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Cognate facilitation in Frisian–Dutch bilingual children's sentence reading: An eye-tracking study

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ABSTRACT

Bilingual adults are faster in reading cognates than in reading non-cognates in both their first language (L1) and second language (L2). This cognate effect has been shown to be gradual: recognition was facilitated when words had higher degrees of cross-linguistic similarity. The aim of the current study was to investigate whether cognate facilitation can also be observed in bilingual children's sentence reading. To answer this question, a group of Frisian–Dutch bilingual children ($N = 37$) aged 9–12 years completed a reading task in both their languages. All children had Dutch as their dominant reading language, but most of them spoke mainly Frisian at home. Identical cognates (e.g., Dutch–Frisian *boek–boek* 'book'), non-identical cognates (e.g., *beam–boom* 'tree'), and non-cognates (e.g., *beppe–oma* 'grandmother') were presented in sentence context, and eye movements were recorded. The results showed a non-gradual cognate facilitation effect in Frisian: identical cognates were read faster than non-identical cognates and non-cognates. In Dutch, no cognate facilitation effect could be observed. This suggests that bilingual children use their dominant reading language while reading in their non-dominant one, but not vice versa.

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Introduction

Acquiring vocabulary in a second language (L2) requires children to connect new lexical forms to concepts that have already been linked to lexical forms in their first language (L1). This L2 word learning process is easier for L2 words that overlap in form with their L1 translation equivalents (i.e., cognates) than it is for L2 words that do not overlap in form with their L1 translation equivalents (i.e., non-cognates) (Comesaña, Moreira, Valente, Hernández-Cabrera, & Soares, 2019; Comesaña, Soares, Sánchez-Casas, & Lima, 2012; Cunningham & Graham, 2000; Kelley & Kohnert, 2012; Malabonga, Kenyon, Carlo, August, & Louguit, 2008; Méndez Pérez, Peña, & Bedore, 2010; Proctor & Mo, 2009; Schelletter, 2002; Tonzar, Lotto, & Job, 2009; Valente, Ferré, Soares, Rato, & Comesaña, 2018). Recent research has shown that this effect is gradual: the more overlap between the L1 and the L2, the easier it is to learn a new L2 word (Bosma, Blom, Hoekstra, & Versloot, 2019; Valente et al., 2018; Von Holzen, Fennell, & Mani, 2019). In a longitudinal study with three annual measurements, for example, 5- to 8-year-old Frisian–Dutch bilingual children with a low intensity of exposure to Frisian at home showed a gradual cognate facilitation effect on a Frisian receptive vocabulary task (Bosma et al., 2019). According to models of bilingual language processing such as the bilingual interactive activation plus (BIA+) model (Dijkstra & Van Heuven, 2002), this implies that words in the input activate semantic, phonological, and orthographic representations in both languages and that the degree of cross-language activation depends on the degree of overlap between a cognate pair.

However, not all children are equally sensitive to cognate information, as sensitivity to cognates develops with age (Bosma et al., 2019; Kelley & Kohnert, 2012; Malabonga et al., 2008). Bosma et al. (2019) showed that as Frisian–Dutch bilingual children grow older, they become better at recognizing regularities in the overlap between the Frisian and Dutch phonological systems. Kelley and Kohnert (2012) found that on an English receptive vocabulary task, 8- to 13-year-old Spanish-speaking learners of English scored higher on cognates than on non-cognates, but this cognate advantage was larger for older children. Similarly, Malabonga et al. (2008) found that on the Cognate Awareness Test, in which children need to choose the right definition of a word among four options, fifth graders obtained higher scores than fourth graders mainly because they performed better on cognate items. Furthermore, performance on cognates, but not on non-cognates, was positively correlated with children's Spanish receptive vocabulary scores. Similarly, Méndez Pérez et al. (2010) found that 5- and 6-year-old Spanish–English bilingual children who were more exposed to Spanish knew more Spanish–English cognates than children who were more exposed to English or equally exposed to Spanish and English. These studies demonstrate that children who are more proficient in their L1 are more sensitive to cognates in their L2.

The cognate facilitation effect has been observed not only in vocabulary acquisition but also in a variety of reaction time tasks, including reading tasks such as lexical decision. When they were tested in their L2, child L2 learners of English obtained faster reaction times and higher accuracy scores on cognate items than on non-cognate items both in a lexical decision task (Brenders, van Hell, & Dijkstra, 2011) and in a picture naming task (Poarch & van Hell, 2012). Similarly, child and adult speakers of Portuguese who learned a set of Portuguese–Catalan cognates and non-cognates performed better on cognate items than on non-cognate items in an auditory recognition task and a go/no-go lexical decision task. For children, but not adults, this effect was gradual: they performed better on cognate items with a larger degree of orthographic and phonological overlap between the L1 and the L2 (Valente et al., 2018). In addition, in a lexical decision task with cross-language phonological priming, French word recognition in 8- and 10-year-old early bilinguals was facilitated by the presentation of English phonological primes (Sauval, Perre, Duncan, Marinus, & Casalis, 2017). Furthermore, 8-year-old L1 English children who were enrolled in a French immersion program where they were learning to read simultaneously in English and French made fewer errors on cognate items than on non-cognate items in a French single-word reading-aloud task but not in an English one. Monolingual French and monolingual English children, in contrast, did not show a difference between cognate and non-cognate items (Jared, Cormier, Levy, & Wade-Woolley, 2011).

In balanced bilingual children, who were equally proficient in German and English, cognate effects were found in both languages in a picture naming task (Poarch & van Hell, 2012) and a lexical decision task (Schröter & Schroeder, 2016). In line with Malabonga et al. (2008) and Méndez Pérez et al. (2010), these results show that the degree of cross-language activation depends on children's proficiency in the non-target language. Following the BIA+ model (Dijkstra & Van Heuven, 2002), this can be explained by the relatively weak connections between the phonological, semantic and orthographic representations in the L2 lexical system of less proficient L2 speakers. As a result of these weak connections, processing is slower in L2 speakers with lower levels of proficiency as compared with L2 speakers with higher levels of proficiency. Because slower L2 processing provides a longer time window for coactivation of the L1, this leads to stronger cross-language activation in less proficient L2 speakers.

Whereas sensitivity to cognates in vocabulary acquisition has been argued to develop as children grow older (Bosma et al., 2019; Kelley & Kohnert, 2012; Malabonga et al., 2008), the opposite has been found with respect to reading. In an explicit translation recognition task among Spanish–Basque bilingual children aged 8–15 years, younger children were significantly more sensitive to cognates than older children, which suggests that less proficient readers rely more on cross-language orthographic overlap than more proficient readers (Duñabeitia, Ivaz, & Casaponsa, 2016).

In adults, cognate effects have been studied more abundantly than in children. They have been found not only in L2 vocabulary learning (De Groot & Keijzer, 2000), picture naming (Costa, Caramazza, & Sebastian-Galles, 2000), and word reading in isolation (Dijkstra, Miwa, Brummelhuis, Sappelli, & Baayen, 2010) but also in sentence reading (for a meta-analysis, see Lauro & Schwartz, 2017). As far as we know, this is the first study that investigated whether cognate facilitation could also be observed in bilingual children's sentence reading. Word recognition usually occurs within the context of a meaningful sentence, which can have an important influence on lexical access in general and the degree of cross-language interaction in particular (Libben & Titone, 2009; Titone, Libben, Mercier, Whitford, & Pivneva, 2011). Therefore, it is important to examine whether cognate effects can also be found in bilingual children's sentence reading.

The population that we examined consisted of 9- to 12-year-old Frisian–Dutch bilingual children, the same population as in Bosma et al. (2019) but a different age sample and, hence, a different data set. It must be noted that the bilingual children who we investigated are a little different from the groups of bilingual children that have been examined in previous studies in that the children's first *reading* language was not necessarily the same as their first *spoken* language. We further explain this in the section on the Frisian–Dutch bilingual context after discussing previous research on cognate facilitation in bilingual adults' sentence reading.

Cognate effects in adults' sentence reading

In sentence reading studies with bilingual adults, cognates are read faster than non-cognates both in the L2 (Bultena, Dijkstra, & van Hell, 2014; Duyck, Van Assche, Drieghe, & Hartsuiker, 2007; Van Assche, Drieghe, Duyck, Welvaert, & Hartsuiker, 2011; Van Assche, Duyck, & Brysbaert, 2013) and in the L1 (Titone et al., 2011; Van Assche, Duyck, Hartsuiker, & Diependaele, 2009), but the effect tends to be larger in the L2 (Lauro & Schwartz, 2017). Whereas some studies found a continuous and gradual cognate facilitation effect in adults' sentence reading (Bultena et al., 2014; Van Assche et al., 2009, 2011), other studies found a facilitation effect for identical cognates but not for non-identical cognates (Duyck et al., 2007). What is clear, however, is that more overlap results in a larger degree of cognate facilitation both in the L1 (Van Assche et al., 2009) and in the L2 (Duyck et al., 2007; Van Assche et al., 2011). Furthermore, it has been found that L2 proficiency modulates cognate effects in the L1 and L2 in different ways: whereas higher L2 proficiency is associated with smaller cognate effects in the L2 (Bultena et al., 2014; Libben & Titone, 2009; Pivneva, Mercier, & Titone, 2014), it is associated with larger cognate effects in the L1 (Titone et al., 2011). As in children, this can be explained by a faster L2 processing speed in speakers with higher levels of L2 proficiency (Dijkstra & Van Heuven, 2002).

Another factor that modulates cognate facilitation in sentence reading is semantic context: when the target word cannot be predicted from the linguistic context (low-constraint sentences), cognate effects are larger than when the target word can be predicted from the linguistic context (high-constraint sentences). In low-constraint sentences cognate effects were found in both early lexical processing (first fixation duration, gaze duration, and skipping) and late lexical processing (go-past time and total reading time), whereas in high-constraint sentences cognate effects were found only in early lexical processing (Libben & Titone, 2009; Titone et al., 2011). Whereas the early-stage measures are thought to reflect initial lexical access, the later-stage measures are thought to reflect higher-order processes such as semantic integration and ambiguity resolution (Rayner, 1998). The observation that cognate facilitation can be found in both low- and high-constraint sentences shows that the linguistic context itself does not prevent activation of lexical items in the non-target language (Dijkstra & Van Heuven, 2002). However, the finding that the cognate effect is larger in low-constraint sentences than in high-constraint sentences shows that semantically biasing information does attenuate the effect. When the linguistic context reduces the number of possible lexical candidates, this leads to faster access to the target word, thereby reducing the influence of coactivated representations in the non-target language at later stages of comprehension (Lauro & Schwartz, 2017).

Taken together, previous studies with bilingual adults show a cognate facilitation effect in sentence reading. This effect is modulated by L2 proficiency, degree of form overlap, and semantic context. In the current study, we investigated whether cognate facilitation could also be observed in bilingual children's sentence reading.

The Frisian–Dutch bilingual context

The two languages that we investigated in the current study are Frisian[1] and Dutch. Frisian is a regional minority language spoken in the Dutch province of Fryslân, where it has official status next to the national majority language Dutch. Fryslân has about 650,000 inhabitants (Centraal Bureau voor Statistiek, 2018) and is located in the northwest of The Netherlands.

During the past few decades, policymakers have taken measures to improve the position of Frisian in various societal domains. This resulted in the recognition of Frisian under Part III of the European Charter for Regional and Minority Languages (ECRML), which went into force in 1998. This charter requires the Dutch government to take practical measures to stimulate the use of Frisian in domains such as education, administration, and the media. A few years later, in 2005, the Dutch government recognized Frisian as the only national minority language under the Framework Convention on the Protection of National Minorities. More recently, in 2014, the *Wet Gebruik Friese Taal* [Law on the Use of the Frisian Language] came into effect in The Netherlands, giving Frisian the status of official language in the province of Fryslân, next to Dutch.

In the last sociolinguistic survey commissioned by the provincial government of Fryslân (Provinsje Fryslân, 2015), more than half of the Frisian population (55.3%) indicated that they were native speakers of Frisian. A bit less than half of the inhabitants reported that they spoke Frisian with their partners (45.6%) and children (47.5%). From the people who reported speaking Frisian with their partners, 93% also reported speaking Frisian with their children. These numbers show that Frisian still has a relatively strong position in the province, although it must be said that it is mostly used as an oral language in informal domains, for example, within the family and among friends (Breuker, 2001). Indeed, although 85.1% of the inhabitants indicated that they could understand Frisian well and 66.6% reported that they could speak Frisian well, only 51.8% indicated that they could read it well and only 14.5% reported that they could write it well.

This low level of literacy in Frisian is the result of the subordinate position of Frisian in education. Although policymakers and politicians have taken measures to improve the position of Frisian, Dutch is still the dominant language. Under Part III of the ECRML, it is mandatory to teach Frisian as a subject at Frisian primary schools for at least 1 hour per week. Many schools go even further, using Frisian as a language of instruction next to Dutch or next to Dutch and English in the *Trijtalige skoalle* [trilingual school] project (Van Ruijven & Ytsma, 2008). Even in these schools, however, Frisian does not have an equal status to Dutch; by the end of primary school, all children need to take a national language test developed by the Dutch test institute Cito that focuses exclusively on Dutch. For Frisian, the educational goals are determined at the individual level, depending on the linguistic background and com-

[1] Outside of The Netherlands, Frisian is known as West Frisian in order to avoid confusion with the Frisian languages that are spoken in Germany.

petences of each child (Mercator European Research Centre on Multilingualism and Language Learning, 2011).

As a result of this educational policy, all children become proficient in Dutch, whereas only the children who speak Frisian at home become fluent in Frisian (Dijkstra, Kuiken, Jorna, & Klinkenberg, 2016; Van Ruijven, 2006; Ytsma, 1995, 1999). This situation is very similar to the English–Welsh context, where all children develop a high command of English, regardless of their home language background, but only children with a sufficient amount of Welsh input at home and at school become fluent in Welsh (Gathercole & Thomas, 2009). In a longitudinal study with 2.5- to 4-year-old children, Dijkstra et al. (2016) showed that children who speak Frisian at home and children who speak Dutch at home performed similarly on a number of Dutch language measures, including receptive vocabulary, mean length of utterance, and lexical diversity. The children with Frisian as their home language obtained lower scores only on Dutch productive vocabulary. In contrast, the children who speak Dutch at home obtained significantly lower scores on all Frisian language measures than the children who speak Frisian at home. Similarly, Ytsma (1999) showed that the Dutch language development of 4- and 5-year-old children with Frisian as their home language showed a steeper growth trajectory than the Frisian language development of their peers with Dutch as their home language. Other research showed that by the time they were 7 or 8 years old (fourth grade), children who speak Frisian at home performed similarly to their monolingual peers in the rest of The Netherlands with respect to Dutch vocabulary, morphology, and syntax (Van Ruijven, 2006). In contrast, children who speak Dutch at home were still behind in Frisian vocabulary and morphology compared with their peers who speak Frisian at home (Ytsma, 1995).

Not much is known about children's reading skills in Frisian, probably because reading and writing in Frisian do not play an important role in education. The main educational goal for Frisian is to improve listening and speaking skills and to create a positive attitude toward the language. Extending vocabulary knowledge and acquiring reading and writing skills are usually not part of the curriculum (Gorter, 2008). This means that when formal reading education starts at 6 years of age, all children in the province of Fryslân first learn to read in Dutch and, as a result, Dutch becomes the dominant reading language even for children who grow up with Frisian as their home language (Stichting Lezen, 2018). It is no wonder, then, that in a survey conducted among 396 9- and 10-year-old children (sixth and seventh grades) from 18 different primary schools in Fryslân, a large proportion of the children (41%) indicated that they were not able to read Frisian or that they had trouble reading Frisian. Only 5% indicated that they were able to read Frisian without any problems. In addition, whereas most children reported reading books in Dutch (92%), only few children reported reading books in Frisian (21%) (De Jager, 2003).

Taken together, the studies described above show that despite political efforts to promote the use of Frisian, Dutch is still the dominant language in education. In the current study, we examined how this affects bilingual children's reading abilities. More specifically, we investigated whether bilingual children make use of their dominant reading language (Dutch) while reading in their non-dominant reading language (Frisian) and vice versa. Because previous research has shown cognate facilitation in bilingual children's vocabulary acquisition (Bosma et al., 2019; Kelley & Kohnert, 2012; Malabonga et al., 2008), bilingual children's single-word reading (Brenders et al., 2011; Duñabeitia et al., 2016; Jared et al., 2011; Sauval et al., 2017; Schröter & Schroeder, 2016; Valente et al., 2018) and in bilingual adults' sentence reading (Bultena et al., 2014; Duyck et al., 2007; Van Assche et al., 2009, 2011), we also expected a cognate facilitation effect in bilingual children's sentence reading. We hypothesized that the effect would be larger in Frisian than in Dutch because Frisian is the children's non-dominant reading language. Because children first learn to read in Dutch, the connections among orthographic, semantic, and phonological representations will be stronger in Dutch than in Frisian. As a result, processing is expected to be slower in Frisian than in Dutch, thereby providing a longer time window for coactivation of the Dutch orthographic representations. This will lead to a stronger level of Dutch coactivation when reading in Frisian as compared with the level of Frisian coactivation when reading in Dutch. Furthermore, in line with previous research, we expected the cognate facilitation effect to be modulated by degree of form overlap (Bosma et al., 2019; Duyck et al., 2007; Van Assche et al., 2009, 2011).

Method

All stimuli, analysis scripts, anonymized data, and results are available on Open Science Framework (https://osf.io/hfde6/).

Participants

A total of 66 9- to 12-year-old Frisian–Dutch bilingual children were recruited from five different primary schools in the countryside of the province of Fryslân. The schools distributed information folders and consent forms among the parents of the children, and only the children whose parents had signed the consent form were tested. All children had normal or corrected-to-normal vision. A number of children were not included in the final sample because they had been diagnosed with dyslexia ($n = 4$) or because of calibration problems during either the Frisian or Dutch version of the experiment ($n = 21$). We also excluded the data of 2 participants who performed at chance on the comprehension questions of the cognate reading task. Furthermore, the data of 2 other participants were excluded because their reading time measures were more than 3 standard deviations above the participant group mean. Eventually, 37 children (23 female and 14 male) were included in the final sample of the current study. Table 1 provides an overview of children's background characteristics, including age, non-verbal IQ, socioeconomic status (SES), intensity of exposure to Frisian and Dutch at home, and Frisian and Dutch receptive vocabulary scores.

SES and intensity of exposure were assessed with an online parental questionnaire based on the Questionnaire for Parents of Bilingual Children (COST Action ISO804, 2011; Tuller, 2015). SES was measured as the mean educational level of the mother and father of the child on a 9-point scale ranging from no education (1) to university degree (9), thereby capturing the Dutch educational system in a fine-grained manner. Intensity of exposure to Dutch and Frisian was measured as the mean percentage of language input that the child received from his or her mother, father, siblings, and other adults who cared for the child at least once a week. For all these people, we asked which languages they spoke to the child: only Frisian (100% Frisian, 0% Dutch), more Frisian than Dutch (75% Frisian, 25% Dutch), approximately the same amount of Frisian and Dutch (50% Frisian, 50% Dutch), more Dutch than Frisian (25% Frisian, 75% Dutch), or only Dutch (0% Frisian, 100% Dutch). Because two parents only partially completed the questionnaire, there are two missing values for SES and one missing value for exposure.

Non-verbal IQ was measured with the Raven's Standard Progressive Matrices (Raven, 2003), in which children need to identify the missing piece of a geometric pattern presented in black and white. The task consists of five sets of 12 items each, listed in order of difficulty. Raw scores were converted into percentiles.

Dutch receptive vocabulary was estimated with the Peabody Picture Vocabulary Test-III-NL (PPVT-III-NL; Schlichting, 2005), a standardized multiple-choice test containing 204 items divided into 17 sets of 12 items. The test starts with the easiest and most frequent items in the first set, after which there is a gradual increase in complexity. Each item consists of four pictures from which the child

Table 1
Participant characteristics.

Characteristic	*n*	Mean (*SD*)	Range	Maximum possible score
Age (years;months)	37	10;5 (1;2)	8;5–12;11	–
Non-verbal IQ	37	59 (28)	3–96	100
Socioeconomic status	35	7 (1)[a]	5–9	9
% Frisian exposure	36	65 (37)	0–100	100
% Dutch exposure	36	36 (37)	0–100	100
Frisian receptive vocabulary	37	116 (9)	95–130	144
Dutch receptive vocabulary	37	130 (13)	107–160	204

[a] Because the mean is not the optimal central tendency measure for ordinal data, we also report the median and mode for socioeconomic status (median: 7; mode: 8).

needs to choose the picture that matches the stimulus word. For scoring, basal and ceiling rules were applied. Frisian receptive vocabulary was estimated with an adaptation of the Dutch PPVT (Bosma et al., 2019). This adaptation consists of 144 items divided into 12 sets. In contrast to the Dutch task, all children completed all items because there are no basal and ceiling criteria for this Frisian version. Raw scores were used for both the Dutch and Frisian versions because there are no norm scores available for Frisian.

Cognate reading task

To investigate cognate facilitation in bilingual children's reading, we developed a cognate reading task in which we measured children's eye movements with an eye tracker. We used eye tracking because it is considered to be the most time-sensitive experimental operationalization of natural reading (Van Assche, Duyck, & Hartsuiker, 2012).

The target stimuli of the cognate reading task consisted of 42 Frisian–Dutch translation equivalents (14 identical cognates, 14 non-identical cognates, and 14 non-cognates). The selection of the target words was made based on Van Orden's (1987) orthographic similarity measure. All identical cognates had a score of 1, all non-identical cognates had a score between 1 and 0.5, and all non-cognates had a score below 0.5. It must be noted here that Frisian orthography largely follows Dutch orthography but that Frisian has some diacritics and diphthongs that are not shared with Dutch (Visser & Weening, 2018). Some of these unique Frisian features also occurred in the target words. An overview of the lexical characteristics of the target items can be found in Table 2. A one-way analysis of variance (ANOVA) with category (identical cognates, non-identical cognates, or non-cognates) as the independent variable and phonological similarity, Frisian word length, Dutch word length, Dutch orthographic neighborhood density, Dutch phonological neighborhood density, and Dutch word frequency as dependent variables showed that there was a significant difference between the cognate categories with respect to phonological similarity, $F(2, 39) = 214.33$, $p < .001$, but that there were no significant differences with respect to word length in Frisian, $F(2, 39) = 0.37$, $p = .69$, word length in Dutch, $F(2, 39) = 0.29$, $p = .75$, Dutch orthographic neighborhood density, $F(2, 39) = 0.25$, $p = .78$, Dutch phonological neighborhood density, $F(2, 39) = 0.59$, $p = .56$, and Dutch word frequency, $F(2, 39) = 0.02$, $p = .98$. Furthermore, because Bultena et al. (2014) showed that the cognate effect is larger in nouns than in verbs, we included only singular nouns as target items.

Dutch word frequencies were retrieved from the SUBTLEX-NL corpus (Keuleers, Brysbaert, & New, 2010) and transformed into logarithmic scores because frequencies are perceived logarithmically (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014). Unfortunately, Frisian word frequencies could not be taken into account because the only available Frisian corpus is a non-lemmatized database of standardized written language that is not representative of spoken Frisian (Breuker, 1993). However, because Frisian and Dutch are closely related languages, we assumed that Dutch frequencies would also be representative of the Frisian frequencies (see also Bosma et al., 2019). Dutch phonological and orthographic neighborhood densities were retrieved from the CLEARPOND database (Marian, Bartolotti, Chabal, & Shook, 2012). Because such a database does not exist for Frisian, neighborhood density for the Frisian target items could not be calculated. Phonological similarity was calculated using the Levenshtein distance, which is the least costly set of operations (i.e., insertions, deletions, or substitutions) to change one word into the other (cf. Heeringa, 2004).

Table 2
Means and standard deviations of lexical characteristics for matched experimental items.

Lexical characteristic	Identical cognates	Non-identical cognates	Non-cognates
Van Orden's orthographic similarity	1.00 (0.00)	0.69 (0.13)	0.20 (0.13)
Phonological similarity	0.98 (0.09)	0.57 (0.11)	0.16 (0.11)
Word length, Frisian	4.36 (1.00)	4.64 (1.00)	4.64 (1.00)
Word length, Dutch	4.36 (1.00)	4.64 (1.84)	4.50 (1.09)
Orthographic neighborhood density, Dutch	9.36 (6.96)	8.00 (5.74)	8.00 (4.87)
Phonological neighborhood density, Dutch	10.64 (8.14)	10.29 (6.92)	13.21 (8.19)
Word frequency	3.18 (0.41)	3.16 (0.64)	3.20 (0.68)

For each of the target stimuli, two sentence contexts were constructed (Versions A and B) and translated into both Dutch and Frisian. In this way, the same target words could be tested in both languages, but the participants would not read the same sentences twice. The target word was always the fifth word in the sentence, and all the sentences were eight words in length. The two different versions were counterbalanced across participants. Thus, participants who were presented with sentence context A in Frisian were presented with sentence context B in Dutch and vice versa. Example sentences are presented in Table 3. To make sure that participants paid attention throughout the experiment and that they understood what they were reading, we constructed 10 comprehension questions for each of the two versions of the experiment.

We made sure that the target stimuli were not predictable from the sentence context because previous research with adults has shown that cognate effects are larger for low-constraint sentences (Libben & Titone, 2009; Titone et al., 2011). Target word predictability was assessed in an online sentence completion study with 52 adults (29 female and 23 male). Participants were native speakers of Dutch with a mean age of 26 years ($SD = 5$). They were asked to complete Dutch sentences in which the target word had been left out, for example, *De tuinman maakt de ____ schoon voor morgen* ('The gardener cleans the ____ for tomorrow'). Participants saw each of the 84 sentences (42 with sentence context A and 42 with sentence context B) only once and in random order. The results of the cloze test showed that all sentences were low constraint. None of them had a cloze probability higher than .20, and there were no significant differences in predictability between sentence context A ($M = .02$, $SD = .05$) and sentence context B ($M = .02$, $SD = .03$), $t(41) = 0.98$, $p = .34$. Furthermore, there were no significant differences in cloze probability among the three cognate categories, either in sentence context A, $F(2, 39) = 0.41$, $p = .66$, or in sentence context B, $F(2, 39) = 1.00$, $p = .38$.

As a result of the requirement that the target items should be highly unpredictable within the sentence context, some of the sentences that we created were rather unusual. Because this might influence the reading time measures of the target words, we examined the acceptability of each of the sentences that we created in an online acceptability judgment study with 37 adults (22 female and 15 male). Participants were native speakers of Dutch with a mean age of 32 years ($SD = 13$). They were asked to indicate how natural each of the sentences was to them on a Likert scale from 1 (*very unnatural*) to 7 (*very natural*). The results showed that there were no significant differences between sentence context A ($M = 5.43$, $SD = 0.64$) and sentence context B ($M = 5.52$, $SD = 0.65$), $t(41) = -0.64$, $p = .53$, and that there were also no significant differences among the three cognate categories either in sentence context A, $F(2, 39) = 0.03$, $p = .97$, or in sentence context B, $F(2, 39) = 0.29$, $p = .75$.

Finally, it must be noted that because Frisian and Dutch share a large part of their vocabularies (Bosma et al., 2019), the sentences that we created contained a large number of cognates. Because children might read a cognate faster if the previous words were also cognates, we examined whether there were differences regarding the average orthographic similarity measure (Van Orden, 1987) of the four words prior to the target word. The results showed that there were no significant differences

Table 3
Example sentences with target words highlighted.

Category	Version	Frisian	Dutch	English translation
Identical cognate	A	De túnman makket de **bus** skjin foar moarn.	De tuinman maakt de **bus** schoon voor morgen.	The gardener cleans the **bus** for tomorrow.
	B	De monteur reparearret de **bus** fan de bakker.	De monteur repareert de **bus** van de bakker.	The mechanic repairs the **bus** of the baker.
Non-identical cognate	A	De boskwachter yt faak **sûker** yn it wykein.	De boswachter eet vaak **suiker** in het weekend.	The forester often eats **sugar** during the weekend.
	B	Us omke keapet soms **sûker** yn de winkel.	Mijn oom koopt soms **suiker** in de winkel.	My uncle sometimes buys **sugar** at the store.
Non-cognate	A	De atleet wol de **baarch** net graach ferkeapje.	De atleet wil het **varken** niet graag verkopen.	The athlete does not want to sell the **pig**.
	B	De keizer sjocht in **baarch** neist de rivier.	De keizer ziet een **varken** naast de rivier.	The emperor sees a **pig** next to the river.

between sentence context A (M = 0.71, SD = 0.14) and sentence context B (M = 0.66, SD = 0.17), $t(41)$ = 1.70, p = .10, and that there were also no significant differences among the three cognate categories either in sentence context A, $F(2, 39)$ = 0.11, p = .90, or in sentence context B, $F(2, 39)$ = 0.53, p = 0.59.

Eye movements were recorded with a portable duo EyeLink 1000 eye tracker (SR Research, Ottawa, Ontario, Canada) with a sampling rate of 500 Hz. The eye tracker was mounted on a Lenovo ThinkPad E460 and recorded eye movements only from the right eye. Sentences were presented on a 14-inch Dell Latitude E5470 monitor using SR Research Experiment Builder 2.1.140 software. Participants were seated 52 cm from the computer screen, and a chin rest was used to reduce head movements during the experiment.

The cognate reading task started with a nine-point grid calibration procedure in which participants were required to saccade toward nine fixation points that appeared sequentially in a 3 × 3 grid. We obtained an average fixation error of 0.80° of visual angle, which is higher than the average fixation error of <0.50° that is typically adhered to in the eye movement reading literature concerning well-trained adults. It has been attested, however, that the use of a portable eye tracker among children often results in poorer data quality because children's body movements are difficult to restrain (Hessels, Niehorster, Kemner, & Hooge, 2017). After validation of the calibration, participants received instructions about the task on the computer screen. They were informed that they would read sentences and that in some cases comprehension questions would be asked. They were instructed to press the spacebar on a wireless keyboard when they finished reading the current sentence in order to move to the next one and to use the left or right arrow key to answer the questions with either *yes* or *no,* respectively. Furthermore, participants were verbally instructed to move their head and body as little as possible while reading and to read at a normal pace.

Sentences were aligned on the left side of the screen in black 20-point monospaced Consolas font against a light gray background. One character (26.12 pixels wide) corresponded to a 0.41° visual angle horizontally. Before each sentence, a fixation cross was presented for 500 ms at a fixed position on the left side of the screen in order to indicate the position of the first word of the sentence. Comprehension questions occurred at random intervals during the experiment and were presented in red as well as the fixation cross that preceded the question. The 42 sentences were presented in random order, and there were two breaks in between, after which a drift check was performed. The whole experiment, including camera setup and calibration, lasted about 10 min.

Five different reading measures were analyzed: *first fixation duration* (FFD), the duration of the first fixation on the target word if that fixation is progressive; *gaze duration* (GD), the total duration of all fixations on a target word until the eyes fixate on a different word provided that the first fixation is progressive; *skipping,* the proportion of trials where the target word is not fixated on; *go-past time* (GPT), the total duration of all fixations on a target word until the eyes fixate on a different word that is progressive to the target word provided that the first fixation is progressive; and *total reading time* (TRT), the total duration of all fixations on a target word. These measures have previously been used in other eye-tracking studies on sentence reading (e.g., Bultena et al., 2014; Duyck et al., 2007; Libben & Titone, 2009) and are thought to reflect different stages of lexical access; whereas FFD, GD, and skipping are thought to reflect early lexical processing, GPT and TRT are thought to reflect late lexical processing (Rayner, 1998).

Reading fluency

Reading fluency in Frisian and reading fluency in Dutch were assessed by calculating the average sum of all fixation durations across all words in the cognate reading task (see also Bultena et al., 2014; Libben & Titone, 2009). Note that lower scores reflect better reading fluency.

Procedure

All children were tested individually by a native speaker of the tested language in a quiet room at school during school hours. There were two experimenters: a research assistant, who is a native speaker of both Dutch and Frisian, and the second author, who is a native speaker of Dutch. The experimenters always spoke the target language to the child. There were two sessions that lasted about

60 min each with a minimum of 4 days in between, including 2 weekend days. The tasks that were used in the current study were part of a larger test battery that also included tasks that are not reported on in the current study. The tasks were administered in the following order: the Frisian receptive vocabulary task and the Frisian cognate reading task in the first session, followed by the Dutch receptive vocabulary task and the Dutch cognate reading task in the second session. In between the receptive vocabulary tasks and the cognate reading tasks, children performed a picture naming task that is not reported on in the current study but that involved the same target words as the ones used in the cognate reading task. This was done to make sure that the children knew the target words that they were going to read. After completing the second session, the children were rewarded with a gel pen. The non-verbal IQ task was administered in a separate group session that lasted about 30 min where a maximum of 5 children took the test at the same time.

Results

The current study investigated whether a cognate facilitation effect can be found in Frisian–Dutch bilingual children's sentence reading and, if so, whether the effect is modulated by language and degree of form overlap. To answer this question, we analyzed reading times on the target words and skipping rates for the target words that were not fixated on when the participant read the sentence for the first time. Reading times were analyzed based on fixations on the target words. Fixations had a minimal duration of 100 ms because readers are assumed not to be able to process information from fixations of less than 100 ms (Rayner, Sereno, Morris, Schmauder, & Clifton, 1989). Neighboring fixations with a duration of less than 100 ms were merged when they were within 1° of one another.

A total of 3108 data points were recorded (37 participants, 42 items, 2 languages). We excluded items with a fixation on the target word after a blink and items where the first fixation of the sentence was on the target word (182 data points, 5.9% of the data), leaving 2926 data points. For the reading time analyses, we discarded another 233 data points because of skipping and another 191 data points because the first fixation was not progressive, resulting in a final amount of 2502 data points for FFD, GD, and GPT and a final amount of 2693 for TRT. Because there were no outlier items with reading time measures that were more than 3 standard deviations above the item means of the three individual cognate categories, we included all items in the final analyses.

On the comprehension questions of the Frisian cognate reading task the children obtained an average accuracy score of 88.9% ($SD = 12.7$), and on the comprehension questions of the Dutch cognate reading task they obtained an average accuracy score of 91.9% ($SD = 8.5$). A paired-samples t test showed that there was no significant difference between these two scores, $t(36) = -1.38$, $p = .18$. Means and standard deviations of the reading measures are presented per cognate category in Table 4. For the analyses, these measures were log transformed to correct for non-normal distributions. Reading fluency scores in Frisian and Dutch are presented in Table 5. Recall that lower scores reflect better reading fluency because fluency was measured as the average sum of fixation durations. A paired-samples t test showed that children's reading fluency scores were significantly better for Dutch ($M = 305$, $SD = 92$) than for Frisian ($M = 462$, $SD = 124$), $t(36) = -11.10$, $p < .001$. This demonstrates that Dutch is indeed the dominant reading language of our participants. Correlations between the reading

Table 4
Means (and standard deviations) of the reading measures ($N = 37$).

Reading measure	Frisian			Dutch		
	Identical cognates	Non-identical cognates	Non-cognates	Identical cognates	Non-identical cognates	Non-cognates
FFD	242 (111)	258 (130)	270 (144)	219 (76)	222 (84)	215 (83)
GD	291 (159)	342 (218)	340 (211)	246 (110)	256 (129)	250 (125)
GPT	329 (196)	441 (309)	405 (259)	280 (150)	288 (161)	276 (174)
TRT	437 (314)	603 (449)	565 (426)	354 (238)	362 (226)	339 (221)
Skipping	.13 (.34)	.08 (.27)	.10 (.30)	.18 (.39)	.17 (.37)	.20 (.40)

Note. FFD, first fixation duration; GD, gaze duration; GPT, go-past time; TRT, total reading time.

Table 5
Children's reading fluency scores.

Measure	*N*	Mean (*SD*)	Range
Frisian reading fluency	37	462 (124)	269–818
Dutch reading fluency	37	305 (92)	167–551

fluency scores and children's background measures are presented in Table 6. Because there was a very high correlation between reading fluency in Frisian and reading fluency in Dutch, $r(35) = .72$, $p < .001$, we created one composite reading fluency measure for the analyses. In what follows, we first present the linear mixed-effects models that we used to analyze our four continuous dependent variables (FFD, GD, GPT, and TRT), followed by the generalized linear mixed-effects model that we used for the analysis of our binomial dependent variable (skipping).

Mixed model analysis: reading time measures

To answer the research question, reading time measures were analyzed using linear mixed-effects models in R (Version 3.5.3; R Core Team, 2018) and RStudio (Version 1.1.463; RStudio Team, 2016). The mixed model was run using the *lmer* function as implemented in the lme4 package for R (Version 1.1–21; Bates, Mächler, Bolker, & Walker, 2015). We included random intercepts for both subject and item and included random slopes for language by subject and item to account for the highly variable reading patterns across individuals and items. For each of the four dependent variables (FFD, GD, GPT, and TRT), we fitted the maximal model (Barr, Levy, Scheepers, & Tily, 2013) to the data with language (Frisian or Dutch), category (identical cognates, non-identical cognates, or non-cognates), age (in months, centered), reading fluency, and version (counterbalanced Group A or B) as fixed factors. We applied Helmert contrasts to the factor category with identical cognates as the reference level. This way, the first contrast compared identical cognates (Level 1) with non-identical cognates and non-cognates (average of Levels 2 and 3), whereas the second contrast compared non-identical cognates with non-cognates (Level 2 vs. Level 3). The models were further refined by adding an interaction between language and category, which was the interaction of interest. We did not add interactions between potentially modulating factors because this could result in overfitting of the model. Model comparison using a log-likelihood ratio test was used with bootstrap resampling ($r = 1000$) to compute chi-square and p values using the *lmercomp* function as implemented in the comix package for R (Version 0.1.0; Jessop, 2019). The final models are presented in Table 7. Below, we focus only on the results of greatest interest, that is, the effects of category and language and the interaction between category and language.

Following Von der Malsburg and Angele (2017) advice on running multiple comparisons in eye-tracking research on reading, we applied a Bonferroni correction by dividing the alpha (α) threshold by the number of statistical tests that we performed. This means that significance was determined

Table 6
Correlations between reading fluency scores and background measures.

Measure	2	3	4	5	6	7	8
1. Frisian exposure	.25***	−.27	−.09	.48**	−.14	.27	−.00
2. Age	–	−.07	−.18	.59***	.46**	.04	−.29
3. Socioeconomic status		–	.21	.16	.17	−.36*	−.17
4. Nonverbal IQ			–	.16	.22	−.12	−.17
5. Frisian receptive vocabulary				–	.59***	−.04	−.37*
6. Dutch receptive vocabulary					–	−.26	−.40*
7. Frisian reading fluency						–	.72***
8. Dutch reading fluency							–

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 7
Fixed effects of the linear mixed-effects models for reading time measures on target words with language (Dutch), category (identical), and version (A) as reference levels.

Variable	β	*SE*	χ^2	*p*
First fixation duration				
(Intercept)	2.08 [1.73, 2.44]	0.18	–	–
Language, Du + Fr	0.05 [0.04, 0.07]	0.01	29.16	.001
Category, idC + nidCnC	0.01 [0.00, 0.02]	0.01	3.56	.08
Category, nidC + nC	0.00 [−0.02, 0.02]	0.01	0.00	.96
Age	0.00 [0.00, 0.00]	0.00	1.40	.25
Reading fluency	0.10 [−0.04, 0.24]	0.07	2.13	.15
Version, A + B	0.00 [−0.02, 0.01]	0.01	0.08	.78
Language, Du + Fr: Category, idC + nidCnC	0.02 [0.00, 0.04]	0.01	5.74	.01
Language, Du + Fr: Category, nidC + nC	0.03 [0.00, 0.06]	0.02	2.62	.11
R^2_m = .0388, R^2_c = .1284				
Gaze duration				
(Intercept)	1.91 [1.50, 2.35]	0.22	–	–
Language, Du + Fr	0.09 [0.07, 0.12]	0.01	30.37	<.001
Category, idC + nidCnC	0.02 [0.00, 0.04]	0.01	3.74	.07
Category, nidC + nC	0.00 [−0.03, 0.02]	0.01	0.24	.62
Age	0.00 [0.00, 0.00]	0.00	2.21	.15
Reading fluency	0.19 [0.02, 0.35]	0.08	4.82	.03
Version, A + B	−0.02 [−0.04, 0.00]	0.01	3.65	.07
Language, Du + Fr: Category, idC + nidCnC	0.03 [0.01, 0.06]	0.01	6.22	.01
Language, Du + Fr: Category, nidC + nC	0.01 [−0.03, 0.05]	0.02	0.19	.65
R^2_m = .0707, R^2_c = .1870				
Go-past time				
(Intercept)	1.53 [1.16, 1.91]	0.19	–	–
Language, Du + Fr	0.12 [0.09, 0.15]	0.02	38.14	<.001
Category, idC + nidCnC	0.03 [0.01, 0.05]	0.01	3.52	.08
Category, nidC + nC	−0.02 [−0.06, 0.01]	0.02	1.36	.27
Age	0.00 [0.00, 0.00]	0.00	3.01	.10
Reading fluency	0.36 [0.21, 0.50]	0.07	18.49	<.001
Version, A + B	−0.02 [−0.04, 0.01]	0.01	2.35	.14
Language, Du + Fr: Category, idC + nidCnC	0.06 [0.03, 0.09]	0.02	13.94	<.001
Language, Du + Fr: Category, nidC + nC	−0.01 [−0.06, 0.04]	0.03	0.09	.76
R^2_m = .1282, R^2_c = .2366				
Total reading time				
(Intercept)	1.17 [0.84, 1.51]	0.17	–	–
Language, Du + Fr	0.16 [0.13, 0.20]	0.02	44.98	<.001
Category, idC + nidCnC	0.04 [0.01, 0.06]	0.01	1.51	.25
Category, nidC + nC	−0.03 [−0.07, 0.02]	0.02	1.14	.31
Age	0.00 [0.00, 0.00]	0.00	0.85	.36
Reading fluency	0.54 [0.41, 0.66]	0.07	40.32	<.001
Version, A + B	−0.01 [−0.04, 0.02]	0.02	0.64	.45
Language, Du + Fr: Category, idC + nidCnC	0.08 [0.05, 0.11]	0.02	16.93	<.001
Language, Du + Fr: Category, nidC + nC	0.00 [−0.06, 0.06]	0.03	0.00	1.00
R^2_m = .1565, R^2_c = .2523				

Note. Du, Dutch; Fr, Frisian; idC, identical cognates; nidC, non-identical cognates; nC, non-cognates.

using the threshold α = .05/5 = .01. There were significant main effects of language for all four reading time measures (FFD: β = 0.05 [0.04, 0.07], *SE* = 0.01, $\chi^2(1)$ = 29.16, *p* = .001; GD: β = 0.09 [0.07, 0.12], *SE* = 0.01, $\chi^2(1)$ = 30.37, $p < .001$; GPT: β = 0.12 [0.09, 0.15], *SE* = 0.02, $\chi^2(1)$ = 38.14, $p < .001$; TRT: β = 0.16 [0.13, 0.20], *SE* = 0.02, $\chi^2(1)$ = 44.98, $p < .001$), showing that target words were read faster in Dutch than in Frisian. There were no significant main effects of category, but there was a significant interaction between language and category (Level 1 vs. Level 2/3) for all four reading time measures (FFD: β = 0.02 [0.00, 0.04], *SE* = 0.01, $\chi^2(1)$ = 5.74, *p* = .01; GD: β = 0.03 [0.01, 0.06], *SE* = 0.01, $\chi^2(1)$ = 6.22, *p* = .01; GPT: β = 0.06 [0.03, 0.09], *SE* = 0.02, $\chi^2(1)$ = 13.94, $p < .001$; TRT: β = 0.08 [0.05, 0.11], *SE* = 0.02, $\chi^2(1) = 16.93$, $p < .001$). This interaction showed that the effect of category (Level 1 vs. Level 2/3) was significantly larger for Frisian than for Dutch. In fact, further inspection of the data (Table 4) showed that there were no differences among the three cognate categories in Dutch, only in Frisian. The violin plot in Fig. 1 shows the interaction effect for FFD.

Overall, the models accounted for 3.9% to 15.7% (FFD: 3.9%; GD: 7.1%; GPT: 12.8%; TRT: 15.7%) of the variance in the data without the random effect structure and for 12.8% to 25.2% (FFD: 12.8%; GD: 18.7%; GPT: 23.7%; TRT: 25.2%) of the variance when the random effect structure was included.

Mixed model analysis: skipping

To analyze children's skipping rates, we used a generalized linear mixed-effects model with a logistic link function. The mixed model was run using the *glmer* function as implemented in the lme4 package for R (Version 1.1–21; Bates et al., 2015). We included random intercepts for both subject and item and included random slopes for language by subject and item. We fitted the maximal model (Barr et al., 2013) to the data with skipping (0 or 1) as the binary dependent variable and language (Frisian or Dutch), category (identical cognates, non-identical cognates, or non-cognates), age (in months, centered), and version (counterbalanced Group A or B) as fixed factors. The model did not converge when we also added reading fluency. Again, we applied Helmert contrasts to the factor category with identical cognates as the reference level. Finally, we added an interaction between language and category, which was the interaction of interest. The final model is presented in Table 8.

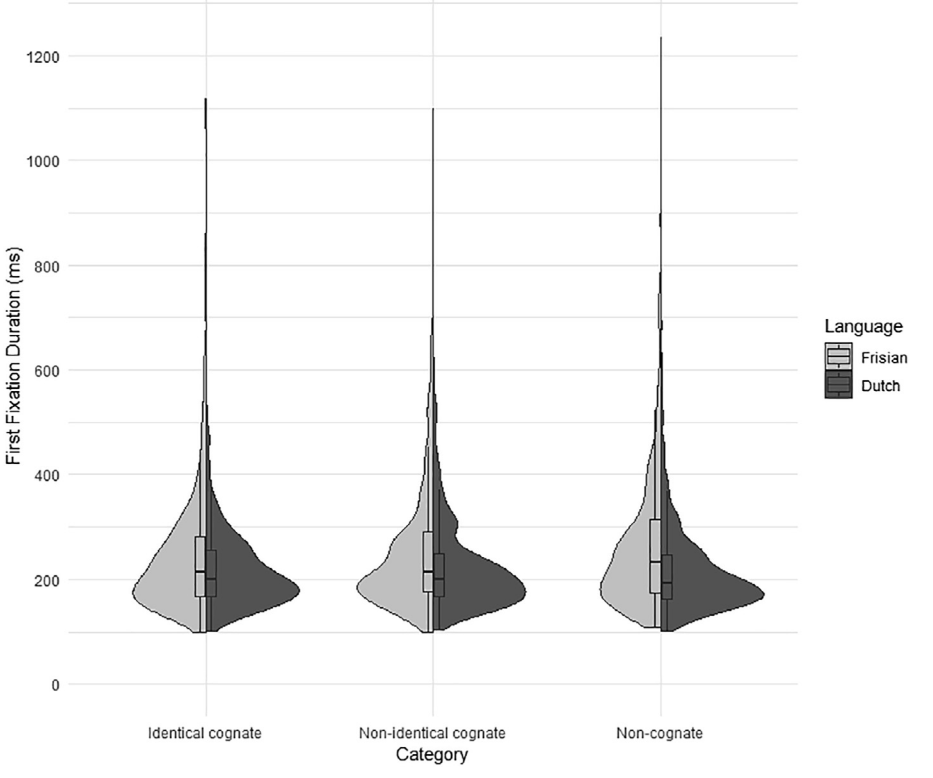

Fig. 1. Violin plots showing the distribution of the first fixation duration for each language (left sides: Frisian; right sides: Dutch) for each cognate category (identical cognates, non-identical cognates, and non-cognates). The plot outline shows the density of data points at different first fixation durations. The boxplot shows the interquartile range.

Table 8
Fixed effects of the generalized linear mixed-effects model for skipping with language (Dutch), category (identical), and version (A) as reference levels.

Variable	*β*	*SE*	χ^2	*p*
Skipping				
(Intercept)	−2.04 [−2.33, −1.76]	0.14	–	–
Language, Du + Fr	−0.64 [−0.96, −0.32]	0.16	16.51	.001
Category, idC + nidCnC	−0.17 [−0.36, 0.03]	0.10	2.29	.17
Category, nidC + nC	0.27 [−0.10, 0.64]	0.19	1.88	.21
Age	0.00 [−0.02, 0.02]	0.01	0.00	1.00
Version, A + B	−0.47 [−0.71, −0.22]	0.13	10.91	.001
Language, Du + Fr: Category, idC + nidCnC	−0.35 [−0.70, 0.02]	0.18	3.66	.07
Language, Du + Fr: Category, nidC + nC	0.07 [−0.56, 0.71]	0.33	0.03	.89

Note. Du, Dutch; Fr, Frisian; idC, identical cognates; nidC, non-identical cognates; nC, non-cognates.

There was a significant main effect of language (β = −0.64 [−0.96, −0.32], *SE* = 0.16, $\chi^2(1)$ = 16.51, *p* = .001), showing that there was more skipping in Dutch than in Frisian. There was, however, no main effect of category and no interaction between category and language.

Discussion

In the current study, we investigated whether cognate facilitation can be found in Frisian–Dutch bilingual children's sentence reading. The results showed a cognate facilitation effect in Frisian but not in Dutch. The effect in Frisian was non-gradual: reading times (FFD, GD, GPT, and TRT) for identical cognates were significantly faster than for non-identical cognates and non-cognates, but there was no significant difference between non-identical cognates and non-cognates. For skipping, we did not find a cognate facilitation effect either in Frisian or in Dutch.

These results are in line with previous studies on cognate facilitation in bilingual children's vocabulary acquisition (Bosma et al., 2019; Comesaña et al., 2012, 2019; Kelley & Kohnert, 2012; Malabonga et al., 2008; Méndez Pérez et al., 2010; Proctor & Mo, 2009; Schelletter, 2002; Tonzar et al., 2009; Valente et al., 2018), picture naming (Poarch & van Hell, 2012), lexical decision (Brenders et al., 2011; Sauval et al., 2017; Schröter & Schroeder, 2016; Valente et al., 2018), and translation recognition (Duñabeitia et al., 2016) as well as with previous research on cognate facilitation in bilingual adults' sentence reading (Bultena et al., 2014; Duyck et al., 2007; Van Assche et al., 2011, 2013). In addition, they support the observation that the degree of cross-language activation depends on children's (reading) proficiency in the non-target language (Brenders et al., 2011; Malabonga et al., 2008; Méndez Pérez et al., 2010). Furthermore, the observation that the cognate effect was non-gradual is in line with the results of Duyck et al. (2007), who also found that identical cognates were read faster in comparison with non-identical cognates and non-cognates (but see Bultena et al., 2014, and Van Assche et al., 2011, who found a gradual cognate facilitation effect).

The results of the current study show that bilingual children use their knowledge of their dominant reading language when reading in their non-dominant one. In the Frisian–Dutch bilingual context, all children first become literate in Dutch, meaning that even for children who grow up with Frisian as their home language, Dutch becomes the dominant reading language (Stichting Lezen, 2018). This was confirmed in the current study as children's reading fluency scores were significantly better for Dutch than for Frisian. A possible explanation, provided by the BIA+ model (Dijkstra & Van Heuven, 2002), is that the connections among phonological, semantic, and orthographic representations in children's Frisian lexical system are relatively weak in comparison with the representations in their Dutch lexical system. Therefore, the processing of orthographic information will be slower in Frisian than in Dutch, providing a longer time window for coactivation of the other language. As a result, cross-language activation will be stronger when reading in Frisian than when reading in Dutch.

The absence of a gradual effect could be explained in several ways. First, it could be that identical cognates are read faster because they can be found in texts in both languages and, therefore, are more frequent than non-identical cognates and non-cognates (Gollan, Forster, & Frost, 1997). However, if this is the case, we would also expect to find a cognate effect in Dutch, and we did not. Second, because children's orthographic representations are still developing, children might not be as sensitive to the partial *orthographic* overlap of non-identical cognates as they are to their partial *phonological* overlap (Bosma et al., 2019). Third, it could be that children have difficulty with some characteristics of the Frisian spelling system. Although Frisian orthography largely follows Dutch orthography, it has some diacritics and diphthongs that are not shared with Dutch (Visser & Weening, 2018). Because these features occur only in non-identical cognates and non-cognates, this could be a reason why both non-identical cognates and non-cognates were read more slowly than identical cognates. Further work is needed to explore these possibilities.

In contrast to previous research with bilingual adults in which cognate effects in low-constraint sentences were found in both early reading measures (FFD, GD, and skipping) and late ones (GPT and TRT) (Libben & Titone, 2009; Titone et al., 2011), the effects in our study were more pronounced in later stages of lexical processing. This shows that bilingual children are more inclined to refixate on Frisian words that are not identical to Dutch, suggesting that they need more time to process words that exist only in Frisian as compared with words that also exist in Dutch. We speculate that this might, in part, be the result of the large overlap between the Frisian and Dutch vocabularies. When reading a text with many identical cognates, an interconnected set of representations of items from both languages gets active in the brain, making it harder to decide whether an individual word is Frisian or Dutch. In other words, cross-language ambiguity may be solved more slowly in later stages of lexical processing when the linguistic context does not guide the reader to one language in particular. If this is indeed the case, the cognate effect may depend on the prevalence of cognates and possibly also on the number of interlingual homographs ("false friends") in the pair of languages under investigation. Future studies should further investigate this issue. This could be done by comparing cognate effects in closely related language pairs, such as Spanish and Catalan, with cognate effects in less closely related languages, such as English and Welsh, or by systematically manipulating the orthographic similarity of the words prior to cognate and non-cognate target words.

The current study has some limitations. It must be noted that all children were first tested in Frisian. The two languages were not counterbalanced across participants because it would have been difficult to match the two counterbalanced groups on all background variables (age, exposure, SES, non-verbal IQ, and receptive vocabulary). Due to this design, it could be that the observed differences between the Frisian and Dutch reading time measures were larger than they actually are. We do not think, however, that this could have influenced the cognate effect because this effect is a within-language comparison of different cognate categories. Furthermore, we were unable to examine whether age and reading fluency modulate the cognate facilitation effect because of the relatively low number of data points. Because Duñabeitia et al. (2016) have shown that less proficient readers rely more on cross-language orthographic overlap than more proficient readers, it could be that the younger children in our sample were more sensitive to cognates than the older children.

The findings of the current study have some practical implications for education. They clearly show that children's reading skills in Frisian are less developed than their reading skills in Dutch, a result that can be explained by the dominant position of Dutch in education. On the other hand, the findings also show that reading fluency in Dutch and reading fluency in Frisian are highly correlated, suggesting that reading is a transferable skill; children with strong reading skills in Dutch also tend to exhibit strong reading skills in Frisian. This lines up with previous research showing that, at least in part, learning to read requires general cognitive and linguistic abilities that transfer across languages (Jared et al., 2011). This suggests that more educational time for reading in Frisian would not necessarily harm literacy development in Dutch (see also Berens, Kovelman, & Petitto, 2013). In fact, it could strengthen bilingual children's cross-linguistic representations, which might also benefit reading skills in Dutch. Whether this is indeed the case is a topic for future research.

Taken together, the main finding of the current study is that Frisian–Dutch bilingual children show a non-gradual cognate facilitation effect in Frisian sentence reading but not in Dutch sentence reading. This suggests that bilingual children use their dominant reading language when reading in their non-dominant one but not vice versa.

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