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A longitudinal study on the gradual cognate facilitation effect in bilingual children's Frisian receptive vocabulary

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ABSTRACT

This longitudinal study investigated to what extent the acquisition of cognates among bilingual children depends on the degree of cross-language similarity and intensity of exposure to the tested language, and whether children's sensitivity to cognates with different degrees of cross-language similarity changes over time. For three consecutive years, 120 Frisian-Dutch bilingual children were tested on their Frisian receptive vocabulary. The sample was split into three groups that differed with respect to intensity of exposure to Frisian at home. In the receptive vocabulary task, cross-language similarity was systematically manipulated through four cognate categories, differing in their degree of overlap between Frisian and Dutch. The results showed a gradual cognate facilitation effect for children with a low intensity of exposure to Frisian. The higher the degree of cross-language similarity, the better their performance. This implies that the co-activation of the two languages depends on the degree of cross-language similarity. Over time, their performance improved the most on non-identical cognates with a cross-linguistic phonological regularity between Frisian and Dutch. This suggests that as they grow older, children with a low intensity of exposure to Frisian become better at recognizing regularities in the overlap of the Frisian and Dutch phonological systems.

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The gradual cognate facilitation effect

Over the last two decades it has become clear that the two vocabularies of bilingual children and adults are intertwined depending on similarities in form and meaning between individual words in the two languages. The co-activation of information in both linguistic systems of a bilingual is apparent when both a word's meaning and its form overlap between languages, as in the case of cognates (e.g. Dijkstra, Grainger, and Van Heuven 1999; Versloot and Hoekstra, *forthcoming*). Examples of cognate pairs are the English-German translations *apple-Apfel* and the English-Spanish translations *elephant-efefante*.

Part of the evidence for this co-activation comes from reaction time (RT) studies in the second language (L2) in which both bilingual adults (e.g. De Groot, Dannenburg, and Van Hell 1994; Lotto and De Groot 1998; Dijkstra, Grainger, and Van Heuven 1999; Rosselli et al. 2014) and bilingual children (e.g. Brenders, Van Hell, and Dijkstra 2011; Poarch and Van Hell 2012) respond faster and with

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fewer errors to cognate items in comparison to non-cognate items. The faster responses for cognates can be seen as evidence that the phonological representations have become active in both languages and that they influence each other (Dijkstra et al. 2010; Poarch and Van Hell 2012).

Some studies with bilingual adults have shown that the degree of this *cognate facilitation effect* depends on the similarity between the two words of a cognate pair. As far as we know, it has not been investigated yet if this works the same in bilingual children. In a lexical decision task with adults, RTs for orthographically identical cognates were faster than RTs for orthographically non-identical cognates, which were faster than RTs for non-cognates (Duyck et al. 2007; Dijkstra et al. 2010). Furthermore, Dijkstra et al. (2010) found that only within the set of orthographically identical cognates, phonological similarity resulted in an additional effect. Other studies have found a continuous cognate facilitation effect, based on Van Orden's (1987) orthographic overlap measure (Van Assche et al. 2009; Van Assche et al. 2011). In an eye-tracking reading study with bilingual adults with Dutch as their first language (L1) and English as their L2, Van Assche et al. (2011) found that the recognition of English words was facilitated by a higher degree of orthographic similarity to Dutch. In a similar type of experiment, Van Assche et al. (2009) found the same effect in the L1: the reading of Dutch words was facilitated by a higher degree of orthographic similarity to English.

The results of the studies described above show that for the co-activation of cognates, the cognate pair does not have to be identical. Partial similarity also results in a cognate facilitation effect, but to a lesser degree than complete similarity, showing that the effect is not binary, but gradual. Theoretically, this is an important finding, because it implies that the spreading of activation of words in the bilingual lexicon is a function of cross-language similarity between lexical representations. The graduality of the cognate facilitation effect demonstrates that a word in the input activates semantic, phonological and orthographic representations in both languages depending on the overlap with that particular word in the input. How fast cognates get activated in comparison to non-cognates depends on the degree of the semantic, phonological and orthographic overlap between the two words of a cognate pair.

Most previous research on the effect of cognates on bilingual vocabularies focused on bilingual adults, and it is still unknown if the degree of cross-language similarity also affects lexical acquisition in bilingual children. Moreover, little is known about the developmental trajectory of cognate effects. The aim of the present study was to fill this empirical gap by investigating a gradual cognate effect in Frisian-Dutch bilingual children. In the next section, previous research on cognate facilitation in child L2 learners is discussed.

Cognate facilitation in child L2 learners

Further evidence for the co-activation of the two lexicons comes from vocabulary tests with child L2 learners and children with a low intensity of exposure to the tested language. These children obtained higher accuracy scores on cognates than on non-cognates (Schelletter 2002; Malabonga et al. 2008; Kelley and Kohnert 2012). The explanation is that children with a low intensity of exposure to the tested language use their other, more developed, language to understand cognate items. For non-cognate items, their knowledge of the other language is not helpful, since these words do not show overlap in form across the two languages. The advantage for cognates over non-cognates was not found in the studies with bilingual children by Umbel and Oller (1994) and Umbel et al. (1992). However, these studies did not control for item difficulty. Not controlling for item difficulty could result in cognates being more difficult than non-cognates, because cognates tend to be biased towards more complex, less frequent vocabulary items (Méndez Pérez, Peña, and Bedore 2010; Kelley and Kohnert 2012; Stadthagen-González et al. 2013). Furthermore, differences between studies may be the result of variations in exposure, since not all studies report the children's amount of exposure to each language.

How intensity of exposure influences children's performance on cognates and non-cognates is shown by Dijkstra (2013) for Frisian-Dutch and Méndez Pérez, Peña, and Bedore (2010) for

Spanish-English bilingual children. Dijkstra (2013) tested 2.5- to four-year-old Frisian-Dutch bilingual children on a Frisian receptive vocabulary task. With respect to non-cognate items (defined as non-cognates and non-identical cognates), the children who spoke Frisian at home performed significantly better than the children who spoke Dutch at home. However, on cognate items (defined as identical cognates), the results showed no difference between the two groups. These results line up with the observation that children with a low intensity of exposure perform better on cognates than non-cognates, because children who speak Dutch at home can use their knowledge of Dutch to understand Frisian words that are cognates with Dutch, but they cannot use their Dutch to understand Frisian words that are non-cognates.

A similar result for non-cognate items was found by Méndez Pérez, Peña, and Bedore (2010), who tested the English receptive vocabulary skills of five- and six-year-old Spanish-English bilingual children. Children who were more exposed to English and children who were equally exposed to the two languages scored higher on non-cognate items than children who were more exposed to Spanish. In contrast, children who were more exposed to Spanish and children who were equally exposed to Spanish and English knew more Spanish-English cognates than children who were more exposed to English. This latter finding could be explained by the fact that Spanish-English cognates often belong to the higher registers in English, but to the lower registers in Spanish (Stadthagen-González et al. 2013). For example, the meaning of the English word 'floral' can be guessed when a child knows the Spanish word *flor* 'flower'. These register differences may explain why exposure affected the results for cognates in Spanish-English bilingual children, but not in Frisian-Dutch bilingual children.

A few studies investigated how exposure affects cognate facilitation in bilingual children, but it is virtually unknown to what extent the cognate facilitation effect is gradual, as in bilingual adults. To our knowledge, one child vocabulary study took into account different kinds of cognates, but the purpose of that study was not to investigate the graduality of the cognate effect and no statistical comparisons were made. Bosch and Ramon-Casas (2014) tested the expressive vocabulary of 18-month-old Catalan-Spanish bilingual children through parent report using a bilingual questionnaire with 152 lexical items. Items were identified as translation equivalents if the child produced them in both languages. Form-identical translation equivalents represented 28% of the children's total lexicon, whereas form-similar and form-dissimilar translation equivalents represented only 1% and 0.33%, respectively. These results suggest a non-gradual cognate advantage, with better scores for form-identical cognates in comparison to form-similar cognates and non-cognates, but no advantage for form-similar cognates in comparison to non-cognates.

Since the children in this study were very young it could be that their sensitivity to form-similar cognates had not been fully developed yet. As age has been shown to be positively related to cognate performance (Malabonga et al. 2008; Kelley and Kohnert 2012), the cognate effect may work differently in children than in adults. On average, the 8- to 13-year-old Spanish-speaking English language learners in Kelley and Kohnert's (2012) study scored higher on cognate items than on non-cognate items in a receptive vocabulary task, but not all children demonstrated this advantage. Age was found to be a significant predictor of cognate performance, accounting for 26% of the variance. In a longitudinal study, Malabonga et al. (2008) measured cognate awareness in 9- and 10-year-old Spanish-speaking English language learners using the Cognate Awareness Test (CAT). In this English multiple-choice task, children have to choose the right definition of a cognate item out of four possible definitions. The results showed that in the second year, children's performance on English vocabulary had improved and that this was mainly due to an improved performance on cognates.

Kelley and Kohnert (2012) argue that growing cognate sensitivity could be the result of growing metalinguistic skills. Since metalinguistic skills have been shown to be positively related to age (Edwards and Kirkpatrick 1999; Corthals 2010), the relationship between age and cognate sensitivity could be explained by developing metalinguistic skills. In particular with respect to the graduality of the cognate effect, vocabulary growth may also play a role, as smaller vocabularies will provide fewer

possibilities for the spreading of activation of words in the bilingual lexicon. This raises the question whether children are sensitive to different degrees of cross-language similarity and if so, how this sensitivity develops over time.

The studies described above show that children with a low intensity of exposure to the tested language use their knowledge of the other language to understand the meaning of cognate items. This provides further evidence for the co-activation of the two languages of a bilingual, next to the fact that in RT studies, bilinguals respond faster and with fewer errors to cognate items in comparison to non-cognate items. In RT studies with bilingual adults, the degree of the cognate facilitation effect has been shown to depend on the similarity between the two words of a cognate pair. This implies that the spreading of activation of words in the bilingual lexicon is a function of cross-language similarity between lexical representations. However, if the degree of cross-language similarity affects lexical acquisition in bilingual children is still unknown. Therefore, the present longitudinal study explored the graduality of the cognate facilitation effect in bilingual children's lexical acquisition. It was examined whether a gradual cognate effect could be found in the Frisian receptive vocabulary scores of Frisian-Dutch bilingual children with a low intensity of exposure to Frisian and if children's sensitivity to different degrees of cross-language similarity changed as they grew older. Before we describe the present study, we will give an overview of the Frisian-Dutch bilingual context.

Frisian and Dutch

Fryslân is a bilingual province in the Netherlands, where both the national majority language Dutch and the regional minority language Frisian have official status. Outside of the Netherlands, the regional language is known as West Frisian to avoid confusion with the Frisian languages spoken in Germany. In this article, whenever the term Frisian is used, it refers to the West Frisian language. Frisian is predominantly used in informal domains and is much stronger in rural than in urban areas (Breuker 2001). In a recent survey, 55.3% of the population of Fryslân reported to speak Frisian as a mother tongue. About 45.6% of the population speaks Frisian with their partner and 47.5% speaks it with their children. About 66.6% of the inhabitants reported to speak the language well, but only 14.5% can write it well (Provinsje 2015).

Dutch-Frisian bilingual schools have been legally allowed since 1955 (Mercator 2007) and more and more primary schools are becoming trilingual (Dutch, Frisian and English) in the *Trijetalige skoalle* ('trilingual school') project (Van Ruijven and Ytsma 2008). However, Dutch is still the dominant language in education. At the end of primary school, all pupils take the national test on the Dutch language as developed by the Dutch national test institute Cito. However, for Frisian as a subject, the educational goals depend on the pupils' linguistic backgrounds and competences (Mercator 2011). As a result, most children who speak Frisian at home become balanced bilinguals, whereas children who speak Dutch at home do not (Ytsma 1995).

Both Dutch and Frisian are West Germanic languages. Traditionally, three Frisian dialects are distinguished: *Klaaifrysk* (clay Frisian) in the west of the province, *Wâldfrysk* (forest Frisian) in the east and *Súdwesthoek*s (southwest quarter) in the southwest (Hof 1933; Tiersma 1999). These dialects are mutually intelligible, differing slightly on the lexical and phonological level. Historically, the Frisian dialects are more closely related to English than to Dutch. However, over time English and Frisian have diverged, while Dutch and Frisian have converged (Gooskens and Heeringa 2004). As a result, the Frisian and Dutch languages that are spoken nowadays share a large part of their vocabularies and cognates occur at all levels of acquisition, from easy to difficult words.

It has been argued that bilingual speakers of phonologically overlapping languages make use of cross-linguistic phonological regularities (Sjölin 1976; Rys 2009; Taeldeman 2013). Two examples of a phonological regularity across Frisian and Dutch are Frisian *-ân* [ɔ:n] and Dutch *-and* [ant], and Frisian *-âld* [ɔ:t] and Dutch *-oud* [aut], as in the cognate pairs below:

Frisian hân [hɑ:n] lân [lɑ:n] strân [strɑ:n]	Dutch hand [hɑnt] land [lant] strand [strant]	'hand' 'country' 'beach'
Frisian kâld [kɑ:t] wâld [wɑ:t] sâlt [sɑ:t]	Dutch koud [kɑut] woud [wɑut] zout [sɑut]	'cold' 'forest' 'salt'

In contrast, the following words are cognates, but without a cross-linguistic phonological regularity:

trijeling [trɛiəlŋ] skjirre [skjlrə]	drieling [dri:lŋ] schaar [sxa:r]	'triple' 'scissors'
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Once a speaker of Dutch is aware of the cross-linguistic phonological regularities, it becomes easier to understand the Frisian language. In light of the cognate facilitation effect, one would expect that cognates with a phonological regularity with only a few phonemes are easier to understand for bilinguals with a low intensity of exposure to Frisian than cognates without or with a more complex phonological regularity. This was taken into account in the present study.

Research questions and predictions for the present study

The current longitudinal study examined if the degree of cross-language similarity affects lexical acquisition in bilingual children. More specifically, it was investigated whether Frisian-Dutch bilingual children with various levels of exposure to Frisian at home (low middle, high) showed a gradual cognate facilitation effect on a Frisian receptive vocabulary task and if so, whether children's sensitivity to different degrees of cross-language similarity changed over time. We were especially interested in the children with a *low* intensity of exposure to Frisian, as opposed to children with a *middle* or a *high* intensity of exposure, since children with a low intensity of exposure to Frisian will use their knowledge of Dutch. The research questions are formulated in (1) and (2).

- (1) Do Frisian-Dutch bilingual children with a low intensity of exposure to Frisian, as opposed to bilingual children with a middle or a high intensity of exposure to Frisian, perform better on cognate items than on non-cognate items, and if so, is the effect determined by the degree of cross-language similarity of the cognate pair?
- (2) Does sensitivity to different degrees of cross-language similarity develop as the children grow older?

With respect to the first research question, Frisian-Dutch bilingual children with a low intensity of exposure to Frisian were expected to perform better on cognate items in comparison to non-cognate items, since they could use their knowledge of Dutch to understand Frisian words that are cognates to Dutch, but they could not use their Dutch to understand non-cognates. In line with previous evidence from RT studies with adults showing that the cognate facilitation effect is gradual, the performance of this group of children was expected to be affected by the degree of similarity between the two words of a cognate pair. Performance on identical cognates was expected to be better than performance on non-identical cognates, and performance on non-identical cognates was expected to be better than performance on non-cognates. Within the group of non-identical cognates, performance on cognates with a cross-linguistic phonological regularity with only one, two or three phonemes was expected to be better than performance on cognates without or with a more complex phonological regularity.

In contrast, the performance of Frisian-Dutch bilingual children with a high intensity of exposure to Frisian was not expected to be influenced by the degree of cross-language similarity, since these children do not need to rely on their knowledge of Dutch. The expectations for the children with a middle intensity of exposure to Frisian were less clear. Their performance could be similar to the high exposure group, but it could also be more similar to the low exposure group.

With respect to the second research question, it was expected that in the low exposure group, the relative performance on different types of cognates would shift over time as a result of children's developing sensitivity to cross-language similarity. We hypothesized that children's performance would improve the most on those cognates where more developed metalinguistic skills could help them recognize patterns in the similarity to Dutch, that is, non-identical cognates with a cross-linguistic phonological regularity. It was expected that over the course of time, performance on this type of cognates would become more similar to performance on identical cognates and more different from performance on non-identical cognates without a phonological regularity.

Method

Participants

A total of 120 children took part in the present longitudinal study. They were five and six years old at time 1, six and seven years old at time 2 and seven and eight years old at time 3. The sample was split into three exposure groups using visual binning (SPSS 23). The cut-off points of these groups were 50% and 80% of exposure to Frisian at home. The intensity of exposure to Frisian at home ranged from 0% to 50% in the low exposure group ($n=42$, 20 girls, 22 boys), from 50% to 80% in the middle exposure group ($n=40$, 23 girls, 17 boys), and from 80% to 100% in the high exposure group ($n=38$, 18 girls, 20 boys). Table 1 provides an overview of the participants' age in months in the first year of the study, nonverbal IQ scores, socio-economic status (SES) and intensity of exposure to Frisian at home. The three groups did not differ with respect to age (time 1), $F(2, 117)=0.090$, $p=.914$, and nonverbal IQ, $F(2, 117)=0.475$, $p=.623$, but they did differ with respect to SES, $F(2, 117)=3.521$, $p=.033$, $\eta_p^2=.057$, and, as expected, intensity of exposure to Frisian, $F(2, 117)=330.930$, $p<.001$, $\eta_p^2=.850$. Therefore, SES was added as a control variable in the analyses.

Nonverbal IQ was estimated with the subsets Matrices and Recognition of the *Wechsler Nonverbal Scale of Ability* (Wechsler and Naglieri 2006). SES scores and information about intensity of exposure to Frisian were obtained through a parental questionnaire, based on the *Questionnaire for Parents of Bilingual Children* (COST Action IS0804 2011; Tuller 2015). SES was calculated as the mean educational level of the father and the mother of the child, which was measured on a 1–9 scale, ranging from no education (1) to university degree (9). Intensity of exposure to Frisian was measured as the mean percentage of Frisian input the child received from his mother, father, siblings and other adults who looked after the child at least once per week. For each of these people the question had to be answered how often (s)he spoke Frisian to the child: 'never' (0%), 'seldom' (25%), 'sometimes' (50%), 'usually' (75%) and 'always' (100%). Exposure to Dutch was 100% minus exposure to Frisian.

Table 1. Mean and standard deviation characteristics of the children with a low, middle and high intensity of exposure to Frisian.

	Low exposure group ($n=42$)	Middle exposure group ($n=40$)	High exposure group ($n=38$)	Max score	$F(2, 117)$	p	η_p^2
Age	69.67 (6.89)	69.90 (6.02)	70.29 (6.83)		0.090	.914	.002
IQ	106.02 (16.07)	108.13 (14.30)	104.97 (13.09)	144	0.475	.623	.008
SES	7.30 (1.25)	6.74 (1.36)	6.61 (1.23)	9	3.521	.033	.057
% FR	28.03 (17.10)	70.63 (7.03)	92.40 (6.09)	100	330.930	<.001	.850

Note: Age = age in months at time 1; SES = socio-economic status; FR = intensity of exposure to Frisian at home.

Participants were recruited by contacting primary schools in the countryside of the province of Fryslân. A total of 14 schools participated. The schools distributed consent forms and folders providing information about the experiment among the parents of the children. Only children whose parents had signed the consent form were tested.

Measurement instruments

For the purpose of this study, we developed a Frisian receptive vocabulary test, which was based on the Peabody Picture Vocabulary Test-III-NL (PPVT-III-NL; Schlichting 2005), which is the Dutch version of the PPVT-III (Dunn and Dunn 1997). We adapted the PPVT in such a way that it was suitable for the measurement of cognate sensitivity, next to the measurement of general vocabulary knowledge. The adaptation process will be explained below. Permission was obtained from the publisher to use this Frisian adaptation for research purposes.

The PPVT measures the understanding of spoken words. It is a standardized multiple-choice test for people between 2;3 and 90 years of age, and it is taken individually. The PPVT contains 204 items in total divided over 17 sets, each containing 12 items. The sets are ordered by difficulty. The test starts with the easier, more frequent items in the first set after which the degree of complexity gradually increases towards the higher sets. Each item is represented on a sheet with four pictures from which the participant has to choose one in order to demonstrate understanding of the stimulus word. For the present study, the first 12 sets, that is, 144 items, were translated and adapted. These sets suffice to test the vocabulary knowledge of the children in our age range. We did not use basal and ceiling criteria to ensure that all children completed all items. The adaptation was done in the following way.

As in Dijkstra's (2013) Frisian adaptation of the Dutch PPVT, words with dialectal variation were removed, since the aural stimulus should be equally recognizable for speakers of the three main Frisian dialects. Furthermore, items were removed that differed with respect to register across Frisian and Dutch. Some of these items were removed, because they are commonly used in Dutch, but not in Frisian. There were also some Frisian translations with another Dutch translation equivalent next to the original Dutch word. If the alternative Dutch translation equivalent belonged to a more everyday register, the Frisian translation was removed.

Special attention was paid to cognates, which are the focus of the present study. The first 144 words of the PPVT-III-NL contain 69 Dutch words that are identical in form and meaning to their Frisian translation equivalents (47%), and 13 Dutch-Frisian non-cognates (9%), reflecting the fact that Frisian and Dutch are closely related languages with many similarities in vocabulary. The proportion of cognates increases with the degree of difficulty of the sets, as a result of the presence of internationalisms in the higher sets, which are cognates by definition (see also Méndez Pérez, Peña, and Bedore 2010; Kelley and Kohnert 2012; Stadthagen-González et al. 2013, who observe something similar for Spanish-English).

In order to systematically investigate to what extent the acquisition of cognates among bilingual children depends on the degree of cross-language similarity, this factor was operationalized by four different cognate categories to which the words in the Frisian receptive vocabulary task were assigned. These four categories are a proxy for what we assume to be a continuum of cognateness, that is, a continuum of similarity in form: identical cognates (category 1), for example, Frisian *poes* and Dutch *poes* 'cat', non-cognates (category 4), for example, Frisian *bern* and Dutch *kind* 'child', and two categories in between those two with non-identical cognates, that is, words that share some, but not all phonological properties with their Dutch translation equivalents. Category 2 consists of cognates with a cross-linguistic phonological regularity of one, two or three phonemes. This makes the phonological overlap between the translation equivalents systematic. In this category there is one phonological regularity that deserves some more explanation, as it includes vowel breaking. Vowel breaking is the change of a monophthong into a diphthong or triphthong (see for vowel breaking in Frisian, Tiersma 1999, 17–20; Van der Meer 1985). The broken vowel that is included in category

Table 2. Cross-linguistic phonological regularities category 2.

Frisian phoneme(s)	Frisian example	Dutch phoneme(s)	Dutch example	English translation
[u:]	klûs [klu:s]	[œy]	kluis [klœys]	safe
[u]	pûlfrucht [pulfroxt]	[ø:]	peulvrucht [pø:lvroxt]	legume
	ûnder [undər]	[o]	onder [ondər]	under
[sk]	skiep [skɛp]	[sx]	schep [sxɛp]	shovel
[ɔ:n]	hân [hɑ:n]	[ant]	hand [hant]	hand
[ɔ:t]	kâld [kɑ:t]	[aut]	koud [kaut]	cold
[a:]	daam [da:m]	[ɑ]	dam [dam]	dam
[ər]	ferstelber [fərstɛlbər]	[a:r]	verstelbaar [vərstɛlba:R]	adjustable
[l.ə]	easten [l.əstən]	[o:]	oosten [o:stən]	east
[i]	dolfyn [dolfin]	[ei]	dolfijn [dolfein]	dolphin
[(k)jə]	timmerje [tɪmərjə]	[ən]	timmeren [tɪmərən]	to hammer
[jɛrjə]	dosearje [do:sjɛrjə]	[l.ərən]	doceren [do:sl.ərən]	to teach
[tsjə]	kadootsje [kado:tsjə]	[tjə]	cadeautje [kado:tjə]	(little) present
[kə]	groepke [gru:pəkə]	[jə]	groepje [xrupjə]	(small) group
	boeid [bu:jt]	[xə]	geboeid [xəbu:jt]	chained

2 is [jɛ] in the suffix *-earje* [jɛrjə], for example, Frisian *dosearje* [do:sjɛrjə] and Dutch *doceren* [do:sl.ərən]. An overview of all cross-linguistic phonological regularities of category 2 and some examples can be found in Table 2. The phonological overlap of the cognates in category 3 is less systematic, which makes these cognates harder to convert than the cognates in category 2. This category comprises three types of cognates: (1) cognates without a cross-linguistic phonological regularity, (2) cognates with a cross-linguistic phonological regularity involving four phonemes and (3) cognates with a cross-linguistic phonological regularity involving vowel breaking with the diphthong [wa], such as Frisian *woarst* [wast] versus Dutch *worst* [uorst] 'sausage'. The words with [wa] vowel breaking were assigned to this category for two reasons: (1) this Frisian diphthong mostly corresponds to Dutch /o:/ and /o/, which have more regular correspondences in Frisian, namely Dutch /o:/ ~ Frisian /o.ə/ (which would fit category 2) and Dutch /o/ ~ Frisian /o/ or /ɔ/ (which would fit category 1); (2) the lexical distribution of the correspondence of the broken diphthong [wa] with Dutch /o:/ or /o/ is unpredictable. An overview of the cross-linguistic phonological regularities of category 3 is given in Table 3.

The cognate categories were evenly distributed over the task. Thus, there were three items of each category in each set. In order to obtain this even distribution, the Frisian translation of the Dutch PPVT was minimally adapted, adding words and illustrations as needed. In most sets, this resulted in the removal of overrepresented identical cognates and the addition of underrepresented non-cognates. The final version of the Frisian task differed from the Dutch PPVT in the following way. One word was replaced by an alternative word that suited the target picture, 6 words were replaced by an alternative word that suited the target picture of another item, 18 words were replaced by an alternative word that suited 1 of the 3 distractor pictures and 12 words were replaced by another word that suited a distractor picture of another item. In those cases, the distractor picture became the target picture. If this was not possible, new words were added using new pictures. This procedure was applied to 22 words. In the Frisian adaptation of the PPVT-NL-III a total amount of 59 words were replaced by another word. In order to maintain the degree of difficulty, frequency was taken into account in the selection of new words.

It was ensured that there were no word frequency differences between the four categories. Van Heuven et al. (2014) proposed a standardized measure of word frequency, the Zipf scale, which uses logarithmic (10-log) instead of absolute frequencies, because frequency is perceived logarithmically.

Table 3. Cross-linguistic phonological regularities category 3.

Frisian phoneme(s)	Frisian example	Dutch phoneme(s)	Dutch example	English translation
[juwə]	skriuwe [skrjuwə]	[ɛivən]	schrijven [sxrɛivən]	to write
[wa]	woarst [wast]	[o]	worst [uorst]	sausage
	boarch [bwarx]	[ø]	burcht [børxt]	castle

For all the words in the Frisian receptive vocabulary test, logarithmic Zipf scores were calculated based on frequencies per million words from two Dutch corpora: CELEX (Center for Lexical Information 1993), a corpus of written Dutch that was also used for the PPVT-III-NL, and Corpus Gesproken Nederlands (CGN; Nederlandse Taalunie 2004), a corpus of spoken Dutch. Dutch frequencies were used instead of Frisian frequencies, since the only available Frisian corpus is a non-lemmatized database of standardized written language, which is not representative of the language that is spoken by speakers of Frisian (Breuker 1993). As Frisian and Dutch are closely related languages, the Dutch frequencies were thought to be representative of the Frisian frequencies. Words that belong to different registers in Frisian and Dutch could present a potential problem. However, those items were removed from the task, as described above.

The four cognate categories each had about the same frequencies in CELEX and CGN. There was a high correlation between the CELEX and the CGN Zipf frequencies, $r = .754$, $p < .001$. A One-Way ANOVA with category as the independent variable and CELEX Zipf frequencies as the dependent variable showed that there was no significant effect of CELEX Zipf frequency, $F(3, 140) = 0.24$, $p = .872$, and that the CELEX frequencies of category 1 ($M = 3.82$, $SD = 0.92$), category 2 ($M = 3.85$, $SD = 1.39$), category 3 ($M = 4.04$, $SD = 1.22$) and category 4 ($M = 3.96$, $SD = 1.37$) could be assumed to be the same. A One-Way ANOVA with category as the independent variable and CGN Zipf frequencies as the dependent variable showed that there was also no significant effect of CGN Zipf frequency, $F(3, 140) = 0.40$, $p = .755$, and that the CGN frequencies of category 1 ($M = 3.71$, $SD = 0.66$), category 2 ($M = 3.79$, $SD = 0.86$), category 3 ($M = 3.93$, $SD = 1.05$) and category 4 ($M = 3.85$, $SD = 0.99$) could be assumed to be the same. Cronbach's alpha, as calculated at time 1, showed that the internal consistency of the items in the test was sufficient, $\alpha = .762$.

Procedure

All participants were tested at their school during school hours, except for one child in the first year, four children in the second year and five children in the third year, who were tested at home. The Frisian receptive vocabulary test, which took about 10 minutes, was administered as the first test in a larger battery of language and cognitive tasks that were divided over two sessions of one hour. Each child was tested individually by a bilingual speaker of Frisian and Dutch. Afterwards the children were rewarded with a gel pen.

Results

Descriptive statistics of the three groups' performance on the four cognate categories are shown in Table 4.

Table 4. Children's performance on the four cognate categories.

Year	Category	Low exposure group ($n = 42$)	Middle exposure group ($n = 40$)	High exposure group ($n = 38$)	Maximum score
1	1	23.62 (2.42)	22.70 (2.28)	23.16 (2.54)	36
	2	21.74 (3.04)	22.70 (2.76)	22.92 (2.73)	36
	3	21.17 (3.82)	24.05 (2.52)	23.47 (1.91)	36
	4	19.33 (4.53)	23.13 (2.54)	24.16 (2.77)	36
2	1	25.36 (2.20)	25.33 (1.89)	24.82 (2.40)	36
	2	23.95 (2.91)	24.65 (2.52)	24.68 (2.26)	36
	3	23.29 (2.95)	25.10 (2.47)	25.24 (2.28)	36
	4	20.98 (3.54)	25.42 (2.33)	25.42 (2.79)	36
3	1	26.50 (2.51)	26.30 (1.79)	25.84 (2.30)	36
	2	26.60 (3.05)	26.30 (2.26)	25.74 (2.86)	36
	3	24.62 (2.48)	26.70 (2.19)	26.76 (2.17)	36
	4	22.86 (2.92)	25.30 (2.32)	26.34 (2.31)	36

First research question

The first research question of this study was whether Frisian-Dutch bilingual children with a low intensity of exposure to Frisian, as opposed to bilingual children with a middle or a high intensity of exposure to Frisian, perform better on cognate items than on non-cognate items, and if so, whether the effect is determined by degree of cognateness. In the analyses, SES was added as a control variable, since the groups differed significantly in this respect. A mixed-design ANCOVA with cognate category as within-subject variable, exposure group as between-subject variable and SES as covariate revealed a significant difference between the three exposure groups, $F(2, 116) = 12.611, p < .001, \eta_p^2 = .179$. LSD *post hoc* tests revealed that the children in the low exposure group performed significantly worse than the children in the middle, $p < .001$, and high exposure groups, $p < .001$, but there was no significant difference between the middle and high exposure groups, $p = .789$. Mauchly's Test for Sphericity was significant for category, $p < .001$. Therefore, sphericity was not assumed and, with respect to the within-subject variables, the Greenhouse-Geisser test was applied. There was a significant interaction effect of category and group, $F(5.194, 301.265) = 21.727, p < .001, \eta_p^2 = .273$, and no main effect of category.

LSD *post hoc* tests were performed to interpret the interaction effect. There was a significant effect of category within the low exposure group, $F(3, 114) = 37.126, p < .001, \eta_p^2 = .494$, and within the middle exposure group, $F(3, 114) = 2.759, p = .045, \eta_p^2 = .068$, but not within the high exposure group, $F(3, 114) = 1.994, p = .119, \eta_p^2 = .050$. Within the low exposure group, the effect was gradual. Performance on category 1 was significantly better than on category 2, $p < .001$, performance on category 2 was significantly better than on category 3, $p = .001$, and performance on category 3 was significantly better than on category 4, $p < .001$. Within the middle exposure group, the effect was not gradual. Performance on category 3 was significantly better than on category 2, $p = .022$, and category 4, $p = .021$, and there was no significant difference between category 1 and category 2, $p = .502$.

Second research question

The second research question of this study was whether sensitivity to different degrees of cross-language similarity changes over time. Since only the low exposure group showed a gradual cognate facilitation effect, the other two exposure groups were not taken into account in the following analysis. A repeated measures ANOVA with cognate category and time as within-subject variables showed a significant effect of time, $F(2, 82) = 87.627, p < .001, \eta_p^2 = .681$, and a significant interaction between time and category, $F(6, 246) = 2.637, p = .017, \eta_p^2 = .060$. Based on the effect sizes, we can conclude that performance on category 2 improved the most, $F(2, 40) = 58.994, p < .001, \eta_p^2 = .747$, followed by category 3, $F(2, 40) = 30.673, p < .001, \eta_p^2 = .605$, category 4, $F(2, 40) = 20.638, p < .001, \eta_p^2 = .508$, and category 1, $F(2, 40) = 19.061, p < .001, \eta_p^2 = .488$.

LSD *post hoc* tests were performed to interpret the interaction effect (Figure 1). At time 1, performance on category 1 ($M = 23.62, SD = 2.42$) was significantly better than performance on category 2 ($M = 21.74, SD = 3.04$), $p < .001$, and performance on category 3 ($M = 21.17, SD = 3.82$) was significantly better than on category 4 ($M = 19.33, SD = 4.53$), $p = .002$. However, there was no significant difference between performance on category 2 and 3.

At time 2, performance on category 1 ($M = 25.36, SD = 2.20$) was significantly better than performance on category 2 ($M = 23.95, SD = 2.91$), $p = .008$, and performance on category 3 ($M = 23.29, SD = 2.95$) was significantly better than on category 4 ($M = 20.98, SD = 3.54$), $p < .001$. However, there was still no significant difference between performance on category 2 and 3.

At time 3, performance on category 2 ($M = 26.60, SD = 3.05$) was significantly better than on category 3 ($M = 24.62, SD = 2.48$), $p < .001$, and performance on category 3 was significantly better than on category 4 ($M = 22.86, SD = 2.92$), $p = .001, p < .001$, but there was no significant difference between performance on category 1 ($M = 26.50, SD = 2.51$) and 2.

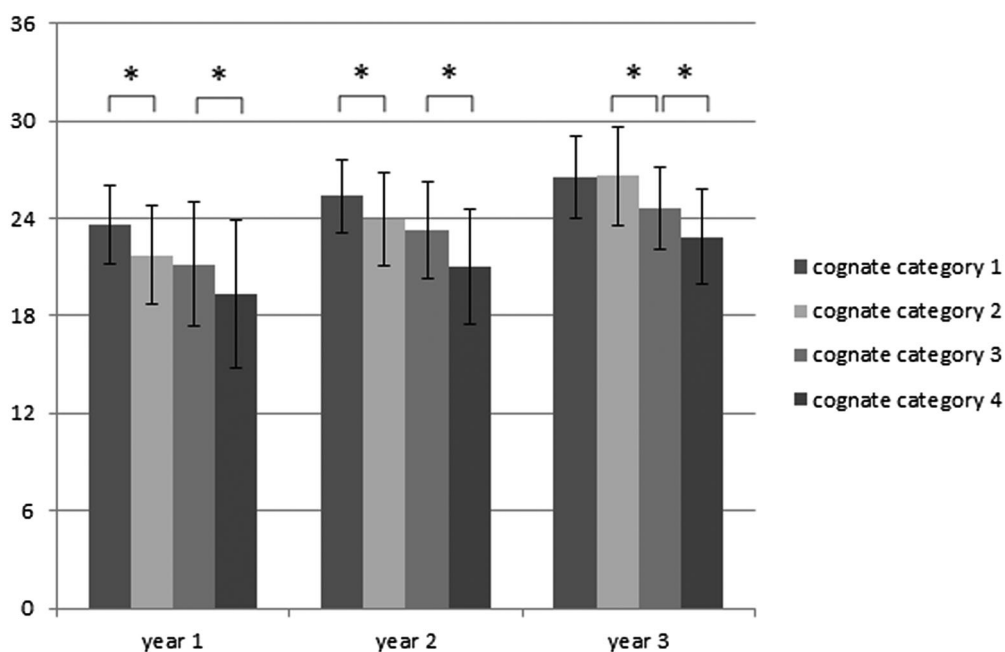


Figure 1. Effect of time and cognate category within the low exposure group.

Note: Only significance notations between adjacent categories are shown. The differences between category 1–3, 2–4 and 1–4 were significant at each time of testing.

Discussion

In this study we examined the role of the degree of cross-language similarity in bilingual children's lexical acquisition. It was investigated whether the cognate facilitation effect that has previously been found in vocabulary studies with other groups of child L2 learners and children with a low intensity of exposure to the tested language (Schelletter 2002; Malabonga et al. 2008; Kelley and Kohnert 2012), could also be observed among Frisian-Dutch bilingual children. In addition, it was examined whether the effect is gradual, that is, whether the size of the effect depends on the degree of similarity between the two words of a cognate pair, which has been shown to be the case in adult RT studies (Duyck et al. 2007; Dijkstra et al. 2010). The graduality of the cognate effect implies that the spreading of activation of words in the bilingual lexicon is a function of cross-language similarity between lexical representations. Since it has been shown that age is positively associated with the cognate effect (Kelley and Kohnert 2012), this graduality may work differently in children than in adults. Therefore, the question was raised whether children are sensitive to different degrees of cross-language similarity and whether their sensitivity to different degrees of cross-language similarity changes over time (age 5 and 6 at time 1, age 6 and 7 at time 2, age 7 and 8 at time 3). As previous studies have shown that the cognate effect is affected by intensity of exposure (Méndez Pérez, Peña, and Bedore 2010; Dijkstra 2013), a group of Frisian-Dutch bilingual children with a low intensity of exposure to Frisian was compared to groups of Frisian-Dutch bilingual children with a middle or a high intensity of exposure to Frisian.

These three groups were tested with a Frisian receptive vocabulary test in which the degree of similarity between Dutch and Frisian word pairs was systematically manipulated through four different cognate categories. Category 1 was defined as identical cognates, that is, words that have the same pronunciation in Dutch and Frisian. Category 2 consisted of non-identical cognates with a simple cross-linguistic phonological regularity of maximally three phonemes. Category 3 comprised non-identical cognates without a cross-linguistic phonological regularity and cognates with a cross-

linguistic phonological regularity with four phonemes or with the broken vowel [wa]. Category 4 consisted of non-cognate items. To control for item difficulty (Méndez Pérez, Peña, and Bedore 2010; Kelley and Kohnert 2012; Stadthagen-González et al. 2013), the four cognate categories in the Frisian receptive vocabulary test were equally represented across the different sets of the test and did not differ with respect to word frequency.

There was a significant effect of category in the groups of children with a low and a middle intensity of exposure to Frisian, but no effect of category in the group of children with a high intensity of exposure to Frisian. For the low exposure group, the effect size was very large, whereas for the middle exposure group, the effect size was small to medium. In the low exposure group, there was a gradual cognate facilitation effect: performance on category 1 was better than on category 2, performance on category 2 was better than on category 3, and performance on category 3 was better than on category 4. In the middle exposure group, the effect was not gradual: performance on category 3 was better than on categories 2 and 4, and there were no significant difference between categories 1 and 2.

A further examination of the effect across time showed that, within the low exposure group, children's sensitivity to different degrees of cross-language similarity changed as they grew older. Their performance on category 2 improved the most, which led to a shift in their relative performance on the four different cognate categories. At time 1 and 2, performance on category 1 was better than on category 2, and performance on category 3 was better than on category 4, but there was no significant difference between performance on categories 2 and 3. In contrast, at time 3, performance on category 2 was better than on category 3, and performance on category 3 was better than on category 4, but there was no difference between performance on categories 1 and 2.

These results confirm, first, that there is a cognate facilitation effect in Frisian-Dutch bilingual children and replicates in this respect previous studies with vocabulary tests that showed that children with a low intensity of exposure to the tested language perform better on cognates than on non-cognates (Schelleter 2002; Malabonga et al. 2008; Kelley and Kohnert 2012). Second, the effect is gradual, which is in line with previous RT studies with bilingual adults (Duyck et al. 2007; Dijkstra et al. 2010). Third, the (gradual) cognate facilitation effect is affected by exposure, confirming previous research with bilingual children (Méndez Pérez, Peña, and Bedore 2010; Dijkstra 2013). Fourth, the effect changes over time. In the low exposure group, performance on category 2 improved the most, resulting in a shift in relative performance on the four cognate categories. As the children got older, their performance on category 2 became more similar to their performance on category 1 and more different from their performance on category 3.

A possible explanation for the cognate effect in a group of children with a low intensity exposure to Frisian is that these children use their knowledge of Dutch to understand the cognate items in the Frisian receptive vocabulary task. As non-cognate items do not show overlap between Dutch and Frisian, their knowledge of Dutch is not applicable for this category, causing significantly better performance on the cognate items compared to the non-cognate items. The observation that the cognate facilitation effect is gradual confirms previous evidence (Duyck et al. 2007; Dijkstra et al. 2010) that the cognate facilitation effect depends on the similarity between the two words of a cognate pair. The current study extends this finding to bilingual children and to offline tasks measuring receptive vocabulary. This finding implies that when children hear a word in the input, semantic and phonological representations of both languages get activated, depending on the cross-language overlap of the cognate pair. The more overlap between a word in the child's weaker language and a word in the child's more developed language, the higher the chances that the cognate word in the more developed language gets activated, helping the child to understand the meaning of the word in the weaker language. The finding that the graduality of the cognate facilitation effect changes over time shows that children's sensitivity to items with a lower degree of cross-language similarity improves when they get older. As children's performance improved the most on cognates with a cross-linguistic phonological regularity, this is probably the result of developing metalinguistic

skills. The results imply that over the course of time, children with a low intensity of exposure to Frisian discover the regularities in the overlap of the Frisian and Dutch phonological systems.

To our knowledge, this is the first study that shows a gradual cognate facilitation effect in children and it is also the first that shows that over time, children's relative performance on different types of cognates changes. On a practical note, our findings imply that the ratio of different types of cognates in a receptive vocabulary task has implications for the performance of children with a low intensity of exposure to the tested language. The more items with a high degree of cross-language similarity in a test, the better the performance of these children. In line with Stadthagen-González et al. (2013), we suggest that future work on cognates should differentiate different types of cognates. More research on the graduality of the cognate facilitation effect could shed light on how cognates are represented in the bilingual mental lexicon, and more longitudinal research with bilingual children could provide insight into the role of development. It is important to note that the four cognate categories in this study are only an attempt to classify different types of cognates on a continuous cognate scale. It is a limitation of the present study that the scale is not continuous and that the defined categories are only an approximation of this scale. Moreover, next to the degree of cross-language similarity and the cross-linguistic phonological regularities, other factors that have an impact on the recognizability of cognate items were not taken into account. For instance, Gooskens, Van Bezooijen, and Van Heuven (2015) pointed to the role of neighbourhood density and Nespors, Peña, and Mehler (2003) argued that the recognition of words depends more on consonants than on vowels. Next to these item-related factors there are also some child-related factors that may be worth further exploration. Kelley and Kohnert (2012) already pointed to the influence of age and IQ on cognate performance in general, but it would be interesting to investigate their influence on different types of cognates as well. Another issue that deserves future attention is the influence of literacy on the cognate facilitation effect. As most children in the current study had not yet received reading instruction at time 1, knowledge of written language was thought to play a minimal role. However, as the children had received reading instruction at time 3, there is a possibility that instruction in written Dutch is a factor that influences the cognate facilitation effect somewhat by equalizing the groups.

Taken together, the main finding of this study is that within bilingual children, the activation of semantic and phonological representations of both languages depends on the cross-language overlap of a cognate pair, thus implying a gradual cognate facilitation effect. The overlap between Frisian and Dutch words helps children with a low intensity of exposure to Frisian to understand Frisian words that are cognates to Dutch. The more similar these words are to Dutch, the easier they are to understand for this group of children. Over time, these children improve their sensitivity to items with a lower degree of cross-language similarity, especially those items with a cross-linguistic phonological regularity.

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