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Bilinguals' sensitivity to specificity and genericity: evidence from implicit and explicit knowledge

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Research Article

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Abstract

The present paper investigates whether school-aged French-English bilingual children's implicit and explicit knowledge of article use is affected by cross-linguistic influence (CLI) during online and offline sentence comprehension. The studies focus on the encoding of plural and mass nouns in specific and generic contexts. We also explore whether individual measures of oral proficiency, language exposure and age play a role in the children's performance. Forty-three 8-to-10-year-old French-English bilingual children took part in a Self-Paced Reading task, a Grammaticality Judgement task and a Cloze test in their two languages. Overall, CLI was observed across tasks in English and French. These findings suggest that CLI can be bi-directional and tap into school-aged bilinguals' implicit and explicit representations during sentence comprehension and production. The data also makes a new contribution to our understanding of the relative amount of language exposure, oral proficiency and age on CLI.

Theoretical background

Although bilingual children's linguistic development largely follows the path of monolinguals (De Houwer, 2009), their linguistic behaviours occasionally differ quantitatively and/or qualitatively. In comprehension and production, bilinguals may rely on features from Language A while processing Language B, a phenomenon known as cross-linguistic influence (CLI), i.e., delay, acceleration and transfer (Serratrice, 2013; van Dijk et al., 2022).

Focusing on the kind of syntactic contexts that may lead to CLI, Hulk and Müller's (2000) seminal hypothesis characterised it in terms of an epiphenomenon whereby if a structure at the interface between syntax and pragmatics has two grammatical analyses in Language A and only one in Language B, then the analysis shared by Language A and B will occasionally be overgeneralized in Language A regardless of the discourse-pragmatic context. This hypothesis considers CLI as a unidirectional phenomenon whereby the "least complex" system is overgeneralised in the language that has the "more complex" system, regardless of pragmatic optimality. However, van Dijk et al.'s (2022) recent meta-analysis of 26 studies investigating CLI in simultaneous bilingual children, has shown that surface overlap was not necessary for CLI and did not affect its magnitude. Computational complexity rather than language domain may be a more relevant predictor of CLI (e.g., Gavarró, 2003; Strik & Pérez-Leroux, 2011). Additionally, they observed a small to moderate average effect size of CLI, suggesting that this phenomenon is inherent to childhood bilingualism. Language dominance, operationalised as the societal language, emerged as the sole significant predictor of CLI.

Adopting a psycholinguistic approach, Serratrice (2007, 2016, 2022) characterised CLI in terms of cross-linguistic priming resulting from the co-activation of syntactic representations across languages. Hartsuiker and Bernolet (2017) posit that adult bilinguals start out with separate syntactic representations that become shared with high L2 proficiency. However, structures may not be shared if they do not have an equivalent in a bilingual's other language or in absence of a complete equivalent (Bernolet & Hartsuiker, 2018). The growing body of studies on bilingual children have shown that their linguistic systems are to some extent constantly co-activated during sentence processing for structures that have comparable form-function mapping across languages (Gámez & Vasilyeva, 2020: passives in English and Spanish; Unsworth, 2023: pre-nominal and post-nominal possessives in Dutch; Vasilyeva et al., 2010: passives in English and Spanish; Wolleb et al., 2018: dative alternation in English and Norwegian). Crucially, CLI has also been evidenced as the result of (i) cross-linguistic priming involving structures that do not have a parallel in the other language (Hsin, et al., 2013: English Adj-N/Spanish N-Adj word order; van Dijk & Unsworth 2023: adjective placement in Spanish-Dutch and French-Dutch) and of (ii) the elicitation of discourse-pragmatically sub-optimal structures (Hervé et al., 2016: French dislocations in English) which are further evidence supporting language co-activation and shared syntactic representations in bilingual children. Serratrice (2022) argues that the priming of cross-linguistic structural

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differences suggests that it is the whole construction, i.e., the meaning-form mapping, rather than simply the structure that is affected. This proposal accounts for bi-directional CLI in any language combination, due to competition between bilinguals' two linguistic systems. Language dominance, i.e., input quantity, proficiency, as well as frequency of the structures would govern the degree of co-activation, hence the entrenchment of the meaning-form mapping in the bilingual children's languages (Hervé et al., 2016; van Dijk & Unsworth 2023; Unsworth 2023).

Implicit and explicit knowledge

The study of school-aged bilinguals has often overlooked the importance of understanding their implicit and explicit linguistic representations, constructs that are highly debated in the L2 processing literature. The growing interest in the role of processing in simultaneous bilinguals (Serratrice, 2022) highlights the necessity of considering how the implicit and explicit knowledge of bilingual children affects processing mechanisms. Children typically acquire their first language by engaging with their caretakers in natural meaningful communication. They extract complex *implicit knowledge* of language structures automatically, as evidenced by children's intuition about acceptable or unacceptable sentences in their language(s) (see MacWhinney, 2018). From the age of 5, children begin to gain metalinguistic knowledge and conscious awareness of grammaticality (Karmiloff-Smith, 1979; Paradis, 2004). Older children can explain simple structures, such as how to form the plural in English (N. Ellis, 2015), based on this new *explicit knowledge.* In some countries, children are trained to use morpho-phonological and syntactic features through explicit grammar teaching (Dąbrowska, 2012). This implies that the children's implicit knowledge can be reinforced by explicit teaching, which contributes to their acquisition of explicit knowledge.

Genericity and specificity marking in French and English, and their bilingual acquisition

Our studies targeted bilingual children's interpretation of specific, i.e., particular entities, and generic, i.e., kind-referring expressions, subject noun phrases (NPs) in English and French. We focus specifically on article use preceding mass nouns (MNs) and plural count nouns (PNs). MNs (e.g., *I like chocolate*) and PNs (e.g., *I hate sweets*) occur as bare nouns (BNs) in generic contexts, and with a definite article in specific contexts (e.g., *Vincent bought the chocolate/the sweets in this shop*) in Germanic languages. These NPs typically occur with a definite article in subject position in Romance languages in both generic (e.g., *J'aime le chocolat/les bonbons*) and specific contexts (e.g., *Vincent a acheté le chocolat/les bonbons dans cette boutique*).

To date, only two experimental studies have examined school-aged bilinguals' comprehension of genericity and specificity in Romance-Germanic language pairs. Serratrice et al. (2009) tested 6–10-year-old Italian-English and Italian-Spanish bilinguals, along with monolingual control groups. The participants were asked to judge grammatical and ungrammatical specific PNs (e.g., *Qui, *Ø/le fragole sono rosse/ Here, *Ø/the strawberries are red*) and generic PNs (e.g., *In genere, *Ø/gli squali sono pericolosi/In general, Ø/*the sharks are dangerous*) in subject position. In English, performance was fairly poor for all English-speaking children, although responses were more accurate in specific than generic contexts. In Italian, responses were at ceiling for the monolinguals and the Italian-Spanish bilinguals. In contrast, the English-Italian bilinguals, especially those living in the UK, accepted significantly more unacceptable BNs in generic contexts. Only the Italian-English bilinguals exhibited CLI from English to Italian, the opposite direction from that predicted by Hulk and Müller's (2000) original hypothesis based on structural overlap. So, plural DPs denoting specific and generic reference in Italian but only specific reference in English would occasionally be mis-associated with generic reference in English (i.e., **the* + PNs instead of Ø + PNs). The authors utilise Chierchia's (1998) Nominal Mapping Parameter hypothesis (NMP), to explain this unexpected finding. The NMP suggests that Germanic languages are more economical than Romance languages in their nominal mapping, as NPs in Germanic languages can appear without determiners. Serratrice et al. argue that in this case, English's more economical system results in CLI in Italian, although differences between their bilingual groups further indicate that language exposure plays a role.

In a truth-value judgement study, Kupisch and Pierantozzi (2010) examined the knowledge of definite PNs in a group of 6-to-10-year-old Italian-German bilingual children living in Germany. In Italian, the bilinguals accepted significantly fewer generic interpretations (50%) than Italian monolinguals (about 70%) suggesting that the German association of definite PNs with specificity may have reinforced this form-semantic association in the bilingual group. In German, all groups over-accepted target-deviant generic readings (37% for both bilingual and monolingual children). This tendency decreased with age, implying that the morphological cues for the interpretation of specificity and genericity are acquired later in German, after school enrolment, where children may be taught explicitly about article use. The unidirectional CLI from German to Italian contradicts Hulk & Müller's structural overlap hypothesis aligning instead with Serratrice et al.'s (2009) proposal that bilinguals occasionally favour the more economical determiner system of the Germanic language based on Chierchia's (1998) NMP.

In a corpus study of two French-English bilinguals aged between 2;4 and 3;7, Hervé and Serratrice (2018) observed bi-directional CLI in the rate of determiner development (i.e., accelerated development in English; delayed acquisition in French). The children's productions included unidirectional transfers from English to French as evidenced by determiner omission in indefinite specific contexts (e.g., *je veux manger (du) chocolat/I want to eat chocolate.)* and generic contexts (e.g., *Il aime (le) thé/ He likes tea*). Crucially, the transfers were constrained to a small class of nouns and verbs that are high frequency words in the children's input (e.g., *chocolate, tea, rice-crispies, love, do*). They also only occurred during periods of English dominance, irrespective of the language spoken to them. While neither structural overlap (Hulk & Müller, 2000) nor structural economical constraints (Serratrice et al., 2009), can predict all these instances of CLI, the lexical and expressive dominance constraints governing transfer occurrences support processing models of CLI (Serratrice, 2022).

Research questions and predictions

Previous research has shown that school-aged bilinguals' metalinguistic judgments in their Romance language are influenced by the semantics of plural NPs in Germanic languages (Kupisch & Pierantozzi, 2010; Serratrice et al., 2009). Corpus studies on preschool children also indicate that CLI affects the rate of determiner development in bilinguals as a function of language dominance (Hervé & Serratrice, 2018; Kupisch, 2003, 2007). However, it remains unclear whether these effects of CLI are observed in online sentence processing. The present studies on CLI use a combination of online and offline tasks to:

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1. Assess whether school-aged French-English bilinguals' processing of morphosyntactic markers of specificity and genericity shows evidence of cross-linguistic influence (CLI) by comparing their performance in two comprehension tasks with a written production task.
2. Investigate the extent to which their implicit and explicit linguistic knowledge of the two languages affects their performance in each task.
3. Refine the role of individual and group measures of the children's relative dominance by using performance-based (proficiency scores) and experience-based (language exposure) measures.

Following the L2 literature on the role of implicit and explicit knowledge on L2 processing, the bilinguals' implicit knowledge during sentence processing was assessed by means of a self-paced reading task (SPR; Jegerski, 2014; Marsden et al., 2018). While prior online studies on early L2ers opted for self-paced listening task to avoid making inferences about processing through L2 reading (see Marinis, 2010), SPR has been used from age 8 in L1 research (e.g., Booth et al., 2000). SPR is suitable in our study as our simultaneous bilinguals attend bilingual schools which ensures they can read in their two languages. Their explicit knowledge was examined with an untimed grammaticality judgement task (GJT; Godfroid et al., 2015). Finally, cloze-tests (c-tests), a constrained production measure exclusively targeting determiners, were included to examine whether the children's responses varied in comprehension and production. The c-test can call for both explicit and/or implicit knowledge depending on whether the participants fill the gap by relying of formal syntactic and semantic cues or based on their intuition. A comprehensive overview of the methodological details is specified in the methods section.

Predictions on the effects of CLI

CLI should lead to qualitative and quantitative differences in the way bilinguals and monolinguals process generic and specific reference in our different tasks. In our data,

- if structural surface overlap predicts CLI, it should occur from French (structurally less complex) to English (structurally more complex) (Hulk & Müller, 2000).
- if surface overlap is applied to semantics (Kupisch, 2012), French maps both genericity and specificity on *the* + NP whereas English only maps specificity onto this form, therefore, CLI should be observed from English (semantically less complex) to French (semantically more complex).
- if structural economical constraints (Serratrice et al., 2009) affect CLI, it should be unidirectional from English to French because Chierchia's (1998) NMP denotes the English determiner system as more economical than the French system as it gives bare PNs to kind reference through a type shifting operation rather than the projection of an extra determiner.
- if CLI is the result of co-activated constructions, i.e., meaning-form mapping, during sentence processing (Serratrice, 2022), it should be bi-directional and the entrenchment of language-specific features should be mediated by extra-linguistic factors.

Predictions on the nature of linguistic representation

If children have developed both implicit and explicit knowledge of article use (i.e., encoding of genericity and specificity), their performance should be consistent across tasks. However, if they primarily rely on implicit knowledge, they are expected to demonstrate greater sensitivity to grammaticality violation in the SPR tasks compared to untimed GJT tasks.

Predictions for language dominance

Hervé and Serratrice (2018) found that productive abilities affect the degree of co-activation of language-specific form-function mapping in encoding genericity and specificity. Therefore, bilinguals with higher English proficiency should exhibit CLI from English to French, while those with higher French proficiency should show CLI from French to English.

In contrast, Serratrice et al. (2009) noted an effect of the language of the home country on CLI, where the magnitude and direction of CLI could be influenced by language exposure. Specifically, the percentage of language exposure may correlate with bilinguals' sensitivity to grammaticality violation in the SPR, as well as their accuracy in the GJT and c-test.

Method

Participants

Two groups of French-English simultaneous bilinguals participated in this research: 23 children attending a bilingual school in London (range: 8;1–10;2, mean: 8.99, SD: 0.69), and 20 children attending a bilingual school in Paris (range: 7;7–9;8, mean: 8.97, SD: 0.46). Twenty-four French monolinguals (range: 8;4–10;4, mean: 9.30, SD: 0.59), and 20 English monolinguals (range: 8;9–10;5, mean: 9.39, SD: 0.45) also took part in the study in their respective language. The monolinguals were recruited from schools that matched the upper-middle class status of the children attending the private bilingual schools.

All the bilingual participants were exposed simultaneously to English and French from birth or soon after. They were either the offspring of mixed French-English couples (N = 24), or of French couples living in the UK (N = 18), or of an English-speaking couple living in France (N = 1). The parents were asked to report on their child's language background using a modified version of Cattani et al.'s (2014) questionnaire. The questionnaire collected information on (i) the child's time spent at the bilingual school and with a childminder, (ii) languages spoken by each parent at home, (iii) weekly alone time with each parent, (iv) whether the parents engaged equally with their child, (v) child's daily sleep hours, and (vi) parents' rating of their child's proficiency in both languages on a scale from 1 to 10. Teachers also independently rated the children's proficiency in their teaching language. The proficiency scores provided by parents and teachers were largely consistent. In cases of disparity, we calculated a mean rating. By analyzing questionnaire responses, we estimated each child's language exposure to English, then deduced exposure to French by subtraction (children who were exposed to three or more languages were not included in the study). Following Cattani et al. (2014), we considered 60% exposure to establish the majority input language. As seen in another study reporting individual language dominance measures (Hervé et al., 2016), children showed variability in proficiency and exposure to the wider linguistic environment (see Table 1).

Materials

Both the French and English studies comprised three tasks: (i) a SPR task, (ii) a GJT, and (iii) a C-test. The experimental sentences

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Table 1. Language exposure and proficiency scores in the Paris and London bilingual groups

	Index	Paris bilinguals	London bilinguals
Language exposure	Dominant in French (Exp > 60%)	3	13
	Balanced (60% > Exp > 40%)	6	5
	Dominant in English (Exp < 40%)	9	3
	NA	2	2
Speaking proficiency	Dominant in French (French = 10; English ≦ 9)	8	9
	Balanced (French = 10; English = 10)	7	10
	Dominant in English (French ≦ 9; English = 10;)	5	4

used were translation equivalents in the French (e.g., (1.a) and (2.a)) and the English (e.g., (1.b) and (2.b)) experiments. Each language had 16 doublets of target (i.e., grammatical or felicitous) and target-deviant (i.e., ungrammatical or infelicitous) sentences. In French, grammaticality was manipulated, as article omission in argument position is strictly unacceptable. In English, felicity was manipulated, as sentence acceptability depends on the correct interpretation of the semantic context (specific versus generic). Eight paired sentences included a critical NP in a generic context as in (1), and eight pairs contained a critical NP in a specific context as in (2). In each condition, both the English count/mass distinction and the French gender distinction were counterbalanced. All the critical NPs included inanimate objects from the food and fruit semantic categories. They were all followed by the copula "be/*être*" in the present tense and by an adjective. They were controlled for length (i.e., number of syllables and letters) and frequency. The participants were presented with only one item from each pair.

(1) Generic doublets in the SPR and GJT

a. Paul/ adore/ les fruits verts; / il/ pense /
Paul loves fruit he thinks
que/ **les** vs. ***Ø kiwis** / sont / délicieux./
that the vs. *Ø kiwis are delicious
'Paul loves green fruit; he thinks that kiwis are delicious.'

b. Paul / loves / green fruit; / he / thinks / that /
Ø vs. ***the kiwis** / are / delicious./

In the generic condition, sentences began with a phrase introducing the discourse context in which the semantics of the state verbs (i.e., love, hate) and the direct object (e.g., green fruit, drinks, red berries) signalled that the upcoming referent refers to the whole class it represents. The second part of the sentence contained the critical NP (e.g., kiwis, water, strawberries).

(2) Specific doublets in the SPR and GJT

a. Julie/ veut acheter/ des fruits / au marché;/ elle/ pense
Julie wants to buy some fruit at market she thinks
que/ / **les** vs. ***Ø poires** / sont / mûres./
that the vs. *Ø pears are ripe
'Julie wants to buy fruit at the market; she thinks that the pears are ripe.'

b. Julie/ wants to get/ some fruit/ at the market;/ she/ thinks/
that/ **the** vs. ***Ø pears/** are/ ripe./

In the specific condition, sentences began with a phrase containing a main verb followed by an infinitive phrase. The inclusion of a locative (e.g., at the shop, at the market) indicated the agent's intention to do something with/about a referent in a specific location. The critical NP in the second part of the sentence needed to be interpreted as a subset of the referent (e.g., the pears from the shop in (2)) (see Table S1 in supplementary materials for a complete overview of the experimental sentences).

The C-test used the same 16 experimental sentences as the SPR and GJT. The critical noun was preceded by a blank as in (3) and (4). Participants were instructed to fill the gap if necessary.

(3) English experimental sentences as presented in the c-test

a. Vincent hates pricey food; he thinks … meat is expensive. (generic)

b. Helen wants to buy some food on the market stall; she thinks … rice is sticky. (specific)

(4) French experimental sentences as presented in the c-test

a. Chloé adore les fruits ronds; elle pense que …. melons sont succulents (generic)
Chloé loves the fruit round she thinks that … melons are delicious
'Chloe loves round fruit; she thinks that …. melons are delicious'.

b. Nathan veut acheter des aliments au supermarché; il pense que …. farine est périmée. (specific)
Nathan wants to buy some food at+the supermarket he thinks that … flour is out-of-date
'Nathan wants to buy some food at the supermarket; he thinks that … flour is out-of-date'.

Procedure

The SPR experiments utilised a non-cumulative Moving Window task, where participants pressed a button to read each successive word in a sentence (Just, Carpenter, & Woolley, 1982). They were run using the E-prime 3.0 software and responses were collected via a Chronos response box (Psychology Software Tools, Pittsburgh, PA). The 16 experimental items were pseudo-randomized and mixed with 32 grammatical fillers that referred to animate subject noun phrases from the animal semantic category (e.g., At the zoo, the panda is climbing on a stone). To ensure participants read for meaning, all test items and half of the fillers were followed by yes/no comprehension questions (e.g., Is she talking about a dairy product? / Is it eating?), with an equal number of positive and negative response options.

The experimental sentences were presented in a segment-by-segment fashion. For presentation purposes, all the generic sentences were split into 9 segments and the specific sentences were divided into 10 segments (to accommodate the extra locative PP in the introductory statement). RTs were collected for each segment, as well as response accuracy for the comprehension question. Each trial sentence was preceded by a fixation cross in the centre of the screen. All text was presented in white 18-point Courier New font on a black background in the centre of a 13.3-inch Macbook Pro laptop (LED-backlit display, 5120 × 2880 resolution at 60 Hz).

The participants were told to read each segment at their own pace for comprehension and to press on the spacebar to move to the next segment. They were informed that most sentences would be followed by a yes/no comprehension question that should be answered with the corresponding keys on the response box (key 2: 'yes', key 4: 'no', key 3: 'do not know'). Comprehension question

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accuracy was relatively high in both English (Paris bilinguals: M = 74%, SD = 0.44; London bilinguals: M = 80%, SD = 0.40; English monolinguals: 87%, SD:0.34) and French (Paris bilinguals: M = 74%, SD = 0.44; London bilinguals: M = 85%, SD = 0.36; French monolinguals: 78%, SD = 0.41). RT analyses were only performed on the items that were followed by a correct response. RTs followed by a wrong or a do not know answer were removed from the analyses.

In the untimed written GJT, the participants were asked to rate each of the 16 sentences as 'acceptable', 'unacceptable' or 'I do not know'. No fillers were included in this task. Responses were collected on a Chronos response box. In the c-test, the participants were presented with a gap-fill exercise on paper displaying the sentences as detailed above. No fillers were included in this task. The participants had to write either 'the' in English, 'le, l', la, les' in French or 'leave a blank' depending on whether they thought an article was needed.

The participants were seen individually. They all completed (i) the SPR task followed by (ii) the untimed GJT and then (iii) the untimed c-test. Instructions were given orally in the language of their testing session (counterbalanced across the bilingual participants). In the SPR, the test phase started with 3 practice sentences. The participants were given the opportunity to ask any questions until the end of the practice session. Each testing session lasted about 15 min.

Results

In both the French and the English studies, analyses were conducted with R (R Core Team, 2013). Separate linear mixed effects models were fitted for each test in each language with the lme4 package (Bates et al., 2015). Random effects in all models included by-subject and by-item random intercepts, and the inclusion of random and fixed effects in each model were justified by means of likelihood ratio testing. Continuous variables were centred prior to inclusion. The reported *p*-values were estimated with the lmerTest package (Kuznetsova et al., 2017). Post hoc pairwise comparisons used Tukey's adjustment and were estimated using least-squares means via the emmeans package (Length, 2018).

To investigate specific effects of exposure and oral proficiency among the bilingual participants, separate sub-analyses were conducted for each test which excluded the monolingual participants. It must be noted however that proficiency and exposure scores, as well as the categorical variable school (London versus Paris bilingual school), were highly collinear. In order to justify including all three variables in the models, exposure was residualised against school, and proficiency was residualised against exposure and school. Thus, school accounts for the largest proportion of shared variance, with residualised exposure including only that variance not accounted for by school, and proficiency containing only that variance found in neither school nor exposure measures.

In the GJTs, we measured the participants' accuracy at accepting grammatical/felicitous sentences and at rejecting ungrammatical/infelicitous sentences in the generic and specific conditions. These analyses were conducted using a binomial GLMM treating accuracy as the dependent variable and grammaticality/felicity, condition (specific/generic), bilingual status (monolingual/bilingual), and either nominal gender (m/f, in French) or noun type (count/mass, in English) as fixed factors. Participant age and word frequency were included as continuous covariates. Attention will be drawn mainly to ungrammatical/infelicitous sentences which have a clear critical area (i.e., the error) that calls for explicit knowledge (see Godfroid et al., 2015).

In the SPR, outlying RTs which were faster than 200 msec or slower than 2000 msec were removed, affecting 2% of the French data and 5% of the English data. As the critical segment differed in length depending on the presence or absence of a definite article that manipulated grammaticality/felicity, the analyses were conducted on the residualized reading times (RRTs). Three segments were analysed: the critical segment, and its two following segments. However, only the results from the critical segment are reported as there were no observable spill-over effects. Given that longer RRTs are considered to signal a greater processing load than shorter RRTs, this measure was analysed in a linear mixed-effects model, with fixed and random factors identical to those used in the GJT described above.

In the c-tests, we measured the participants' accuracy at selecting the appropriate article (i.e., the + NP in specific and generic contexts in French; the + NP in specific contexts and ∅ + NP in generic contexts in English) to complete the test sentences. The models were identical to those of the GJT except that grammaticality/felicity was removed from the analyses as the test items did not include this variable (i.e., grammaticality/felicity depended on the children's own choice of article).

Study 1: French results

Grammaticality Judgement Task

Figure 1 illustrates the mean number of acceptances for grammatical sentences and rejections for ungrammatical sentences in specific and generic contexts for all three groups of children. In the model with both monolingual and bilingual participants, we find two significant interactions with grammaticality: bilingual status ($F(1,968) = 4.17$, $p < .05$) and condition ($F(1,968) = 15.25$, $p < .001$). Although there is a trend in age towards greater accuracy as children get older, this does not quite reach significance ($p = .06$). Nominal gender and noun frequency do not contribute significantly to the model.

Looking at the significant interactions, we find monolingual accuracy is approximately the same across both grammatical (86%) and ungrammatical (81%) sentences, whereas the bilinguals are better at accepting grammatical sentences (88%) than rejecting ungrammatical sentences (72%; $z = -5.413$, $p < .0001$, OR = 0.25). Regardless of bilingual status, responses to ungrammatical generic sentences are overall significantly worse (70%) than for either grammatical generic sentences (91%; $z = -5.87$, $p < .0001$, OR = 0.18) or for ungrammatical specific sentences (81%; $z = -2.00$, $p = .05$, OR = 0.46). This pattern appears to be driven by the bilingual group, as detailed in the sub-analysis below.

In the bilingual sub-analysis, we again observe a significant interaction between grammaticality and condition ($F(1,586) = 9.38$, $p < .01$), such that responses are least accurate for ungrammatical generic sentences (64%). This is significantly lower than responses to grammatical generic sentences (90%, $z = -5.62$, $p < .0001$, OR = 0.09) and ungrammatical specific sentences (87%, $z = -2.42$, $p < .05$, OR = 0.36). A second significant interaction between school and grammaticality ($F(1,586) = 6.48$, $p < 0.01$) shows that the London group is significantly better at accepting grammatical sentences compared to the Paris group (London mean = 96%, Paris mean = 78%; $z = 3.63$, $p < .001$, OR = 9.31). Both bilingual school groups are nevertheless significantly better at accepting grammatical sentences compared to rejecting ungrammatical sentences ($z = 5.17$, $p < .0001$, OR = 4.88).

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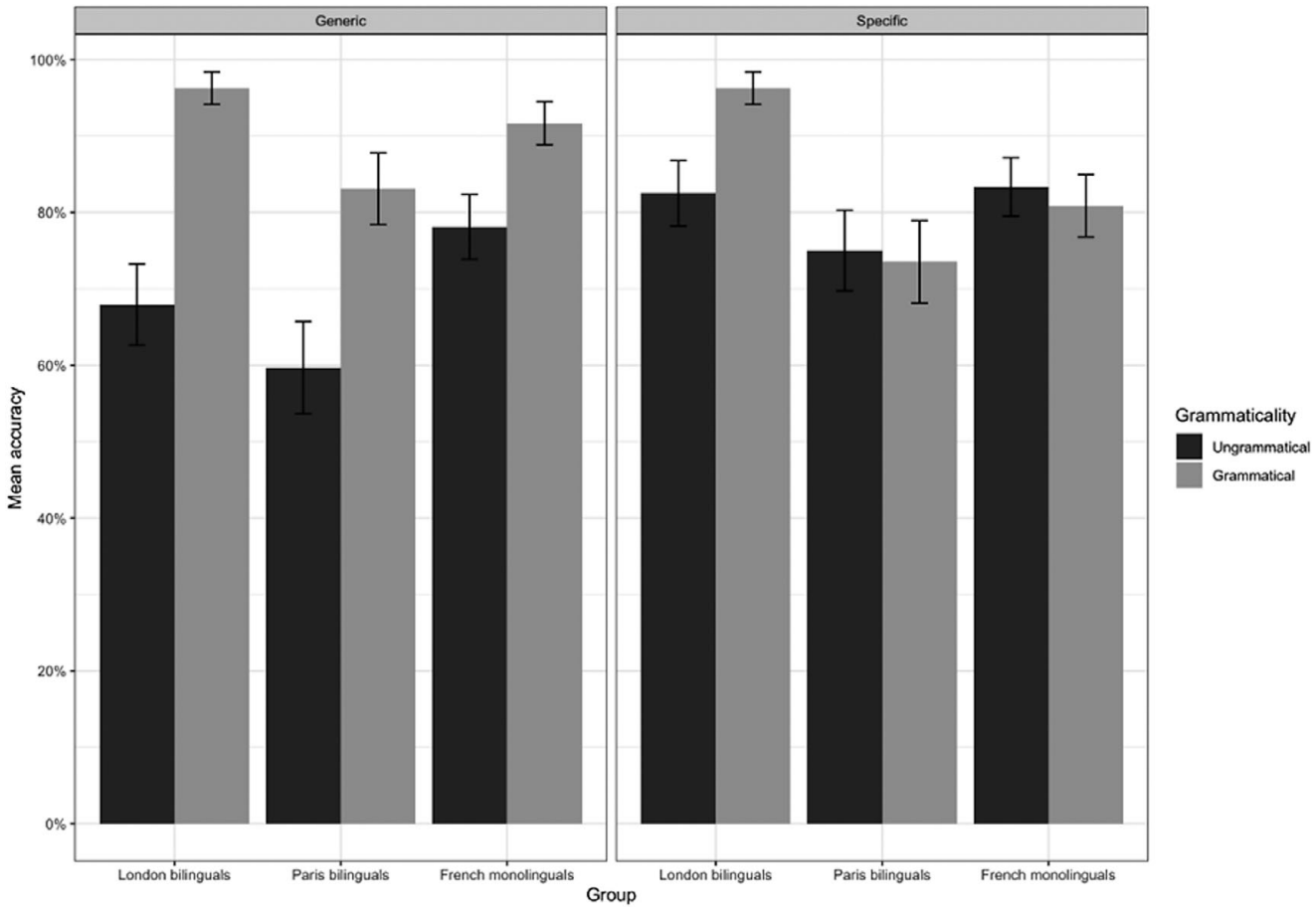


Figure 1. Mean accuracy scores in the French GJT.

French proficiency did not have an effect on response accuracy, although there is a significant interaction between French exposure and grammaticality ($F(1,586) = 6.12$, $p < .01$). This interaction suggests that the bilingual participants with more French exposure are more likely to correctly reject ungrammatical sentences ($z = 2.81$, $p < .01$, OR = 1.92). This same effect is not observed with grammatical sentences (see Figure S1 in supplementary materials). Note that this exposure effect is independent of the influence of schools, as the variable had been residualised as described above.

Self-paced reading

Figure 2 illustrates the RRTs for the grammatical and ungrammatical segments in the generic and specific conditions for all participants. In general, ungrammatical segments took longer to read than grammatical segments. However, there is a significant interaction between grammaticality and condition ($F(1,708) = 9.55$, $p < .01$). Post hoc testing shows that ungrammatical specific NPs had longer RRTs (mean = 188 msec) than ungrammatical generic NPs (mean = 56 msec, $\beta = 130.27$, $t = 3.05$, $p < .01$) across groups. There was no difference between conditions in grammatical sentences. Bilingual status was shown to play a role in reading times, with monolingual participants having longer RRTs (mean = 82 msec) than bilinguals (mean = 27 msec, $\beta = 78.07$, $z = 2.56$, $p < .05$). There was no significant effect of age, noun frequency, or noun gender in this analysis.

The bilingual sub-analysis shows again that ungrammatical specific NPs (mean = 192 msec) have slower RRTs than ungrammatical generic NPs (mean = 23 msec, $\beta = 167.47$, $t = 3.20$, $p < .01$). As in the GJT, school again played a role, with the London group having slower RRTs for ungrammatical segments in both conditions (London mean: 51 msec, Paris mean: −1.6 msec, $\beta = 156.27$, $t = 3.41$, $p < .001$). There was no significant effect of proficiency, exposure, age, nominal gender, or noun frequency on RRTs.

Cloze-test

In the *c*-test, all groups were at ceiling in both the specific condition (bilinguals: 97%; monolinguals: 97%) and in the generic condition (bilinguals: 97%; monolinguals: 99%) (see Figure S2 in supplementary materials). Between the monolingual and bilingual groups, the error types differed. In the monolinguals, all seven errors (made by a total of six participants) were number errors (e.g., *la fraises* instead of *les fraises*). In the bilinguals, 7 children made a total of 10 number errors, 2 participants made gender errors, and crucially, 4 participants omitted a total of 9 definite articles. Statistical analysis confirmed that none of the factors included in the model reached significance. While greater exposure to French did result in marginally better performance in bilinguals ($z = 1.78$, $p = .07$, OR = 2.88), the effect falls short of the statistical threshold and therefore can only be considered suggestive (see Figure S3 in supplementary materials).

Discussion

The results of the French study display comparable patterns across tasks. In the GJT, i.e., assessing the children's explicit knowledge of

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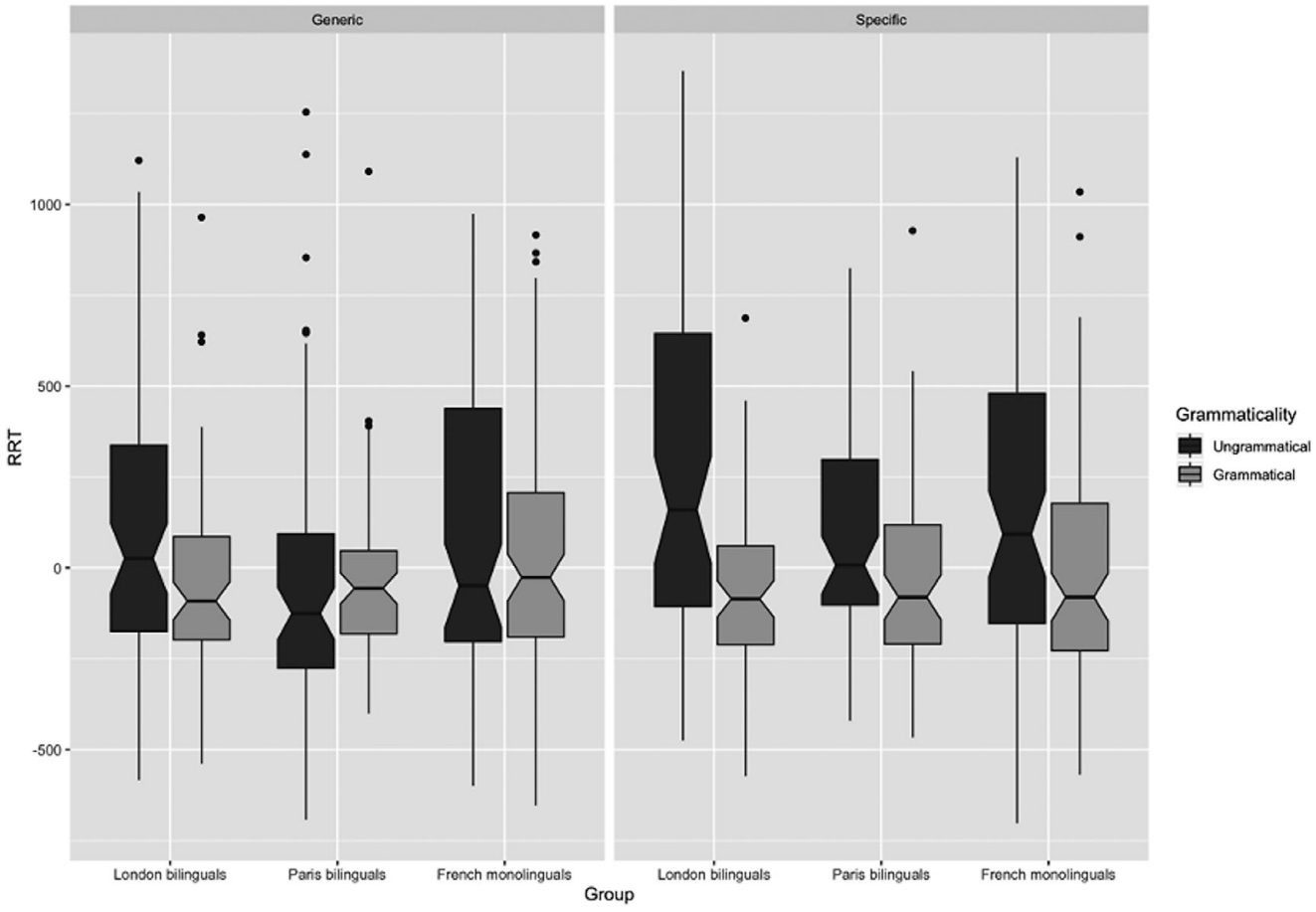


Figure 2. Residualized reading times (RRT) for the critical segment of grammatical and ungrammatical sentences in the French SPR task.

specificity and genericity, the French monolinguals and bilinguals were largely successful at accepting grammatical sentences regardless of the semantic context. Rejection rates of generic ungrammatical sentences were lower than specific ones for all participants. This discrepancy relative to specific and generic ungrammatical sentences is particularly evident in the bilingual group, although why French monolinguals exhibit the same pattern in responses is unclear (see general discussion).

Critically, bilinguals showed improved accuracy in rejecting ungrammatical sentences with increased French exposure. This suggests that CLI influences bilinguals' explicit representation of article use, as increased English exposure, where both overt and null articles are present in the input, reduces their sensitivity to grammatical violations in French, a language where articles are obligatory in argument position. These results are in line with previous offline studies on CLI at the article level (Serratrice et al., 2009; Kupisch & Pierantozzi, 2010) and corroborate evidence supporting the role of individual measures of language exposure on the likelihood of CLI (Hervé et al., 2016). Older children also performed marginally better on this GJT, indicating that cumulative language experience enhances sensitivity to target-language structures over time. With age, children develop some explicit metalinguistic awareness of article use in subject/object positions. They also develop greater attentional skills (Robson, 2006) which may explain why even the monolingual children still sometimes fail to notice missing articles in ungrammatical sentences.

In the online SPR task, i.e., measuring the children's implicit knowledge of genericity and specificity marking, RRTs were slower for ungrammatical than grammatical segments in all groups. Interestingly, among the bilinguals, the Paris group exhibited lower sensitivity to ungrammatical segments than the London group. Although there were no independent French exposure or proficiency effects, it appears that the school environment itself effected the likelihood of CLI at the level of the bilinguals' implicit knowledge of French article use.

Finally, in the cloze-test, all groups performed at ceiling in this constrained written production task. In line with the GJT, French exposure had a marginal effect on the bilinguals' performance, although it did not reach statistical significance in this case. Accuracy was overall higher than in the GJT, even for the monolinguals, possibly due to differences in test modalities (reception versus production), a topic we further discuss in the general discussion. Error analysis found qualitative differences between groups, with omissions indicating the transfer of this linguistic feature from English to French.

Study 2: English results

Grammaticality Judgement Task

Figure 3 reports the mean number of acceptances of felicitous sentences and rejections of infelicitous sentences in specific and generic contexts for all participant groups. Responses were much more accurate for felicitous than infelicitous sentences ($z = 13.32$, $p < .0001$, OR = 11.87). While monolinguals were somewhat more accurate in rejecting infelicitous sentences in the generic (40%) and the specific (38%) conditions than the bilinguals (about 30% and

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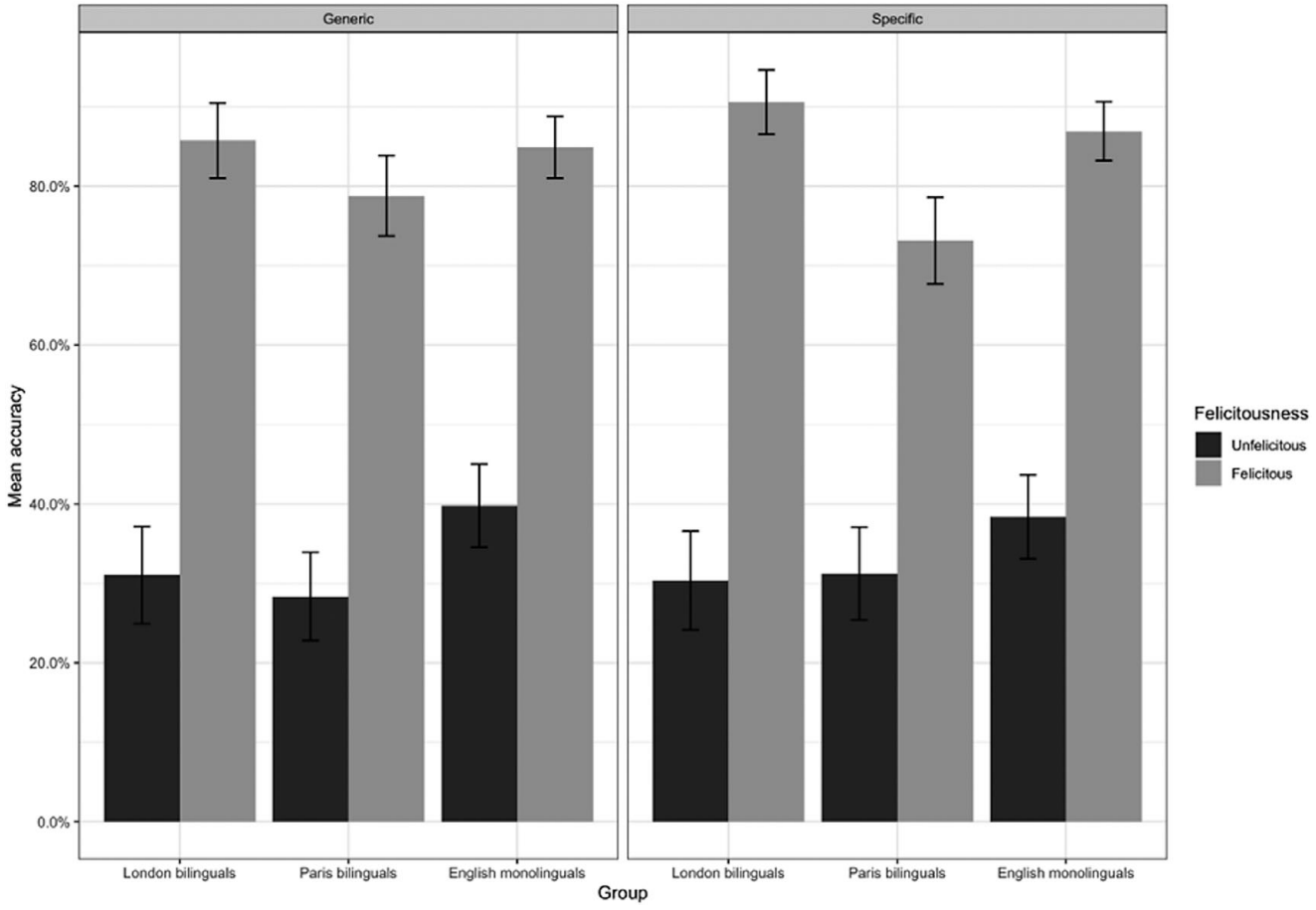


Figure 3. Mean accuracy scores in the English GJT.

31%, respectively), this difference was not significant. In fact, the GLMM revealed no significant effect of bilingual status, age, word frequency, or noun type.

In the bilingual subset model, a very large effect of felicity is found (z = 10.29, p < .0001, OR = 13.94), as well as significant interactions with both proficiency and exposure. Felicitous sentences were more likely to be correctly accepted by participants with greater English exposure (z = 2.81, p < .01, OR = 1.70), and a similar but non-significant trend is observed with increased English proficiency (z = 1.81, p = .07, OR = 1.46). For infelicitous sentences, however, accuracy shows no relationship with proficiency (z = −.78, p > .1, OR = 0.88), and participants with greater English exposure actually accept more infelicitous sentences than those with less exposure to English (z = −2.56, p < .05, OR = 0.65; see Figure S3).

Self-paced reading

Figure 4 illustrates RRTs for felicitous and infelicitous segments in generic and specific conditions for all groups. Reading times are largely equivalent for nearly all critical stimuli in monolingual and bilingual groups. There was, however, a marginally significant interaction between felicity and noun type (β = 79.59, t = 2.068, p < .05). Post hoc comparisons show felicitous MNs take somewhat longer to read than felicitous PNs (MN RRT = −10.19 msec, PN RRT = −69.76 msec; β = −58.75, t = −2.15, p < .05), which suggests that the children are less confident with MNs than PNs in felicitous contexts. There was no significant effect of age, frequency, condition or bilingual status on RRTs.

In the bilingual subset model, we also find that none of the experimental manipulations are significant, nor are the bilingual-specific measures of school, exposure or proficiency. Although the effect of school was not significant, it is worth noting that the trends in reading times are not the same in both bilingual groups. The London group displays unexpectedly longer RRTs for felicitous than infelicitous generic segments, while the Paris group shows longer RRTs for infelicitous than for felicitous generic segments, in line with the monolingual data. Although this pattern does not come out as significant in our model, the different RRTs for generic segments between the Paris and the monolingual group as opposed to the London group might suggest that the latter's implicit representations of generic reference could be less developed than that of the other groups. In contrast, in specific contexts, it appears all the children fail to discriminate felicity, as RRTs are longer for felicitous than infelicitous segments.

Cloze-test

In the *c*-test, we observe a significant interaction between bilingual status and noun type (β = − 0.73, z = −2.25, p < .05). Here, the monolingual participants performed significantly better on PNs (81.55%) than MNs (69.0%), whereas the bilingual participants had equivalent accuracy on both (PNs = 64.10%, and MNs = 63.78%; see Figure S4 in supplementary materials). While there was a trend

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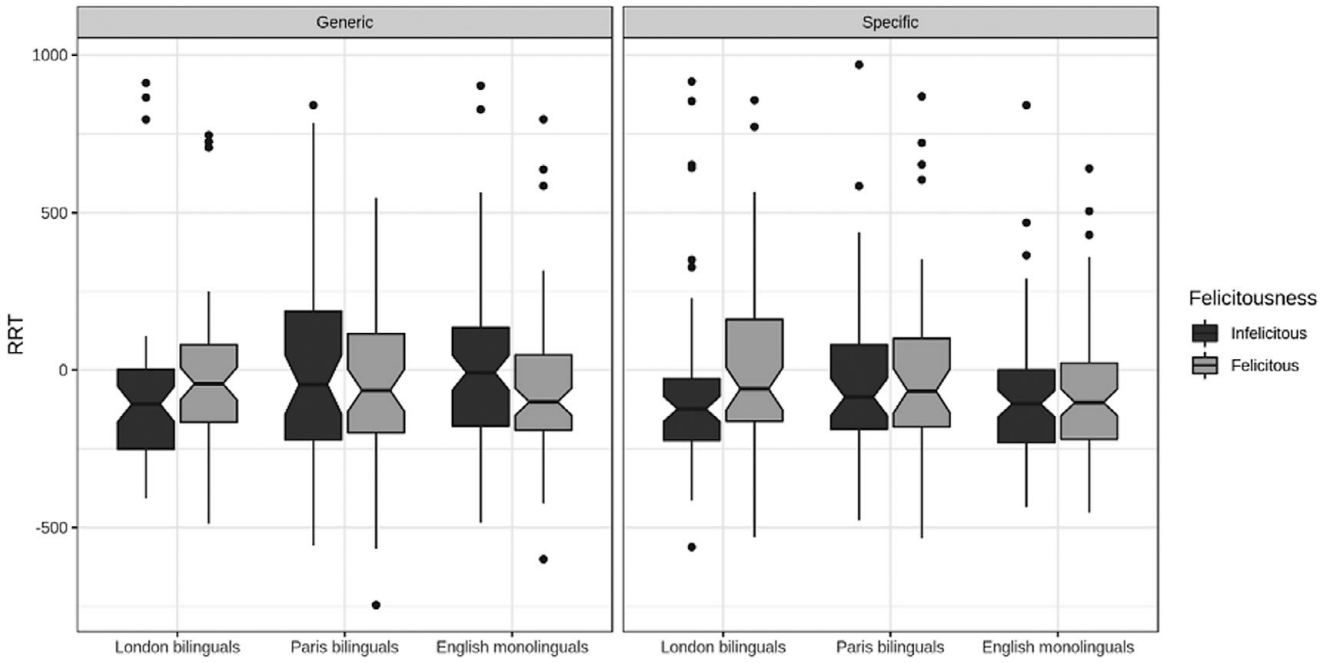


Figure 4. Residualized reading times (RRT) for the critical segment of felicitous and infelicitous sentences in the English SPR.

towards higher accuracy with specific (71.2%) compared to generic NPs (64.6%) in all participants, this did not reach the threshold for significance in the model ($\beta = 0.41$, $z = 1.87$, $p = .06$). While age did significantly improve accuracy across all participants ($\beta = 0.78$, $z = 3.37$, $p < .001$), no other factors were significant in the model.

In the bilingual subset we observe that accuracy was higher with specific nouns (67.3%) compared to generic nouns (60.6%). However, this effect is driven by a significant interaction with school, with the London bilinguals providing more accurate responses for specific nouns than the Paris bilinguals (London mean: 76.8%, Paris mean: 56.2%, $\beta = 0.85$, $z = 2.27$, $p < .05$). Performance in generic sentences was equivalent ($\beta = -.05$, $z = -.147$, $p > .50$).

In generic sentences, greater English exposure resulted in less accurate performance ($\beta = -0.39$, $z = -2.39$, $p < .05$), while there was no effect of English exposure on specific sentences ($\beta = -0.08$, $z = -0.463$, $p > .50$). In addition, we find age is again a strong predictor, with older participants performing better than younger participants ($\beta = 1.13$, $z = 4.14$, $p < .0001$), and responses being more accurate to higher frequency words ($\beta = 0.15$, $z = 2.14$, $p < .05$). The effects of school, condition, and exposure are illustrated in Figure S5 in supplementary materials.

Discussion

Comparable to previous GJT and TVJT studies on English and German articles with similarly aged bilingual and monolingual children (Kupisch & Pierantozzi, 2010; Serratrice et al., 2009), we find in our study that children have generally poor performance when rejecting infelicitous Ø + PNs and Ø + MNs in English. Surprisingly, however, the bilinguals exposed the least to English were better at rejecting infelicitous sentences, suggesting that the children with more English exposure were more tolerant to infelicitous structures. These within bilingual group differences suggest that the bilinguals' judgements of infelicitous sentences are vulnerable to CLI. Therefore, their explicit knowledge of English article use that is called upon to complete this GJT is affected by transfers from French to English. The negative English exposure effect on sentence rejection indicates that CLI is here mediated by language-external factors as also observed in French. As discussed in depth in the general discussion, this striking phenomenon might be accounted for by school instruction and the fact that the children who are the least exposed to English in our data set might have more metalinguistic knowledge than the English dominant children.

In the SPR, neither the English monolinguals nor the bilinguals displayed sensitivity to semantic violation which suggests either (i) the inability to regress to prior segments to reassess their interpretation of the semantic context might in part be responsible for the lack of violation detection in this online sentence comprehension task which was followed by questions targeting the overall sentence meaning, or (ii) that another linguistic feature is not fully acquired at that age. Following up on this latter point, it is interesting to note that all the children processed felicitous PNs faster than felicitous MNs which suggests that their implicit knowledge of the encoding of MNs is less settled than that of PNs even in optimal grammatical context. As discussed below, prior L2 studies have also reported that noun types present particular challenges in the acquisition of English local markers of genericity and specificity (Sarko, 2009; Hervé & Lawyer, Unpublished).

In the *c*-test, both monolinguals and bilinguals displayed some knowledge of English article use. Their response accuracy was well-above chance, implying that they were sensitive to the semantic and syntactic cues associated with generic and specific readings in our sentences. These results contrast with those found in our two comprehension tasks, highlighting two fundamental differences in tasks used in our study, namely (i) testing modality (comprehension vs. production); (ii) whether the tasks mainly call for implicit (SPR) or explicit (untimed GJT) linguistic representations, or both (the *c*-test). Nonetheless, the c-test shows clear evidence of CLI as the bilinguals were less accurate than the

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monolinguals, particularly in selecting appropriate markers to encode PNs. Crucially, the noun type effect, also observed in the SPR, confirms that children acquire the encoding of PNs before learning that of MNs.

General discussion

The aim of the present studies was to contribute to the general understanding of mechanisms at play during the online and offline processing of local markers of genericity and specificity. Online self-paced reading tasks and offline grammaticality judgement tasks were used to assess how bilinguals' implicit and explicit linguistic representations are affected by CLI at the determiner level in French and English. We supplemented this comprehension data by measuring the children's choice of determiners in a short production task (cloze-tests). A secondary aim was to consider the role of language dominance on the direction and magnitude of CLI by combining experience (language exposure) and performance measures (proficiency scores).

We formulated several hypotheses on (i) the effects of CLI, on (ii) the nature of the bilinguals' linguistic representations and on (iii) the effect of experience and performance measures of language dominance.

Models of CLI

Our first main finding is that the bilinguals' comprehension and production largely differed from that of their monolingual peers. Unlike Serratrice et al.'s (2009) GJT study on Italian-English and Kupisch & Pierantozzi's (2010) TVJT on Italian-German bilinguals, CLI in our data is a bi-directional phenomenon across tasks. In the English to French direction, the bilinguals allowed significantly more often than the monolinguals ungrammatical bare NP in French. In the French offline task, the children exposed the most to French were better at rejecting ungrammatical sentences. In the online task, article omission triggered a greater processing cost in the monolinguals than in the bilinguals, with the London bilinguals showing greater sensitivity to grammatical violation than the Paris bilinguals. In the cloze-test, increased French exposure led to better performance, and critically, instances of article omission were only observed in the bilingual group. In the French to English direction, the bilinguals tended to accept infelicitous DPs in English. In the offline GJT, all the children largely failed to reject infelicitous generic and specific sentences. Among the bilinguals, those exposed the least to English were better at rejecting sentences. In the online task, neither the monolinguals nor the bilinguals displayed sensitivity to felicity violation, especially in the specific condition. In the c-test, the bilinguals were less accurate at selecting the target determiner as a function of English exposure.

On this basis, we cannot conclude that the likelihood of CLI involving article use in generic and specific context is associated with or boosted by structural overlap (Hulk & Müller, 2000), semantic overlap (Kupisch, 2012) or Serratrice et al.'s (2009) economical principles. This corroborates with van Dijk et al.'s (2022) meta-analysis on 26 CLI studies.

Our results are compatible with Serratrice's (2007, 2016, 2022) cross-linguistic priming theory which delves into the psycholinguistic mechanisms underlying CLI in comprehension and production. The French-English bilinguals have shown that the language-specific meaning-form mapping associated with specificity and genericity are to some extent co-activated during both online and offline sentence processing occasionally leading to the sub-optimal admission of an infelicitous overt article in English, and of an ungrammatical bare NP in French. Crucially, CLI was also observed in production (*c*-test) which shows that co-activation took place in comprehension and production. This finding is consistent with the growing body of priming literature which showed that bilingual children share syntactic representations across languages (e.g., Hsin et al., 2013; Hervé et al., 2016; van Dijk & Unsworth, 2023). It also corroborates recent studies using the visual world eye-tracking paradigm reporting evidence of co-activated syntactic features during the processing of gender and case-marking cues in bilingual children (Lemmerth & Hopp, 2019; Meir et al., 2020).

The nature of linguistic representations

CLI was evident in both online and offline sentence comprehension, tapping either implicit or explicit linguistic representations. In French, both monolinguals and bilinguals exhibited a processing cost whilst reading ungrammatical sentences, indicating access to implicit knowledge that overt articles are obligatory in argument position. Moreover, all French-speaking children displayed explicit knowledge of the French article system as they all largely rejected article omissions in the GJT. These findings were further supported by the c-test. In the English comprehension tasks, performance was overall poor. But, the GJT calling for explicit knowledge of article use seems to reflect some fundamental differences relative to the children's metalinguistic awareness. The Paris and London French-English bilingual schools follow the French curriculum even in English lessons while the English primary school follows the national curriculum for England. The teaching of grammatical features appears to be taught inductively in England through generalisations over patterns observed in texts (Ofsted, 2013: 1). The French approach is more prescriptive, making repeated use of practice exercises aimed at automatizing this knowledge (Ministère de l'Education et de la Jeunesse, 2018: 18–21). This implies that all our bilingual participants should have been taught and trained explicitly to use articles in their respective languages from age 6. However, the Paris English teacher reported not teaching English grammar as she did not feel confident enough in her own linguistic expertise. Therefore, only the London bilinguals received explicit instruction of English article use. As for the English monolinguals, the teacher from the primary school involved in the study reported that our Year 4 participants (8–9-year-olds) had not been taught about the "*the* + noun" because it is taught in Year 5 (cf. personal communication with the teacher). Overall, these disparities in grammar instruction across the schools provide valuable insights into the potential factors influencing the participants' language proficiency and metalinguistic awareness, which may have contributed to the observed patterns in the study's results.

A second factor in the poor performance on the GJT may be that the manipulation involved *felicity* rather than *grammaticality*. While neither Kupisch & Pierantozzi (2010) nor Serratrice et al. (2009) considered the role of metalinguistic awareness on their participants' judgements, they posited instead that it is always possible in some sense for English/German comprehenders to conjure up a semantic context in which the morphosyntactic marking is acceptable, a phenomenon also observed in comprehenders of all ages and linguistic backgrounds (e.g., Galambos & Goldin-Meadow, 1990; Gavarró et al., 2006).

In the English SPR, neither the monolinguals nor the bilinguals discriminated between felicitous and infelicitous sentences. However, using these same materials with adult L2ers and English monolinguals, Hervé and Lawyer (Unpublished) find participants

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were able to discriminate between these sentences. That suggests in the present context (i) that the children's implicit linguistic representation of English article use was not fully settled, (ii) the importance of noun type in the acquisition and use of English article use (see below), or (iii) that the children found it difficult to process felicity associated with the semantic contexts, without the possibility to regress to prior segments. These adult-child differences in the treatment of the same experimental sentences might also accord with Gelman et al.'s (2008) observation that both children and adults interpret generics as referring to kinds; but adults furthermore interpret generics as referring to an inborn property.

Finally, the cloze-test results clearly show that the children were sensitive to the syntactic and semantic cues embedding the generic or specific reading associated with our experimental sentences, as also observed in the study on adult L2ers (Hervé & Lawyer, Unpublished). The negative effect of English exposure in this task suggests that the bilinguals least exposed to English were relying on their metalinguistic awareness when completing it. The ability to identify grammatical cues yielding the semantic context seems to have boosted the bilinguals' performance.

The semantics of English article use

The English article system is complex, as it involves selecting an overt or null article depending on the semantic context (i.e., generic vs. specific) as well as depending on the noun type (i.e., count vs. mass). The SPR data suggests that there seems to be a trend for genericity being acquired before specificity marking. Moreover, the interactions between condition and noun type in the SPR and in the c-test, indicate that English-speaking children interpret and appropriately select PNs marking earlier than that of MNs. These results corroborate with prior findings from the French-English L2 literature (Sarko, 2009; Hervé & Lawyer, Unpublished). Acquiring the syntactic, pragmatic and semantic constraints governing MNs may be more difficult than count NPs due to (i) their abstract nature (e.g., uncountable substance or concept), (ii) the lack of plural marking, (iii) being associated with a singular verb form, and (iv) also in the context of our study the cross-linguistic differences in the way French and English encode them (Fieder et al., 2014). Overall, our findings suggest that complex interplay between the semantic context and noun type contributes to the difficulty of acquiring the English article system, and may not yet be fully settled for 8-to-10-year-old English-speaking children.

The role of language dominance

Another main finding is that individual English exposure and school-based group differences, rather than oral proficiency scores, affected the magnitude of CLI within the bilingual children. In French, the children least exposed to French were the least accurate at rejecting ungrammatical sentences. This finding was observed at the individual level (percentage of English exposure) and at the group level, as the Paris group was less sensitive to grammatical violation. Greater English exposure may hinder the bilingual children's judgments of ungrammatical sentences and give rise to a greater linguistic flexibility when judging sentence acceptability. A parallel phenomenon has been observed in French-English bilinguals' production of dislocations, where relative amount of language exposure in each language predicted the likelihood of CLI in French and English (Hervé et al., 2016).

In English, the picture that emerges from our results is more complex. In the GJT, we observed that the bilinguals least exposed to English were the most accurate at rejecting infelicitous sentences. In the c-test, the London group (i.e., greater exposed to French) was more accurate than the Paris bilinguals (i.e, greater exposed to English) with specific sentences – the + NP, the only French option. Along the same line, greater English exposure led to less accuracy with generic sentences. This pattern seems to reflect two related factors: (i) most of the French-dominant bilinguals (London: 13/21 + 2 NAs; Paris: 3/18 + 2 NAs) attended the London bilingual school; (ii) the children's metalinguistic awareness based on the teaching approaches to English grammar. The *c*-test results call into question whether the London bilinguals were reinforcing their implicit intuitions with metalinguistic knowledge acquired in class, whereas the Paris group did not seem to be able to compensate for their slightly weaker implicit representations with explicit knowledge learnt in class.

While our study provides further experimental evidence supporting recent work establishing a direct relationship between individual measures of input quantity and the likelihood of CLI (Hervé et al., 2016; Bosch & Unsworth, 2021), it also uncovers a new complexity in the relationship between language dominance and CLI in school-aged bilinguals, adding a new dimension, i.e., linguistic representations, to this already unsettled debate (see Nicoladis, 2016).

The task effects

Although we find evidence of CLI throughout our study, there are nevertheless subtle differences in results across tasks, which add nuance to the interpretation of our findings.

Although all three French tasks manipulated the exact same experimental sentences, treatment differences were observed across groups. In the GJT, all groups were better at rejecting ungrammatical sentences in specific contexts than in generic contexts. In the SPR, however, ungrammatical generic segments appeared to be more salient than the ungrammatical specific segments. And in the c-test, performance was comparable in the two conditions. These contradictory findings question whether one semantic context was actually more challenging regardless of bilingual status. In both conditions, the semantic context is embedded in the first clause but then the critical NP is presented in an identically constructed clause (Generic: *Paul adore les fruits verts; il pense que* ****Ø kiwis*** *sont délicieux* > *Paul loves green fruit; he thinks that* ****Ø kiwis*** *are delicious*; Specific: *Adam veut acheter des fruits au marché; il pense que* ****Ø poires*** *sont mûres/Adam wants to buy some fruit at the market, he thinks that* ****Ø pears*** are ripe). The un-informativeness of referents such as *fruit at the market* may trigger greater attention on the specific critical NP and therefore on potential errors. In contrast, generic referents such as *green fruit* might accelerate the processing of a sub-class of this kind (e.g., kiwi) and reinforce its memorization, especially in view of responding to a meaning-focused question in the SPR. Nonetheless, task differences also likely account for the overall higher accuracy in the c-test than in the GJT. As French is unequivocal regarding the obligatory status of articles in argument position, equivalent performance in these tasks should be expected. However, GJTs involve reading sentences with the aim of identifying an error, implying that participants not only read for meaning but also for grammatical optimality. While reading typically involves scanning for content words, our GJTs also involved paying attention to short function words, i.e., determiners, which may be skipped when reading for meaning. In contrast, the cloze-test is a gap-fill exercise in which the area of attention is signalled by a blank (prior to critical NPs) and by the instruction

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("fill the gap if needed"). Leaving a blank out in a c-test triggers a decision-making process, whereas failing to identify that a short function word is missing can be easily caused by a lapse in attention. Fatigue effects may also arise from the length and the artificial nature of the experimental procedure. In the French c-test, attention-driven errors can only correspond to number agreement errors as observed in the monolingual data.

In English, a similar pattern is observed when comparing the GJT and cloze-test. The negative effect of English exposure on the bilingual results in these tasks seems to reinforce the above interpretation. While the monolinguals performed better than the bilinguals, those who were least exposed to English were better at rejecting infelicitous sentences in the GJT and at leaving a blank in front of a generic NP in the c-test. Both processes involve a decision-making process that may be due to (i) a strong intuition (implicit knowledge) as seems to be the case for the English monolinguals, but also (ii) relying on formal cues (explicit knowledge) to make a decision as the bilinguals seem to do. Indeed, most of the bilinguals exposed the least to English received formal grammatical instruction at school (see discussion above).

Conclusion

Our studies displayed cross-linguistic influence in the bilinguals' implicit and explicit knowledge of article use. Its bi-directionality, vulnerability of different kinds of linguistic representation, as well as the role of language dominance and age provide further evidence supporting the cross-linguistic priming model of CLI (Serratrice, 2007, 2016, 2022). Finally, our results provide a new picture of the role of individual measures of language exposure on the likelihood of CLI in school-aged bilinguals.

Supplementary material. To view supplementary material for this article, please visit http://doi.org/10.1017/S1366728924000488.

Data availability statement. Data are available Dr Coralie Hervé with the permission of the ethics committee of the University of Essex.

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Competing interest. None declared.

References

Bates, D., **Maechler, M.**, **Bolker, B.**, & **Walker, S.** (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, **67**(1), 1–48. 10.18637/jss.v067.i01

Bosch, J. E., & **Unsworth, S.** (2021). Cross-linguistic influence in word order: Effects of age, dominance and surface overlap. *Linguistic Approaches to Bilingualism*, **11**(6), 783–816. 10.1075/lab.18103.bos

Booth, J. R., **Mac Whinney, B.**, & **Harasaki, Y.** (2000). Developmental differences in visual and auditory processing of complex sentences. *Child Development*, **71**(4), 981–1003. 10.1111/1467-8624.00203

Bernolet, S. & **Hartsuiker, R.** (2018). Syntactic representations in late learners of a second language: A learning trajectory. In D. Miller, F. Bayram, J. Rothman, & L. Serratrice (Eds.), *Bilingual cognition and language: The state of the science across its subfields* (pp. 205–224). John Benjamins. 10.1075/sibil.54.10ber

Cattani, A., **Abbot-Smith, K.**, **Farag, R.**, **Krott, A.**, **Arreckx, F.**, **Dennis, I.**, & **Foccia, C.** (2014). How much exposure to English is necessary for a bilingual toddler to perform like a monolingual peer in language tests? *International Journal of Language & Communication Disorders*, **49** (6), 649–671. 10.1111/1460-6984.12082

Chierchia, G. (1998). Reference to kinds across language. *Natural Language Semantics*, **6**(4), 339–405. 10.1023/A:1008324218506

Dąbrowska, E. (2012). Different speakers, different grammars: Individual differences in native language attainment. *Linguistic Approaches to Bilingualism*, **2**(3), 219–253. 10.1075/lab.2.3.01dab

De Houwer, A. (2009). *Bilingual first language acquisition*. Multilingual Matters.

Ellis, N. (2015). Implicit and explicit learning: Their dynamic interface and complexity. In P. Rebuschat (Ed.), *Implicit and explicit learning of languages* (pp. 3–23). John Benjamins.

Fieder, N., **Nickels, L.**, & **Biedermann, B.** (2014). Representation and processing of mass and count nouns: A review. *Frontiers in Psychology*, **5**, Article 589. 10.3389/fpsyg.2014.00589

Galambos, S. J., & **Goldin-Meadow, S.** (1990). The effects of learning two languages on levels of metalinguistic awareness. *Cognition*, **34**(1), 1–56. 10.1016/0010-0277(90)90030-N

Gámez, P. B., & **Vasilyeva, M.** (2020). Shared syntactic representations in balanced bilinguals: Crosslinguistic priming with and without verb overlap. *Language Learning and Development*, **16**(1), 89–106. 10.1080/15475441.2019.1689822

Gavarró, A. (2003). Economy and word order patterns in bilingual English-Dutch acquisition. *Bilingualism: Language and Cognition*, **6**(1), 69–79. 10.1017/S1366728903001044

Gavarró, A., **Pérez-Leroux, A. T.**, & **Roeper, T.** (2006). Definite and bare noun contrasts in child Catalan. L. Escobar & V. Torrens (Eds.), *The acquisition of syntax in Romance Languages* (pp.51–68). John Benjamins.

Gelman, S. A., **Goetz, P. J.**, **Sarnecka, B. W.**, & **Flukes, J.** (2008). Generic language in parent-child conversations. *Language Learning and Development*, **4**(1), 1–31. 10.1080/15475440701542625

Godfroid, A., **Loewen, S.**, **Jung, S.**, **Park, J. H.**, **Gass, S.**, & **Ellis, R.** (2015). Timed and untimed grammaticality judgments measure distinct types of knowledge: Evidence from eye-movement patterns. *Studies in Second Language Acquisition*, **37**(2), 269–297. 10.1017/S0272263114000850

Hartsuiker, R. J., & **Bernolet, S.** (2017). The development of shared syntax in second language learning. *Bilingualism: Language and Cognition*, **20**(2), 219–234. 10.1017/S1366728915000164

Hervé, C., & **Lawyer, L.** (unpublished) unpublished manuscript. *Adult L2 learners' knowledge of generic and specific reference in English and French: A self-paced reading study*.

Hervé, C., & **Serratrice, L.** (2018). The development of determiners in the context of French–English bilingualism: a study of cross-linguistic influence. *Journal of Child Language*, **45**(3), 767–787. 10.1017/S0305000917000459

Hervé, C., **Serratrice, L.**, & **Corley, M.** (2016). Dislocations in French-English bilingual children: An elicitation study. *Bilingualism: Language and Cognition*, **19**(5), 987–1000. 10.1017/S1366728915000401

Hsin, L., **Legendre, G.**, & **Omaki, A.** (2013). Priming cross-linguistic interference in Spanish–English bilingual children. In S. Baiz, N. Goldman, & R. Hawkes (Eds.), *Proceedings of the 37th annual Boston University conference on language development* (pp. 165–177). Cascadilla Press.

Hulk, A., & **Müller, N.** (2000). Bilingual first language acquisition at the interface between syntax and pragmatics. *Bilingualism: Language and Cognition*, **3**(3), 227–244. 10.1017/S1366728900000353

Jegerski, J. (2014). Self-paced reading. In J. Jegerski, & B. VanPatten (Eds.), *Research methods in second language psycholinguistics* (pp. 20–49). Routledge.

Just, M. A., **Carpenter, P. A.**, & **Woolley, J. D.** (1982). Paradigms and processes in reading comprehension. *Journal of Experimental Psychology*, **111**(2), 228–238. 10.1037/0096-3445.111.2.228

Karmiloff-Smith, A. (1979). Micro-and macro-developmental changes in language acquisition and other representational systems. *Cognitive Science*, **3**(2), 91–118. 10.1016/S0364-0213(79)80027-0

Kupisch, T. (2003). The DP, a vulnerable domain? Evidence from the acquisition of French. In N. Müller (Ed.), *(In)vulnerable domains in Multilingualism* (pp. 1–39). John Benjamins Publishing.

https://doi.org/10.1017/S1366728924000488 Published online by Cambridge University Press

Kupisch, T. (2007). Determiners in bilingual German–Italian children: What they tell us about the relation between language influence and language dominance. *Bilingualism: Language and Cognition*, **10**(1), 57–78. 10.1017/S1366728906002823

Kupisch, T. (2012). Specific and generic subjects in the Italian of German–Italian simultaneous bilinguals and L2 learners. *Bilingualism: Language and Cognition*, **15**(4), 736–756. 10.1017/S1366728911000691

Kupisch, T., & **Pierantozzi, C.** (2010). Interpreting definite plural subjects: A comparison of German and Italian monolingual and bilingual children. *In Proceedings of the 34th annual Boston University conference on language development* (pp. 245–254). Cascadilla Press. 10.1017/S1366728906002823

Kuznetsova, A., **Brockhoff, P.**, & **Christensen, R.** (2017). LmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, **82**(13), 1–26. 10.18637/jss.v082.i13

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. 10.1080/10489223.2017.1391815

Length, R. (2018). *emmeans: Estimated marginal means, aka least-squares means.* R package version 1.3.0. https://CRAN.R-project.org/package=emmeans

MacWhinney, B. (2018). A unified model of first and second language learning. In M. Hickmann, E. Veneziano, & H. Jisa, (Eds.), *Sources of variation in first language acquisition: Languages, contexts, and learners*, (Vol. **22**, pp. 287–312). John Benjamins Publishing.

Marinis, T. (2010). On-line sentence processing methods in typical and atypical populations. In: S. Unsworth, & E. Blom (Eds.), *Experimental methods in language acquisition tesearch*, (pp. 139–162). John Benjamins Publishing.

Marsden, E., **Thompson, S.**, & **Plonsky, L.** (2018). A methodological synthesis of self-paced reading in second language research. *Applied Psycholinguistics*, **39**(5), 861–904. 10.1017/S0142716418000036.

Meir, N., **Parshina, O.**, & **Sekerina, I. A.** (2020). The interaction of morphological cues in bilingual sentence processing: An eye-tracking study. In *Proceedings of the 44th annual Boston University conference on language development* (pp. 376–389). Cascadilla Press.

Ministère de l'Education Nationale et de la Jeunesse. (2018). *Programme des enseignements du cycle 2.* http://cache.media.eduscol.education.fr/file/programmes_2018/20/0/Cycle_2_programme_consolide_1038200.pdf

Nicoladis, E. (2016). Measuring language dominance in bilingual children: Implications for crosslinguistic influence. In Silva-Corvalán & J. Treffers-Daller (Eds.), *Language dominance in Bilinguals: Issues of measurement and operationalization* (pp. 219–234). Cambridge University Press.

Ofsted. (2013). *National curriculum in England: English programmes of study.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335190/English_Appendix_2_-_Vocabulary_grammar_and_punctuation.pdf

Paradis, M. (2004). *A neurolinguistic theory of bilingualism* (Vol. **18**). John Benjamins Publishing.

R Core Team. (2013). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing. ISBN 3–900051–07-0, http://www.R-project.org/

Robson, S. (2006). *Developing thinking and understanding in young children*. Routledge.

Sarko, G. (2009). L2 English article production by Arabic and French speakers. In R. Hawkins, & M.Garcia Mayo (Eds.), *Second language acquisition of articles: Empirical findings and theoretical implications* (pp. 37–66). Amsterdam: John Benjamins.

Serratrice, L. (2007). Cross-linguistic influence in the interpretation of anaphoric and cataphoric pronouns in English-Italian bilingual children. *Bilingualism Language and Cognition*, **10**(3), 225–238. 10.1017/S1366728907003045

Serratrice, L. (2013). Cross-linguistic influence in bilingual development: Determinants and mechanisms. *Linguistic Approaches to Bilingualism*, **3**(1), 3–25. 10.1075/lab.3.1.01ser

Serratrice, L. (2016). Cross-linguistic influence, cross-linguistic priming and the nature of shared syntactic structures. *Linguistic Approaches to Bilingualism*, **6**(6), 822–827. 10.1075/lab.6.6.15ser

Serratrice, L. (2022) What can syntactic priming tell us about crosslinguistic influence?. In: K. Messenger, (Ed.), Syntactic priming in language acquisition: representations, mechanism and applications. Trends in language acquisition research (pp. 129–156). John Benjamins. 10.1075/tilar.31.07ser

Serratrice, L., **Sorace, A.**, **Filiaci, F.**, & **Baldo, M.** (2009). Bilingual children's sensitivity to specificity and genericity: Evidence from metalinguistic awareness. *Bilingualism: Language and Cognition*, **12**(2), 239–257. 10.1017/S1366728909004027

Strik, N., & **Pérez-Leroux, A. T.** (2011). Jij doe wat girafe?: Wh-movement and inversion in Dutch-French bilingual children. *Linguistic Approaches to Bilingualism*, **1**(2), 175–205. 10.1075/lab.1.2.03str

Unsworth, S. (2023). Shared syntax and cross-linguistic influence in bilingual children: Evidence from between-and within-language priming. *Linguistic Approaches to Bilingualism*. 10.1075/lab.22093.uns.

van Dijk, C., & **Unsworth, S.** (2023). On the relation between cross-linguistic influence, between-language priming and language proficiency: Priming of ungrammatical adjective placement in bilingual Spanish-Dutch and French-Dutch children. *Open Mind*, **7**, 732–756. 10.1162/opmi_a_00105.

van Dijk, C., **van Wonderen, E.**, **Koutamanis, E.**, **Kootstra, G. J.**, **Dijkstra, T.**, & **Unsworth, S.** (2022). Cross-linguistic influence in simultaneous and early sequential bilingual children: a meta-analysis. *Journal of Child Language*, **49**(5), 897–929. 10.1017/S0305000921000337.

Vasilyeva, M., **Waterfall, H.**, **Gamez, P. B.**, **Gomez, L. E.**, **Bowers, E.**, & **Shimpi, P.** (2010). Cross-linguistic syntactic priming in bilingual children. *Journal of Child Language*, **37**(5), 1047–1064. 10.1017/S0305000909990213.

Wolleb, A., **Sorace, A.**, & **Westergaard, M.** (2018). Exploring the role of cognitive control in syntactic processing. *Linguistic Approaches to Bilingualism*, **8**(5), 606–636. 10.1075/lab.17002.wol.

https://doi.org/10.1017/S1366728924000488 Published online by Cambridge University Press