occurred using other paradigms (Cleland & Pickering, 2006; Corley & Scheepers, 2002; Pickering & Branigan, 1998). In addition, Cleland and Pickering (2003) found similar effects for noun phrases in dialogue. Participants were more likely to use a complex noun phrase like *the sheep that's red* after hearing *the door that's red* than after *the red door*. This tendency was enhanced when the prime was *the sheep that's red* rather than *the door that's red*. Interestingly, it was also enhanced, though to a smaller extent, by *the goat that's red*, where *goat* and *sheep* are semantically related (*the semantic boost*). Hence, repetition of content-word heads (verbs or nouns) enhances syntactic priming. In contrast, repetition of function words does not appear to enhance priming (Bock, 1989; see also Fox Tree & Meijer, 1999).

As already noted, there have been very few experimental investigations of syntactic processing in bilinguals. However, four studies have investigated syntactic priming between languages in bilinguals. In a picture-description task, Loebell and Bock (2003) found syntactic priming between English and German dative sentences. Specifically, a similar dative alternation appears to occur in both languages, with both languages admitting comparable prepositional-object constructions (e.g., *The girl bought a newspaper for the blind woman* vs. *Das Mädchen kaufte eine Zeitung für die blinde Frau*) and double-object constructions (e.g., *The girl*

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