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What can syntactic priming tell us about crosslinguistic influence?

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When a child is simultaneously exposed to two different languages, they will need to parse the incoming input, and map form to meaning to create mental representations that are consistent with those of the adult speakers of those languages. How exactly bilingual children do this, the extent to which they develop linguistic systems that are independent of each other, and the place of crosslinguistic influence, are still the object of much current research. Syntactic priming is a promising methodology to test different hypotheses about the (relative) interdependence of bilingual children's linguistic systems. Starting with a historical perspective on the one vs. two systems hypothesis in bilingual development, I consider the limits of crosslinguistic influence, then I make a proposal on how co-activation and syntactic priming could explain crosslinguistic influence.

Keywords: crosslinguistic influence, language dominance, overlap, co-activation, shared structures

Introduction

From an adult perspective, two different languages - for example Italian and English - can be clearly differentiated on the basis of their distinct phonological, lexical, and morpho-syntactic systems. What is less clear is how a child that is simultaneously exposed to two different languages in early childhood processes this bilingual input and develops syntactic representations that are language-specific, i.e. how will they acquire the morpho-syntax of Italian and English? The other main question concerns the relationship between syntactic representations across languages, i.e. will their syntactic representations always be separate for Italian and English, or will they be shared? If they are separate, can they influence each other? And if crosslinguistic influence (CLI) is a possibility, how does it manifest itself, and what are the underlying mechanisms? Syntactic priming, a speaker's tendency to re-use syntactic structures from a recently processed structure (Bock, 1986), is a theoretical and methodological

paradigm that has been extensively used to investigate the nature of syntactic representations in monolingual adults (Pickering & Braningan, 1999; Mahowald et al., 2016) and children (Messenger et al., 2011; Rowland et al., 2012; Kidd, 2012). In adult bilingual speakers (Hartsuiker & Bernolet, 2017 - for an overview) syntactic priming effects have been shown both within- and across languages, leading to the formulation of the shared syntactic structure hypothesis (Hartsuiker et al., 2004). A few studies have used crosslinguistic priming in studies with bilingual children to investigate the extent to which structures may be shared across languages in younger bilinguals (Gámez & Vasilyeva, 2020; Hsin et al., 2013; Vasilyeva et al., 2010; Wolleb et al., 2018), but so far only one has used it to investigate CLI (Hsin et al., 2013). In this chapter I will argue that crosslinguistic syntactic priming is a promising theoretical framework and methodology to address the issue of shared syntactic structures and CLI in childhood bilingualism.

Just like adult bilinguals, child bilinguals are an extremely heterogeneous population with different ages of onset in their two languages, varying amounts of relative exposure and proficiency, learning different pairs of languages that may be more or less closely related in terms of vocabulary and syntax. Because the number of studies adopting the crosslinguistic syntactic priming with bilingual children is still limited, we know relatively little about the role of individual differences, but language dominance is a promising predictor. In a recent meta-analysis including data from 26 studies and 750 simultaneous and early sequential bilingual children, van Dijk et al. (2021) identified language dominance, operationalised as societal language, as a significant predictor of CLI, while surface overlap, language domain, and age were not. The authors also acknowledged the wide variation that exists in the literature when it comes to defining CLI and its predictors, which is potentially problematic for the formulation of hypotheses that can be empirically tested. In the following I will start by going back to the state of the art before the notion of CLI became part of the narrative in the bilingual development literature.

One system vs. two: Independent and autonomous?

Over the last twenty years, the study of CLI has been one of the more prominent lines of enquiry in the field of bilingual language development and one that is very much at the forefront of current research (Austin, 2020). Before the notion of CLI emerged in the late 90s-early 2000s (Döpke, 1998; Hulk & Müller, 2000; Müller & Hulk, 2001; Paradis, 2001; Serratrice, Sorace, & Paoli, 2004), the field's focus was on the issue of language differentiation. The question was whether bilingual children's language knowledge is organised in one undifferentiated system, where words and constructions belong together (one-system hypothesis), or whether young bilinguals do differentiate their two languages from early on (two-systems hypothesis). Te

dominant view in the late 70s-early 80s was that children initially possess a single language system that gradually separates into two systems starting with the lexicon followed by the differentiation of morphology and then syntax (Redlinger & Park, 1980; Vihman, 1985; Volterra & Taeschner, 1978). The existence of mixed utterances containing words from two languages was initially taken as evidence for a common language storage. In the late 80s-early 90s re-analyses of some of the data originally used to argue for the unitary language system hypothesis showed that, when children's utterances were considered as a function of the language of their addressee, there was no indication of undifferentiated language use; on the contrary, the evidence was overwhelmingly in favour of appropriate language-specific use (Geneseee, 1989; Genesee, Nicoladis, & Paradis, 1995). Although children may produce mixed utterances and use, for example, both German and Italian words in the same utterance, they will use relatively more German words when addressing a German speaker, and relatively more Italian words when addressing an Italian speaker. this kind of evidence has been used as a counter argument to the one-system approach, where the expectation would be that context should not make a difference in children's language choices. Several subsequent studies investigating bilingual children's development of morphosyntax also contributed to the formulation of the independent development hypothesis, whose central tenet is that children can indeed acquire language-specific morpho-syntactic structures with little evidence of indiscriminate non-target use (Meisel, 1989; De Houwer, 1990).

However, even if bilingual children can represent and process two languages as largely independent systems, there will inevitably be instances in which they influence each other, therefore they may not be entirely autonomous. Starting in the late 90s- early 2000s some scholars began questioning the one system vs. two systems dichotomy and started considering what systematic CLI might mean for bilingual children's developing grammars (Döpke, 1998; Hulk & Müller, 2000; Müller & Hulk, 2001; Paradis, 2001). To account for systematic instances of CLI, while at the same time arguing for independent syntactic systems, some have argued for independence but not autonomy (Paradis, 2001; Serratrice, 2007). The general idea is that children will have separate and independent language-specific syntactic representations but - under certain circumstances- interaction across languages is possible and predictable. Currently, some doubts are beginning to emerge as to whether the hypothesis that bilingual development is completely independent is still tenable, given what we now know about syntactic representations in adult bilinguals (Serratrice, 2016).

Research using the syntactic priming paradigm has made a strong case for the existence of shared syntactic structures in adult second language (L2) learners (Hartsuiker et al., 2004; Hartsuiker & Bernolet, 2017). Whether this is also the case for bilingual children is not yet clear, but there are theoretically principled reasons to think that the same could apply to child bilingual speakers. If the syntactic system of bilingual children - similarly to that of bilingual adults - allows for shared

syntactic structures, then the stronger version of language independence becomes less plausible. A more parsimonious option is to think of a bilingual language system where (some) structures are shared across languages for bilingual children too. This lack of a strong independence assumption does not necessarily imply that children do not have language-specific representations if the system still tags structures as a function of language; the implication is rather that - over time - structures that exist in both languages become shared. For example, if a child has a syntactic structure for the passive construction in English and an equivalent syntactic structure for the passive in Italian, the child would end up with one single syntactic structural representation for the passive construction that is no longer language-specific. Sharing could be possible even for structures that are not equivalent, and in fact this may well be a pre-requisite for the existence of CLI, as we will see later.

Te case for shared syntactic structures has been made for adult L2 learners; of course, the fundamental distinction between this population and simultaneous bilingual children is that the former are already competent speakers of an L1 and typically already quite proficient in their L2 as well, while the latter need to make structural sense of input from two languages. Bilingual children typically also differ in the opportunities to encounter potentially equivalent syntactic constructions in their two languages as a function of different contexts (e.g. different speakers, different settings), and because of different amounts of relative exposure. For example, some children might be exposed to passive constructions at the same time in both of their languages, and they may follow a process - in which syntactic representations emerge gradually and are later entrenched - that is parallel in the two languages but initially independent. For other children, exposure to the passive construction happens in one language before the other; for example, they may hear passives in texts in the language of schooling, but not at home. In the case of this asynchronous exposure across languages, it might take longer for passives to become shared because children need more time to establish an equivalence across languages.

How different is bilingual development from monolingual development and what is the role of CLI?

The language learning goal is essentially the same regardless of whether children grow up with one or two languages. Both monolingual and bilingual children need to learn their languages' sounds, words, morphology, syntax, and they need to discover how to use this linguistic knowledge in semantically and pragmatically appropriate ways. It might be logical to think that for bilingual children this process is twice as demanding, both because their input is divided across two languages, and because they need to learn the phonology, lexicon and morphosyntax of two languages. In

one sense this assumption is correct; to become a competent speaker, a child exposed to two languages will ultimately need to acquire the language-specific properties of both, and this comes at some cost. For instance, because of the reduced opportunities in terms of exposure and use, and the different contexts in which bilingual children hear and use their languages, they tend to have smaller single-language vocabularies than monolinguals (Hoff et al., 2012); their knowledge is distributed across two languages rather than being limited to only one. A smaller single language vocabulary is not an inevitable outcome in bilingual acquisition; though some studies have reported no significant differences between monolinguals and bilinguals tested in the same language in either receptive or expressive vocabulary (De Houwer et al., 2014), or receptive vocabulary alone (Tordardottir, 2011).

At the same time, it is not necessarily the case that a bilingual child has to do everything twice; they can potentially use the knowledge they have acquired in one language to bootstrap learning in the other. The notion of bilingual bootstrapping, i.e. that bilingual children can use what they know in one language to facilitate learning in the other is not a new one (Gawlitzek-Maiwald & Tracy, 1996). In its original formulation the bilingual bootstrapping hypothesis was intended to explain cases of code-switching as evidence for children's resourceful solution to a knowledge gap, rather than as a sign of linguistic confusion. Children typically do not use mixed utterances because they cannot discriminate between the two languages. Using a word, a morpheme, or a construction from language α while speaking language a is an option available to bilingual speakers to fill a knowledge gap, or it can be a processing relief strategy when lexical or morpho-syntactic access fails.

In a broader sense, bilingual bootstrapping can be conceptualised as a pooling of resources where linguistic knowledge is shared across languages. It makes little sense to think that children who routinely deal with two languages in their daily lives keep their learning in neatly discrete language silos. In the most extreme version of bilingual bootstrapping, one could argue that what children learn in one language is a catalyst for learning in the other language - especially in cases in which words and structures are identical or near-identical across languages. In a more conservative interpretation of the hypothesis, it could simply be that, even if form-meaning mappings do take place independently as part of a language-specific process, the outcome becomes knowledge that is eventually shared across languages when there is a sufficient degree of structural equivalence.

Te hypothesis that linguistic knowledge is shared across languages in bilingual speakers has implications for mental representations, for language processing, and for understanding the mechanisms that lead to CLI. While we have an increasingly large body of evidence for shared lexical and syntactic representations in bilingual adults - particularly late L2 learners (see Bobb & Kroll, 2018 for an overview of the bilingual lexicon; Bernolet & Hartsuiker, 2018 for an overview of syntactic representations in

adult bilinguals) - we know far less about developing representations in bilingual children (Nicoladis, 2018; Chondrogianni, 2018). As for processing, lexical co-activation is a well-established fact in the adult literature (Dijkstra & van Heuven, 2002; Kroll et al., 2010), and to some extent in the developmental literature (Singh, 2014; von Holzen & Mani, 2012). Semantic priming studies have shown that for bilinguals, words in one language are automatically accessed upon hearing a related word in the other language. Evidence for syntactic co-activation in adult bilingual speakers also comes from studies of code-switching (Fricke & Kootstra, 2016) and from studies of crosslinguistic priming (van Gompel & Arai, 2018).

Psycholinguistic accounts of linguistic representations in adult bilinguals have relied heavily on syntactic priming as an experimental methodology (Bock, 1986), particularly in the domain of sentence production where systematic and robust priming effects have been repeatedly found for a range of constructions (Bernolet et al., 2007, 2009, 2012, 2013; Cai et al., 2011; Desmet & Declercq, 2006; Kantola & Van Gompel, 2011; Meijer & Fox Tree, 2003; Salamoura & Williams, 2007; Schoonbaert et al., 2007; Shin & Christianson, 2009). Research using this paradigm with bilingual children is - surprisingly - considerably sparser (Gámez & Vasilyeva, 2020; Hsin et al., 2013; Vasilyeva et al., 2010; Wolleb et al., 2018) and, with the exception of the Hsin et al. study, it has not yet directly addressed the issue of crosslinguistic influence.

Crosslinguistic influence: Contexts and constraints

Contexts of bilingual acquisition are extremely varied and generalisations about developmental trajectories are always problematic. Despite this caveat, there is now a consensus that children who are simultaneously exposed to two languages in early childhood - typically before the age of 3 - can acquire their two languages as independent systems (De Houwer, 1990), although the reality is likely to be more nuanced than this. For instance, a child exposed to Italian and English will mostly use Italian words, Italian morphology, and Italian syntax when speaking Italian, and English words, English morphology, and English syntax when speaking English. At the same time, it is also likely that English words, and potentially English morphology and English syntax might surface in Italian, and vice versa. The use of two languages in the same sentence (intra-sentential code-switching) and across sentences (inter-sentential code-switching) is a common feature of bilingual speech in both children and adults and a clear overt display of the way in which a bilingual's two languages interact. Other less obvious manifestations of bilingual language interaction are structural instances of CLI, i.e. cases in which a speaker may use or accept a syntactic construction which is either pragmatically sub-optimal, ungrammatical,

or generally dispreferred in that language, but perfectly acceptable in their other language. In Hulk and Müller's (2000) original hypothesis, two pre-requisites for the occurrence of CLI were stipulated: (1) an interface level between two modules of grammar, and (2) surface level overlap between the two languages. More specifically, the overlap that Hulk and Müller (2000) considered - and that much subsequent work on CLI has investigated - is a superset-subset case of partial overlap in which language a has two syntactic options and language α has only one of them (e.g. both overt and null subjects in Italian, and overt subjects only in English). Over the last twenty years the hypothesis has been tested in multiple language combinations and in different types of constructions at the syntax-pragmatics interface (pronominal subjects and objects, Haznedar, 2010; Serratrice et al., 2004; Serratrice et al. 2012; Sorace et al., 2009; dislocation structures Hervé et al., 2016), at the syntax-semantics interface (articles in specific and generic contexts, Kupisch & Pierantozzi, 2010), and in cases where word order is not overtly pragmatically or syntactically constrained (word order in Greek subordinate clauses - Argyri & Sorace, 2007, word order in main clauses, Bosch & Unsworth, 2021; compounds Foroodi-Nejad & Paradis, 2009, adjectives, Nicoladis, 2006 - see van Dijk et al., 2021 for a meta-analysis of studies of CLI). Twenty years afer the original formulation of the CLI hypothesis, the interim conclusion of ongoing research is that structural overlap is not a necessary requirement for CLI, and neither is the interface level between two modules of grammar (e.g. syntax-pragmatics). While several studies have found evidence for CLI at the interface between syntax and pragmatics, other studies have shown CLI in constructions where word order is not dictated by interface considerations.

As for structural overlap, in cases in which there is partial overlap across languages, the repeated finding is that the structure that is common to the two languages is the one that tends to become over-accepted or over-produced in the language where two options are available. Italian-English bilingual children for example tend to over-accept overt subject pronouns as co-referential with a topic subject antecedent in Italian (Sorace et al., 2009) and postverbal pronouns in non-focus contexts in Italian (Serratrice et al., 2012); Greek-English bilingual children over-accept and over-produce pragmatically inappropriate preverbal subjects in Greek (Argyri & Sorace, 2007). Importantly, these results are modulated by children's language dominance; only children who were dominant in English displayed CLI in Italian (Sorace et al., 2009) and Greek (Argyri & Sorace, 2007). The absence of overlap is however not an impediment to CLI, and several studies have shown that bilingual children are significantly more likely than monolingual peers to produce ungrammatical word orders in a range of structures including noun-noun compounds (Nicoladis, 2002), possessive constructions (Nicoladis, 2012), adjectival phrases (Nicoladis & Gavrila, 2015), wh-questions in situ and prenomial relatives (Yip & Matthews, 2000).

In a recent meta-analysis of 26 studies investigating CLI in simultaneous bilingual children, van Dijk et al. (2021) reported a significant small to moderate average effect size of CLI based on the differential mean between a bilingual and a monolingual group, confirming that CLI is a systematic feature of childhood bilingualism. Surface overlap, language domain, and age were not significant predictors of CLI, while the societal language - a proxy for language dominance - was. Essentially, the findings of the meta-analysis show that CLI is not limited to one specific aspect of syntax, semantics, or pragmatics; it is not necessarily something children grow out of as they get older; and it can affect constructions that do not share the same word order. In contrast, the societal language is the best predictor of whether a child will be affected by CLI in the suboptimal or ungrammatical use of a construction in their other language. At least from the time children start school the societal language is the language that they use more frequently, in a wider range of contexts, and in which they have access to a larger number of speakers, including influential peers. Because of the weight of the societal language in their daily experience, children have more opportunities to map meaning and form in that one language in both comprehension and production. In so doing, the constructions in the societal language - with the associated lexical, morpho-syntactic, and pragmatic information - become more entrenched representationally and as such more easily accessible during processing.

Mental representations and CLI

CLI as an outcome is manifested when the form-meaning mapping across the two languages is not identical in one of at least three possible scenarios: language *a* allows two form-meaning mappings in two different constructions, but language *α* allows only one of these constructions; for instance, ditransitives in English allow both the prepositional object construction and the double object construction with two full noun phrases (e.g. *I gave the ball to Lucy/I gave Lucy the ball*), while Italian only allows the prepositional object construction (e.g. *Ho dato la palla a Lucy/*Ho dato Lucy la palla*). A second possible scenario is when the same meaning maps onto the same construction, but the word order, i.e. the syntactic structure, is different within the construction across the two languages. Tese word order conflicts are exemplified by attributive constructions where the adjective precedes the noun in a language like English (e.g. *red horse*), but it follows the noun in a language like Welsh (e.g. *ceffyl coch*), or by sentence-final double infinitives where Dutch requires the modal to precede the infinitive (e.g. *willen kopen*), but the order is reversed in German (e.g. *kaufen wollen*). Lastly, there are contexts in which the same meaning maps onto a different construction across the two languages. For instance, genericity maps onto bare plural noun constructions in a language like English (e.g.

sharks are dangerous), but onto definite plural noun constructions in languages like French and Italian (e.g. *gli squali sono pericolosi*). Given this range of possibilities the question about the nature of bilingual children's mental representations is twofold: (1) do they have shared syntactic structures for constructions that are identical across languages? (2) what is the relationship for constructions that only partially overlap, where there is a word order conflict, or where the same meaning maps onto different constructions? An additional and related question concerns the way in which representations are affected by processing, i.e. the extent to which language comprehension and production shape mental representations.

Early accounts of CLI focused on formal syntactic aspects of the phenomenon in terms of feature underspecification (Sorace & Serratrice, 2009). As a result of bilingual language exposure and use - features such as [+/− topic shift] associated with the distribution of null and overt pronominal subjects in null-subject languages might be underspecified for the appropriate discourse pragmatic contexts because of the lack of distinction in the other language. In the case of subject pronouns, in English they can be associated with both [+topic shift] and [-topic shift] discourse features, while overt pronominal subjects in a null-subject language like Italian are preferentially associated with a [+topic shift] feature. The under-specification argument is that the English superset - where there are no pragmatic constraints on the use of overt pronominal subjects - will end up affecting the one-to-one mapping in Italian. Over time and particularly as a function of greater exposure and use of English - the [+/− topic shift] feature is likely to be underspecified in Italian for an English-Italian bilingual speaker. This will result in the use/acceptance of overt subject pronouns for both types of topic shift contexts thus leading to some sub-optimal pragmatic options in Italian in the case of overt subjects in [-topic shift] contexts. The fact that underspecification is a logical possibility does not necessarily imply that this will be the case for all bilingual children, and at all times. Because bilingual language exposure is not static over time or across contexts, the prediction is that the pragmatically infelicitous use of overt subjects in [-topic] contexts will be more likely for those children that have more exposure to English, use English more, and have less exposure to Italian from non-attrited speakers (see Paradis & Navarro, 2003, for the role of parental input).

While these representational accounts provide some insight into the kind of syntactic contexts that might lead to CLI - especially when it comes to interface phenomena - they do not directly address the psycholinguistic mechanisms that underlie CLI when it comes to processing language in production and comprehension. This is an important issue because we do know that the languages of a bilingual speaker are always co-activated to some extent, and language processing and syntactic representations must influence each other in a bi-directional relationship in which processing shapes syntactic representations, and in turn syntactic

representations affect processing (Lewis & Phillips, 2005). Co-activation of syntactic representations is also a necessary pre-requisite for crosslinguistic structural priming, particularly when structures are not (yet) completely shared, when there is only a partial overlap between the semantics and the syntax of a construction across languages, or in cases of word order conflict.

Language co-activation and CLI: Processing mechanisms

Language co-activation has been well documented for the lexicon in adults (Bobb & Kroll, 2018 for a recent review) and in children too, to some extent (Singh, 2014; Von Holzen & Mani, 2012). In the lexical domain, crosslinguistic overlap in phonological form and in meaning for identical or near-identical translation equivalents facilitates early vocabulary acquisition in children learning closely related language pairs like Catalan and Spanish (Bosch & Ramon-Casas, 2014), or English and German (Schelleter, 2002). In closely related languages, the high phonological similarity of a cross-language synonym increases the exposure to its form-meaning pairing as the children encounter it not just in one, but in both of their languages, ending in lexical knowledge that is at least partly integrated across languages. The extent to which syntactic knowledge is also co-activated is less clear as there is little research on syntactic processing in bilingual children. Two recent contributions are studies using visual world eye-tracking of the processing of gender and case-marking cues (Lemmerth & Hopp, 2019; Meir et al., 2020). Lemmerth and Hopp (2019) investigated Russian-German simultaneous and successive bilingual 8-9-year-olds' processing of gender cues in German in an eye-tracking study. Both German and Russian have a tripartite gender system (feminine, masculine, neuter) and they both mark gender on adjectives. However, German also marks gender on articles, whereas Russian does not have articles. Lemmerth and Hopp (2019) manipulated the gender congruency of a target noun in a four-picture display (same or different across the two languages), the gender marking cue (article condition vs. adjective condition), and the type of gender match between the target and its competitors (same gender vs. different gender). Regardless of gender congruency with Russian (irrelevant for the monolinguals) and of gender marking cue, the monolinguals and the simultaneous bilinguals successfully exploited the gender cue in the condition in which the target item had a different gender from its competitors. The successive bilinguals also looked faster at the target item in the different vs. same trials and regardless of whether the cue was on the article or on the adjective, but they could only do so when the gender of the target noun was congruent with the gender of its Russian translation equivalent. This gender congruency effect is evidence that co-activation affects the gender features of the translation equivalents, which in turn affect the forward computation of agreement dependencies with an upcoming noun.

The lack of a positive association between proficiency in Russian and performance on non-congruent nouns led Lemmerth and Hopp (2019) to conclude that there is not an obvious direct link between L2 performance and L1 knowledge. However, they did not directly measure current and/or cumulative amount of input in the two languages, therefore this conclusion should be treated with some caution. Previous research has repeatedly found an effect of input on gender acquisition in bilingual children, although there are mixed findings as to the role of cumulative vs. current amount of input. Some offline studies have found a significant and positive relationship between the cumulative amount of input in the minority language at home - and accuracy in gender marking - but no significant relationship with current amount of exposure (e.g. Rodina & Westergard, 2017, for Norwegian-Russian 4- to 7-year-olds in Norway). Others have found that cumulative amount of input is a better predictor of gender accuracy for some bilinguals (e.g. in Dutch for the Dutch-English bilinguals in Unsworth et al., 2014), but for other bilinguals the significant predictor is current amount of exposure (e.g. in Greek for the Greek-English bilinguals in Unsworth et al., 2014).

In another visual world eye-tracking study, Meir et al. (2020) tested Russian-Hebrew bilingual children and monolingual Hebrew-speaking controls between the ages of 5 and 6; a monolingual Russian-speaking group was included from a previous study (Sekerina & Mitrofanova, 2017). The comprehension component of the study was an investigation of children's sensitivity to accusative markers in SVO and OVS constructions - morphological case on nouns in Russian and the particle *et* before definite nouns in Hebrew. In Russian, the bilingual children showed sensitivity to the accusative case cue similarly to the monolingual children tested by Sekerina and Mitrofanova (2017), but they were slower than monolinguals in the integration of the case cue. The more surprising finding was in Hebrew: unlike the monolingual children - who showed no sensitivity to the accusative maker *et* - the bilinguals did make use of the case marker as a predictive cue. Meir et al. (2020) interpreted these findings as evidence that the predictive processing of young bilingual speakers can be boosted by CLI in processing strategies when the co-activation of the language in which the form-meaning mapping is more frequent (Russian case in this case) reinforces the less frequent and weaker cue in the other language (the *et* case-marking particle in Hebrew). On the basis of questionnaire-based information on current amount of language exposure, Meir et al. (2020) classify the bilingual children as balanced bilinguals but they did not use these data in their analyses. Inconsistency in measuring and in using information on input is problematic for the comparability across studies and it is an issue in the field of childhood bilingualism that affects any attempt at the quantification of the bilingual experience (Kašćelan et al., 2021). This issue of inconsistency in the operationalisation of language exposure and language dominance was also recently highlighted in the van Dijk et al.'s (2021) meta-analysis where they had to resort to societal language as a generic proxy for language dominance.

Aside from the issue of language dominance and the role of input in CLI, the findings of the two studies of language processing in young bilinguals are in line with much research on the online processing in adult L2 speakers where the focus has mostly been on whether L2 speakers can acquire syntactic properties and constructions that do not exist in their L1 or that are expressed differently. This has been a fruitful line of research that has tested the limits of L2 speakers' learning of a new form-meaning mapping for different constructions (Chen, Shu, Liu, Zhao, & Li, 2007; Hopp, 2010; Meulman, Stowe, Sprenger, Bresser, & Schmid, 2014). this evidence is, however, less informative on the issue of language co-activation when there is a direct conflict between the form-meaning mappings across the L1 and the L2. Specifically, fewer studies have examined what happens when word order structure in one construction in the L1 is the exact opposite of the word order structure in the same construction in the L2 (Erdocia & Laka, 2018; Erdocia, Zawiszewski, & Laka, 2014). Tese are the kind of studies that are going to be particularly informative about those cases of crosslinguistic influence where children produce a word order that is ungrammatical in one language (e.g. a N+Adj construction in English: *horse red*), but which is perfectly grammatical in the other (e.g. in Welsh N+Adj: *ceffyl coch*). While there are currently no published studies of how bilingual children process these ungrammatical word orders online, offline studies have shown that some ungrammatical or semantically/pragmatically dispreferred word orders are indeed more acceptable to bilingual children - compared to their monolingual counterparts - when these word orders are grammatical/acceptable in their other language (see Serratrice, 2013 for an overview).

Evidence from online studies of sentence processing of conflicting word orders with adults can shed some light on the mechanisms that lead to these instances of CLI in children. The argument is that syntactic constructions that share a conceptual core are co-activated. If the co-activated constructions map onto the same word order in both languages, there will be no overt effect of co-activation. thiswould be the case for adjectival constructions in a Spanish-Italian speaker, for instance, as the canonical N+Adj word order is the same in both languages. However, if the co-activated constructions map onto different word orders across the two languages, e.g. N+Adj in Welsh but Adj+N in English, we have a potential situation for CLI in which a child might produce an incorrect word order in one language because they are using the word order in the co-activated construction in the other language (e.g. Nicoladis & Gavrila, 2015). Additional mechanisms of inhibition and entrenchment, and different contexts of bilingual use must play a part in determining when CLI takes place because it does not happen all the time. Most of the time children do use the language-specific word order, but when the other language construction is highly entrenched and/or highly activated inhibition fails, instances of CLI will occur.

Recent evidence from online sentence processing studies with adult bilinguals suggests that syntax must be co-activated to some extent. In cases in which L1 and L2 have either conflicting word orders (Mickan & Lemhöfer, 2020), or conflicting patterns of gender agreement (Hopp & Lemmerth, 2018; Alemán-Bañón & Martin, 2021) competition from the L1 leads to processing that is qualitatively different from that of monolingual L1 speakers. Co-activation is a notion that is central to structural priming across languages and that has been at the core of an approach that sees L1 and L2 structures becoming shared in proficient L2 speakers (Hartsuiker & Bernolet, 2017).

Crosslinguistic structural priming in adult bilinguals

Crosslinguistic structural priming is one way in which syntactic co-activation and its consequences can be investigated, and it is a promising tool to shed light on CLI. Loebell and Bock (2003) were the first to test whether structural priming would work across languages, i.e. whether a structure from one language is more likely to be produced afer the equivalent structure is used in the other language. Their rationale for this line of inquiry was that the feasibility of crosslinguistic priming in production is supported by research on code-switching and transfer showing that structures in both languages can be simultaneously active or actually shared. Incidentally, a similar argument for co-activation and for unified syntax in the bilingual mind was recently made by Declerck et al. (2020) for comprehension using a different methodology, the bilingual version of the Rapid Parallel Visual Representation paradigm (Snell & Grainger, 2017).

So far, most of the evidence for the argument that syntactic structures are shared in bilingual speakers comes from research on adult L2 learners (Bernolet & Hartsuiker, 2018 for a recent overview) and it is based on a psycholinguistics model of lexico-syntactic representations initially proposed by Pickering and Branigan (1998). In the bilingual version of the model, information about syntactic structures is represented in combinatorial nodes (e.g. active and passive structures) connected to lemma nodes in a single integrated lexicon (e.g. transitive verbs in both languages). This is the model that Hartsuiker et al. (2004) proposed to account for the finding that Spanish-English bilinguals were significantly more likely to produce a passive in L2 English to describe a transitive target afer having been exposed to a passive prime in Spanish rather than an active or an intransitive prime. Several subsequent studies have provided further evidence for the existence of structural priming across languages in adult bilinguals (Bernolet, Hartsuiker & Pickering, 2012; Cai et al., 2011; Kantola & Van Gompel, 2011; Salamoura &

Williams, 2007; Schoonbaert, Hartsuiker & Pickering, 2007; Shin & Christianson, 2012) and more recently Hartsuiker and Bernolet (2017) have made a proposal that gives an account of shared syntactic structures as the outcome of a developmental trajectory in adult L2 learners.

Unlike simultaneous bilingual children - or even young L2 learners - adult L2 learners already have well-established lexical and morpho-syntactic knowledge in their L1. For them, the process that leads to shared syntactic structures is one of gradual abstraction that starts out with the use of L2 words and L1 syntactic structures and the imitation of L2 structures afer retrieval from explicit memory. This initial phase is followed by a phase in which L2 learners start to form a lexically specific representation of a structure afer repeated exposures (e.g. starting to use the *s*-genitive construction in English with a small number of nouns). At this stage, the hypothesis is that L2 learners should be sensitive to structural priming only in cases of lexical overlap, because of the residual activation of lexically specific structural nodes. As more L2 word types are encountered in the context of a construction, the structure gradually becomes abstract and productive (e.g. the ability to use the *s*-genitive in English with any number of nouns). According to Hartsuiker and Bernolet (2017), at this later stage L2 learners still have separate syntactic representations in their L1 and in their L2 and it is only when L2 learners have reached a high level of proficiency that syntactic structures that are equivalent in the two languages are fully shared.

In a more recent version of their model, Bernolet and Harstuiker (2018) also clarify that it is not necessarily the case that all syntactic structures are shared across languages. The notion of shared structures is not relevant for L2 structures that have no equivalent in the L1, and for those L2 structures that are not fully equivalent. In these cases, there would only be L2 representations and in the absence of overlapping word order they would not expect crosslinguistic priming. This is, for instance, what Bernolet et al. (2007) found in within- and between-languages priming of Dutch, English, and German relative clauses. Priming in the Bernolet et al. (2007) study occurred from Dutch to German, two languages with verb-final relative clauses; but there was no priming between Dutch and English, as English does not have verb-final word order.

Whether word order overlap is necessary for crosslinguistic priming is still a matter of debate (Muylle et al., 2020, 2021). Some studies have failed to find any significant effect of priming in the absence of word order overlap in production (Bernolet et al., 2007; Jacob et al., 2017; Loebell & Bock, 2003) and in comprehension (Kidd et al., 2015), while in other studies the absence of word order overlap was not an impediment to crosslinguistic priming in production (Bernolet et al., 2009; Chen et al., 2013; Weber & Indefrey, 2009; Hwang et al., 2018; Shin & Christianson, 2009). The presence/absence of case marking across languages,

on the other hand, does not seem to be an impediment to crosslinguistic priming (Fleischer et al., 2012; Flett et al., 2012; Hartsuiker et al., 2016; Loebell & Bock, 2003; Salamoura & Williams, 2007). Trough the creation of an artificial language where they could manipulate the presence of case-marking and word order overlap with Dutch, Muylle et al. (2020) showed that Dutch speakers were successfully primed in the production of transitive constructions both within- and between-languages in all three versions of the artificial language (with and without word order overlap or case marking). The magnitude of priming was larger for more accurate participants, i.e. those participants that had acquired more accurate vocabulary and syntactic knowledge of the artificial language in the course of the experiment- a finding in line with previous research reporting a positive correlation between L2 proficiency and likelihood of priming. For ditransitive constructions there were no between-languages priming effects but only within-languages effects. The difference in the likelihood of crosslinguistic priming observed across transitives and ditransitives suggest that syntactic structures might become shared to different degrees for different constructions, and at different times during the developmental trajectory of L2 acquisition. More complex structures may require longer to be acquired and thus be initially less subject to priming.

Crosslinguistic priming in younger bilinguals and mechanisms of CLI

In contrast with a relatively well researched role of syntactic priming in the emergence of shared syntactic structures in adult L2 learners, there is a considerably sparser literature on younger bilingual children. Tere are currently two published studies on the priming of transitives in Spanish-English bilingual children (Gámez & Vasilyeva, 2020; Vasilyeva et al., 2010), one on the priming of ditransitives in Norwegian-English bilingual children (Wolleb et al., 2018), and one on the priming of adjectival constructions in Spanish-English bilinguals (Hsin et al., 2013). Vasilyeva et al. (2010) and Gámez and Vasilyeva (2020) tested the hypothesis that Spanish-English bilingual children would have a shared representation for the passive, a construction in which the two languages have an equivalent form-function mapping and the same word order structure (e.g. The *dog was washed by the cat, El perro fue lavado por el gato*). In a group of Spanish-English 5-year-olds, Vasilyeva et al. (2010) reported a significant effect of priming from Spanish to English, with more passives produced in English afer a passive prime than an active prime in Spanish, but no significant effect in the direction from English to Spanish. As a potential reason for the asymmetric direction of the priming effect Vasilyeva et al. (2010) appealed to the children's language dominance and to the relatively low frequency of passives in spoken Spanish. The latter explanation has received

some support over the years with studies showing that functionally monolingual Spanish-speaking children were primed to produce a passive only in the condition in which they had to repeat the passive prime (Gámez & Vasilyeva, 2015; Gámez & Shimpi, 2016). As for the issue of language dominance, the argument in Vasilyeva et al.'s (2010) study was speculative as there was no formal assessment of children's proficiency in the two languages and/or of their relative amount of language exposure. Another crucial reason that no firm conclusions can be drawn on the nature of the asymmetric nature of priming is due to the study's design. Unlike crosslinguistic priming studies with adult L2 learners that are fully within-subjects, this was a between-subjects study where children were assigned either to the Spanish-English condition or the English-Spanish condition, and where priming condition was also between-subjects.

In another crosslinguistic priming study on the production of passives in Spanish-English six-year-olds, Gámez and Vasilyeva (2020) tried to address the language dominance issue by using standardised receptive vocabulary scores in both languages as a proxy measure of proficiency; language exposure was established by asking parents about their children's exposure to Spanish and English at home from mother, father, siblings, other adults on a 5-point scale ranging from 1 = only Spanish to 5 = only English. The children included in the studies were classified as balanced bilinguals according to parental reports and on the basis of no statistical difference in their receptive vocabulary knowledge between the two languages. With more balanced Spanish-English bilingual children, the effect of priming was significant in both directions, a result that the authors interpret in support of fully shared syntactic structures in young simultaneous bilinguals. Whether this is indeed the case is yet to ascertain as there were some methodological differences from crosslinguistic priming studies with adult L2 learners. The study was a 2×2 design with prime type (active vs. passive) as a within-subjects condition, and active and passive primes were presented in counterbalanced blocks; verb overlap (matched verb between prime and target vs. unmatched verb) as a between-subjects condition. Two of the experimental design choices in this study need to be considered when interpreting the results: the between-subjects condition for the verb overlap and the blocking of primes may have increased the likelihood of priming. Tere are no principled reasons why children - bilingual or monolingual - cannot be tested in the priming paradigm using the same protocols used with adults (Messenger et al., 2011), even if the number of experimental items will not be as large for younger learners.

Some of these methodological issues were addressed in Wolleb et al.'s (2018) investigation of within- and between-language priming of ditransitive structures in Norwegian-English bilinguals between the ages of 4 and 8. Although all the children lived in Norway at the time of testing, and had done so for a minimum of three years, they had significantly larger receptive vocabulary scores in English and the

decision was made to test crosslinguistic priming only from English to Norwegian. In this study priming was within-subjects in both the within-language and the between-language experiments, half of the primes were prepositional object datives and half double object datives, and presentation was not blocked. Methodologically this study of crosslinguistic priming is the only one so far that has adopted the same methodology used in adult studies, however the bi-directionality of priming was not investigated as children only ever heard primes in English and produced target descriptions in Norwegian. The effect of priming was significant with children producing more double object datives in Norwegian after hearing a double object dative than a prepositional object dative whether the prime was in English (within-language experiment) or in Norwegian (crosslinguistic experiment).

Despite their non-trivial methodological limitations, the few studies that have used crosslinguistic syntactic priming with bilingual children have all reported significant effects of priming between languages, and one reported the same effect for the same group of children both within and between languages (Wolleb et al., 2018). This is initial evidence that syntactic structures that are equivalent across languages - passives in English and Spanish, and ditransitives in Norwegian and English - can be shared in young simultaneous bilingual learners. While this is an important first piece of the puzzle, it does not yet show that crosslinguistic priming can give rise to CLI where a prime including a syntactic structure for a given construction (e.g. the Adj+N structure for the adjectival construction in English) leads to the use of the same syntactic structure (e.g. Adj+N) in the other language even though in this language the construction maps onto a different structure (e.g. N+Adj in Spanish adjectival constructions) and the resulting target is therefore ungrammatical. thisis the question investigated by the only crosslinguistic priming study with young bilinguals that has direct relevance for cases of CLI in the absence of word order overlap (Hsin et al., 2013). In their study of 4- and 5-year-old Spanish-English bilinguals, Hsin et al. (2013) elicited the production of adjectival constructions in Spanish in two conditions: a neutral condition and an interference condition; in both conditions the experimenter always spoke English and the children were instructed to use Spanish. In the neutral condition the experimenter provided the adjective in a predicative construction where the word order is the same in the two languages (e.g. *that apple was green*); in the interference condition the experimenter used an adjectival construction (e.g. *the green apple*) where the word order in English is the exact opposite of the word order in Spanish (e.g. *la manzana verde*). Overall, the children mostly produced the expected N+Adj structure in Spanish, although they did produce the ungrammatical Adj+N structure in both the neutral condition and the interference condition. Crucially, they did so significantly more frequently in the interference condition after hearing an English Adj+N structure, and there was no correlation between their production of ungrammatical structures

in Spanish and their dominance in English. Hsin et al. (2013) concluded that it is possible to prime crosslinguistic interference (what we have called CLI here), and that priming is made possible by a shared representation of the abstract syntactic structure. This was again a uni-directional crosslinguistic priming study so there was no fuller test of the shared syntactic structure hypothesis, but this is so far the only piece of experimental evidence showing that CLI could indeed be driven by crosslinguistic priming (Serratrice, 2016).

In their developmental account of shared syntactic structures for adult L2 learners, Hartsuiker and Bernolet (2017) argued for two principles: representational specificity and economy. Their rationale was that language-specific representations are necessary to capture structures that are different across languages, and that it is more economical to share those that are identical. In this model, the existence of CLI remains unexplained if there is no mechanism for language-specific linguistic representations to interact. A more promising way to include CLI as a possible outcome of crosslinguistic priming is to redefine what precisely is meant by structure, representation, and construction. Hwang et al. (2018) make this distinction when they talk about construction - the mapping between concept and form - and structure which refers to sentence form only. Languages ofen use different structures to map onto the same concept; for instance, the concept of a causative event, i.e. a causative construction, maps to the form of a causative structure in English (e.g. *Jen had her computer fixed*), but the mapping for a causative construction in Korean is to a transitive structure (e.g. *Jen-NOM her computer-ACC fixed*). The same construction can also map the same concept to syntactic structures that differ morpho-syntactically across languages. For instance, Dutch and English both have an identical *of*-genitive to mark possession (e.g. *Het ei van de non, The egg of the nun*) but in spoken Dutch the possessive *'s* morpheme in the *s*-genitive is replaced by a form of the possessive pronoun that agrees in gender and number with the possessor (e.g. *De non haar ei/ Te nun's egg*). In a crosslinguistic priming experiment, Bernolet et al. (2009) found that L2 speakers of English produced more *s*-genitives in English afer *s*-genitives in Dutch - despite the fact that the two structures were not identical. The effect was driven by the more proficient speakers - evidence that it was only with increased proficiency that a single construction emerged for these L2 learners - regardless of morpho-syntactic differences. Of particular interest for the argument that crosslinguistic priming can lead to CLI is the finding that a quarter of the "other" responses that were neither an *s*-genitives or *of*-genitives were ungrammatical English structures replicating the Dutch structure (e.g. The *nun her shoe*). For Bernolet et al. (2009) these ungrammatical responses - which I would argue are clear instances of CLI - are an unintended consequence of the fact that Dutch and English have a shared *s*-genitive construction regardless of the morphosyntactic differences between the two languages.

These findings, alongside other reports of successful crosslinguistic priming despite superficial word order differences, point to the sharing of more than sentence structure. As Muylle et al. (2020) argue on the basis of their artificial grammar experiments, bilinguals' abstraction can go beyond morphosyntactic differences. Tose studies that have found crosslinguistic priming despite sentence structure differences between languages provide evidence that it is not just structure that it is being primed, but a whole construction, i.e. the meaning-form mapping regardless of whether the form that the meaning maps to is identical or not. So, for example it is the possessive construction more generally that was primed in Bernolet et al. (2009) when L2 English learners produced a structure like *the nun's shoe*, and not the specific morpho-syntactic realisation because the actual structure was different between English and Dutch. At the same time, the fact that there were instances in which the L2 speakers did use the Dutch word order in their English target descriptions (e.g. *the nun her shoe*) must allow for sharing at the level of the specific morphosyntactic structure. This is the level at which sharing needs to be inhibited when it is not equivalent across languages; when inhibition fails, CLI takes place in the form of ungrammatical or dispreferred syntactic structures.

Factors affecting structural entrenchment and the likelihood of CLI

The reason for CLI, i.e. not using the most appropriate form-meaning mapping in a given language, is connected to how well entrenched a given construction is for the bilingual speaker in that language, and how effectively entrenchment can pre-empt the use of an unconventional form to express a given meaning (Ambridge & Brandt, 2013; Boyd & Goldberg, 2011; Tachihara & Goldberg, 2020). In the case of bilingual children who are simultaneously acquiring two languages, or who are early learners of a second language, the extent to which language-specific knowledge is well entrenched will inevitably be determined by how much relative exposure they've had in their two languages and by the contexts of exposure (e.g. school vs. home, natives vs. non-native speakers). In their meta-analysis, van Dijk et al. (2021) report that CLI was stronger from the societal language to the non-societal language; for children of school age, the societal language is the one in which they will acquire literacy skills and in which they will be exposed to a wide variety of written and spoken texts, mostly from monolingual speakers. For the non-societal language, the situation will inevitably be more variable in terms of quantity of input - most of their time will be spent at school and doing school-related activities in the societal language rather than the non-societal language. Children with older siblings are also more likely to have more access to the societal language through their older sisters and brothers (Duncan & Paradis, 2020; Tsinivits & Unsworth, 2021). Other

variables that affect amount of input in the non-societal language are the range of written and spoken contexts in which they can get exposure (Papastefanou, Marinis, & Powell, 2021), the number of bilingual vs. monolingual speakers (Place & Hoff, 2016), and the extent to which the bilingual speakers of the non-societal language may themselves be vulnerable to CLI (Paradis & Navarro, 2003). Another variable that may be more or less likely to affect the level of entrenchment of children's constructions in the non-societal language is the pattern of use. Cases in which adults address children in the non-societal language and children respond in the societal language can create optimal conditions for crosslinguistic priming outside of the lab. Studies of parent-child crosslinguistic interaction over time could make a useful contribution to a more ecologically valid understanding of the place of CLI in bilingual language development.

Questions (not yet) answered and future directions

So far, the focus on crosslinguistic priming in bilingual children has been limited - especially in comparison to the flourishing literature on adult L2 learners. With the exception of Hsin et al. (2013) who specifically focused on the possibility that crosslinguistic priming could lead to CLI, the other studies have investigated the extent to which structures that are equivalent in both languages are shared, and they offer a tentative affirmative answer to the first question I set out to answer here: do bilingual children have shared constructions for structures that are identical across languages? The answer is inevitably tentative as several methodological changes are necessary before we can be more confident.

Following a now well-established tradition of using syntactic priming in research with monolingual children (e.g. Rowland et al., 2012; Messenger, 2021), priming conditions should be within- rather than between-subjects, priming conditions should not be blocked, and fillers should be used wherever possible in the limits of what is feasible with young children with limited attention spans. Tese are all design choices that will make any significant priming effects more robust and reliable.

Bi-directional studies should also be the norm when participant recruitment allows it to shed light on potential asymmetrical effects. Asymmetrical findings cast some doubts as to whether structures are fully shared, if they were, we would not expect any asymmetry in the directionality of priming. Asymmetrical priming speaks to a differential in the strength of entrenchment of different structures across the two languages and to the hypothesis that constructions may be connected but their structural realisation not fully shared.

More than one construction should be included as different constructions may be on a different timescale of acquisition and they may have achieved different levels of entrenchment which in turn determines the extent to which sharing is more or

less likely. Measures of language dominance via parental questionnaires, and of language proficiency through multiple measures of vocabulary and grammar (e.g. vocabulary breadth and depth, sentence repetition tasks) should also be included to investigate what predicts CLI. Both relative amount of language exposure and proficiency in each language are proxy measures for the relative entrenchment of linguistic knowledge. Studying bilingual children across the spectrum of exposure and proficiency will allow us to test predictions about the likelihood and magnitude of CLI across a range of constructions.

More typological variety in the language combinations - particularly language pairs that are more distant than those investigated so far - would provide a test case for the limits of what is shared in bilingual children's representations, and on the importance of structural alignment.

The answer to the second question I posed is even more speculative: what is the relationship for constructions that only partially overlap, where there is a word order conflict, or where the same meaning maps onto different constructions? We do not really know yet, we only have one study that investigated the role of crosslinguistic priming in a construction with a word order conflict and therefore much still remains to be done. Although bilingual children can and do use language-specific constructions, CLI is a phenomenon that is an integral part of bilingual language development, and as such it is worthy of further investigation.

The answer to the third and final question, i.e. how processing shapes mental representations and how representations affect processing, relates to whether crosslinguistic priming turns out to be a likely mechanism leading to CLI. If future research will show that this is the case, then notions of co-activation, entrenchment, and pre-emption will play a key role in our understanding of how bilinguals manage two languages in one speaker.

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