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Syntactic alignment and shared word order in code-switched sentence production: Evidence from bilingual monologue and dialogue

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ABSTRACT

In four experiments, we investigated the role of shared word order and alignment with a dialogue partner in the production of code-switched sentences. In Experiments 1 and 2, Dutch–English bilinguals code-switched in describing pictures while being cued with word orders that are either shared or not shared between Dutch and English. In Experiments 3 and 4, the same task was embedded in a confederate-scripted dialogue situation, and the confederate's use of word order and sentence position of switching was manipulated. We found that participants had a clear preference for using the shared word order when they switched languages, but also aligned their word order choices and code-switching patterns with the confederate. These findings demonstrate how the integration of languages in sentence production depends on processes of syntactic co-activation between languages and on processes of alignment between dialogue partners, and extend the notion of interactive alignment to bilingual speech and code-switching.

Introduction

One of the most fascinating phenomena in bilingual speech is code-switching. This merging of two languages within a coherent utterance is one of the few reflections of co-activation of languages in natural discourse, and reveals the true flexibility of language processing. Code-switching is quite frequent among bilinguals (Wei, 2007), especially in informal dialogue settings in which interlocutors can freely use both their languages (Grosjean, 2001).

Experimental studies on code-switching (in psycholinguistics often termed *language* switching) have mainly examined lexical processes. Language production studies typically focused on the time-course of producing language switches in word naming (e.g., Christoffels, Firk, & Schiller, 2007; Costa & Santesteban, 2004; Meuter & Allport, 1999; see Meuter, 2005, 2009, for reviews), and perception studies mainly considered the processing of switches in and out of a sentence context (e.g., Li, 1996; see Van Hell & Witteman, 2009; Altarriba & Basnight-Brown, 2009, for reviews). Typical of these studies is that they are restricted to single-word switches at fixed points within a sentence or stimulus list. In natural discourse, however, code-switching includes more than this externally induced switching of single words. It consists of the integration of two languages within a coherent sentence that is internally generated by the speaker him/herself and situated in a rich discourse context (Gullberg, Indefrey, & Muysken, 2009). This not only involves lexical processing but also syntactic and discourse processing. These syntactic and discourse processes in code-switching are the topic of the present study.

In four picture-driven sentence-completion experiments, we examined how Dutch–English bilinguals' syntactic choices in code-switching are influenced by cross-language word order equivalence and alignment with a dialogue partner. Experiments 1 and 2 investigated cross-language

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word order equivalence in code-switching in monologue and Experiments 3 and 4 examined the further influence of an interlocutor in dialogue. The tasks were constructed such that we kept experimental control over manipulated variables, but left participants free to generate the grammatical form and syntactic positioning of their code-switches themselves. This enabled us to study the cognitive mechanisms of relatively free code-switching in experimental conditions.

We build on the interactive alignment model of dialogue processing (Pickering & Garrod, 2004). This model captures many aspects of syntactic processing in dialogue, but has not yet been extended to code-switching. An important goal of our study is, therefore, not only to investigate syntactic choice of code-switches in monologue and dialogue, but also to widen the scope of the interactive alignment model to bilingual processing in dialogue. We will now first give an outline of the interactive alignment model, followed by a description of bilingual sentence production and syntactic choice in code-switching.

The interactive alignment model in a nutshell

Based on the argument that dialogue – and not monologue – is the basic setting of language use, Pickering and Garrod (2004) proposed the interactive alignment model to account for the cognitive mechanisms of language processing in dialogue. As explained by these researchers, the goal of dialogue is not just to encode a message, but to get a message *across* and to obtain mutual understanding. This is essentially a cooperative process (see also Clark, 1996; Grice, 1975), in which dialogue partners build on each other's language and copy elements of each other's expressions. This alignment of linguistic behavior not only aids mutual understanding but also facilitates language production, as it enables speakers to make 'shortcuts' in their own language production process (Garrod & Pickering, 2004; Schober, 2006).

Evidence for alignment is well established. In both experimental and naturalistic studies, dialogue partners have been found to repeat each other's words, syntactic structures, and even articulation in the production of utterances. Alignment effects have been found in different languages and speaker populations, including adults (e.g., Branigan, Pickering, & Cleland, 2000; Gries, 2005; Levelt & Kelter, 1982; Pardo, 2006), children (e.g., Huttenlocher, Vasilyeva, & Shimpi, 2004), second language learners (Costa, Pickering, & Sorace, 2008; McDonough, 2006), and deaf children (Van Beijsterveldt & Van Hell, 2009). It has been also been found that alignment at one level, such as the lexical level, enhances alignment at other levels, such as the syntactic level (e.g., Branigan et al., 2000; Schoonbaert, Hartsuiker, & Pickering, 2007). For a comprehensive review of alignment findings, see Pickering and Garrod (2004).

The interactive alignment model (see Fig. 1) accounts for these alignment effects by assuming a coupling of interlocutors' linguistic representations at all levels of linguistic processing (horizontal arrows). The model further assumes a coupling of interlocutors' situation models (i.e., one's mental representation of the discourse situation at hand; cf., Zwaan & Radvansky, 1998), which represents mutual understanding. These situation models are directly connected with the linguistic representations (semantics, lexicon, syntax, phonology, articulation) that are activated and selected during speech production and comprehension (vertical arrows). The interconnectivity within (vertical arrows) and between (horizontal arrows) dialogue partners enables alignment to occur: Activated linguistic representations resonate through the interlocutors' language processing systems, which increases the likelihood that

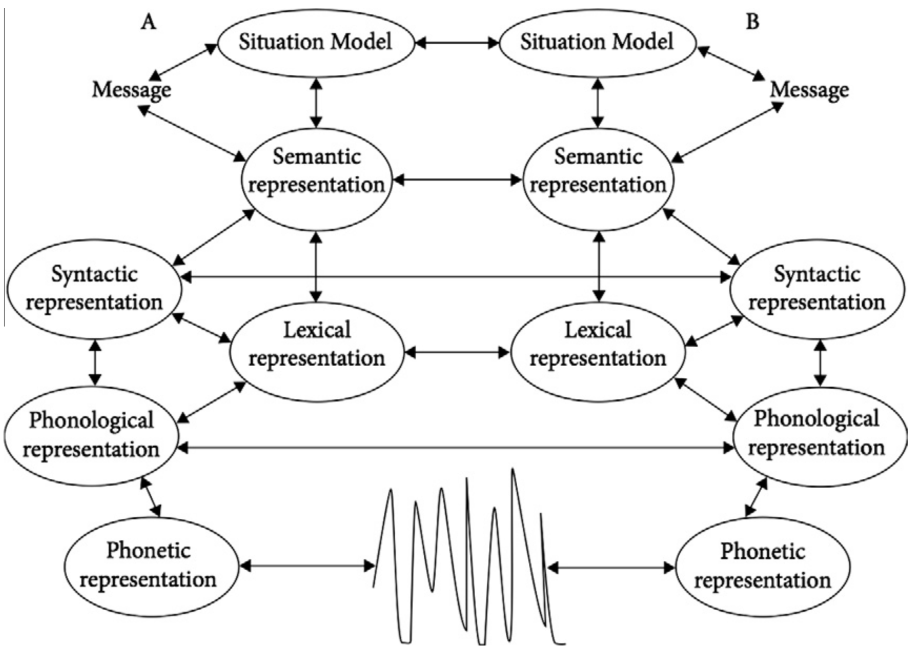

Fig. 1. The interactive alignment model. 'A' and 'B' refer to dialogue partners A and B. Reproduced from Pickering and Garrod (2004, p. 176) with permission from the authors Cambridge University Press.

these representations are selected again, and in turn results in alignment between dialogue partners. As Pickering and Garrod (2004) argue, this alignment process takes place automatically and is essentially the same as priming. Peoples' linguistic choices in dialogue are thus based on an interaction between processes internal to an individual's language processing system and processes of alignment between individuals.

How does this interaction of intra- and inter-individual processes influence code-switching? Although the interactive alignment model itself does not make specific claims about code-switching, there is some evidence that bilinguals adapt their tendency to code-switch to their dialogue partner and the global language setting of the discourse situation. Treffers-Daller (1997), for instance, made recordings of a Turkish–German bilingual in monolingual and bilingual dialogue settings, and found that this person code-switched more often in the bilingual than in the monolingual setting. Similarly, Fokke, De Ruyter de Wildt, Spanjers, and Van Hell (2007) used Grosjean and Miller's (1994) story-retelling paradigm to examine how Dutch–English bilinguals retold a movie fragment to a confederate who either played the role of a Dutch university student who never code-switched, or of an exchange student enrolled in an American university who often code-switched. Participants code-switched more often when talking to the exchange student than to the Dutch student. This and other evidence from, amongst others, Myers-Scotton (1993), Ng and He (2004), and Sachdev and Bourhis (1990) demonstrates that bilinguals are sensitive to the 'bilinguality' of the dialogue situation and adjust their tendency to code-switch accordingly.

The studies above have demonstrated that bilinguals in dialogue adapt their tendency to code-switch to their dialogue partner and the general discourse situation. The next question is whether, above and beyond this adaptation to the sheer occurrence of switching, bilinguals also adapt their *syntactic choices* to those of their dialogue partner in code-switching, which would point to alignment of the way in which bilinguals syntactically integrate multiple languages into one sentence. To investigate this question and thus extend the interactive alignment model to bilingual processes, it is necessary to connect the model with what is known about the processes underlying syntactic choice in code-switching.

Syntactic choice in code-switching has been widely investigated in linguistic corpus studies (see e.g., Muysken, 2000, for an overview). These studies, however, mostly remain silent on the processes underlying the production of code-switched sentences, and typically abstract away from the discourse context. The cognitive mechanisms of sentence production in bilinguals *are* the focus in studies on cross-language syntactic priming (e.g., Hartsuiker, Pickering, & Veltkamp, 2004; Loebell & Bock, 2003), but these are typically concerned with non-code-switched sentences. To investigate the cognitive mechanisms of syntactic choice and alignment in code-switching, we combine the corpus-based studies on the syntax of code-switching with the processing-based studies of bilingual sentence production into a processing-based interpretation of syntactic choice in code-switching that is compatible with the mechanisms of the interactive alignment model.

A processing-based account of syntactic choice in code-switching

Research on bilingual language processing has shown that elements from bilinguals' two languages can be co-activated at all levels of processing and thus influence language production and comprehension (e.g., Kootstra, van Hell, & Dijkstra, 2009; Kroll, Bobb, & Wodniecka, 2006). Because code-switching involves the combined use of these co-activated languages in one sentence, it will probably be easiest to switch when the level of this co-activation is very high. Co-activation at the syntactic level has been investigated in cross-language syntactic priming studies.

Cross-language syntactic priming refers to the process whereby a bilingual's syntactic processing of an utterance in one language is facilitated by the structure of a preceding utterance in another language. The assumption is that cross-language syntactic priming reflects syntactic co-activation of languages. By examining which syntactic structures are primed across languages and which are not, the nature of syntactic co-activation across languages can be determined.

Loebell and Bock (2003) were among the first to study cross-language syntactic priming. They asked German–English bilinguals to reproduce a dative or passive sentence in a specific language (either German or English) and to then describe a picture in the other language. The critical question was whether the syntactic structure of the reproduced sentence primed the syntactic structure of the picture description (i.e., whether the same syntactic structure as the reproduced sentence was used). Loebell and Bock found priming for datives, which have the same word order in German and English, but not for passives, which do not have the same word order in both languages. In contrast with German and English, passives do have the same word order in Spanish and English. Hartsuiker et al. (2004) studied priming of these passive sentences between Spanish and English. In line with the cross-language word order equivalence between Spanish and English, Hartsuiker et al. found a priming effect for passives.

Cross-language syntactic priming effects have been replicated in different tasks and language combinations (e.g., Bernolet, Hartsuiker, & Pickering, 2007; Meijer & Fox Tree, 2003; Salamoura & Williams, 2007; Schoonbaert et al., 2007; Weber & Indefrey, 2009; see Pickering & Ferreira, 2008, for a review). In these studies, priming typically occurred when the target syntactic structures were the same across languages. As cross-language syntactic priming is supposed to reflect syntactic co-activation of languages, it can be concluded that this co-activation is highest when word order is equivalent across languages. The implication for code-switching is that it should be easiest to switch when the word order of both languages is the same.

One of the most notable accounts on this role of word order equivalence in code-switching is given by Poplack (1980). Poplack collected speech recordings of Spanish–English bilinguals in New York, and found that of 1835 switches, only 11 (less than 1%) occurred at points where the word orders of both languages were not the same. Similar patterns were found in other studies (e.g., Deuchar, 2005; Eppler, 1999; Lipski, 1978; Pfaff, 1979; Poplack & Meechan, 1995). Based on her findings, Poplack formulated the 'equivalence constraint', which holds that code-switches tend to occur only at positions where the word orders of both languages are the same. This constraint can, for instance, be applied to Dutch–English code-switching in transitive sentences. English has only one possible word order (SVO: Subject–Verb–Object), whereas Dutch has three (SVO, SOV and VSO), depending on the sentence context[1]:

(1)	English SVO: Everyone is happy, because	*John kisses Mary*
	Dutch SVO: Iedereen is blij, want	*Jan kust Marie*
(2)	English SVO: Peter points at a picture, on which	*John kisses Mary*
	Dutch SOV: Peter wijst naar een plaatje, waarop	*Jan Marie kust*
(3)	English SVO: Yesterday	*John kissed Mary*
	Dutch VSO: Gisteren	*kuste Jan Marie*

The equivalence constraint predicts that Dutch–English bilinguals will avoid code-switching when producing a sentence with an SOV or VSO structure; code-switching will be largely restricted to sentences with the (shared) SVO structure.

This shared word order advantage also follows from another account on the syntax of code-switching: the matrix language framework (Myers-Scotton, 1997, 2002; see also Jake & Myers-Scotton, 2009). Simplifying grossly, this theory holds that all elements that convey morphosyntactic information (in transitive sentences: the inflected verb) should come from one-and-the-same language, and the sentence's word order should grammatically match with this 'matrix' language. This principle automatically implies an advantage for shared word orders. That is, matching a sentence's word order with the sentence's matrix language comes naturally when the word order is shared, as a shared word order inherently entails a grammatical match between both languages. It thus follows from the matrix language framework that switching is facilitated by a shared word order, just as this follows from the equivalence constraint.

When we combine the studies on the syntax of code-switching with the earlier-discussed studies on cross-language syntactic priming, it is interesting to see that both fields of study show an advantage for shared word order in the production of utterances that involve an interaction between two languages. A processing-based interpretation of this common finding is that shared word order facilitates the integration of multiple languages because a shared word order results in more co-activation of languages than a language-specific word order and keeps both languages available to contribute to the sentence without any syntactic restrictions. Importantly, this processing-based interpretation is based on an underlying processing system that is fully interactive, which enables co-activation of elements from both languages. This idea of a co-activation of linguistic elements caused by the interconnectivity of the processing system is compatible with the interconnectivity and resonance that is assumed in Pickering and Garrod's (2004) interactive alignment model.

The present study

Although our processing-based hypothesis of shared word order in code-switching is based on the same mechanisms as the interactive alignment model, the question is still to what extent processes of syntactic co-activation between languages interact with processes of syntactic alignment between speakers. That is, syntactic alignment in code-switching has not yet been systematically investigated and the role of word order in code-switching has only been studied in corpus studies without experimental control on word order conditions. It is therefore still unclear to what extent the hypothesized preference for shared word order in code-switching is a systematic finding and to what extent the code-switching patterns of a dialogue partner influence these syntactic preferences in code-switching. We conducted a series of experiments to gain more insight into these issues.

The study consists of four experiments in which the roles of shared word order and the speech of a dialogue partner were systematically investigated. Experiments 1 and 2 are monologue experiments in which Dutch–English bilinguals completed sentence fragments by describing a picture. In describing the pictures, participants were cued to use at least one word of a different language than the sentence fragment – and therefore had to code-switch – or to use at least one word of the same language as the sentence fragment, so that they did not have to switch (but could if they wanted to). The sentence fragments cued the SVO, SOV, or VSO word order in Dutch, and thus sometimes created word order conflicts between Dutch and English (namely when the sentence fragments cued SOV or VSO in Dutch). To examine whether the shared word order would be chosen more frequently and whether switching in a shared word order would be more flexible, we tested (1) to what extent syntactic choice was influenced by the different word order cues and by the cue to switch into the other language, and (2) to what extent participants' own syntactic choices influenced the way in which they syntactically integrated the code-switch into the sentence (i.e., do the syntactic position of switching and language of the inflected verb vary as a function of whether the participants used a shared or non-shared word order).

The difference between Experiments 1 and 2 was the direction of switching. Experiment 1 examined switching

[1] Dutch is considered a V2-language with SOV as the basic word order in most subordinate clauses (Koster, 1975). The use of SVO or SOV is dependent on the specific conjunction being used. In the SVO lead-in fragment, the conjunction 'want' (meaning 'because'/'for') cues the use of SVO, whereas in the SOV lead-in fragment the conjunction 'waarop' (meaning 'on which') cues SOV. Because of the V2-characteristics of Dutch, subject and verb are inverted when a sentence starts with an adverbial clause such as 'Op dit plaatje'. This is why the VSO lead-in fragment cues a VSO word order.

from Dutch into English and Experiment 2 examined switching from English into Dutch. We included both these switching directions because it is conceivable that the influence of the word order cues that are given by the sentence fragments depends on the language the participants are cued to use, so that syntactic choices are different when participants switch into Dutch than when they switch into English.

To study the influence of alignment in dialogue, Experiments 3 and 4 are confederate-scripted dialogue tasks. These experiments used the same materials as Experiments 1 and 2, but now the task was embedded in a dialogue game in which a 'confederate' (a person who is hired by the experimenter) and a participant took turns in describing a picture and selecting the matching picture (see, e.g., Branigan et al., 2000; Hartsuiker et al., 2004 for similar applications of this technique). The confederate was scripted to use word orders that are either shared between Dutch and English (SVO) or specific to Dutch (SOV and VSO) and to code-switch at prescripted syntactic positions. The confederate thus primed both word order and syntactic position of switching. The critical question in Experiments 3 and 4 was whether the confederate's linguistic behavior influenced the participants' responses, and whether this influence interacted with the hypothesized shared word order advantage in code-switching.

We expected that when participants did not have to switch languages, they would choose the word order that is normal in unilingual sentence production in the particular language. The SVO word order would always be used when participants could describe the sentence fragment and picture entirely in English, and the word order that is cued by the lead-in fragment would always be used when participants could describe the sentence fragment and picture entirely in Dutch. When participants had to code-switch, however, we expected a higher frequency of SVO word order choices (as this is the shared word order between Dutch and English) and a higher switching flexibility (with respect to switch position and language of the verb) when the SVO word order was used than when the SOV or VSO word orders were used. This expectation is based on the hypothesis we formulated earlier in this paper that the use of a shared word order should result in more co-activation of languages than the use of a language-specific word order, and should therefore facilitate the syntactic integration of multiple languages into one sentence.

In the dialogue experiments, we expected alignment to occur. That is, although the interactive alignment model does not make any specific claims about bilingual processes, the discussed evidence from studies on language choice in different discourse situations and the studies of cross-language syntactic priming suggests that the mechanisms of alignment are not principally different in bilingual dialogue compared to monolingual dialogue. Because word order in the dialogue tasks was not only cued by a sentence fragment but also primed by the confederate's previous utterance (the cued and primed word order were always the same), we expected that participants in the dialogue tasks would be more likely to use the cued word order in their picture descriptions than participants in the monologue tasks. We also expected participants in the dialogue tasks to align the sentence position of the switch and the language of the verb with those produced by the confederate. We expected that this alignment would be strongest when the confederate uses the SVO word order, because in that situation both alignment mechanisms and mechanisms of syntactic co-activation between languages lead to the same syntactic choice in code-switching.

Experiment 1: switching in monologue from Dutch into English

Method

Participants

The participants were 20 students of the Radboud University Nijmegen. All were native speakers of Dutch, who had started to learn English as an L2 at school from 5th grade of elementary school onwards. Participants' self-ratings of their English language skills and an English proficiency test (L_Lex Vocabulary Test; Meara, 1996) revealed that the participants were fairly proficient speakers of English. The participants also reported that they code-switch in their daily lives. Table 1 describes the participants' background characteristics in all four experiments reported in this paper. Across the different experiments, the participants did not differ significantly on the tested background variables and none of them took part in more than one experiment.

Table 1
Characteristics of the participants in Experiments 1, 2, 3, and 4.

Measure	Mean (SD)							
	Experiment 1 (*N* = 20)		Experiment 2 (*N* = 24)		Experiment 3 (*N* = 25)		Experiment 4 (*N* = 24)	
Age	21.40	(2.58)	21.92	(2.21)	21.20	(3.38)	21.38	(3.60)
Age of acquisition of English	10.45	(1.96)	9.92	(1.38)	9.64	(1.89)	10.63	(1.10)
Years of education in English	7.45	(1.10)	7.92	(1.06)	8.16	(1.11)	7.46	(1.10)
L_Lex English proficiency score	79.05	(12.95)	79.25	(11.84)	80.00	(8.30)	75.63	(11.68)
Self-rated speaking ability in English (seven-point scale)[a]	5.05	(0.94)	5.21	(0.88)	5.28	(0.61)	4.79	(1.02)
Self-rated listening ability in English (seven-point scale)[a]	5.85	(0.75)	6.00	(0.70)	6.00	(0.87)	5.71	(0.91)
Self-reported amount of code-switching (five-point scale)[b]	2.93	(0.65)	3.06	(0.68)	2.66	(0.66)	2.94	(0.73)

Note: L_Lex scores between 70 and 80 are equal to TOEFL scores of 550–600.
[a] 1 = no ability; 7 = native-like ability.
[b] 1 = never; 5 = very often.

Materials

We created 180 pictures of simple transitive events involving an actor, an action, and a patient (e.g., a girl kicking a horse). The pictures were constructed from pictures used in previous studies on language production (e.g., Hartsuiker et al., 2004) and picture databases for psycholinguistic research (Szekely et al., 2004). We used 72 pictures for critical trials and 108 for filler trials. The critical trials were constructed from a pool of 12 different actors, 12 different actions, and 36 different patients which were all denoted by non-cognate words. The Dutch and English translation equivalents of these words were matched on lemma log frequency (Dutch: $M = 1.41$, $SD = 0.58$; English: $M = 1.49$, $SD = 0.61$) and length in number of letters (Dutch: $M = 5.75$, $SD = 2.29$; English: $M = 5.33$, $SD = 1.48$), as obtained from the Web-based Celex lexical database (http://celex.mpi.nl; Baayen, Piepenbrock, & Van Rijn, 1993). To make sure that participants could unambiguously identify the agent and the patient in the pictures, the agent was always depicted on the left side of the picture. See Appendix A for the complete list of actors, actions, and patients used in the critical trials.

In each experimental trial, a picture was accompanied by a lead-in fragment and a background color. The lead-in fragment was one of three Dutch sentence-beginnings that cued the SVO, SOV, or VSO word order in Dutch, which always had to be read aloud by the participants:

- SVO: Een grappig plaatje, want… (A funny picture, because…)
- SOV: Een grappig plaatje, waarop… (A funny picture, on which…)
- VSO: Op dit plaatje… (On this picture…)

After having read aloud the lead-in fragment, the picture's background color cued the use of a specific language in describing the picture. This background-color-cueing procedure is often used in language switching studies (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999). Participants had to use at least one English word when the background was green and at least one Dutch word when the background was red. This combination of a lead-in fragment in a fixed language and a background color that cues either English or Dutch ensured that participants needed to code-switch in specific trials, namely in those where the cued language differed from the language of the lead-in fragment. When the cued language was the same as the language of the lead-in fragment, participants did not have to switch, but were not forced *not* to switch: As long as they used at least one word of the cued language, they were free to use words from the other language too. Thus, whereas the use of a language cue sometimes forced participants to switch (which is a slight deviation from natural code-switching, but guarantees a sufficient sample of code-switches in controlled conditions), the language cue never forced participants to inhibit a language in part of the trials (which is similar to natural code-switching).

The three lead-in fragments and two background colors were combined into six conditions and evenly distributed across the 72 critical trials. The stimulus list was completed with the 108 filler trials, which were all-English (English lead-in fragment + green background color, in which the lead-in fragments were translations of the three Dutch lead-in fragments, and were evenly distributed across the experiment), to create a language environment in which both English and Dutch were highly activated (the lexical items used in the fillers were different from those in the critical trials; the fillers were also used to create 12 practice trials).

Four pseudo-randomized versions of the experiment were constructed, in which we made sure that every next time a specific actor, action, or patient occurred in a picture, the language cue with this picture was different from the previous time this actor, action, or patient occurred in a picture. The occurrence of trials with a Dutch or English language cue was always unpredictable. We counterbalanced the critical pictures such that each picture never occurred more than once in each list and pictures with a Dutch language cue in one version had an English language cue in another version (and vice versa).

Apparatus and procedure

All participants were tested individually in a quiet room. Prior to the experiment, participants were familiarized with the actors, actions, and patients that were used in the experiment by naming the Dutch and English names that accompanied the pictures. The purpose of this familiarization was to ensure that participants were familiar with the Dutch and English names of the actors, actions, and patients, so that the code-switching patterns in the experimental task could be associated with syntactic processing and not with problems in lexical access. This familiarization procedure is quite common in studies on bilingual picture naming (e.g., Costa & Santesteban, 2004; Hermans, Bongaerts, de Bot, & Schreuder, 1998).

After the familiarization, participants received instructions for the experimental task. They were told that they would be performing a computer task in which they had to read aloud a sentence fragment and complete it by describing the picture depicted below the sentence fragment (sentence fragment and picture were depicted on the same computer screen). In describing the pictures, participants had to use at least one English word when the picture's background color was green and at least one Dutch word when the background color was red. Participants were free to decide how they constructed their picture descriptions: As in natural code-switching, they could switch at any sentence position they wanted, as often as they wanted to, and use whatever word order they wanted. Participants were told there was no 'right' or 'wrong' way of doing this task; we were just interested in how they described these pictures in different languages.

Each participant completed a block of 12 practice trials and then completed one of four versions of the stimulus list described in the materials section. The task was self-paced (participants pressed the space bar to initiate the next trial) and was conducted on a laptop using E-prime. Responses were recorded and transcribed. After the experimental task, participants performed the L_Lex vocabulary task and filled in a language history questionnaire. A complete testing session lasted about 50 min.

Scoring and analysis

For each response, we determined the word order choice, sentence position of switching, and language of the verb. Word order choices were scored for whether the SVO, SOV, or VSO structure was used. We subsequently used the number of SVO responses relative to non-SVO responses as the dependent measure in the statistical analysis. Sentence position of switching was scored for whether the switch was made pre-description (i.e., switch directly after the participant had read aloud the lead-in fragment, but no switch within the picture description itself) or mid-description (i.e., the picture description itself contains a code-switch). Responses containing more than one switch (e.g., *Een grappig plaatje, want THE GIRL schopt THE HORSE* [meaning the girl kicks the horse]) were counted as mid-description switches. Language of the verb was scored for whether the verb was English or Dutch.

We tested to what extent participants' syntactic choices (i.e., SVO or non-SVO) were influenced by the word order cue (as given by the lead-in fragment) and by the language cue (as given by the background color). We further explored to what extent participants' switch position (i.e., pre-description or mid-description) and language of the verb in the mid-description switches (i.e., English or Dutch) depended on the actual word order the participants chose.

We used the lme4-package (Bates, Maechler, & Dai, 2007) in R version 2.7.2. (R Development Core Team, 2008) to perform mixed-effects logistic regression analyses with random intercepts for participants and items (see, e.g., Baayen, 2008; Baayen, Davidson, & Bates, 2008) in all data analyses. The advantage of mixed-effects models compared to the more traditional analysis of variance is that they directly include subject and item variance in the model, and therefore no longer require separate F_1 and F_2 analyses. They are also better capable of dealing with missing values than ANOVA. Moreover, because the dependent measures were binomial in all our analyses (chosen word order SVO or not SVO; switch position pre-description or mid-description; verb language English or Dutch), logistic regression makes it possible to perform the analyses directly on the participants' actual responses; it does not require aggregation to a mean response per condition (see also Dixon, 2008; Jaeger, 2008). Finally, the mixed-effects models enabled us not only to examine the influence of *manipulated* variables, but also to include participants' *own syntactic choices* as predictors for the sentence position of switching and language of the verb in mid-description switches. See the supplementary materials for more details on the analyses (Appendix C).

The mixed-effects analyses are summarized in tables that report the influence of each predictor variable by giving its parameter estimate (*B*), the standard error of the parameter estimate (*SE B*), its *z*-value (which is a measure of whether that specific predictor variable makes a significant contribution to the model, similar to a predictor's *t*-value in linear regression) and its *p*-value. Because these analyses directly examine the effect of levels within manipulated factors and not the factor as a whole (the levels of a factor are converted into dummy variables, which are used as predictors in the analysis), the predictor variables in the tables refer to these levels within the manipulated factors. Since the use of mixed-effects logistic regression is still quite new, we will also report the results of more traditional analyses (ANOVA[2] or Chi Square).

Results

The participants produced 1444 picture descriptions, consisting of 805 switched utterances and 639 non-switched utterances. Table 2 presents the proportions of responses per condition, as well as the total proportion of responses per condition in which the participants used the SVO word order (below the dotted line in Table 2).

The results of the mixed logistic regression analysis on the participants' likelihood to use the SVO word order are given in Table 3 (this table gives the results of the same analysis for all four experiments). The analysis yielded significant effects of cued word order and significant interaction effects of cued word order with cued language. The participants preferred to use SVO when they had to switch to English, irrespective of the word order that was cued by the lead-in fragments. However, when they had to use at least one Dutch word (and therefore did not have to switch to English), they generally followed the word order cue, with the effect that the preference for SVO was only present when the lead-in fragment cued this word order (see Table 2). Similar conclusions can be drawn from a 3 (cued word order) $\times$ 2 (cued language) ANOVA on the same data: cued word order, $F_1(2, 18) = 71.78$, $p < .001$; $F_2(2, 70) = 1582.99$, $p < .001$; *Min* $F'(2, 20) = 68.66$, $p < .001$; cued language, $F_1(1, 19) = 151.66$, $p < .001$; $F_2(1, 71) = 2226.37$, $p < .001$; *Min* $F'(1, 22) = 141.98$, $p < .001$; cued word order $\times$ cued language, $F_1(2, 18) = 80.77$, $p < .001$; $F_2(2, 70) = 1107.47$, $p < .001$; *Min* $F'(2, 21) = 75.27$, $p < .001$.

We further explored to what extent participants' switch position (pre- vs. mid-description) depended on the actual word order they had chosen. Table 4 presents the descriptives of this analysis (for all four experiments reported in this study), and shows that the number of pre- relative to mid-description switches was more absolute when participants had chosen SOV or VSO than when they had chosen SVO: SOV or VSO switches basically occurred only mid-description, whereas SVO switches occurred both mid- and pre-description. This is confirmed in the analysis reported in Table 5 (which gives a summary of the same analysis in all four experiments). Switch positions were significantly different when SVO was chosen than when SOV or VSO was chosen. This interdependency between switch position and chosen word order was also found in a chi square analysis on the same data: $\chi^2(2) = 88.68$, $p < .001$.

When we focus on the mid-description switches, Table 4 suggests that the number of English verbs relative to Dutch verbs differed depending on whether the SVO, SOV, or VSO word order was chosen. The analysis in Table

[2] In the ANOVAs, missing values were imputed using the estimation maximization method in SPSS Missing Values Analysis. Because of differences in the way ANOVA and mixed-effects logistic regression are calculated, the results of the ANOVAs may sometimes differ slightly from the mixed-effects models.

Table 2
Proportions of response types per condition in Experiment 1 (switching in monologue from Dutch into English).

	No switch needed (language cue = Dutch)			Switch needed (language cue = English)		
Participant:	SVO	SOV	VSO	SVO	SOV	VSO
Does not switch						
– and uses SVO	.82	.03	.07	.05	.00	.00
– and uses SOV	.00	.84	.00	.00	.05	.00
– and uses VSO	.00	.00	.80	.00	.00	.01
Switches pre-description						
– and uses SVO	.03	.01	.01	.65	.66	.64
– and uses SOV	.00	.00	.00	.00	.00	.00
– and uses VSO	.00	.00	.00	.00	.00	.03
Switches mid-description						
– and uses SVO	.15	.08	.07	.30	.19	.22
– and uses SOV	.00	.04	.00	.00	.10	.00
– and uses VSO	.00	.00	.05	.00	.00	.10
Total use of SVO word order	1.00	.12	.15	1.00	.85	.86

6 confirms this pattern. The number of English relative to Dutch verbs was significantly higher when SVO was chosen than when SOV or VSO was chosen. The analysis further showed that the number of Dutch relative to English verbs was significantly higher when VSO was chosen than when SOV was chosen. This interdependency between language of the verb and chosen word order was also found in a chi square analysis: $\chi^2(2) = 35.67$, $p < .001$. Furthermore, in those cases where SVO was chosen, there were no significant differences in the number of English relative to Dutch verbs between whether these SVO switches were made after an SVO, SOV, or VSO lead-in fragment (lead-in fragment SVO: 55% English verbs; lead-in fragment SOV: 63% English verbs; lead-in fragment VSO: 64% English verbs; $F(2, 235) = 0.90$, $p = .41$), which shows that the SVO choices did not lead to different switching patterns when participants did not follow the cued word order (i.e., after SOV or VSO lead-in fragments) as compared to when they did (i.e., after SVO lead-in fragments).

Discussion

Experiment 1 showed that participants adapted their syntactic choices to the word order cued by the lead-in fragments, but only when they did not have to switch and had to use Dutch in their picture description. When they had to switch and use English, they nearly always used the SVO word order, irrespective of the word order that was cued. The analyses on switch position and language of the verb demonstrated that the use of SVO led to different switching patterns than the use of SOV or VSO. On those infrequent occasions that a VSO or SOV switch was made, the switches were almost always mid-description, whereas the distribution of pre- and mid-description switches was more balanced in SVO sentences. Moreover, the verb in these SOV and VSO switches was more often Dutch than English, which was not the case in SVO switches, irrespective of whether these SVO switches were made after an SVO, SOV, or VSO lead-in fragment.

Parts of our data can be accounted for by different explanations. The SVO preference could have arisen because participants had to switch into English and SVO is the only grammatical word order in English. Although this can explain the higher frequency of SVO choices, it cannot explain the higher flexibility of switching within this SVO word order. The same counts for a second possible explanation of the SVO preference, namely that the all-English fillers could have primed the SVO word order in the critical conditions. A third explanation for the SVO preference could be that the agent was always depicted on the left side of the picture, which could have made subject–verb word orders more likely than verb–subject orders. However, this explanation would predict no differences between SOV and SVO responses because the agent is named before the action in both these word orders, which is not what we observed. Fourth, suppression of L1 word orders (SOV and VSO) could have caused the SVO word order to be more accessible, as is observed with the suppression of L1 words and associated asymmetrical switching costs in studies on language switching in word production (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999). This suppression explanation is difficult to reconcile with the fact that the participants were never forced to inhibit one of their languages in performing the experimental task (and, indeed, they sometimes switched when in conditions in which a switch was not needed; see Table 2). The only explanation that covers the complete pattern of our data is that the shared status of the SVO word order makes it easier for both languages to be merged in one sentence. This explanation not only accounts for the higher frequency of SVO switches, but especially for the higher flexibility of switching while using this word order. Thus, while a combination of factors may have contributed to the observed SVO preference when switching from Dutch into English, the most plausible explanation for the combined finding of an SVO preference and a higher flexibility of switching in SVO descriptions is the shared status of the SVO word order.

To investigate the scope of this explanation, it is critical to examine switching from English into Dutch as well. As Dutch has three different word orders in transitive sentences, it could well be that switching into Dutch results in a less predominant preference for the SVO word order.

Table 3
Summary of mixed logistic regression analyses for variables predicting SVO word order choice in Experiments 1, 2, 3 and 4.

Predictor	*B*	*SE B*	*z*-value	*p*-value
Experiment 1				
Cued word order:				
SOV vs. SVO	−8.50	0.85	−10.05	.0000
VSO vs. SVO	−8.12	0.83	−9.69	.0000
Cued word order × cued language:				
SOV vs. SVO × English vs. Dutch	4.88	1.13	4.29	.0000
VSO vs. SVO × English vs. Dutch	4.62	1.13	4.08	.0000
Experiment 2				
Cued language:				
English vs. Dutch	−2.66	0.76	−3.47	.0005
Cued word order × cued language:				
SOV vs. SVO × English vs. Dutch	−3.29	0.99	−3.31	.0009
VSO vs. SOV × English vs. Dutch	1.98	0.77	2.58	.0098
Experiment 3				
Cued word order:				
SOV vs. SVO	−9.31	1.21	−7.66	.0000
VSO vs. SVO	−9.27	1.22	−7.59	.0000
Cued word order × cued language:				
SOV vs. SVO × English vs. Dutch	3.12	1.48	2.11	.0353
VSO vs. SVO × English vs. Dutch	3.02	1.49	2.03	.0426
Experiments 1 and 3 *combined*				
Cued word order:				
SOV vs. SVO	−8.18	0.60	−13.58	.0000
VSO vs. SVO	−7.99	0.59	−13.38	.0000
Cued word order × cued language:				
SOV vs. SVO × English vs. Dutch	4.02	0.55	7.26	.0000
VSO vs. SVO × English vs. Dutch	3.73	0.54	6.83	.0000
Cued word order × experimental setting:				
SOV vs. SVO × monologue vs. dialogue	1.97	0.55	3.59	.0003
VSO vs. SVO × monologue vs. dialogue	2.11	0.55	3.81	.0001
Experiment 4				
Cued word order:				
SOV vs. SVO	−3.23	0.84	−3.86	.0001
VSO vs. SVO	−4.04	0.83	−4.85	.0000
VSO vs. SOV	−0.81	0.38	−2.15	.0317
Cued word order × cued language:				
SOV vs. SVO × English vs. Dutch	−3.24	0.98	−3.31	.0009
VSO vs. SOV × English vs. Dutch	1.90	0.45	4.20	.0000
Experiments 2 and 4 *combined*				
Cued word order:				
SOV vs. SVO	−2.21	0.48	−4.64	.0000
VSO vs. SVO	−3.09	0.46	−6.59	.0000
VSO vs. SOV	−0.88	0.32	−2.77	.0057
Cued word order × cued language:				
SOV vs. SVO × English vs. Dutch	−3.61	0.49	−7.38	.0000
VSO vs. SVO × English vs. Dutch	−1.68	0.46	−3.66	.0002
VSO vs. SOV × English vs. Dutch	1.92	0.35	5.46	.0000
Cued word order × experimental setting:				
SOV vs. SVO × monologue vs. dialogue	2.06	0.45	4.58	.0000
VSO vs. SVO × monologue vs. dialogue	2.34	0.43	5.41	.0000
Cued language × experimental setting:				
English vs. Dutch × monologue vs. dialogue	−1.48	0.34	−4.33	.0000

Note: For the sake of conciseness, non-significant predictors were not included in the table. Experiment 1 tested switching in monologue from Dutch to English; Experiment 2 tested switching in monologue from English to Dutch; Experiment 3 tested switching in dialogue from Dutch to English; Experiment 4 tested switching in dialogue from English to Dutch. Standard deviations of random intercept terms were for *Experiment 1*: 1.35 for participants and 0.29 for Items; *Experiment 2*: 1.32 for participants and 0.11 for Items; *Experiment 3*: 1.58 for participants and 0.52 for Items; *Experiment 1 and 3 combined*: 1.14 for participants and 0.25 for Items; *Experiment 4*: 1.48 for participants and 0.41 for Items; *Experiment 2 and 4 combined*: 1.44 for participants and 0.21 for Items.

The argumentation goes as follows. If participants maintain the SVO preference when they switch into Dutch – even though the lead-in fragments cue the SOV or VSO word order – and switching flexibility is still higher in the SVO word order when participants switch into Dutch, we can safely argue that the shared word order (SVO) facilitates switching between languages. However, if participants mainly use the cued word order just as they did in the all-Dutch conditions in Experiment 1, and the switching flexibility is not higher in the SVO word order than in the SOV and VSO word order, the conclusion of shared word order as a facilitator of code-switching needs to be

Table 4
Cross-tabulation of switch position with chosen word order and language of the verb with chosen word order for Experiments 1, 2, 3, and 4.

	Chosen word order		
	SVO	SOV	VSO
Experiment 1			
Pre-description switch	481 (.67)	2 (.05)	8 (.17)
Mid-description switch	241 (.33)	35 (.95)	38 (.83)
– English verb	145 (.60)	13 (.37)	4 (.11)
– Dutch verb	96 (.40)	22 (.63)	34 (.89)
Experiment 2			
Pre-description switch	288 (.49)	190 (.91)	113 (.93)
Mid-description switch	303 (.51)	19 (.09)	8 (.07)
– English verb	166 (.55)	0 (.00)	0 (.00)
– Dutch verb	137 (.45)	19 (1.00)	8 (1.00)
Experiment 3			
Pre-description switch	300 (.64)	35 (.29)	43 (.34)
Mid-description switch	170 (.36)	86 (.71)	84 (.66)
– English verb	107 (.63)	32 (.37)	16 (.19)
– Dutch verb	63 (.37)	54 (.63)	68 (.81)
Experiment 4			
Pre-description switch	217 (.56)	118 (.59)	113 (.71)
Mid-description switch	170 (.44)	80 (.41)	46 (.29)
– English verb	92 (.54)	6 (.08)	38 (.83)
– Dutch verb	78 (.46)	74 (.92)	8 (.17)

Note: Experiment 1 tested switching in monologue from Dutch to English; Experiment 2 tested switching in monologue from English to Dutch; Experiment 3 tested switching in dialogue from Dutch to English; Experiment 4 tested switching in dialogue from English to Dutch. The numbers between parentheses are column proportions.

revised. Code-switching from English into Dutch was therefore studied in Experiment 2.

Experiment 2: switching in monologue from English into Dutch

Method

Participants

We selected 24 participants from the same population as in Experiment 1. See Table 1 for an overview of the participants' characteristics.

Materials

The stimuli, design, randomization, and counterbalancing procedures were identical to Experiment 1. In Experiment 2, however, we translated all materials that were Dutch in Experiment 1 into English and vice versa, resulting in 72 critical trials with English lead-in fragments and 108 all-Dutch filler trials (Dutch lead-in fragment + red background color; the three different lead-in fragments being evenly distributed across the experiment). The lead-in fragments for the critical items cued the Dutch SVO, SOV, or VSO word order:

- SVO: A funny picture, because...
- SOV: A funny picture, on which...
- VSO: On this picture...

Apparatus and procedure; scoring and analysis

The apparatus and procedure as well as the scoring and analyses were identical to those of Experiment 1.

Table 5
Summary of mixed logistic regression analyses for variables predicting participants' switch position in Experiments 1, 2, 3 and 4.

Predictor	*B*	*SE B*	*z*-value	*p*-value
Experiment 1				
Chosen word order:				
SOV vs. SVO	3.21	0.86	3.73	.0002
VSO vs. SVO	2.06	0.49	4.19	.0000
Experiment 2				
Chosen word order:				
SOV vs. SVO	−2.43	0.32	−7.51	.0000
VSO vs. SVO	−2.53	0.44	−5.72	.0000
Experiment 3				
Step 1				
Chosen word order:				
SOV vs. SVO	1.07	0.28	3.81	.0001
VSO vs. SVO	1.12	0.27	4.05	.0000
Step 2				
Chosen word order:				
SOV vs. SVO	1.14	0.28	4.04	.0000
VSO vs. SVO	1.17	0.27	4.26	.0000
Switch position confederate:				
Mid-description vs. pre-description	1.09	0.25	4.36	.0000
Experiment 4				
Step 1				
Chosen word order:				
VSO vs. SVO	−0.88	0.27	−3.25	.0012
VSO vs. SOV	−1.02	0.31	−3.34	.0008
Step 2				
Chosen word order:				
SOV vs. SVO	−1.71	0.59	−2.88	.0040
VSO vs. SVO	−1.42	0.61	−2.33	.0200
Switch position confederate:				
Mid-description vs. pre-description	1.06	0.35	2.99	.0028
Chosen word order × switch position conf.:				
SOV vs. SVO × mid-descr. vs. pre-descr.	2.68	0.67	4.00	.0000
VSO vs. SOV × mid-descr. vs. pre-descr.	−1.95	0.86	−2.28	.0222

Note: For the sake of conciseness, non-significant predictors were not included in the table. Experiment 1 tested switching in monologue from Dutch to English; Experiment 2 tested switching in monologue from English to Dutch; Experiment 3 tested switching in dialogue from Dutch to English; Experiment 4 tested switching in dialogue from English to Dutch. Standard deviations of random intercept terms were for *Experiment 1*: 1.65 for participants and 0.73 for Items; *Experiment 2*: 1.73 for participants and 0.83 for Items; *Experiment 3, Step 1*: 1.27 for participants and 0.66 for Items; *Experiment 3, Step 2*: 1.27 for participants and 0.51 for Items; *Experiment 4, Step 1*: 1.42 for participants and 0.87 for Items; *Experiment 4, Step 2*: 1.41 for participants and 0.63 for items.

Results

The participants produced 1727 picture descriptions, of which 921 contained a code-switch and 806 contained no code-switch. An overview of the responses per condition is given in Table 7.

The results of the mixed logistic regression analysis on the participants' likelihood to use the SVO word order are given in Table 3. The analysis yielded a significant effect of Cued Language, and a significant interaction effect of cued language by cued word order. When participants did not have to switch and had to produce (at least one word in) English in their picture description, they nearly always chose the SVO word order. However, when they needed to switch and produce (at least one word in) Dutch,

Table 6
Summary of mixed logistic regression analyses for variables predicting participants' language of the verb in mid-description switches in Experiments 1, 2, 3 and 4.

Predictor	*B*	*SE B*	*z*-value	*p*-value
Experiment 1				
Chosen word order:				
SOV vs. SVO	0.94	0.48	1.96	.0497
VSO vs. SVO	3.01	0.66	4.59	.0000
VSO vs. SOV	2.07	0.77	2.67	.0075
Experiment 2				
Chosen word order:				
SOV vs. SVO	3.16	1.16	2.72	.0065
VSO vs. SVO	2.37	1.22	1.95	.0523
Experiment 3				
Step 1				
Chosen word order:				
SOV vs. SVO	1.01	0.28	3.60	.0003
VSO vs. SVO	1.96	0.33	5.97	.0000
VSO vs. SOV	0.95	0.36	2.61	.0091
Step 2				
Chosen word order:				
SOV vs. SVO	1.66	0.32	5.12	.0000
VSO vs. SVO	1.71	0.34	5.04	.0000
Verb language confederate:				
English vs. Dutch	1.31	0.29	4.45	.0000
Experiment 4				
Step 1				
Chosen word order:				
VSO vs. SVO	3.14	0.71	4.41	.0000
VSO vs. SVO	−1.66	0.50	−3.34	.0008
VSO vs. SOV	−4.81	0.83	−5.78	.0000
Step 2				
Chosen word order:	2.85	0.73	0.38	.0001
SOV vs. SVO	−0.99	0.53	−1.88	.0606
VSO vs. SVO	−3.85	0.86	−4.46	.0000
VSO vs. SOV				
Verb language confederate:	1.81	0.38	4.71	.0000
English vs. Dutch				

Note: Non-significant predictors were not included in the table. Experiment 1 tested switching in monologue from Dutch to English; Experiment 2 tested switching in monologue from English to Dutch; Experiment 3 tested switching in dialogue from Dutch to English; Experiment 4 tested switching in dialogue from English to Dutch. Standard deviations of random intercept terms were for *Experiment 1*: 0.78 for participants and 1.03 for Items; *Experiment 2*: 0.66 for participants and 0.67 for Items; *Experiment 3, Step 1*: 0.11 for participants and 0.13 for Items; *Experiment 3, Step 2*: 0.09 for participants and 0.10 for Items; *Experiment 4, Step 1*: 0.59 for participants and 0.79 for Items; *Experiment 4, Step 2*: 0.84 for participants and 0.66 for items.

word order preferences depended on the conditions. The SVO preference remained in the SVO condition, but in the SOV and VSO conditions there was no real preference for either the cued word order or the SVO word order (although responses suggest a slight preference for SOV in the SOV condition and a slight preference for SVO in the VSO condition; see Table 7). Similar conclusions can be drawn from ANOVAs on the same data: Cued Word Order, $F_1(2, 22) = 54.61$, $p < .001$; $F_2(2, 70) = 167.12$, $p < .001$; *Min* $F'(2, 37) = 41.16$, $p < .001$; cued language, $F_1(1, 23) = 73.91$, $p < .001$; $F_2(1, 71) = 690.92$, $p < .001$; *Min* $F'(1, 28) = 66.76$, $p < .001$; cued word order × cued language, $F_1(2, 22) = 66.63$, $p < .001$; $F_2(2, 70) = 205.46$, $p < .001$; *Min* $F'(2, 37) = 50.31$, $p < .001$.

Table 5 shows the results of the mixed logistic regression analysis on the extent to which participants switched pre-description or mid-description as a function of the word order they chose (descriptive statistics are given in Table 4). Significant effects of chosen word order were obtained. When participants used the SOV or VSO word order, they hardly switched mid-description, but when they used the SVO word order, the relative number of mid-description versus pre-description switches was quite balanced (see Table 4). This interdependency between switch position and chosen word order was also found in a chi square analysis on the same data: $\chi^2(2) = 171.18$, $p < .001$.

Table 4 further suggests that the language of the verb in the mid-description switches depended on the chosen word order. The verb was never English when SOV or VSO was used, whereas the distribution of English relative to Dutch verbs was almost fifty–fifty when SVO was used. This relation between the language of the verb and chosen word order was confirmed in the mixed logistic regression analysis that is summarized in Table 6, as well as in a chi square analysis: $\chi^2(2) = 29.77$, $p < .001$. In addition, the balanced distribution of English relative to Dutch verbs in SVO switches was independent of whether these SVO switches were made after an SVO, SOV, or VSO lead-in fragment (lead-in fragment SVO: 49% English verbs; lead-in fragment SOV: 58% English verbs; lead-in fragment VSO: 59% English verbs; $F(2, 300) = 1.34$, $p = .26$). This shows that the SVO choices did not lead to different switching patterns when participants did not follow the cued word

Table 7
Proportions of response types per condition in Experiment 2 (switching in monologue from English into Dutch).

	No switch needed (language cue = English)			Switch needed (language cue = Dutch)		
Participant:	SVO	SOV	VSO	SVO	SOV	VSO
Does not switch						
– and uses SVO	.85	.85	.83	.07	.09	.10
– and uses SOV	.00	.00	.00	.00	.01	.00
– and uses VSO	.00	.00	.01	.00	.00	.00
Switches pre-description						
– and uses SVO	.00	.01	.01	.60	.10	.28
– and uses SOV	.00	.00	.00	.08	.57	.00
– and uses VSO	.00	.00	.01	.00	.00	.39
Switches mid-description						
– and uses SVO	.15	.13	.12	.24	.18	.21
– and uses SOV	.00	.01	.00	.01	.05	.00
– and uses VSO	.00	.00	.02	.00	.00	.01
Total use of SVO word order	1.00	.99	.96	.91	.37	.59

order (i.e., after SOV or VSO lead-in fragments) as compared to when they did (i.e., after SVO lead-in fragments).

Discussion

Similar to Experiment 1, participants in Experiment 2 nearly always chose the SVO word order in SVO conditions. Contrary to Experiment 1, however, there was now no clear preference for either SVO or the cued word order when participants had to switch into Dutch while being cued with the SOV or VSO word order. Interestingly, this mixed preference turned out to coincide with the participants' sentence position of switching. When participants switched into Dutch and used the SOV or VSO word order, they mainly did so by switching pre-description (and thus in effect produced a monolingual picture description). In contrast, almost all mid-description switches (which can be argued to be the only 'real' cases in which the participant *actively* uses multiple languages within the picture description itself) were made with the SVO word order. The same restrictions on switching in SOV and VSO word orders were observed with respect to the language of the verb. SOV or VSO switches with an English verb were non-existent, whereas SVO switches were made with both Dutch and English verbs, irrespective of whether the lead-in fragment cued SVO, SOV, or VSO. These findings demonstrate that English and Dutch can contribute equally in the SVO word order, without any constraints on the position of switching or the language of the verb, while switching mid-description with an SOV or VSO word order is restrictive and generally avoided. Together with the higher frequency of SVO choices in general, this is evidence that the shared status of the SVO word order facilitates code-switching.

The next question is how the linguistic behavior of a dialogue partner further influences bilinguals' production of code-switched sentences. Do bilinguals align their code-switching patterns with those of their dialogue partner? And will they do so even when the dialogue partner produces syntactically unlikely code-switches? In Experiments 3 and 4, we tested alignment in code-switching by embedding the tasks of Experiments 1 and 2 in confederate-scripted dialogue.

Experiment 3: switching in dialogue from Dutch into English

Method

Participants

The participants were 25 students from the same population as in Experiments 1 and 2. Their background characteristics are reported in Table 1. The confederate was a female student of the Radboud University Nijmegen (age: 23), whose language background was comparable to the real participants. None of the participants knew the confederate or were aware that the confederate played a part in the experimental manipulation.

Materials

As in Experiments 1 and 2, an experimental trial consisted of a picture accompanied by a lead-in fragment and a background color. The additional feature in the present experiment was a prime utterance by the confederate that was added to each trial.

The lead-in fragments and background colors in the critical trials were the same as in Experiment 1 (Dutch lead-in fragments cueing SVO, SOV, or VSO; green and red background colors cueing English and Dutch, respectively). We constructed 210 pictures (105 for the confederate and 105 for the real participant), of which 90 were used in the critical trials and 120 in filler trials. The 90 critical pictures were constructed from a pool of 15 different actors, 12 different actions, and 45 different patients.[3] The names of all actors, actions, and patients were non-cognates, and their Dutch and English translation equivalents were matched on lemma log frequency (Dutch: $M = 1.30$, $SD = 0.65$; English: $M = 1.37$, $SD = 0.68$) and length in number of letters (Dutch: $M = 5.65$, $SD = 2.22$; English: $M = 5.30$, $SD = 1.39$). See Appendix B for the complete list of actors, actions, and patients.

The confederate's prime utterance consisted of a lead-in fragment that was completed by a picture description. In both switch and non-switch conditions, the confederate always used the word order that was cued by the lead-in fragment, even when this would lead to an ungrammatical picture description. The word order condition in the confederate's turn and the participant's subsequent turn was always the same, so that the confederate's prime utterance provided an additional word order prime to the word order cue from the lead-in fragment in the participant's turn. The confederate's utterance was also manipulated with respect to the position of the code-switch. The switch was either positioned directly at the first word of the picture description (so: pre-description switch), before the second word of the picture description (mid-description switch), or before the third word of the picture description (mid-description switch). The confederate always switched only once in every utterance. Examples of the confederate's turn and the participant's subsequent turn are given in Table 8. This table also shows that the lead-in fragment and the language cue in the participant's turn were always the same as in the confederate's turn (so the participant always had to switch on the same trials the confederate switched), and that the actor and the verb always overlapped between the prime and target. This was done to optimize the conditions for alignment to occur.

Because the inclusion of all conditions in one list would result in either very long stimulus lists or very few trials per condition, we distributed the different conditions across three different stimulus lists, with each list containing six conditions in which a code-switch was needed and three conditions in which no code-switch was needed. The first list contained the conditions in which the confederate switched at the first or the second word of the picture

[3] The reason for a different number of actors and patients in Experiment 3 as compared to Experiments 1 and 2 was the dialogue setting of Experiment 3. In this setting, a picture was needed for both the confederate's trials and the participant's trials. To be able to come up with sufficient picture pairs for the confederate and the participant and at the same time retain some variation between the pictures to be described, we used more different actors and patients in the critical trials of Experiment 3.

Table 8
Overview of prime-target pairs between the confederate and participant in code-switch conditions in Experiment 3.

Condition	Trial turn	Lead-in fragment	Picture description
|SVO	Confederate prime	Een grappig plaatje, want...	THE GIRL KICKS THE HORSE
	Participant target	Een grappig plaatje, want...	[picture of girl kicking turtle]
S|VO	Confederate prime	Een grappig plaatje, want...	Het meisje KICKS THE HORSE
	Participant target	Een grappig plaatje, want...	[picture of girl kicking turtle]
SV|O	Confederate prime	Een grappig plaatje, want...	Het meisje schopt THE HORSE
	Participant target	Een grappig plaatje, want...	[picture of girl kicking turtle]
|SOV	Confederate prime	Een grappig plaatje, waarop...	THE GIRL THE HORSE KICKS
	Participant target	Een grappig plaatje, waarop...	[picture of girl kicking turtle]
S|OV	Confederate prime	Een grappig plaatje, waarop...	Het meisje THE HORSE KICKS
	Participant target	Een grappig plaatje, waarop...	[picture of girl kicking turtle]
SO|V	Confederate prime	Een grappig plaatje, waarop...	Het meisje het paard KICKS
	Participant target	Een grappig plaatje, waarop...	[picture of girl kicking turtle]
|VSO	Confederate prime	Op dit plaatje...	KICKS THE GIRL THE HORSE
	Participant target	Op dit plaatje...	[picture of girl kicking turtle]
V|SO	Confederate prime	Op dit plaatje...	Schopt THE GIRL THE HORSE
	Participant target	Op dit plaatje...	[picture of girl kicking turtle]
VS|O	Confederate prime	Op dit plaatje...	Schopt het meisje THE HORSE
	Participant target	Op dit plaatje...	[picture of girl kicking turtle]

Note: The vertical dash ('|') refers to the sentence position where the confederate switched languages. Capitalized words are in English; non-capitalized words are in Dutch.

description; the second list contained the conditions in which the confederate switched at the first or the third word of the picture description; the third list contained the conditions in which the confederate switched at the second or the third word of the picture description. The three conditions in which no switch was needed were the same in each list (SVO, SOV, and VSO). Together with 60 all-English filler items, each stimulus list consisted of 105 trials (where a trial consists of the confederate's prime utterance and the participant's target item), in which there were always five trials in each condition. Each stimulus list was randomized into three versions. Randomization and counterbalancing of items was identical to Experiments 1 and 2.

Apparatus and procedure

The participants were tested in a quiet room. Each session started with a similar familiarization procedure as in Experiments 1 and 2, in which the confederate and the real participant sat in front of the same laptop and named the words that were printed below the pictures in turns. Then, in the true experiment, the confederate and participant sat opposite each other, both with a laptop in front of them. They were told that they would be performing a dialogue game in which they had to take turns in describing pictures and selecting the matching picture. The instructions for describing a picture were the same as in Experiments 1 and 2: Read aloud the depicted sentence fragment and complete it by describing the picture, in which at least one English word has to be used when the background color is green and at least one Dutch word when the background color is red. The instructions for choosing the matching picture were to choose the described picture from two pictures that were displayed on the participant's laptop by pressing one of two keys on the laptop. On pressing the key, a new trial began in which the turns changed; the person who had just chosen a picture now had to describe one (the participants' laptops were connected by means of a null modem cable, so that the key press for choosing the matching picture automatically served as input for the other laptop to initiate the next trial). The confederate pretended to perform the same task as the real participant, but was in fact simply reading aloud her entire turn exactly as presented on her screen. The confederate always had the first turn in describing the pictures. The confederate and real participant were treated as if they both were true participants.

The participants started with a block of 12 practice trials and then completed the 105 experimental trials. Each participant was assigned one of the experimental versions described in the materials section, in which the different stimulus lists were evenly distributed across the participants (the first and second stimulus lists were assigned to eight participants; the third stimulus list was assigned to nine participants). The experiment was run on laptops using E-prime. Responses were recorded and transcribed. After the experimental task, the confederate and real participant were taken to different rooms to perform the L_Lex vocabulary task and to fill in a language history questionnaire (but in fact only the real participant performed these additional tasks). An entire session lasted about 60 min.

Scoring and analysis

The scoring and analyses were done as in Experiments 1 and 2, except that we now also examined whether the participants' responses were influenced by the confederate's utterance. To test this with respect to word order choice, we combined the data of the present experiment with the data of Experiment 1 to directly compare word order choice in monologue (in which word order was only cued by a lead-in fragment) with word order choice in dialogue (in which word order was not only cued by a lead-in fragment, but also primed by the confederate). To analyze alignment of switch position and language of the verb, a comparison between a Step 1 and Step 2 analysis on the

Table 9
Proportions of response types per condition in Experiment 3 (switching in dialogue from Dutch into English).

	No switch			Confederate switches pre-description			Confederate switches mid-description		
Participant:	SVO	SOV	VSO	SVO	SOV	VSO	SVO	SOV	VSO
Does not switch									
– and uses SVO	1.00	.00	.00	.01	.00	.00	.03	.00	.00
– and uses SOV	.00	1.00	.00	.00	.00	.00	.00	.01	.00
– and uses VSO	.00	.00	1.00	.00	.00	.00	.00	.00	.01
Switches pre-description									
– and uses SVO	.00	.00	.00	.68	.33	.35	.49	.38	.31
– and uses SOV	.00	.00	.00	.00	.23	.00	.00	.11	.00
– and uses VSO	.00	.00	.00	.00	.00	.30	.00	.00	.12
Switches mid-description									
– and uses SVO	.00	.00	.00	.31	.10	.11	.48	.14	.16
– and uses SOV	.00	.00	.00	.00	.34	.00	.00	.36	.00
– and uses VSO	.00	.00	.00	.00	.00	.24	.00	.00	.40
Total use of SVO word order	1.00	.00	.00	1.00	.43	.46	1.00	.52	.47

same data sufficed. The Step 1 analyses were exactly the same analyses as those done in the monologue experiments; the Step 2 analyses included the confederate's switch position respectively language of the verb as an additional predictor. In the analysis on switch position, we collapsed the conditions in which the confederate switched at the second or third word into one condition labeled 'mid-description switch' (the confederate's switch positions were thus scored as either 'pre-description' or 'mid-description').

Results

The participants produced 966 picture descriptions, consisting of 718 switched utterances and 248 non-switched utterances. Table 9 gives an overview of the participants' responses.

The results of the mixed logistic regression analysis on the participants' likelihood to use the SVO word order are given in Table 3. The analysis yielded significant effects of cued word order and significant interaction effects of cued word order with cued language. When participants had to use Dutch (and so did not have to switch), they always used the word order cued by the lead-in fragment (see Table 9). When participants had to switch and use English in their picture description, however, syntactic choices were not that absolute. The SVO word order was still always used in the SVO conditions, but was used in about half of the cases in the SOV and VSO conditions. This joint influence of cued word order and cued language was also found in ANOVAs on the same data: Cued Word Order, $F_1(2, 23) = 218.04$, $p < .001$; $F_2(2, 43) = 2017.85$, $p < .001$; *Min* $F'(2, 28) = 196.77$, $p < .001$; cued language, $F_1(1, 24) = 45.63$, $p < .001$; $F_2(1, 44) = 536.05$, $p < .001$; *Min* $F'(1, 28) = 42.05$, $p < .001$; cued word order × cued language, $F_1(2, 23) = 19.67$, $p < .001$; $F_2(2, 43) = 185.14$, $p < .001$; *Min* $F'(2, 28) = 17.78$, $p < .001$.

The combined analysis of Experiments 1 and 3 in Table 3 demonstrates the influence of the experimental setting on participants' syntactic choice. In addition to the already discussed effects of cued word order and cued language, this analysis yielded significant interaction effects of

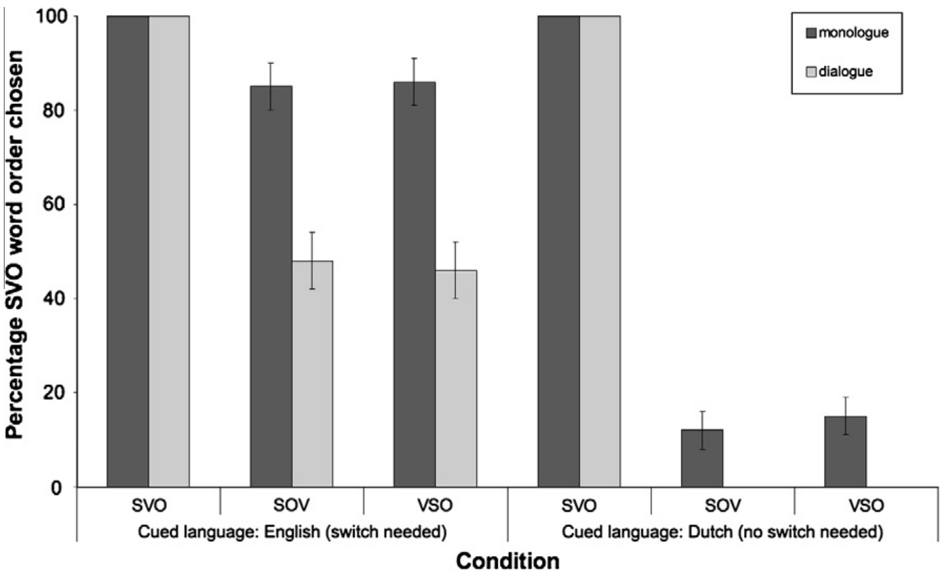

Fig. 2. Percentages of responses per condition in which the SVO word order was used in Experiment 1 (switching in monologue from Dutch into English) versus Experiment 3 (switching in dialogue from Dutch into English), including 95% confidence interval error bars.

experimental setting with cued word order. This effect is depicted in Fig. 2: In SOV and VSO conditions, participants in the dialogue experiment used the SVO word order less frequently than participants in the monologue experiment. Other interaction effects with Experimental Setting did not significantly improve the fit of the model. Similar conclusions on the effect of the experimental setting in the combined analysis can be drawn from an ANOVA (although this analysis did lead to a significant three-way interaction): experimental setting, $F_1(1, 43) = 24.36$, $p < .001$; $F_2(1, 115) = 221.95$, $p < .001$; $Min\ F'(1, 53) = 21.95$, $p < .001$; cued word order × experimental setting, $F_1(2, 42) = 9.42$, $p < .001$; $F_2(2, 114) = 94.12$, $p < .001$; $Min\ F'(2, 51) = 8.56$, $p < .05$; cued language × experimental setting, $F_1(1, 43) = 8.73$, $p < .005$; $F_2(1, 115) = 111.56$, $p < .001$; $Min\ F'(1, 50) = 8.09$, $p < .005$; cued word order × cued language × experimental setting, $F_1(2, 42) = 4.56$, $p < .05$; $F_2(2, 114) = 57.55$, $p < .001$; $Min\ F'(2, 49) = 4.22$, $p < .05$. Both the mixed logistic regression analysis and the ANOVA show that the experimental setting had a prominent effect on the participants' syntactic choices.

The next analysis focused on participants' switch position (see Table 4 for the descriptives and Table 5 for a summary of the mixed logistic regression analysis). The analysis in Step 1 (see Table 5) yielded significant effects of chosen word order. When participants had chosen SOV or VSO, they switched mid-description more often than when they had chosen the SVO word order (see Table 4). A chi square analysis gave similar results: $\chi^2(2) = 68.87$, $p < .001$. The analysis in Step 2, however, also yielded a significant effect of switch position confederate. Participants switched more often mid- respectively pre-description when the confederate had also done so (see Table 9). This effect of the confederate's switch position was only significant as a main effect, so the confederate's influence was independent of the word order the participants used.

The final analysis focused on the language of the verb in mid-description switches (see Table 4 for descriptives and Table 6 for analyses). The analysis in Step 1 shows that the number of English relative to Dutch verbs was significantly different for each word order the participants had chosen. The use of English verbs relative to Dutch verbs was highest when participants had chosen the SVO word order and lowest when they had chosen the VSO word order (see Table 4). This was paralleled by a chi square analysis: $\chi^2(2) = 46.92$, $p < .001$. The analysis in Step 2, however, shows that the verb language in the confederate's turn also significantly influenced participants' verb language. As illustrated in Table 10, participants more often used a Dutch respectively English verb when the confederate had done so. This effect was only significant as a main effect, so the confederate's influence was independent of the word order the participants used.

Table 10
Cross-tabulation of the participant's language of the verb in mid-utterance switches with the confederate's language of the verb in mid-utterance switches for Experiments 3 and 4.

	Confederate	
Participant	English verb	Dutch verb
Experiment 3		
English verb	111 (.55)	44 (.31)
Dutch verb	89 (.45)	96 (.69)
Experiment 4		
English verb	91 (.73)	42 (.32)
Dutch verb	34 (.27)	88 (.68)

Note: Experiment 3 tested switching in dialogue from Dutch to English; Experiment 4 tested switching in dialogue from English to Dutch. The numbers between parentheses are column proportions.

Discussion

Experiment 3 showed that even when the word order cue from the lead-in fragment was accompanied by a word order prime from the confederate, participants were influenced by the language they were cued to use. That is, participants still used the SVO word order more when they had to switch to English than when they had to use Dutch. This SVO preference was lower than in Experiment 1, however. Participants used the cued word order more often in Experiment 3 than in Experiment 1. Because the confederate's prime utterance was the only addition of Experiment 3 to Experiment 1, this effect is evidence of syntactic alignment in bilingual dialogue.

Alignment effects were not only found for word order choice, but also for participants' switch position and language of the verb. A notable finding here is that the participants sometimes aligned with both the switch position and the word order of the confederate, but sometimes also aligned only with the word order but not with the switch position of the confederate. That is, participants switched quite often mid-description while using the SOV or VSO word order (especially compared to Experiment 1), and did so even when the confederate had switched pre-description (see Table 9). An explanation for this is that when participants would fully align with the confederate in the conditions in which the confederate made a pre-description switch to English while using the SOV or VSO word order, they would encounter a grammaticality problem. A pre-description switch into English with an SOV or VSO word order is not grammatical, because all lexical elements are English and the word order is Dutch (this is also why pre-description SOV or VSO switches to English were not observed in Experiment 1). Therefore, in order to produce a grammatical sentence, participants had to choose between either switching pre-description and using the SVO word order (thereby aligning with the confederate's switch position but not with the confederate's word order) or 'license' the use of the SOV or VSO word order by including at least a Dutch verb in the picture description (thereby not aligning with the confederate's switch position but aligning with the confederate's word order). This finding shows that syntactic choice in code-switched dialogue is influenced by an interaction between processes of alignment and processes of maintaining a grammatical structure. These processes do not always lead to the same linguistic choices and can therefore compete in the production of a code-switched sentence. Thus, code-switching in dialogue is influenced by both intra-individual and inter-individual sources. As stated in the Introduction, this combination of intra- and inter-individual influences on linguistic behavior is exactly what the interactive alignment model assumes.

In short, the participants in Experiment 3 showed a clear tendency to align with the linguistic behavior of the confederate, but also still preferred not to switch within the SOV or VSO word order. Although this interaction of intra- and inter-individual influences on language processing is exactly what the interactive alignment model predicts, the question remains whether these alignment effects are specific to switching from Dutch into English. We therefore studied switching in dialogue from English into Dutch in Experiment 4.

Experiment 4: switching in dialogue from English into Dutch

Method

Participants

We selected 24 new participants from the same population as in Experiments 1, 2, and 3. Table 1 provides their background characteristics. The confederate was the same person as in Experiment 3. None of the participants knew the confederate or were aware that the confederate was involved in the experimental manipulation.

Materials; apparatus and procedure; scoring and analysis

The same stimuli and design were used as in Experiment 3, except that all materials that were Dutch in Experiment 3 were translated into English (and vice versa) following the same translation procedure as in Experiment 2. The apparatus and procedure as well as the scoring and analyses were identical to Experiment 3.

Results

The participants produced 1069 picture descriptions (744 switched utterances and 325 non-switched utterances). An overview of the responses per condition is given in Table 11.

Table 3 presents the results of the mixed logistic regression analysis of the participants' likelihood to use the SVO word order. The analysis yielded significant effects of cued word order and significant interaction effects of cued word order with cued language. In the SVO conditions participants always chose SVO, irrespective of whether they had to use Dutch or English; in the SOV and VSO conditions participants chose SVO more often when they had to use English and chose the primed SOV or VSO word order more often when they had to switch and use Dutch (see Table 11). These effects were paralleled by ANOVAs: cued word order, $F_1(2, 22) = 52.69$, $p < .001$; $F_2(2, 43) = 700.86$, $p < .001$; *Min* $F'(2, 25) = 49.00$, $p < .001$; cued language, $F_1(1, 23) = 51.79$, $p < .001$; $F_2(1, 44) = 251.26$, $p < .001$; *Min* $F'(1, 33) = 42.94$, $p < .001$; cued word order × cued language, $F_1(2, 22) = 32.29$, $p < .001$; $F_2(2, 43) = 114.53$, $p < .001$; *Min* $F'(2, 35) = 25.19$, $p < .001$.

In addition to these effects of cued word order and cued language, the combined analysis of Experiments 2 and 4 (see Table 3) yielded significant interaction effects of cued word order with experimental setting and of cued language with experimental setting. The three-way interaction between cued word order, cued language, and experimental setting did not improve the fit of the model. As depicted in Fig. 3, the preference for SVO found in Experiment 2 was attenuated in Experiment 4: The cued word order was used more often in the confederate-scripted dialogue experiment (in which word order was cued by the lead-in fragment and also primed by the confederate) than in the monologue experiment (in which word order was only cued by the lead-in fragment). The interaction of cued language with experimental setting is reflected in Fig. 3 by the less extreme effects of cued language in Experiment 4 (dialogue) than in Experiment 2 (monologue). This demonstrates that syntactic choice in the dialogue experiment was not only based on a shared word order preference, but also on the syntactic choices of the confederate. Similar effects of experimental setting on syntactic choice were found in ANOVAs on the same data: experimental setting, $F_1(1, 46) = 12.58$, $p < .005$; $F_2(1, 115) = 231.91$, $p < .001$; *Min* $F'(1, 51) = 11.93$, $p < .005$; cued word order × experimental setting, $F_1(2, 45) = 8.79$, $p < .005$; $F_2(2, 114) = 102.19$, $p < .001$; *Min*

Table 11
Proportions of response types per condition in Experiment 4 (switching from English into Dutch).

	No switch			Confederate switches pre-description			Confederate switches mid-description		
Participant:	SVO	SOV	VSO	SVO	SOV	VSO	SVO	SOV	VSO
Does not switch									
– and uses SVO	.89	.66	.61	.00	.00	.01	.07	.01	.05
– and uses SOV	.00	.15	.00	.00	.00	.00	.00	.00	.00
– and uses VSO	.00	.00	.23	.00	.00	.00	.00	.00	.02
Switches pre-description									
– and uses SVO	.02	.00	.00	.79	.06	.16	.56	.06	.23
– and uses SOV	.00	.02	.00	.00	.80	.00	.00	.31	.00
– and uses VSO	.00	.00	.00	.00	.00	.65	.00	.00	.38
Switches mid-description									
– and uses SVO	.09	.11	.07	.21	.07	.12	.37	.18	.13
– and uses SOV	.00	.00	.00	.00	.07	.00	.00	.44	.00
– and uses VSO	.00	.06	.09	.00	.00	.06	.00	.00	.19
Total use of SVO word order	1.00	.77	.68	1.00	.13	.29	1.00	.25	.41

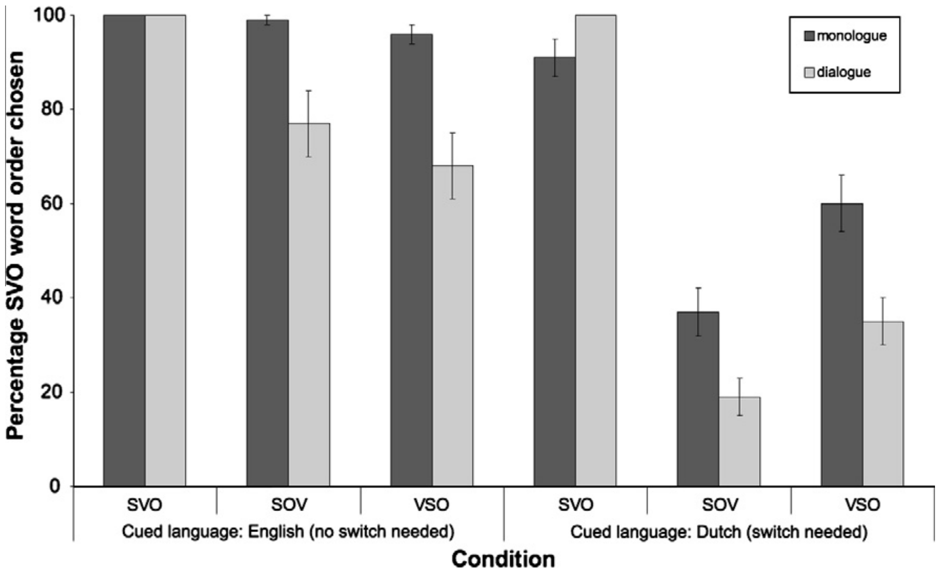

Fig. 3. Percentages of responses per condition in which the SVO word order was used in Experiment 2 (switching in monologue from English into Dutch) versus Experiment 4 (switching in dialogue from English into Dutch), including 95% confidence interval error bars.

$F'(2, 53) = 8.09$, $p < .005$; cued language × experimental setting, $F_1(1, 46) = 1.35$, $p > .05$; $F_2(1, 115) = 19.02$, $p < .001$; *Min* $F'(1, 53) = 1.26$, $p > .05$; cued word order × cued language × experimental setting, $F_1(2, 45) = 0.42$, $p > .05$; $F_2(2, 114) = 1.62$, $p > .05$; *Min* $F'(2, 70) = 0.33$, $p > .05$.

The results of the analysis of participants' switch positions are presented in Table 5. The analysis in Step 1 yielded significant effects of chosen word order on participants' position of switching (see also chi square analysis: $\chi^2(2) = 10.62$, $p < .01$). When participants used the VSO word order, they switched more often pre-description relative to mid-description than when they used SVO or SOV (see Table 4); in SVO and SOV the number of pre- and mid-description switches was more balanced. The analysis in Step 2 places these effects in a different perspective, however. This analysis not only yielded a significant main effect of switch position confederate, but also a significant interaction between switch position confederate and chosen word order. The relatively large number of mid-description switches in the SOV word order was only present when the confederate had also switched mid-description (see Table 11); when the confederate had switched pre-description the participants hardly produced mid-description SOV switches. Thus, the effect of chosen word order on participants' switch positions depended on the switch position of the confederate.

Table 6 summarizes the analysis on whether the language of the verb in mid-description switches was predicted by the word order chosen by the participants (Step 1) and the language of the verb in the confederate's utterance (Step 2). The analysis in Step 1 shows that the use of English relative to Dutch verbs differed for each word order the participants used (see also chi square analysis: $\chi^2(2) = 77.08$, $p < .001$). The number of English verbs relative to Dutch verbs was highest when VSO was used and lowest when SOV was used (see Table 4). There was no real preference for using a Dutch or English verb when SVO was used. The analysis in Step 2 shows that, besides the effect of chosen word order, there was also an effect of verb language confederate on participants' language of the verb. Participants more often used a Dutch verb when the confederate had also done so and, likewise, more often used an English verb when the confederate had done so (see Table 10).

Discussion

The global pattern of responses in Experiment 4 (dialogue from English to Dutch) was similar to those in Experiment 2 (monologue from English to Dutch). Syntactic choices were influenced by the cued language and cued word order, the majority of the code-switches were made with SVO word orders, and the SVO word order was the only word order in which participants did not have a preference towards using either a Dutch or an English verb. These findings support the conclusion that bilinguals prefer the SVO word order for code-switching.

However, the responses in Experiment 4 were *not as strongly* directed towards this shared word order preference as in Experiment 2. Participants in Experiment 4 used the cued SOV and VSO word order more often than in Experiment 2, switched quite often mid-description in a non-shared word order, and had a preference to use the English verb in VSO mid-description switches. These responses are a sign of the influence of the confederate's utterance. The more frequent use of the cued word orders seems to be driven by syntactic priming by the confederate's word order, and the participants' non-SVO mid-description switches reflect the confederate's use of this word order and switch position. Likewise, the preference for using an English verb in VSO mid-description switches can be accounted for by the fact that the verb in the confederate's mid-description switches was always English.

Similar to Experiment 3, the results of Experiment 4 showed how intra- and inter-individual mechanisms of syntactic choice in code-switching interact. That is, in

Experiment 4, we found that the relatively high number of SOV mid-utterance switches was modulated by the confederate's switch position. The large number of mid-description switches when using SOV was only present when the confederate had also switched mid-description. This influence of the confederate was not so strong when participants used the VSO word order. In these cases, participants fully aligned with the confederate's mid-description switches in only 19% of the cases (compared to 44% in the SOV condition; see Table 11). A possible explanation for this is that the verb in the confederate's VSO mid-description switches was always English (the confederate's mid-description switches were always either at the second [subject] or at the third word [object] of the picture, so never at the first word [verb]). Thus, the language of the verb (English) was not matched with the Dutch-specific VSO word order, resulting in an ungrammatical sentence. This was not the case in the confederate's mid-description SOV-switches, in which the verb was always Dutch and hence matched the Dutch-specific SOV word order. The finding that the participants aligned less strongly with the mid-description VSO switches than with the mid-description SOV switches suggests that it was easier for the participants to align with the confederate when she produced a grammatical sentence than when she produced an ungrammatical sentence.

In sum, the observed alignment effects demonstrate that the linguistic behavior of a dialogue partner is a strong predictor of the speaker's own linguistic behavior in code-switching, and interacts with the general preference for a shared word order. As Experiment 3, Experiment 4 has shown clear evidence of an interaction between inter- and intra-individual processes in code-switching, which implies that the assumptions of the interactive alignment model also apply to code-switching in bilingual dialogue.

General discussion

The goal of this study was to connect theories of alignment in dialogue (Pickering & Garrod, 2004), sentence-level code-switching (e.g., Myers-Scotton, 2002; Poplack, 1980), and cross-language syntactic priming (e.g., Hartsuiker et al., 2004) by experimentally studying the cognitive mechanisms of code-switching in monologue and dialogue. In doing so, we provided experimental evidence for corpus-based code-switching theories, and extended Pickering and Garrod's (2004) interactive alignment model to code-switching in bilingual dialogue. We used monologue and dialogue versions of a picture-driven sentence-completion task, in which Dutch–English bilinguals completed Dutch or English lead-in fragments that cued either the (shared) SVO word order or the (Dutch-specific) SOV or VSO word orders by describing pictures using at least one Dutch or English word (as cued by a background color). We investigated the roles of shared word order and the speech of a dialogue partner with respect to participants' syntactic choices, sentence positions of switching, and verb language choices in their production of code-switched sentences.

With respect to the role of word order, the overall pattern was that participants predominantly chose the SVO word order (which is shared between Dutch and English) to switch between languages. The SVO word order also proved more flexible with respect to code-switching patterns than the SOV and VSO word orders. Switching in SVO word order occurred both pre-description and mid-description and with both Dutch and English verbs, whereas switching in SOV or VSO word orders was more constrained: Pre-description SOV or VSO switches only occurred when they were made into Dutch, and mid-description SOV or VSO switches were infrequent in general and occurred almost exclusively in combination with a Dutch verb. With respect to alignment, the confederate's utterances strongly influenced participants' linguistic choices. Participants aligned their syntactic choices, switch positions, and verb language choices with those of the confederate. Alignment was especially strong when the confederate produced grammatical switches, but also occurred when the confederate made ungrammatical switches.

Word order effects on code-switching

The observed SVO preference in code-switching is consistent with the equivalence constraint (Poplack, 1980) and earlier corpus-based studies in which this preference for shared word order was also observed (Deuchar, 2005; Eppler, 1999; Lipski, 1978; Pfaff, 1979; Poplack & Meechan, 1995), as well as with cross-language syntactic priming studies in which priming typically occurred when word order was shared between both languages (e.g., Bernolet et al., 2007; Hartsuiker et al., 2004; Loebell & Bock, 2003). The finding that there was no preference to use a Dutch or an English verb in SVO mid-description switches and a high preference to use a Dutch verb in SOV and VSO mid-description switches is in line with Myers-Scotton's (1997), Myers-Scotton's (2002) matrix language proposal that the language of the verb needs to match grammatically with the chosen word order. This grammatical matching between the verb and the chosen word order is easier when a shared word order is used and, therefore, leads to fewer restrictions with respect to the grammaticality of the code-switch.

Whereas these theories on syntactic aspects of code-switching have been based on corpus analyses of natural speech in uncontrolled conditions, the findings of the present study are based on a systematic manipulation of word order conditions. This experimental manipulation enabled us to connect our results to studies of cross-language syntactic priming, and showed that effects of shared word order are not only present in situations where a prime sentence is given in one language and a target sentence in the other, but also in code-switching, a frequent phenomenon in the natural discourse of bilinguals and a hallmark of bilingual processing. At the same time, by leaving participants free to generate the structure and positioning of their switches themselves, we stayed relatively close to corpus-based studies of code-switching. This embedding of relatively free code-switching in an experimentally controlled setting is a way to bridge the gap between linguistic and psycholinguistic approaches to the study of code-switching (see Gullberg et al., 2009; Kootstra et al., 2009, for further discussion).

With respect to the theoretical interpretation of our effects, the combination of a higher frequency *and* a higher flexibility of switching in the SVO word order was crucial. That is, while the higher frequency of SVO choices alone could have been accounted for by other explanations (see the discussion of Experiment 1), the higher flexibility of switching in the SVO word order demonstrates that the observed SVO preference is truly caused by its shared status. When using SVO, participants used both Dutch and English verbs equally often and switched both pre- and mid-description, irrespective of the direction of switching. In contrast, when SOV or VSO was used, participants hardly switched mid-description and almost exclusively used Dutch verbs. This constrained switching in SOV and VSO sentences and unconstrained switching in SVO sentences suggests that the SVO word order is considered 'language-neutral' (or: shared). The shared status of the SVO word order enables switches to occur at any position and with any word in the sentence without undermining the grammatical coherence of the sentence.

In terms of cognitive mechanisms, the observed shared word order preference confirms the processing-based hypothesis on the role of shared word order in code-switching we formulated in the Introduction, namely that the co-activation of languages caused by shared word order facilitates code-switching. This hypothesis is based on evidence presented in, for example, Kroll et al. (2006) and Kootstra et al. (2009) that languages can in principle be co-activated at all levels of processing, which suggests that language processing in bilinguals is based on an interactive processing system. This interactivity of the processing system is exactly what is also assumed in the interactive alignment model. When we apply this hypothesis of language co-activation caused by shared word order to the interactive alignment model, the explanation of our code-switching findings is quite straightforward. Code-switching entails the co-activation and integration of words from both languages into one sentence. The interactivity between the different levels of processing that is assumed in the interactive alignment model entails that this co-activation resonates through the different levels of the processing system, including the syntactic level. This enhances the likelihood that a shared word order is selected. The same account can also explain the higher flexibility of switching in a shared word order: When a shared syntactic structure is activated, this will result in more co-activation of languages than when a non-shared word order is activated. The co-activation caused by this shared word order resonates through the processing system, and thus makes elements from both languages more readily available for selection than when a non-shared word order was activated.

This interpretation of shared word order in code-switching shows how syntactic choice in code-switching can be accounted for in cognitive terms. The interactivity between processing levels that is assumed in the interactive alignment model proved to be critical for explaining how co-activation and selection of elements from multiple languages concur with co-activation at the syntactic level, which thus explains why the use of words from multiple languages is facilitated by a shared word order. In this respect, the study of code-switching can be informative to what Ferreira and Slevc (2007) called a "perennial debate" in sentence production theories on the way the syntactic level of processing interacts with other levels processing, such as the lexical level.

Alignment effects on code-switching

The observed alignment effects are related to observations in earlier studies on the influence of a dialogue partner on code-switching (e.g., Fokke et al., 2007; Treffers-Daller, 1997). As discussed in the Introduction, these studies demonstrated that bilinguals adapt their propensity to switch to their interlocutor and to the discourse situation in general. Our study went one step further by showing that bilinguals not only adapt to the sheer occurrence of code-switches, but also align the way these switches are syntactically integrated into a sentence. Although alignment was present even when the confederate had switched at syntactically unlikely points, it was strongest when the confederate had switched at syntactically likely points. This suggests that alignment is a powerful mechanism of syntactic choice in code-switching, which interacts with mechanisms of syntactic choice in code-switching that are internal to the speaker.

The interactive alignment model proposes that interlocutors' representations are linked at all representational levels in their language processing systems. A resonance of activated linguistic representations between the interlocutors' language processing systems then enables alignment to occur. In Pickering and Garrod's (2004) original conception of the interactive alignment model, however, no explicit claims about bilingual processing were made. It is evident from our findings that the model can be extended with the assumption that not only interlocutors but also languages interact in bilingual dialogue processing. As already shown in the 'Word order effects on code-switching' section above, this assumption of language interaction is based on the same interactive processing system as the interactive alignment model, and a combination of this assumption of language interaction with the alignment model leads to a straightforward explanation of the word order effects we found. Interestingly, besides accounting for our word order effects, this extended alignment model can also account for our finding that alignment was strongest when the confederate had produced a switch in a shared word order and full alignment not always occurred when the confederate had produced a switch at a syntactically unlikely point. That is, in switches with a shared word order, the resonance within and between interlocutors as assumed by the interactive alignment model is supported by a resonant pattern of co-activated languages. This resonance enables alignment between dialogue partners to occur in an undisrupted manner. When the confederate produces a switch at a syntactically unlikely point in a non-shared word order, however, the co-activation of languages is not that strong or is sometimes even disrupted (which occurred for instance in those cases where the confederate had switched in a Dutch-specific syntactic structure and used an English verb, resulting in a 'language clash' in the processing system). This disruption of co-activation can hamper the full resonance within and between speakers that enables alignment to occur, which explains why participants did not always fully align with ungrammatical switches by the confederate. An extension of the alignment model with the assumption that languages can be co-activated and that this co-activation of languages can resonate through the processing system provides a strong account for the findings in the present study. This extension of the alignment model also improves the model's generalizability and applicability to bilingual dialogue.

Although the extension of the alignment model with the assumption of language co-activation that can resonate through the system provides a sound explanation of the findings in the present study, it is important to investigate the scope of this account. This can be done by manipulating other factors known to influence alignment and co-activation of languages. Factors known to influence alignment are, for instance, lexical overlap between prime-target picture pairs (e.g., Branigan et al., 2000; Schoonbaert et al., 2007) and the interactivity of the dialogue situation (e.g., Branigan, Pickering, McLean, & Cleland, 2006; see also Pickering & Garrod, 2004). Factors known to modulate co-activation of languages (and hence the production of code-switches) are the cognate status of words (e.g., Broersma, Isurin, Bultena, & De Bot, 2009; Kootstra, van Hell, & Dijkstra, in preparation; Witteman & Van Hell, in preparation) and bilinguals' level of dominance in both languages (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999). The present study entailed optimal conditions for alignment because of the lexical overlap between primes and targets and the interactive dialogue situation we simulated. The study also controlled for the influence of cognates by not including cognates in the critical trials and for variations in language dominance by selecting a relatively homogeneous group of participants. Future studies may investigate to what extent these factors further influence the production of code-switches in bilingual dialogue.

To conclude, the present study has combined theory and methodology from linguistics and psycholinguistics to study the cognitive mechanisms of sentence-level code-switching in monologue and dialogue. We have demonstrated that syntactic choice in the encoding of code-switched sentences is a dynamic process in which intra- and inter-individual mechanisms of syntactic choice interact. The results call for an extension of the interactive alignment model with mechanisms of co-activation of languages in bilingual language processing. This extension not only enriches the alignment model, but also provides a productive framework for the study of code-switching and bilingual sentence production in rich discourse situations.

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Appendix A. Actors, actions, and patients used in Experiments 1 and 2

A.1. Actors

boy – *jongen*; farmer – *boer*; fireman – *brandweerman*; girl – *meisje*; granny – *oma*; knight – *ridder*; lady – *dame*; painter – *schilder*; sailor – *matroos*; waitress – *serveerster*; witch – *heks*; wizard – *tovenaar*.

A.2. Actions

call – *roepen*; carry – *dragen*; catch – *vangen*; chase – *achtervolgen*; cut – *snijden*; hit – *slaan*; kick – *schoppen*; paint – *beschilderen*; push – *duwen*; stroke – *aaien*; enchant – *betoveren*; watch – *bekijken*.

A.3. Patients

axe – *bijl*; basket – *mand*; bottle – *fles*; box – *doos*; carrot – *wortel*; chain – *ketting*; chair – *stoel*; chicken – *kip*; deer – *hert*; dog – *hond*; doll – *pop*; donkey – *ezel*; duck – *eend*; fridge – *koelkast*; frog – *kikker*; glove – *handschoen*; gun – *geweer*; horse – *paard*; key – *sleutel*; knife – *mes*; lion – *leeuw*; monkey – *aap*; mushroom – *paddestoel*; onion – *ui*; parrot – *papegaai*; pencil – *potlood*; pig – *varken*; present – *cadeau*; rabbit – *konijn*; raccoon – *wasbeer*; spoon – *lepel*; squirrel – *eekhoorn*; suitcase – *koffer*; tree – *boom*; turtle – *schildpad*; waiter – *ober*.

Appendix B. Actors, actions, and patients used in Experiments 3 and 4

B.1. Actors

boy – *jongen*; chef – *kok*; dog – *hond*; farmer – *boer*; fireman – *brandweerman*; girl – *meisje*; granny – *oma*; knight – *ridder*; lady – *dame*; lion – *leeuw*; painter – *schilder*; sailor – *matroos*; waitress – *serveerster*; witch – *heks*; wizard – *tovenaar*.

B.2. Actions

call – *roepen*; carry – *dragen*; catch – *vangen*; chase – *achtervolgen*; cut – *snijden*; hit – *slaan*; kick – *schoppen*; paint – *beschilderen*; push – *duwen*; stroke – *aaien*; tickle – *kietelen*; watch – *bekijken*.

B.3. Patients

axe – *bijl*; basket – *mand*; bottle – *fles*; box – *doos*; carrot – *wortel*; chain – *ketting*; chair – *stoel*; coat – *jas*; deer – *hert*; doll – *pop*; dress – *jurk*; fridge – *koelkast*; glove – *handschoen*; gun – *pistool*; knife – *mes*; lettuce – *sla*; mushroom – *paddestoel*; onion – *ui*; pencil – *potlood*; peanut – *pinda*; present – *cadeau*; safe – *kluis*; key – *sleutel*; spoon – *lepel*; suitcase – *koffer*; tree – *boom*; bird – *vogel*; chicken – *kip*;

donkey – *ezel*; duck – *eend*; frog – *kikker*; hippo – *nijlpaard*; horse – *paard*; monkey – *aap*; moose – *eland*; parrot – *papegaai*; peacock – *pauw*; pig – *varken*; rabbit – *konijn*; raccoon – *wasbeer*; rhino – *neushoorn*; squirrel – *eekhoorn*; turkey – *kalkoen*; turtle – *schildpad*; waiter – *ober*.

Appendix C. Supplementary material

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jml.2010.03.006.

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