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Shared syntax and cross-linguistic influence in bilingual children

Evidence from between- and within-language priming

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This paper investigates the role of structural priming in cross-linguistic influence, a well-established yet poorly understood characteristic of bilingual language development. More specifically, we test the proposal that cross-linguistic influence may be conceptualized as between-language priming, that is, as the result of prior linguistic exposure (Serratrice, 2016) and shared syntactic representations between languages (Hartsuiker et al., 2004). In Experiment 1, we primed bilingual English-Dutch children between languages using possessive structures (e.g., *the astronaut's dog, the dog of the astronaut*). In Experiment 2, we compared the same group of children with bilingual Spanish-Dutch and monolingual Dutch children using within-language priming. Within-language priming was stronger than between-language priming. In both experiments, we examined the relation between priming behaviour and individual differences in language exposure, use and proficiency. Experiment 1 found between-language priming with long-lasting effects modulated by proficiency. The results of Experiment 2 were consistent with inverse priming effects in within-language priming modulated – to a degree – by properties of the bilingual children's other language. Taken together, these findings are consistent with the proposal that between-language priming is a plausible mechanism underpinning cross-linguistic influence and that bilingual children develop shared syntactic representations for structures which are similar across their two languages.

Keywords: bilingual children, cross-linguistic influence, structural priming, proficiency, shared syntax

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1. Introduction

The language development of bilingual children has largely been found to proceed in language-specific ways, with bilingual children following the same developmental trajectories as their monolingual peers (e.g., Paradis & Genesee, 1996). At the same time, there is ample evidence that bilingual children may differ from their monolingual peers as a result of their (developing) knowledge of another language (Serratrice, 2013; van Dijk et al., 2021). Such cross-linguistic influence is subject to considerable individual variation, and various factors have been found to predict its presence and/or strength, albeit to differing degrees (van Dijk et al., 2021). The exact mechanisms which underpin cross-linguistic influence remain unclear, however.

This is partly because most studies have started from the assumption that bilingual children's two languages develop as separate systems. Over the years, the notion of separate systems has been used to refer both to functional or pragmatic differentiation (i.e., children's ability to use the "right" language with the "right" person; Genesee, Nicoladis, & Paradis, 1995; Lanza, 1992), as well as to autonomous development (i.e., the claim that there are no substantial differences between bilinguals and monolinguals; Meisel, 2007). Neither necessarily entail separation at the level of syntactic representations. Indeed, when it comes to sequential bilingual adults, shared representations across languages is considered quite standard, with evidence for both language non-selective lexical access (e.g., Dijkstra & van Heuven, 2002) and shared syntactic representations (e.g., Hartsuiker et al., 2004).

The notion of shared syntax is gaining traction in the child bilingualism literature, too (Hsin et al., 2013; Vasilyeva et al., 2010). In particular, Serratrice and colleagues (Hervé et al., 2016; Serratrice, 2016, 2022) have proposed that cross-linguistic influence may be conceptualized as between-language priming, that is, as the result of prior linguistic exposure and crucially, of syntactic representations which are shared between languages. The primary purpose of this paper is to test this proposal. We examine the nature of these shared representations and how they develop by comparing patterns of cross-linguistic influence in two groups of bilingual children, using both between-language and within-language priming, and incorporating individual differences. In doing so, this study brings together insights from two related but rather disconnected fields – bilingual first language development and adult bilingual psycholinguistics – to shed light on questions which are relevant to both but remain under-researched in each, namely the role of inherited frequency, the relation between proficiency and within- versus between-language priming, and more generally, the connection between between-language priming and cross-linguistic influence.

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1.1 Factors affecting structural priming in bilingual adults

Structural priming refers to the tendency people have to repeat a syntactic structure they just used themselves or heard someone else using (Bock, 1986). In bilingual adults, priming between languages has been observed for a range of structures and language combinations (see Van Gompel & Arai, 2018 for a recent review). For example, Bernolet et al. (2013) found that bilingual Dutch-English adults were more likely to produce a prenominal possessive in English (e.g., *the nurse's horse*) after hearing a prenominal structure in Dutch (i.e., *de non haar ei* 'the nun's egg') than after hearing a postnominal structure in Dutch (i.e., *het ei van de non* 'the egg of the nun'). Note that, as is standard in the field, the participants in this study were late second language (L2) learners.

Between-language priming has been interpreted as evidence for shared syntactic representations across languages. More specifically, Hartsuiker et al. (2004) proposed a lexicalist model of structural priming, based on the residual activation account of Pickering and Branigan (Pickering & Branigan, 1998), in which both languages are integrated into a single lexicon (see Figure 1). Lexical entries consist of conceptual, lemma and word-form strata, with syntactic information being represented at the lemma stratum (Levelt et al., 1999; Pickering & Branigan, 1998). Within the lemma stratum, there are lemma nodes, connected to language nodes indicating language membership, to a conceptual node capturing meaning, as well as to shared categorical and combinatorial nodes, both containing syntactic information. Thus, when the Dutch-English bilinguals in Bernolet et al. (2013) heard the prenominal possessive in Dutch, this activated the combinatorial node associated with that structure, and because of this residual activation, the same structure was subsequently more readily available when the same speaker needed to produce a possessive in English (Figure 1a). Grammatical rules are assumed to be shared between languages whenever these are sufficiently similar (e.g., Hartsuiker & Pickering, 2008).

We now briefly examine factors known to affect between-language priming, starting with experience or frequency. Typically, less frequent structures are associated with larger priming effects (e.g., Jaeger & Snider, 2013), the *inverse frequency effect*. An explanation for this effect comes from an alternative model of structural priming to the residual activation model just mentioned, namely the error-based learning account (Chang, 2002; Chang et al., 2006). According to this account, the production system adapts depending on the sentences it encounters. Both priming and learning occur when the predictions made by a person's current syntactic representation do not match what they hear. The greater the mismatch, the greater the learning effect. Consequently, greater priming effects are expected when the prime involves an unexpected (or infrequent) structure. For

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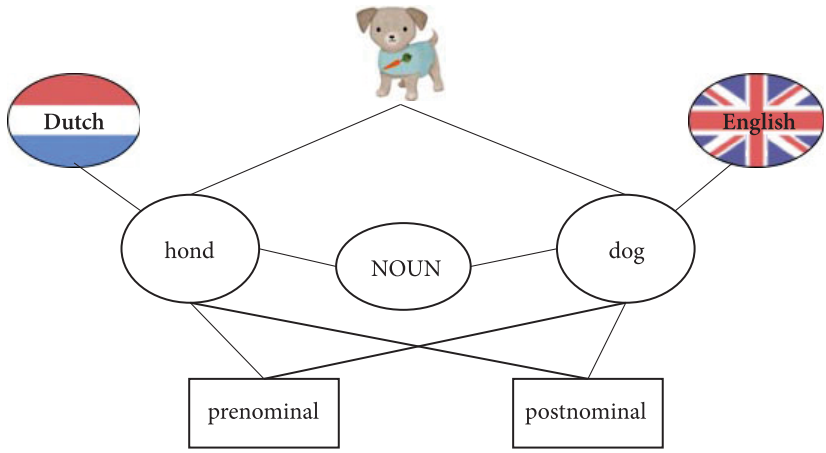
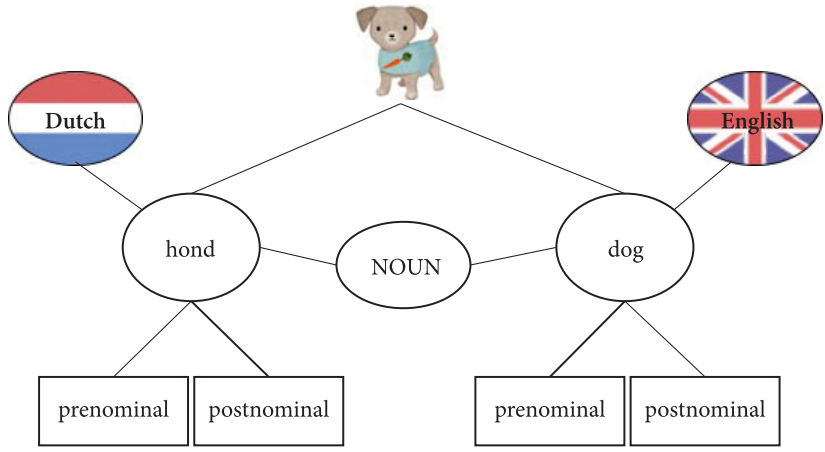


a.



b.

Figure 1. Hypothetical models for the representation of Dutch and English possessives in English-Dutch bilinguals (based on Bernolet et al. 2013, p. 291, Figure 2) where syntax is shared (Figure 1a, upper panel) versus where syntax is separate (Figure 1b, lower panel). Thickness of lines indicates relative frequencies and hence strength of connections (following Kootstra & Doedens, 2016)

bilingual adults, the frequency of a given structure may be determined by both languages, at least when shared between languages. Indeed, such shared representations have been found to "inherit" the structural frequency of the language not in use. For example, Runnqvist, et al. (2013) found that bilinguals' production

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latencies were influenced not only by the structural similarity between English and their other language (Spanish or Mandarin), but also by the frequency of the same structure in the other language. Inherited frequency effects have also been found for (within-language) priming in bilingual adults (Flett et al., 2013; Jackson & Ruf, 2017; Kaan & Chun, 2018; Montero-Melis & Jaeger, 2020; but cf. Muylle et al., 2021), although results are mixed.

Priming effects, both between and within languages, have also been shown to persist over time, both in monolinguals (e.g., Bock & Griffin, 2000) and bilinguals (Jackson & Ruf, 2017; Kaan & Chun, 2018; Kootstra & Doedens, 2016), and usually measured within the course of the same experimental session. Long-lasting priming effects in the absence of lexical repetition are consistent with an error-based learning account of priming (Chang, 2002; Chang et al., 2006), and with some modification with a residual activation account (e.g., Reitter et al., 2011).

On a shared syntax account, both languages activate the same syntactic representation. As such, between-language priming should be just as strong as within-language priming. Findings in this regard are mixed. For example, Kantola and Van Gompel (2011) found that Swedish-English bilinguals were primed at comparable rates in English, irrespective of whether the prime was in their L1 (i.e., Swedish) or L2 (see also Schoonbaert et al., 2007). Other studies have however found stronger within-language than between-language priming. For example, Cai et al. (2011) found that the Cantonese-Mandarin bilinguals in their study showed higher rates of priming from Mandarin to Mandarin than from Cantonese to Mandarin. They accounted for these findings by assuming that activation of the language node leads to activation of other lemmas linked to that node, resulting in a "within-language boost" even when there is no lexical overlap.

According to Hartsuiker and Bernolet's (2017) developmental account of shared syntax, late L2 learners start out with separate syntactic representations for each language (cf. Fig 1b), but merge them given sufficient exposure. More specifically, they found that between-language priming effects were stronger the more proficient participants were in their L2. The relation between L2 proficiency and within-language priming was less clear, however. In addition to proficiency, language dominance, exposure and use have also been found to predict the directionality and strength of priming effects in bilingual adults (e.g., Dussias & Sagarra, 2007; Kootstra & Doedens, 2016). For example, in their between-language priming study, Kootstra and Doedens (2016) found that the bilingual participants were more likely to show priming from their dominant language (Dutch) to their non-dominant language (English) than the other way round.

To summarize, priming in adults takes places between languages when there is sufficient structural similarity between languages, and when bilinguals have developed sufficient proficiency in their L2. Between-language priming may

occur at comparable or lower rates than within-language priming. More generally, priming effects have been found to persist over time, and priming effects are typically larger for less frequent structures, as determined by L1 and possibly also L2 frequency.

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1.2 Structural priming and cross-linguistic influence in bilingual children

Most priming studies with children are with monolinguals. Similar to (bilingual) adults, they have found that the presence and magnitude of priming effects are related to children's general level of proficiency (Kidd, 2012; Serratrice et al., 2015), and that these effects persist over time, in line with an error-based learning account of structural priming (Chang, 2002; Chang et al., 2006). Such long-term priming effects have been observed cumulatively within an experiment, in a post-test directly afterwards, and sometimes one week later (Messenger, 2021; Serratrice et al., 2015; but cf. Kidd, 2012).

Structural priming in bilingual children has received less attention compared with monolingual children, but results from several recent between-language priming studies suggest that as for bilingual adults, syntactic representations may be shared across languages. For example, Vasilyeva et al. (2010) primed passive structures in a group of 5-year-old bilingual Spanish-English children. Results showed priming from Spanish to English but not vice versa, most likely due to frequency differences in the use of passives in the two languages. Two other studies, both designed to simulate cross-linguistic influence, examined priming of ungrammatical (Hsin et al., 2013) or discourse-pragmatically sub-optimal (Hervé et al., 2016) structures. Hervé et al. (2016) primed left dislocations in bilingual French-English 5-year-old children, both within English (e.g., *The girl, she is eating an apple*), where this structure is highly restricted, and within French (e.g., *La fille, elle mange une pomme*), where it is highly frequent.[1] The extent to which children used left dislocations in either language was related to their language dominance, measured using relative exposure. More specifically, the more exposure they had to French, the greater the number of left dislocations use. As the authors note (p. 998), these results demonstrate that cross-linguistic influence may be predicted by both the relative frequency of a given structure, as measured by overall exposure at the level of the individual child, and by the overall frequency of said structure in the language more generally (in line with Runnqvist et al., 2013).

In a between-language study with bilingual Spanish-English 4- and 5-year-old children, Hsin et al. (2013) primed ungrammatical Adjective-Noun combinations

1. The authors described the task as an elicitation task but was very similar to a priming task and hence is referred to as such here.

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in Spanish. In contrast to the previous study, however, they did not find a relation between children's use of the English-like order in their Spanish and their language dominance (i.e., difference scores on an English and Spanish vocabulary test). Likewise, in a study on bilingual Norwegian-English children aged between four and eight years including both between-language and within-language priming, Wolleb et al. (2018) found no relation between priming behaviour and language proficiency in either language. Furthermore, Wolleb and colleagues also found no difference in the magnitude of priming effects between versus within languages (in contrast with Cai et al., 2011).

Taken together, the findings from the handful of available studies on between-language priming in bilingual children are in line with the shared syntax model proposed for adults (Hartsuiker et al., 2014). At the same time, the generalisability of these findings is limited because most focus on structures which are infrequent, pragmatically infelicitous or ungrammatical. To investigate whether cross-linguistic influence can be conceptualized as between-language priming, it is essential to examine priming of (more frequent) grammatical structures, too. Furthermore, except for Wolleb et al. (2017), the available studies included either a within-language or a between-language priming condition, but not both. In addition, to unambiguously establish the existence of cross-linguistic influence in within-language priming, two groups of bilinguals are needed differing in language combination. Without such a second bilingual group, it is hard to know whether any observed differences between bilingual children and their monolingual peers are due to cross-linguistic influence or to more general effects of bilingualism, such as reduced input or increased processing demands (van Dijk et al., 2021). Finally, the extent to which individual differences in language exposure, use and/or proficiency relate to priming behaviour remains unclear: results are mixed and not all studies included such measures.

The goal of this paper is therefore to fill these gaps by examining the nature of syntactic representations and how this relates to cross-linguistic influence in simultaneous bilingual children. We include both between- and within-language priming, test two groups of bilinguals and compare these to monolinguals. In doing so, we address factors which are relevant not only to bilingual children but also to adults, namely the role of inherited frequency, the relation between proficiency and within- versus between-language priming, and more generally, the connection between between-language priming and cross-linguistic influence. In Experiment 1, we first establish whether for a group of bilingual English-Dutch children there is between-language priming from English to Dutch. Subsequently, in Experiment 2, we use within-language priming to test for cross-linguistic influence in the same group of English-Dutch bilinguals, compared with bilingual Spanish-Dutch and monolingual peers. Finally, we compare the extent of

between- and within-language priming for the bilingual English-Dutch children. For each, we test whether the magnitude of any priming effects is predicted by language exposure, use and proficiency.

1.3 Possessive structures in Dutch, English and Spanish and their acquisition

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Both experiments targeted the genitive alternation in Dutch. Dutch allows for three different genitive structures: (i) a postnominal form in which the possessor follows the possessum, as in *de hond van de boer* ('the dog of the farmer'), (ii) a prenominal form in which the possessor precedes the possessum and the possessive relation is marked using the *-s* morpheme, as in *Chantals paard* ('Chantal's horse'), and (iii) a prenominal form in which the possessor precedes the possessum and the possessive relation is marked using a reduced possessive pronoun (i.e., *z'n* 'his', *d'r* 'her'), as in *de boer z'n kat* ('the farmer his cat'). Which structure is chosen depends on a range of factors, including phonological properties of the possessor, animacy and register (Van Bergen, 2011). The present study targeted animate common nouns as possessors. These typically occur in postnominal position (Van Bergen, 2011), but the prenominal *z'n*-genitive structure is also possible (Haeseryn et al., 1997). Monolingual Dutch-speaking children have been shown to acquire all three genitive structures before the age of four (van Kampen & Corver, 2006).

As in Dutch, possessives in English (Experiment 1 & 2) can appear in both prenominal and postnominal positions. In contrast to Dutch, however, it is the prenominal structure which is preferred for all types of possessors in English, although factors such as definiteness, syntactic weight and phonological properties of the possessor may affect which structure is chosen (O'Connor et al., 2013; Rosenbach, 2014). This preference is already established by the age of four (Bannard & Matthews, 2008). Nevertheless, like adults, children at this age can also be primed to use the dispreferred postnominal structure (Skarabela & Serratrice, 2009). Spanish (Experiment 2) differs from both Dutch and English in that all non-pronominal possessive NPs appear postnominally (e.g., *el perro del astronauta* 'the dog of the astronaut).

There is some evidence to suggest that possessive structures are subject to cross-linguistic influence in bilingual children, both in spontaneous (van der Linden & Blok-Boas, 2005) and elicited (Nicoladis, 2012) speech. Possessive structures have also been successfully primed between languages in bilingual adults. More specifically, Bernolet et al. (2013) primed the prenominal (*s*-genitive) structure in participants' L2 English using the prenominal structure from their L1 Dutch, which in Belgian Dutch includes a full pronominal form (i.e., *de boer zijn*

kat) rather than the reduced form used in Netherlandic Dutch introduced above. Priming effects were greater when the head of the noun phrase (i.e., the possessum) was similar in meaning, in form or both, and when the bilinguals were more proficient in English.

In sum, there is some evidence that possessive structures may be subject to cross-linguistic influence and that these can be primed both within and between languages in bilingual adults. We first establish whether between-language priming of possessive structures takes place in bilingual children.

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2. Experiment 1: Between-language priming in bilingual English-Dutch children

Our first research question asked whether there was between-language priming from English to Dutch. We predicted that if syntactic representations of bilingual children's two languages are shared, we should see priming effects from English into Dutch. We therefore expected that the likelihood of producing a prenominal possessive in Dutch would be greater after hearing a prenominal possessive in English.

Our second research question asked whether the magnitude of any priming effects was predicted by language exposure, use and proficiency. Following Hartsuiker and Bernolet (2017), we hypothesised that if better proficiency leads to syntactic sharing, then between-language priming would be positively related to children's developing proficiency in their two languages. Note that, unlike (sequential) bilingual adults, who have one fully developed language (their L1) and are in the process of acquiring proficiency in another (their L2), bilingual children acquire two languages in parallel. For this reason, we included a measure including both languages.

We furthermore hypothesised that between-language priming would also be related to children's relative exposure to and use of their heritage language, English, as a proxy for their language dominance (Unsworth et al., 2018). Language dominance has been shown to affect the likelihood of cross-linguistic influence in bilingual children (e.g., van Dijk et al., 2021). If cross-linguistic influence can be conceptualised as between-language priming, then we expect more exposure to and use of English to be associated with the use of more prenominal structures and larger priming effects, in line with Hervé et al. (2016).

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2.1 Method

2.1.1 *Participants*

Participants were 30 bilingual English-Dutch children aged between 5 and 7 years old ($M = 6.27$; SD 0.98; 15 girls, 15 boys). All were resident in the Netherlands at the time of testing and were growing up in two-parent households. Almost all ($n = 26$) were exposed to both languages from birth, and otherwise before age four. The children came from highly educated families with almost all parents (55/60) holding a university degree or equivalent. On average, children heard Dutch 59.8% ($SD = 14.2\%$) of the time (*Exposure)* and used it at home to approximately the same extent ($M = 57.8\%$, $SD = 33.6\%$; *Use*).

2.1.2 *Materials and design*

Item selection

Following Skarabela & Serratrice (2008), eight colour pictures were created depicting characters associated with a profession (e.g., *astronaut* 'astronaut', *boer* 'farmer'), and another nine depicting a range of family members and pets (e.g., *moeder* 'mother', *kat* 'cat'), resulting in 72 possible combinations. An emblem was created for each professional (e.g., a rocket for the astronaut), and these were used to identify the professional (i.e., the possessor) to which each family member (i.e., the possessum) belonged. Given the tendency for children to overgeneralize the male form of the possessive pronoun (van Kampen & Corver, 2006), the gender of the possessor was kept constant (i.e., male). The average age of acquisition (AoA) for the selected nouns was 5.1 years old (Brysbaert et al., 2014) in Dutch and 4.3 years for the translational equivalents in English (Kuperman et al., 2012). Crucially, the relative AoA for selected nouns was comparable across the two languages. Half of the possessor nouns and three quarters of the possessum nouns were cognates with English.

Elicitation task

A monolingual elicitation task was designed to establish which form of the possessive children preferred in Dutch (following Hsin et al., 2013; Nicoladis, 2006). At the start of this task, children were introduced to the characters and their families so that subsequent use of the possessive structure was pragmatically felicitous. Children were first asked to name all the characters. As they did, the experimenter pointed out the relevant emblem (e.g., "Can you see the rocket?"). Subsequently, children were told that every character had a family, and all eight family members were named. Children also named each family member once. Children thus named each character and each family member once prior to the task and hence possessor and possessum did not differ in salience. Children were subsequently

asked to describe a further eight pictures without any guidance from the experimenter. These depicted a family member combined with a family emblem (e.g., a mother with a rocket), which the child was expected to describe using a possessive.

Syntactic priming task

The syntactic priming task consisted of two phases: a priming phase and a post-test phase. Following Branigan et al., (2005), the priming phase consisted of a card game ("Snap") in which the experimenter first turned over a card from a pre-ordered pile, described what she saw (the prime), and placed it in the middle of the table. The child's task was to do the same with her card (the target), and when the two cards where identical, to place her hand on the communal pile as quickly as possible shouting "snap" or "*hetzelfde*" 'the same'. There was no lexical overlap between prime and target. The game element was therefore implemented using the filler items, pictures of the same character with either the same ($n = 16$) or a different ($n = 8$) colour (e.g., "the red astronaut"). After the priming phase, children were asked to name the remaining cards ($n = 8$) in their pile as a post-test.

To avoid any perseverance effects, prenominal and postnominal primes were presented in separate blocks (following Hsin et al., 2013; Snedeker & Huang, 2015), each with their own post-test phase. Following extensive piloting, the block containing the dispreferred order in the target language, Dutch, (i.e., the prenominal) was always presented first. In other words, the relative order of the prenominal and postnominal blocks was kept constant across children, as also recommended by Goodhew & Edwards (2019) for experimental paradigms investigating individual differences. Each block contained 12 test items and 12 filler items.

Primes were kept the same across children whereas target pictures were rotated through the three phrases using four experimental lists (Kidd, 2012). Family members and professions were distributed evenly across blocks and phases, and stimulus length and cognate status were counterbalanced across blocks and lists. Items were presented in a pseudo-randomised order (see Supplementary Materials (S1) for all items).

Picture-naming task

Children's language proficiency in each language was assessed using the production part of the Cross-linguistic Lexical Task (CLT; Haman, Łuniewska, & Pomiechowska, 2015). Children were shown a colour picture and asked to name what they saw. We used the UK-English (Haman et al., 2013) and the Dutch (van Wonderen & Unsworth, 2020) versions. This task contained 30 nouns and 30 verbs. Children's scores were converted to percentages and averaged to generate a bilingual proficiency score.

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2.1.3 *Procedure*

Informed consent was obtained from all parents. Children were tested individually in their home or at school by a native or near-native research assistant. The near-native assistant's first language was Dutch. The experimenter spoke English only. Children also spoke English, except during the priming task, when they were instructed to speak Dutch. To remind children which language to speak, two small flags (a Dutch one and a UK/US one) were introduced and the relevant flag was placed before the child. Children's responses were audio recorded and where necessary checked afterwards. Information about children's language experience was gathered using the Bilingual Language Exposure Calculator (Unsworth, 2013) during an informal interview with one of their parents.

Tasks were presented in the following order: Monolingual elicitation task, *Priming* phase (prenominal block, priming task), picture-naming task (English CLT), *Post-test* phase (prenominal block, priming task), *Priming* phase (postnominal block, priming task), sentence repetition task (not reported on here), *Post-test* phase (postnominal block, priming task).

This between-language priming session followed a within-language priming session, where the Dutch version of the picture-naming task was administered (see Experiment 2). The lag between sessions was on average 2 weeks.

2.1.4 *Coding and analysis*

For the elicitation task and the priming task, a response was coded as prenominal if the possessor preceded the possessum and a possessive morpheme was added to the possessor (e.g., *de astronaut z'n vis, de astronaut's vis*).[2] A response was

2. The *s*-genitive exists in Dutch but is only used when the possessor is a proper noun (e.g., *Lisa's vis*, 'Lisa's fish'; cf. §1.3). The number of (ungrammatical) s-genitives produced (e.g., *de astronaut's vis*) was very limited. They occurred in 12 of the 183 prenominal possessives (6.6%) produced by in total six different children with one child producing five such responses, two children producing two, and the remaining three children a single s-genitive response each. An anonymous reviewer asks whether such utterances can really be considered the result of between-language priming or whether they may be instances of code-switching. It is possible that in these responses, children may have been using an English 'morphosyntactic frame' and inserted Dutch lexical items (as proposed by the Matrix Language Framework – Myers-Scotton, 1993). At the same time, the observation that the Dutch monolingual children in Experiment 2 also sometimes made the same 'error' in a within-language priming task (three children produced in total five s-genitives; 1.1% of all prenominal possessives) suggests that this might not necessarily be the case. Crucially, re-running the analysis reported in §2.2 without these items did not alter the observed priming effect. In this analysis, the three-way interaction between *Prime, Phase* and *Bilingual Proficiency* was however only marginally significant ($p = .06$). Nevertheless, the overall pattern of results (visualized in Figure 2) was identical (see Table 1d in Supplementary Materials, S2).

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coded as postnominal if the possessor followed the possessum and the appropriate morphology was included (e.g., *de vis van de astronaut*). Responses without possessive morphology (e.g., *piratenmama* 'pirate-mummy'), without either the possessum (e.g., *de dokter*) or the possessor (e.g., *de papa*), or using a different structure to express the relation of possession (e.g., *de hond die bij de boer hoort* 'the dog that belongs to the farmer') were coded as *Other* and excluded from the analyses. Responses containing words which were unambiguously English were also excluded.

Children's responses on the priming task were fit with mixed-effects logistic regression analyses, using the lme4-package (Bates et al., 2015) in RStudio version 1.3.959 (Team, 2020), to predict the likelihood of a prenominal possessive response. The default optimizer (bobyqa) was used to address any convergence issues. We started with a model containing the critical manipulations (i.e., fixed effects) of *Prime* and *Phase*, including the interaction between the two, alongside random intercepts for *Participant* and *Item* as well as random slopes for *Item*. Given that we were interested in accounting for individual differences in priming behaviour, we excluded random slopes for *Participant* at this stage (following e.g., Gullifer et al., 2018). In all models, Helmert contrasts were applied to our categorical fixed effects (i.e., *Prime* and *Phase*), and all continuous variables were centered around zero (Baguley, 2012, pp. 590–621). For *Prime*, the prenominal priming condition (coded as −0.5) was contrasted with the postnominal priming condition (coded as 0.5). For *Phase*, the priming phase (coded as −0.5) was contrasted with the post-test phase (coded as 0.5).

To explore whether the magnitude of any priming effects was predicted by language exposure, use and proficiency, we then added each of our background variables (i.e., relative *Exposure* to Dutch, relative *Use* of Dutch, and *Bilingual proficiency*), first in interaction with *Prime*, and subsequently in interaction with *Prime* and *Phase*. There were no issues of multicollinearity between the various background variables ($r \leq .45$) and hence these were added simultaneously to the same model. In a last step, we added random slopes for *Participant* to account for any remaining residual variance. They were only included in the final model if they significantly improved its fit.

The goodness of fit of each model was compared with the previous, simpler model using the anova function in the base package (R Core Team, 2017). Non-significant interactions with background variables were eliminated if they did not improve the model fit. We checked for any influential cases in the final model using the influence.ME package (Nieuwenhuis et al., 2012). These were defined as follows: a Cook's Distance more than three times greater than the mean and/or greater than 0.5; an absolute standardized DfBeta greater than 1.0 (Field, 2013). Models were re-run without influential cases; this never changed

the results. Predicted probabilities for the best-fitting models were plotted using the sjPlot package (Lüdecke, 2021).

2.2 Results

On average, children scored 69.3% ($SD = 17.5\%$) on the picture-naming task in English and 71.4% ($SD = 14.0\%$) in Dutch. There was no significant difference between scores on the two languages ($t(29) = .504$, $p = .618$, $d = .092$); the average difference in scores was 2.1% ($SD = 22.7\%$), in favour of Dutch. Average scores on the picture naming task, our measure of *Bilingual proficiency*, correlated with scores for each language at comparable rates (English: $r(30) = .776$, $p < .001$; Dutch: $r(30) = .611$, $p < .001$).

In the monolingual Dutch elicitation task, children produced 24 prenominal possessives (10.0%), 185 postnominal possessives (77.1%) and 31 other responses (12.9%). Of the responses containing a possessive structure, 11.5% (24/209) were prenominal, indicating an overwhelming preference for the postnominal structure.

Across all phases of the priming experiment, children produced 183 prenominal possessives (15.3%), 884 postnominal possessives (73.7%) and 133 other responses (11.1%). Table 1 provides the proportion of prenominal possessives out of all responses containing a possessive across conditions and phases.

Table 1. Experiment 1, between-language priming, bilingual English-Dutch children: Proportion of prenominal possessives in different priming conditions (*prenominal* vs. *postnominal*) and phases (*priming* vs. *post-test*)

	Prenominal	**Postnominal**
Priming	.26	.14
Post-test	.13	.13

The best-fitting model revealed a significant main effect of *Prime* ($ß = -2.51$, $SE = 0.81$, $|z| = -3.10$, $p = .002$) and of *Phase* ($ß = -2.20$, $SE = 0.77$, $|z| = -2.84$, $p = .005$), as well as a significant interaction between the two ($ß = 5.51$, $SE = 1.79$, $|z| = 3.07$, $p = .002$), meaning that children produced more prenominal possessives after hearing a prenominal prime but this difference was no longer apparent in the post-test phase. There was a significant three-way interaction between *Prime, Phase* and *Bilingual proficiency* ($ß = -0.33$, $SE = 0.15$, $|z| = -2.12$, $p = .034$); see Figure 2. The more proficient children were, the more likely they were to produce a prenominal possessive after hearing a prenominal prime; furthermore, high levels of bilingual proficiency were also associated with an increased likeli-

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hood of producing a prenominal possessive in the post-test phase of the prenominal block as well as in the priming phase – and to a lesser extent the post-test phase – of the postnominal block. The full model is given in the Supplementary Materials (S2, Table 1a).

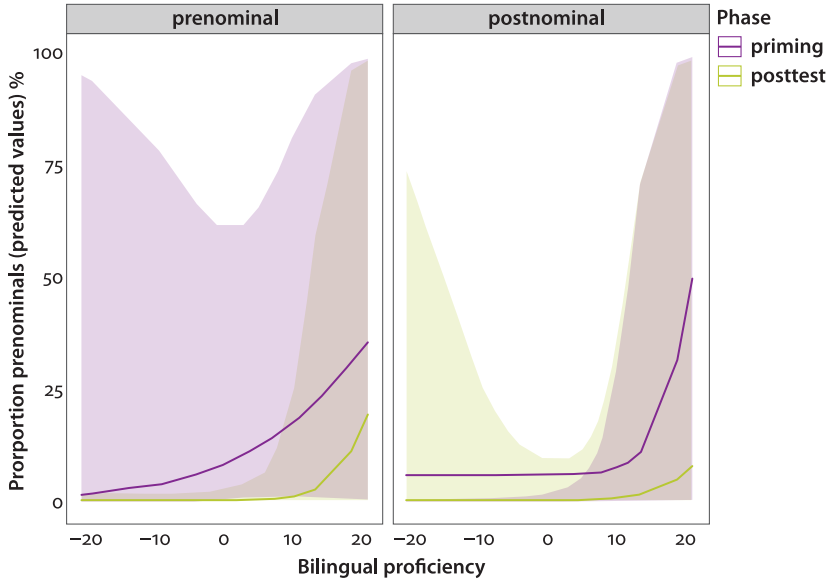

Figure 2. Experiment 1: Effect of *Prime* and *Phase* as a function of *Bilingual proficiency*

To further explore this proficiency effect, we re-ran out the best-fitting model exchanging *Bilingual proficiency* for scores in each language separately: the 3-way interaction between *Prime, Phase* and *Proficiency* was significant for English but not for Dutch language proficiency (see Supplementary Materials, S2, Tables 1b and 1c). None of the other background variables accounted for significant amounts of unique variance.

2.3 Discussion

The bilingual English-Dutch children were primed between languages: upon hearing a prenominal possessive structure in English, children were more likely to produce a prenominal possessive in Dutch. This is in line with Bernolet et al.'s (2013) findings for adults, where between-language priming was found using similar possessive structures in the other direction. The observation that such priming took place, without any lexical overlap between prime and target, suggests that bilingual children shared abstract syntactic representations across their two

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languages (Hartsuiker et al., 2004), confirming previous findings for bilingual children showing between-language priming with ungrammatical and pragmatically infelicitous structures (e.g., Hsin et al., 2013).

At the group level, the priming effect was considerably reduced in the post-test phase. This is inconsistent with results reported for monolingual children by Kidd (2012) and Skarabela and Serratrice (2009). There are two possible, non-mutually exclusive reasons for this difference. First, the timespan between the priming phase and the post-test was longer in the present study (due to an intervening task). Second, as shown in the elicitation task, the target prenominal possessive is highly dispreferred in Dutch (Van Bergen, 2011). Consequently, even when the prenominal was primed, the level of resting activation for the preferred postnominal structure was likely high enough to prevent the prenominal being selected. It is possible that the discrepancy between the present results and a recent study with monolingual children by Messenger (2021), who did observe long-lasting priming effects after an intervening task, might be explained by a more pronounced difference between the dispreferred and preferred forms.

There was considerable individual variation. The only variable found to predict this variation was proficiency. Children with higher levels of bilingual proficiency produced more prenominals in the prenominal priming phase as well as in the post-test phase and the postnominal priming block. Further analyses including proficiency for each language separately suggested that this effect was driven by proficiency in their heritage language, English, rather than the societal language, Dutch. The observation that proficiency was positively related to priming lends further support to the developmental model of shared syntax proposed by Hartsuiker and Bernolet (Bernolet et al., 2013; 2017): as children become more proficient, similar structures become shared and between-language priming becomes possible (see also *General Discussion*).

If bilingual children do indeed develop shared syntactic representations for similar structures in their two languages, and cross-linguistic influence in bilingual children can be conceptualized as between-language priming, the consequences of these shared syntactic representations should be visible not only in situations where both languages are in use, but also in monolingual contexts. In Experiment 2 we therefore tested the same bilingual English-Dutch children using a within-language version of the same priming task. To establish whether the English-Dutch bilingual children's behaviour in Dutch was related to the syntactic properties of their other language, English, we included both a monolingual control group and a second group of bilingual children, whose other language, Spanish, differs from both English and Dutch on the target structure in question.

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3. Experiment 2: Within-language priming in bilingual English-Dutch and Spanish-Dutch children and monolingual Dutch children

Our first research question asked whether bilingual children's within-language priming behaviour in Dutch was affected by the properties of their other language (i.e., English or Spanish). We predicted priming effects to be modulated by surface overlap. More specifically, if the frequencies of alternating structures are determined by properties of both languages (Jackson & Ruf, 2017; Kaan & Chun, 2018; Muylle et al., 2021; Runnqvist et al., 2013), then relative to the monolingual Dutch and bilingual Spanish-Dutch children, the prenominal combinatorial node in the bilingual English-Dutch children should have higher levels of (resting) activation. Similarly, because Spanish only allows the postnominal order, the bilingual Spanish-Dutch children are expected to have higher levels of (resting) activation for the postnominal combinatorial node relative to the other two groups. Following Chang et al.'s error-based learning model (2002; 2006; see also Reitter et al., 2011), which claims that less frequent structures result in larger priming effects, we predicted that the priming effect for prenominal structures would be greatest for the bilingual Spanish-Dutch group and least for the bilingual English-Dutch group, with the monolingual Dutch group falling somewhere in-between.

Our second research question asked whether the magnitude of any priming effects was predicted by language exposure, use and proficiency. Following Hartsuiker and Bernolet (2017), and Experiment 1, our hypothesis was as follows: if bilingual proficiency is a prerequisite for shared syntactic representations, then any within-language priming effects potentially affected by the properties of the bilingual children's heritage language should be positively related to bilingual proficiency. Similarly, we hypothesised that such within-language priming effects would also be related to children's patterns of exposure and use, as a proxy for their language dominance (following Hervé et al., 2016; Unsworth et al., 2018). Language dominance has been shown to affect the likelihood of cross-linguistic influence in bilingual children (van Dijk et al., 2021), also in monolingual contexts. In line with Hervé et al. (2016), we therefore predicted that the extent of any cross-linguistic influence from Spanish or English resulting in inverse frequency effects would be associated with more exposure to and use of those languages relative to Dutch.

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3.1 Method

3.1.1 *Participants*

Participants were the same 30 bilingual English-Dutch children as in Experiment 1, 29 bilingual Spanish-Dutch children (M_{age} = 6.36; *SD* 0.84; 14 girls, 15 boys), and 28 monolingual Dutch children (M_{age} = 6.42; *SD* 0.99; 21 girls, 7 boys). Almost all (n = 27) of the bilingual Spanish-Dutch children were exposed to both languages from birth, and otherwise before age four. All (bilingual and monolingual) children were resident in the Netherlands at the time of testing and were growing up in two-parent households. The children came from highly educated families with almost all parents holding a university degree or equivalent (54/58 for the Spanish-Dutch children and 50/56 for the monolingual children). There were no significant differences between the three groups in terms of gender ($\chi^2(87) = 5.21$, $p = .074$), age ($F(2,84) = .033$, $p = .968$) or parental education ($\chi^2(87) = 3.55$, $p = .470$). On average, the bilingual Spanish-Dutch children heard Dutch 63.2% (*SD* = 14.4%) of the time and used it at home to approximately the same extent (*M* = 57.1%, *SD* = 27.5%). There were no significant differences between the two bilingual groups in terms of how much Dutch they heard ($t(57) = -1.10$, $p = .278$, $d = .146$) or used ($t(57) = -.448$, $p = .656$, $d = .306$).

3.1.2 *Materials and design*

The same tasks were used as in Experiment 1, except primes were now also in Dutch. The average AoA for the selected nouns was 3.6 years for the translational equivalents in Spanish (Alonso, Fernandez, & Díez, 2015; cf. fn. 1). Three of the nine possessor nouns and three of the possessum nouns were cognates with Spanish. A complete list of items is provided in the Supplementary Materials (S1). All children completed the Dutch picture-naming task. In addition, the Spanish-Dutch bilingual children also completed a Spanish version (Haman et al., 2015; van Wonderen & Unsworth, 2020) in a separate test session.

3.1.3 *Procedure*

The procedure was identical to Experiment 1, except that the intervening tasks were now all in Dutch. For the bilingual English-Dutch children, the within-language session (Experiment 2) was completed before the cross-language session (Experiment 1) to maintain comparability across all three groups and avoid any potential long-term between-language priming effects.

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3.1.4 *Coding and analysis*

Responses were coded as in Experiment 1. Our first analysis also included *Group* as a fixed effect, plus the three-way interaction with *Prime* and *Phase*. We used Helmert contrasts to first compare the bilingual English-Dutch children (0.67) to the bilingual Spanish-Dutch (−0.33) and monolingual Dutch (−0.33) children, and subsequently the monolingual Dutch (−0.5) to the bilingual Spanish-Dutch (0.5) children.[3] Where necessary, models were re-levelled to explore other contrasts. To control for any differences in *Dutch language proficiency* and explore its relation to priming, scores on the Dutch CLT were also included, both as a main effect and in interaction with *Prime*. This variable was only retained in the model when it reached significance; it never did. To further understand any priming was compatible with an inverse frequency effect, we analysed the children's responses from the prenominal block in more detail by including *Trial Number* (in interaction with *Group*) instead of *Phase*. Items in the priming phrase were coded as 1 through 12 and items in the post-test as 13 through 20.

Our second main analysis contrasted the bilingual English-Dutch children (0.5) with the bilingual Spanish-Dutch children (−0.5). To explore whether the magnitude of any priming effects was predicted by language exposure, use and proficiency, we added each of our background variables (i.e., relative *Exposure* to Dutch, relative *Use* of Dutch, and *Bilingual proficiency*), first in interaction with *Prime* and *Group*, and where this did not lead to a better fitting model, *Prime* was dropped from the interaction to establish whether there was a general effect of e.g., bilingual proficiency rather than an effect of bilingual proficiency specifically relating to priming behaviour. There were no major issues of multicollinearity between the various background variables ($r \leq .35$ for all pairwise comparisons) but the correlation between *Exposure* and *Use* across both groups was reasonably strong ($r = .61$). For this reason, we started out with separate models for these two variables; given that *Use* was never a significant predictor, an analysis with both was never necessary, however.

In both analyses random slopes for *Participant* were added as a last step to account for any remaining residual variance and only retained if they significantly improved the model's fit.

3. The Spanish-Dutch bilingual children never produced a prenominal possessive in the postnominal priming phrase or in either post-test. This lack of variation meant that it was not possible to perform a logistic regression analysis. Consequently, for the purpose of the analysis, one response in each condition was re-coded as though a prenominal possessive was produced (following Kootstra, van Hell, & Dijkstra, 2010).

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3.2 Results

On average, the bilingual Spanish-Dutch children scored 53.6% ($SD = 21.0\%$) on the picture-naming task in Spanish and 71.6% ($SD = 12.6$) in Dutch. This difference was significant ($t(28) = 4.09$, $p < .001$, $d = .758$); the average difference in scores was 17.9% ($SD = 23.6\%$), in favour of Dutch. Average scores on the picture naming task were more strongly correlated with scores on Dutch ($r(29) = .867$, $p < .001$) than Spanish ($r(29) = .562$, $p = .002$), although the correlation with Spanish remained moderate. There were significant group differences in Dutch language proficiency ($F(2, 84) = 7.47$, $p = .001$, $\eta^2 = .151$): the monolingual Dutch group scored significantly higher ($M = 82.2\%$, $SD = 9.3\%$) than both bilingual groups (English-Dutch: $p = .003$; Spanish-Dutch: $p = .004$), who did not significantly differ from each other ($p = 1.00$). Furthermore, the bilingual English-Dutch children's proficiency scores in English were significantly higher than the bilingual Spanish-Dutch children's proficiency scores in Spanish ($t(57) = 3.11$, $p = .003$, $d = .193$); the two groups also differed significantly on our measure of bilingual proficiency (i.e., the average of the Dutch and English/Spanish scores; English-Dutch: $M = 70.3\%$, $SD = 11.1\%$; Spanish-Dutch: $M = 63.6\%$, $SD = 12.6\%$; $t(57) = 2.50$, $p = .015$, $d = .119$).

In the monolingual Dutch elicitation task, children produced just a single prenominal possessive, 312 postnominal possessives (44.8%) and 383 other responses (55.0%); that is, when children used a possessive, this was postnominal. Across all phases of the priming experiment, the proportion of other responses dropped to 20.8% ($n = 724$), and this was comparable across groups. Prenominal possessives were produced at a rate of 12.5% ($n = 435$) and postnominal possessives at a rate of 66.7% ($n = 2321$). Table 2 provides the proportion of prenominal possessives out of all responses containing a possessive across conditions and phases.

Table 2. Experiment 2, within-language priming: Proportion of prenominal possessives in different priming conditions (*prenominal* vs. *postnominal*) and phases (*priming* vs. *post-test*) per group

	Bilingual English-Dutch		Bilingual Spanish-Dutch		Monolingual Dutch	
	Prenominal	Postnominal	Prenominal	Postnominal	Prenominal	Postnominal
Priming	.47	.08	.45	0	.27	.03
Post- test	.17	.15	0	0	.10	.06

The best-fitting model for the first analysis revealed a significant main effect of *Prime* ($ß = -6.73$, $SE = 1.85$, $|z| = -3.64$, $p < .001$) and of *Phase* ($ß = -0.87$, $SE = 0.426$, $|z| = -2.05$, $p = .041$), as well as a significant interaction between the two ($ß = 5.82$, $SE = 0.851$, $|z| = 6.84$, $p < .001$). In general, children produced more

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prenominal possessives after hearing a prenominal prime than after hearing a postnominal prime but this difference disappeared in the post-test phase. There was no main effect of *Group* (English-Dutch vs. Spanish-Dutch and monolinguals: $ß = 1.66$, $SE = 1.08$, $|z| = 1.54$, $p = .124$; Spanish-Dutch vs. monolinguals: $ß = -0.80$, $SE = 1.42$, $|z| = -0.57$, $p = .572$). There was however a significant interaction between *Group* and *Phase* whereby the bilingual Spanish-Dutch children produced significantly fewer prenominal possessives in the post-test phase than the monolingual Dutch children ($ß = -2.78$, $SE = 1.18$, $|z| = -2.35$, $p = .019$) and – upon re-levelling – than the bilingual English-Dutch children ($ß = -2.64$, $SE = 1.12$, $|z| = -2.35$, $p = .019$). There was no such significant difference between the response patterns of the bilingual English-Dutch and monolingual Dutch children across the priming and post-test phases ($ß = -0.444$, $SE = 0.589$, $|z| = -0.755$, $p = .450$).

Our analysis of children's responses in the priming block only revealed a significant main effect of *Trial number* ($ß = -0.22$, $SE = 0.02$, $|z| = -9.98$, $p < .001$), as well as a significant interaction between *Trial number* and *Group*: the effect of trial number differed between the bilingual Spanish-Dutch and monolingual groups ($ß = -0.18$, $SE = 0.05$, $|z| = -3.59$, $p < .001$) and – upon re-levelling between the two bilingual groups ($ß = -0.13$, $SE = 0.05$, $|z| = -2.66$, $p = .007$); see Figure 3. The bilingual Spanish-Dutch children used more prenominals at the start of the block (at least in comparison with the monolinguals) and switched to postnominals more quickly compared with the other two groups, where this change was more gradual.

In the second analysis (bilingual children only), there was a main effect of *Group* ($ß = 2.57$, $SE = 1.47$, $|z| = 1.975$, $p = .013$) as well as the same effects of *Prime* and *Phase*. There was also a significant interaction between *Bilingual proficiency* and *Group* ($ß = 0.145$, $SE = 0.677$, $|z| = 2.15$, $p = .032$), see Figure 4. Across primes and phases, an increase in bilingual proficiency was associated with more prenominal possessives in the English-Dutch group and more postnominal possessives in the Spanish-Dutch group. To further explore this proficiency effect, we re-ran the best-fitting model exchanging *Bilingual proficiency* for scores in each language separately: the interaction with *Group* remained significant for English/Spanish language proficiency but not for Dutch.

None of the other background variables (i.e., *Exposure, Use*) accounted for significant amounts of unique variance, nor were there any significant three-way interactions. Full models are given in the Supplementary Materials (S2, Tables 2a through 2c, Tables 3a through 3b and Table 4).

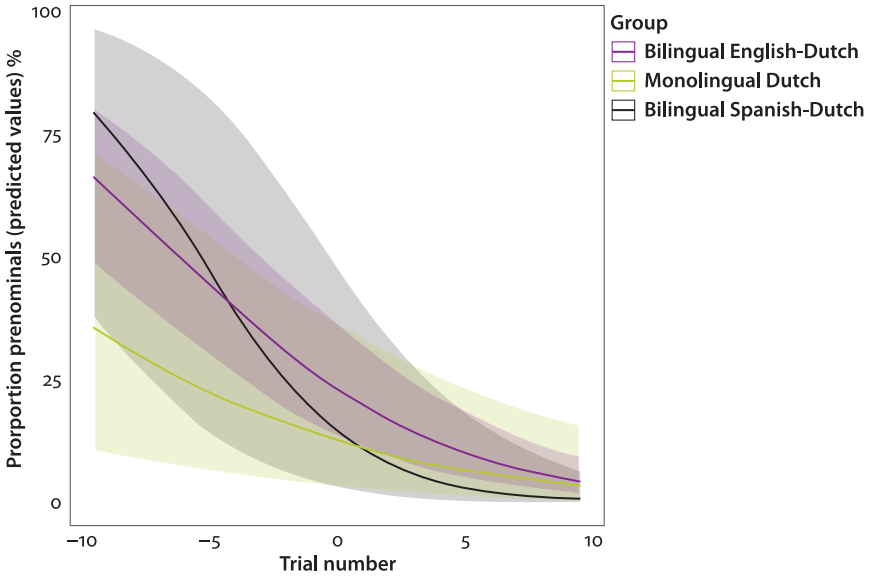

Figure 3. Experiment 2: Effect of *Trial Number* as a function of *Group*. NB: Predicted probabilities are plotted for the priming phase in the prenominal block (i.e., the reference levels for these two variables)

3.3 Discussion

All three groups – monolingual Dutch, bilingual English-Dutch and bilingual Spanish-Dutch children – showed within-language priming with group differences emerging in the post-test phase. More specifically, the bilingual Spanish-Dutch children only produced prenominal possessives in the priming phrase of the prenominal block. In the post-test phase of the same block, as well as in the priming and post-test phases of the postnominal block, they used the postnominal form only. Furthermore, zooming in on children's behaviour in the prenominal block revealed that the bilingual Spanish-Dutch children differed from the other two groups in the effect of trial number. All groups produced the most prenominals at the start of the priming task and this tendency diminished as the task proceeded. However, the bilingual Spanish-Dutch children initially produced more prenominals and their tendency to do so waned more quickly than the other groups.

This finding is consistent with the error-based learning account of structural priming (Chang, 2002; Chang et al., 2006; Reitter et al., 2011), which states that children (and adults) will show a larger priming effect when the prime includes an unexpected structure. Subsequent adjustment to expectations after this initial prediction error depends on the size of the error. In other words, the more the

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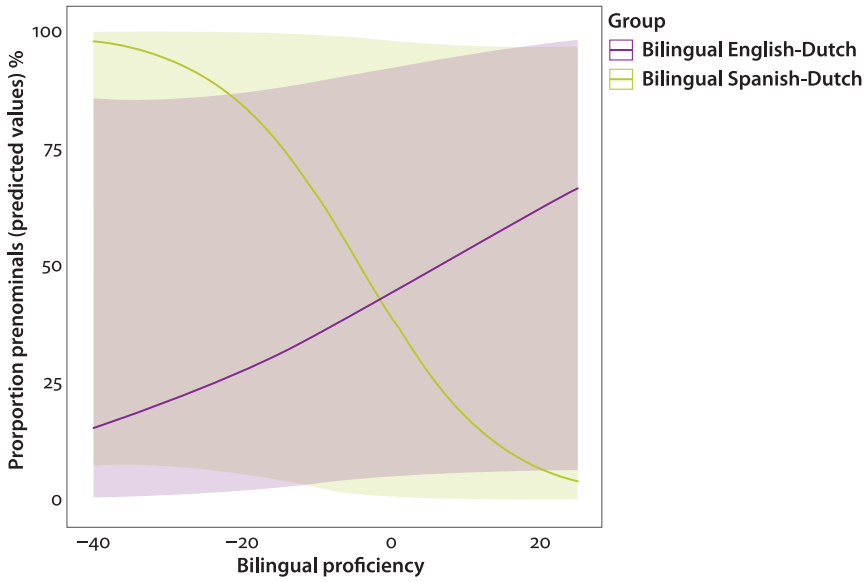

Figure 4. Experiment 2: Effect of *Bilingual Proficiency* as a function of *Group*. NB: Predicted probabilities are plotted for the priming phase in the prenominal block (i.e., the reference levels for these two variables)

input deviates from what is expected, the larger the adjustment. When there was no prime (i.e., in the post-tests) or when the prime structure was expected (i.e., in the postnominal block), the bilingual Spanish-Dutch children returned to the structure which is highly preferred in Dutch and reinforced by their other language. This is consistent with findings from bilingual adults (Jackson & Ruf, 2017).

The results from the bilingual English-Dutch children are harder to explain. They differed from the bilingual Spanish-Dutch group but contrary to our expectations, not from the monolingual group. We expected any inverse frequency effect the bilingual English-Dutch children might have experienced due to prior exposure to English to be attenuated, but this was not the case. One possible explanation is that the relative "frequency boost" from English was limited and therefore insufficient to influence priming behaviour. The results of the elicitation task support this explanation: none of the children produced prenominal structures there. In other words, even if exposure to English did boost prior activation of the prenominal combinatorial node for (at least some of) the children, this was not enough to spontaneously produce said structure when the alternative (i.e., postnominal) was strongly preferred by the only language spoken in the experimental context. The prenominal form was likely just as unexpected in this monolingual context as for the monolingual children. The children in this study lived

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in the Netherlands and on average heard and used more Dutch than English. If our explanation is along the right lines, we would expect a replication study with bilingual English-Dutch children growing up in an English-speaking country *should* result in the attenuated inverse frequency effect (provided they hear more English than Dutch; see Hervé et al., 2016; Unsworth et al., 2018 for relevant discussion).

In the bilingual children, proficiency was not related to priming, but there was a general effect of proficiency whereby, children who were more proficient in their other language (i.e., English or Spanish) were more likely to produce the structure corresponding to the most frequent or only structure in that language. In other words, the bilingual children in the present study were sensitive to the relative frequency of structures in English and Spanish, respectively, whilst speaking Dutch, consistent with findings for both bilingual children (Hervé et al., 2016) and adults (Runnqvist et al., 2013; Muylle et al., 2020), and in line with a shared syntax account for bilingual children.

4. Experiment 1 & 2 compared: Between- vs. within-language priming in English-Dutch bilingual children

The results from Experiment 1 and 2 suggest that bilingual children's syntactic representations are shared. At the same time, the priming effects appear to be greater within language than between languages. To establish whether this is the case, we analysed the data from both sessions for the English-Dutch bilingual children. According to the shared syntax model (Hartsuiker et al., 2004 Hartsuiker & Bernolet, 2017), representations become shared as proficiency develops, at which stage between-language priming should be just as strong as within-language priming. We therefore predicted that with increasing proficiency, priming from English to Dutch should occur at a comparable rate to priming from Dutch to Dutch.

We followed the same procedure as for the separate experiments, adding *Session* (within-language coded as −0.5, between-language as 0.5) as a fixed effect. Subsequently, we added *English proficiency* in interaction with *Session* and *Prime*.[4]

4. We dropped *Phase* from this analysis because our prediction in this comparison did not concern whether priming effects were long-lasting, and including it would require a significant 4-way interaction to test reject our null hypothesis. Four-way interactions are typically hard to interpret and to obtain (especially without a very large sample size). Furthermore, given that the results thus far indicated that it is English proficiency rather than bilingual proficiency which predicted priming behaviour, we started with this variable here. The model with bilin-

There was a significant two-way interaction between *Session* and *Prime* (*ß* = 2.59, *SE* = 0.486, |*z*| = 5.32, *p* < .001), a significant interaction between *English Proficiency* and *Prime* (*ß* = 6.57, *SE* = 2.43, |*z*| = 2.70, *p* = .007), as well as a marginally significant 3-way interaction between *English Proficiency, Prime* and *Session* (*ß* = −5.76, *SE* = 3.32, |*z*| = −1.73, *p* = .083).

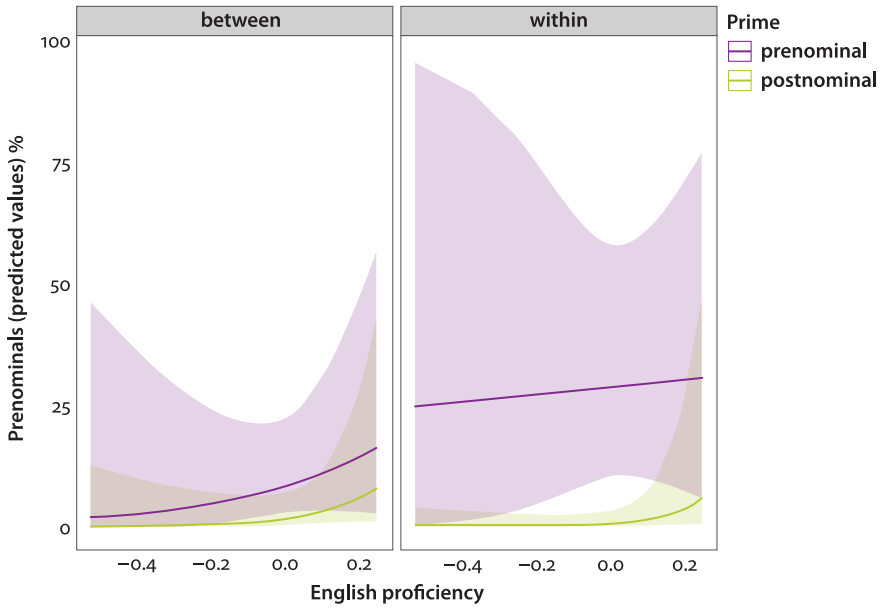

Figure 5. Experiment 1 & 2: (Marginally significant) effect of *English proficiency* as a function of *Prime* and *Session*

As illustrated in Figure 5, between-language priming increased as a function of English proficiency and was virtually non-existent at lower levels of proficiency, whereas within-language priming obtained at all levels of proficiency and to a greater extent than between-language priming across the board. See Supplementary Materials (S2, Table 5a) for the full model.

5. General discussion

Taken together, the results of Experiment 1 and 2 suggest that bilingual children's prior linguistic exposure affects their subsequent behaviour (Hervé et al., 2016;

gual proficiency is provided in the Supplementary Materials (S2, Table 5b) for completeness. The model with Dutch proficiency was not a significant improvement on the base model.

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Serratrice, 2016, 2022), both directly, in the context of between-language priming, and indirectly, in the context of within-language priming. As such, our findings are compatible with the proposal that cross-linguistic influence can be conceptualized as between-language priming, , that is as the result of prior linguistic exposure (Serratrice, 2016, 2022). In addition, they offer further support to a shared syntax account, where syntactic representations are shared between languages when sufficiently similar (Bernolet, Hartsuiker, & Pickering, 2007; Hartsuiker & Pickering, 2008; Hartsuiker et al., 2004). In terms of structural similarity, the case of possessive structures in Dutch, English and Spanish is relatively clear cut. More generally, however, deciding how similar structures need to be for sharing to take place is not trivial (see van Dijk et al., 2021).

The finding that cross-linguistic influence was observed in within-language priming is consistent with most of the research on this topic in bilingual children, which has also focussed on children's behaviour in monolingual contexts. Cross-linguistic influence has already been found in contexts where bilingual children were using one of their languages only in spontaneous speech as well as in a range of experimental tasks, including acceptability judgements and more recently online sentence processing (Lemmerth & Hopp, 2019; van Dijk et al., 2022, see 2021 for an overview). The present study now adds within-language priming to this list. The observation that we see (subtle) effects of cross-linguistic influence both in within- and between-language priming is consistent with the idea that cross-linguistic influence may be conceptualized as between-language priming, that is as the result of prior linguistic (Serratrice, 2016, 2022).

Further evidence in support of between-language priming as the mechanism underlying cross-linguistic influence comes from the results of Experiment 2, which showed that – in line with Runnqvist et al. (2013) and Kootstra and Doedens (2016) – it is not only structural similarity that shapes the extent of any interaction between bilinguals' two languages, but also frequency. Our findings add to the growing body of evidence from adults (Kaan & Chun, 2018; Montero-Melis & Jaeger, 2020; Muylle et al., 2021) that inherited frequency influences priming behaviour in bilinguals. We show that this also holds for bilingual children and for within-language priming (*contra* Flett et al., 2013; in line with e.g., Jackson & Ruf, 2017).

Long-lasting priming effects were observed in relation to bilingual proficiency in between-language priming: the more proficient English-Dutch bilingual children were more likely to continue using the prenominal structure in the post-test phase. Long-lasting priming effects in the absence of lexical repetition are also consistent with an implicit learning account of priming (Chang, 2002; Chang et al., 2006), although it is not immediately clear why sustained priming effects should be associated with greater proficiency. One explanation might be that

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more proficient language users may be better at adapting to the probabilistic use of syntactic structures in their environment (Jaeger & Snider, 2013; Kaschak et al., 2015).

Consistent with Bernolet et al. (2013) and Hartsuiker and Bernolet (2017), between-language priming was modulated by proficiency (cf. Wolleb et al., 2018). In both experiments, we started by using a combined score because bilingual children's proficiency may be still developing in both languages. This is unlike adult L2 learners (in e.g., Hartsuiker & Bernolet, 2017), whose L1 proficiency is assumed to be (more or less) stable, at least for morphosyntax. Variable proficiency in both languages was evident in the bilingual children tested here: despite all living in the Netherlands and consequently showing less variation in Dutch proficiency compared to English/Spanish, individual differences were apparent; the range of scores for bilinguals was furthermore greater than for monolinguals. At the same time, additional analyses revealed that where proficiency effects obtained, these were most likely driven by children's proficiency in their heritage language (i.e., English or Spanish) rather than Dutch. In between-language priming, higher proficiency in the heritage language was associated with a larger priming effect, whereas in within-language priming, the proficiency effect was more general in nature. In other words, higher proficiency in the heritage language was associated with greater use of the structure corresponding to the most frequent or only structure in that language across the board. This differential effect makes sense given the direct presence of the heritage language in the between-language priming context. This finding may also partly reflect the greater variability in heritage language proficiency compared to Dutch, in much the same way that adult L2 learners exhibit more variability in their L2 proficiency compared with their L1 proficiency.

Finally, our results showed that in the same group of children, within-language priming was greater than between-language priming. At first blush, this finding appears to be inconsistent with a shared syntax account, which in its original formulation, predicts equally strong priming within and between languages (e.g., Kantola & van Gompel, 2011). In adults, comparable rates of within- versus between-language priming have been shown to only emerge with sufficient proficiency (Bernolet et al., 2007; Hartsuiker & Bernolet, 2017). This was not the case here: English language proficiency was related to priming between languages but not (or at least less so) to priming within languages, although caution is warranted in attributing too much importance to this finding given that this three-way interaction was only marginally significant. Bearing this caveat in mind, our results seem more compatible with the account put forward by Cai et al. (2011). They proposed that activation of the language node leads to activation of other lemmas linked to that node, resulting in a "within-language boost" even when there is no

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lexical overlap, whilst at the same time assuming shared syntactic representations. On this approach, children in Experiment 2 activated the Dutch language node upon hearing a Dutch prime and this in turn activated other lemmas linked to that node, leading to greater priming than when the prime was in English (see Kantola & van Gompel, 2011 for an alternative interpretation of Hartsuiker et al.'s (2004) shared syntax model which works similarly).

There are however two alternative explanations for the differences we observed for between- versus within-language priming. The first is that weaker between-language priming resulted from lower proficiency and thus weaker structural representations in English relative to Dutch (following Schoonbaert et al., 2007). Whilst it is possible that this may have been the case for individual children, there was overall no significant difference between children's proficiency scores in their two languages, and hence this seems unlikely to be the full story. In this regard, it is worth noting that averaging proficiency scores as we did for our bilingual proficiency measure is not entirely unproblematic as it fails to capture such variation in language dominance. How best to measure bilingual proficiency and how proficiency relates to dominance is a complex question (Unsworth et al., 2018). It is possible, for example, that effects of language dominance may only transpire once a certain level of (bilingual) proficiency has been attained.

A second alternative explanation is that – in line with the 'connected syntax' account discussed in Kantola and van Gompel (2011, p. 280) – children's syntactic representations of similar structures are not shared between languages. Rather, there are separate combinatorial nodes for the same structure in each language and these are connected to each other (see Nicoladis, 2006 for a similar account of cross-linguistic influence in bilingual children). On this approach, structural priming can boost the activation of a combinatorial node between languages but only indirectly, namely via these connections. In contrast, within-language priming is direct, because it results from the residual activation of the combinatorial node in the language in question, and consequently, it is also stronger. In principle, the findings of the present study are compatible with such an approach, assuming that the observed inherited frequency effects can also be accounted for using the same connections. It however remains unclear how such connections are supposed to develop and how exactly this relates to proficiency (see Hartsuiker & Bernolet, 2017 for how shared syntactic representations might develop).

There are several limitations to the present study which should be acknowledged. First, other factors (e.g., syntactic weight or length of the possessor noun) may have affected children's choices in deciding which structure to choose (Rosenbach, 2014; Van Bergen, 2011). Whilst every endeavour was made to control for these, some variation remained. Second, the high number of cognates between

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Dutch and English in the stimulus materials may have contributed to the size of the observed priming effect, which may limit the generalisability of the findings. Note, however, that including cognate status in the statistical analyses did not change the results. Third, because the within-language priming session (Experiment 2) took place before the between-language priming session (Experiment 1), we cannot rule out that long-term priming effects were evident in the monolingual elicitation task (compare 10% prenominals ($n = 24$) in Experiment 1 with a single exemplar (<1%) in Experiment 2). To determine whether the results of Experiment 1 may have been different had this session been conducted first, replication with a similar group of children is needed. Finally, testing large samples with child bilingual populations is hard (especially compared with the bilinguals tested in most adult studies). Whilst our sample sizes were reasonable compared with similar studies with children, the two experiments may not have had enough power to detect all possible interactions. At the same time, priming effects may be larger in children than in adults (Rowland et al., 2012) and hence potentially easier to detect. Finding ways to gather data from sufficient children is a challenge which needs addressing in future research on cross-linguistic influence (and structural priming) (van Dijk et al., 2021).

To conclude, our findings are consistent with the idea that cross-linguistic influence in bilingual children may be conceptualized as the result of prior linguistic exposure, which manifests itself as a result of shared syntactic representations. One consequence of this shared syntax is subtle forms of cross-linguistic influence even in monolingual contexts. The present findings furthermore suggest that, as for adults, shared syntax develops with increasing proficiency, though how exactly sharing takes place for two languages developing in parallel remains unclear. This contrast in timing of acquisition is an important difference between sequential and simultaneous bilinguals, which merits further attention in future priming studies. Indeed, if we are to gain a more comprehensive understanding of how two languages in the bilingual mind interact and what it means for underlying syntactic representations, it is essential to broaden the scope of our investigations to include bilinguals from a range of different learning contexts and language combinations.

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Data availability

Supplementary materials and the data that support the findings of this study are openly available at OSF.

References

Alonso, M.A., Fernandez, A., & Díez, E. (2015). Subjective age-of-acquisition norms for 7,039 Spanish words. *Behavior Research Methods*, *47*(1), 268–274.

Baguley, T.S. (2012). *Serious stats: A guide to advanced statistics for the behavioural sciences*. Palgrave Macmillan.

Bannard, C., & Matthews, D. (2008). Stored word sequences in language learning: the effect of familiarity on children's repetition of four-word combinations. *Psychological Science*, *19*(3), 241–248.

Bates, D., Mächler, M., Bolker, B.M., & Walker, S.C. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1).

Bernolet, S., Hartsuiker, R.J., & Pickering, M.J. (2007). Shared syntactic representations in bilinguals: Evidence for the role of word-order repetition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(5), 931–949.

Bernolet, S., Hartsuiker, R.J., & Pickering, M.J. (2013). From language-specific to shared syntactic representations: The influence of second language proficiency on syntactic sharing in bilinguals. *Cognition*, *127*(3), 287–306.

Bock, K.J. (1986). Syntactic persistence in language production. *Cognitive Psychology*, *18*, 355–387.

Bock, K.J., & Griffin, Z.M. (2000). The persistence of emphasis in language production: Transient activation or implicit learning? *Journal of Experimental Psychology: General*, *129*, 177–192.

Branigan, H.P., McLean, J.F., & Jones, M. (2005). A blue cat or a cat that is blue? Evidence for abstract syntax in young children's noun phrases. In A. Brugos, M. Clark-Cotton, & S. Ha (Eds.), *Proceedings of the 29th Boston University Conference on Language Development* (pp. 109–121). Cascadilla Press.

Brysbaert, M., Stevens, M., De Deyne, S., Voorspoels, W., & Storms, G. (2014). Norms of age of acquisition and concreteness for 30,000 Dutch words. *Acta Psychologica*, *150*, 80–84.

Cai, Z. G., Pickering, M. J., Yan, H., & Branigan, H. P. (2011). Lexical and syntactic representations in closely related languages: Evidence from Cantonese-Mandarin bilinguals. *Journal of Memory and Language*, *65*(4), 431–445.

Chang, F. (2002). Symbolically speaking: A connectionist model of sentence production. *Cognitive Science*, *26*, 609–651.

Chang, F., Dell, G. S., & Bock, K. (2006). Becoming syntactic. *Psychological Review*, *113*(2), 234–272.

Dijkstra, T., & van Heuven, W. J. B. (2002). The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism: Language and Cognition*, *5*(3), 175–197.

Dussias, P. E., & Sagarra, N. (2007). The effect of exposure on syntactic parsing in Spanish-English bilinguals. *Bilingualism: Language and Cognition*, *10*(1), 101–116.

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics* (4th edition). SAGE Publications Ltd.

Flett, S., Branigan, H. P., & Pickering, M. J. (2013). Are non-native structural preferences affected by native language preferences? *Bilingualism*, *16*(4), 751–760.

Genesee, F., Nicoladis, E., & Paradis, J. (1995). Language differentiation in early bilingual development. *Journal of Child Language*, *22*(3), 611–631.

Goodhew, S. C., & Edwards, M. (2019). Translating experimental paradigms into individual-differences research: Contributions, challenges, and practical recommendations. *Consciousness and Cognition*, *69*(November 2018), 14–25.

Gullifer, J. W., Chai, X. J., Whitford, V., Pivneva, I., Baum, S., Klein, D., & Titone, D. (2018). Bilingual experience and resting-state brain connectivity: Impacts of L2 age of acquisition and social diversity of language use on control networks. *Neuropsychologia*, *117*, 123–134.

Haeseryn, W., Romijn, K., Geerts, G., de Rooij, J., & van den Toorn, M. C. (1997). *Algemene Nederlandse Spraakkunst*. Martinus Nijhoff/Wolters Plantyn.

Haman, E., Łuniewska, M., Polišenská, K., Mieszkowska, K., & Chiat, S. (2013). *Cross-linguistic Lexical Tasks: British English version (CLT-EN). As part of LITMUS COST IS0804 Battery*. Unpublished material.

Haman, E., Łuniewska, M., & Pomiechowska, B. (2015). Designing Cross-linguistic Lexical Tasks (CLTs) for bilingual preschool children. In S. Armon-Lotem, J. De Jong, & N. Meir (Eds.), *Assessing multilingual children: Disentangling bilingualism from language impairment* (pp. 196–240). Multilingual Matters.

Hartsuiker, R. J., & Bernolet, S. (2017). The development of shared syntax in second language learning. *Bilingualism: Language and Cognition*, *20*(2), 219–234.

Hartsuiker, R. J., & Pickering, M. J. (2008). Language integration in bilingual sentence production. *Acta Psychologica*, *128*, 479–489.

Hartsuiker, R. J., Pickering, M. J., & Veltkamp, E. (2004). Is syntax separate or shared between languages? Cross-linguistic syntactic priming in Spanish-English bilinguals. *Psychological Science*, *15*, 409–414.

Hervé, C., Serratrice, L., & Corley, M. (2016). Dislocations in French–English bilingual children: An elicitation study. *Bilingualism: Language and Cognition*, *19*(05), 987–1000.

Hsin, L., Legendre, G., & Omaki, A. (2013). Priming cross-linguistic interference in bilingual children. *BUCLD 37: Proceedings of the 37th Annual Boston University Conference on Language Development, September 2016*, 165–177.

Radboud Universiteit Nijmegen (cid-5800811 6/1) IP: 145.116.135.204 On: Tue, 30 Jan 2024 13:26:56

Jackson, C. N., & Ruf, H. T. (2017). The priming of word order in second language German. In *Applied Psycholinguistics*, 38(2).

Jaeger, T. F., & Snider, N. E. (2013). Alignment as a consequence of expectation adaptation: Syntactic priming is affected by the prime's prediction error given both prior and recent experience. *Cognition*, *127*(1), 57–83.

Kaan, E., & Chun, E. (2018). Priming and adaptation in native speakers and second-language learners. *Bilingualism*, *21*(2), 228–242.

Kantola, L., & van Gompel, R. P. G. (2011). Between- and within-language priming is the same: evidence for shared bilingual syntactic representations. *Memory & Cognition*, *39*(2), 276–290.

Kaschak, M. P., Kutta, T. J., & Coyle, J. M. (2015). Long and short term cumulative structural priming effects. *Language, Cognition and Neuroscience*, *29*(6), 728–743.

Kidd, E. (2012). Individual differences in syntactic priming in language acquisition. *Applied Psycholinguistics*, *33*(02), 393–418.

Kootstra, G. J., & Doedens, W. J. (2016). How multiple sources of experience influence bilingual syntactic choice: Immediate and cumulative cross-languaage effects of structural priming, verb bias and language dominance. *Bilingualism: Language and Cognition*, *19*(4), 710–732.

Kootstra, G. J., van Hell, J. G., & Dijkstra, T. (2010). Syntactic alignment and shared word order in code-switched sentence production: Evidence from bilingual monologue and dialogue. *Journal of Memory and Language*, *63*(2), 210–231.

Kuperman, V., Stadthagen-Gonzalez, H., & Brysbaert, M. (2012). Age-of-acquisition ratings for 30 thousand English words. *Behavior Research Methods*, *44*(4), 978–990.

Lanza, E. (1992). Can bilingual two-year-olds code-switch? *Journal of Child Language*, *19*, 633–658.

Lemmerth, N., & Hopp, H. (2019). Gender processing in simultaneous and successive bilingual children: Cross-linguistic lexical and syntactic influences. *Language Acquisition*, *26*(1), 21–45.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences*, *22*, 1–75.

Lüdecke, D. (2021). *sjPlot: Data visualization for statistics in social science.* (R package). https://cran.r-project.org/package=sjPlot

Meisel, J. M. (2007). On autonomous syntactic development in multiple first language acquisition. In H. Caunt-Nulton, S. Kulatilake, & I.-H. Woo (Eds.), *Proceedings of the 31st Boston University conference on language development* (pp. 26–45).

Messenger, K. (2021). The Persistence of Priming: Exploring Long-lasting Syntactic Priming Effects in Children and Adults. *Cognitive Science*, *45*(6).

Montero-Melis, G., & Jaeger, T. F. (2020). Changing expectations mediate adaptation in L2 production. *Bilingualism*, *23*(3), 602–617.

Muylle, M., Bernolet, S., & Hartsuiker, R. J. (2021). The role of L1 and L2 frequency in cross-linguistic structural priming: An artificial language learning study. *Bilingualism*, *24*(4), 767–778.

Myers-Scotton, C. (1993). *Social motivations for codeswitching: Evidence from Africa.* Carendon Press.

Radboud Universiteit Nijmegen (cid:5008116/1) IP: 145.116.135.204 On: Tue, 30 Jan 2024 13:26:56

Nicoladis, E. (2006). Cross-linguistic transfer in adjective–noun strings by preschool bilingual children. *Bilingualism*, *9*(01), 15.

Nicoladis, E. (2012). Cross-linguistic influence in French–English bilingual children's possessive constructions. *Bilingualism: Language and Cognition*, *15*(02), 320–328.

Nieuwenhuis, R., te Grotenhuis, M., & Pelzer, B. (2012). Influence.ME: Tools for detecting influential data in mixed effects models. *R Journal*, *4*(2), 38–47.

O'Connor, C., Maling, J., & Skarabela, B. (2013). Nominal categories and the expression of possession. In K. Börjars, D. Denison, & A. Scott (Eds.), *Morphosyntactic categories and the expression of possession* (pp. 89–121). John Benjamins.

Paradis, J., & Genesee, F. (1996). Syntactic Acquisition in Bilingual Children. *Studies in Second Language Acquisition*, *18*(1), 1–25.

Pickering, M. J., & Branigan, H. P. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language*, *39*, 633–651.

Reitter, D., Keller, F., & Moore, J. D. (2011). A Computational Cognitive Model of Syntactic Priming. *Cognitive Science*, *35*(4), 587–637.

Rosenbach, A. (2014). English genitive variation – the state of the art. *English Language and Linguistics*, *18*(2), 215–262.

Rowland, C. F., Chang, F., Ambridge, B., Pine, J. M., & Lieven, E. V. M. (2012). The development of abstract syntax: Evidence from structural priming and the lexical boost. *Cognition*, *125*(1), 49–63.

Runnqvist, E., Gollan, T. H., Costa, A., & Ferreira, V. S. (2013). A disadvantage in bilingual sentence production modulated by syntactic frequency and similarity across languages. *Cognition*, *129*, 256–263.

Schoonbaert, S., Hartsuiker, R. J., & Pickering, M. J. (2007). The representation of lexical and syntactic information in bilinguals: Evidence from syntactic priming. *Journal of Memory and Language*, *56*, 153–171.

Serratrice, L. (2013). Cross-linguistic influence in bilingual development. *Linguistic Approaches to Bilingualism*, *3*(1), 3–25.

Serratrice, L. (2016). Cross-linguistic influence, cross-linguistic priming and the nature of shared syntactic structures. *Linguistic Approaches to Bilingualism*, *6*(6), 822–827.

Serratrice, L. (2022). What can syntactic priming tell us about crosslinguistic influence? In K. Messenger (Ed.), *Syntactic priming in language acquisition: Representations, mechanisms and applications* (pp. 129–156). John Benjamins.

Serratrice, L., Hesketh, A., & Ashworth, R. (2015). The use of reported speech in children's narratives: A priming study. *First Language*, *35*(1), 68–87.

Skarabela, B., & Serratrice, L. (2009). "The doctor's mother" or "the mother of the doctor"?: Syntactic priming of possessive noun phrases in English preschoolers. In J. Chandlee, M. Fanchini, S. Lord, & M. Rheiner (Eds.), *BUCLD 33 Online Proceedings Suppplement*. Cascadilla Press. http://www.bu.edu/bucld/proceedings/supplement/vol33/

Snedeker, J., & Huang, Y. T. (2015). Sentence processing. In E. L. Bavin & R. Naigles Letitia (Eds.), *The Cambridge handbook of child language* (pp. 409–437). Cambridge University Press.

Team, Rs. (2020). *RStudio: Integrated development for R*. RStudio, PBC.

Radboud Universiteit Nijmegen (wid-5800816/1) IP: 145.116.135.204 On: Tue, 30 Jun 2024 13:28:56

Unsworth, S. (2013). Assessing the role of current and cumulative exposure in simultaneous bilingual acquisition: The case of Dutch gender. *Bilingualism*, *16*(1), 86–110.

Unsworth, S., Chondrogianni, V., & Skarabela, B. (2018). Experiential Measures Can Be Used as a Proxy for Language Dominance in Bilingual Language Acquisition Research. In *Frontiers in Psychology*.

Van Bergen, G. (2011). *Who's first and what's next? Animacy and word order variation in Dutch language production*. Radboud University, The Netherlands.

van der Linden, E., & Blok-Boas, A. (2005). Exploring possession in simultaneous bilingualism: Dutch/French and Dutch/Italian. *EUROSLA Yearbook*, *5*(1), 103–135.

van Dijk, C., Dijkstra, T., & Unsworth, S. (2022). Cross-linguistic influence during online sentence processing in bilingual children. *Bilingualism*, *25*(4), 691–704.

van Dijk, C. N., van Wonderen, E., Koutamanis, E., Kootstra, G. J., Dijkstra, T., & Unsworth, S. (2021). Cross-linguistic influence in simultaneous and early sequential bilingual children: a meta-analysis. *Journal of Child Language*.

Van Gompel, R. P. G., & Arai, M. (2018). Structural priming in bilinguals. *Bilingualism: Language and Cognition*, *21*(3), 448–455.

van Kampen, J., & Corver, N. (2006). Diversity of possessor marking in Dutch child language and Dutch dialects. In M. Vliegen (Ed.), *Variation in Sprachtheorie und Spracherwerb* (pp. 385–398). Peter Lang.

van Wonderen, E., & Unsworth, S. (2020). Testing the validity of the Cross-Linguistic Lexical Task as a measure of language proficiency in bilingual children. *Journal of Child Language*.

Vasilyeva, M., Waterfall, H. R., Gámez, P. B., Gómez, L. E., Bowers, E. P., & Shimpi, P. M. (2010). Cross-linguistic syntactic priming in bilingual children. *Journal of Child Language*, *37*(05), 1047–1064.

Wolleb, A., Sorace, A., & Westergaard, M. (2018). Exploring the role of cognitive control in syntactic processing. *Linguistic Approaches to Bilingualism*, *8*(5), 606–636.

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