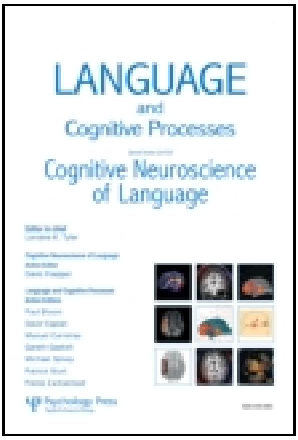

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Lexical competition in a non-Roman, syllabic script: An inhibitory neighbour priming effect in Japanese Katakana

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Lexical competition in a non-Roman, syllabic script: An inhibitory neighbour priming effect in Japanese Katakana

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Previous masked priming studies have reported that lexical decision latencies are slower when a word target is primed by a higher-frequency neighbour (e.g., *blue*-*BLUR*) than when it is primed by an unrelated word of equivalent frequency (e.g., *care*-*BLUR*). These results suggest that lexical competition plays an important role in visual word identification in Indo-European languages such as English, French, and Dutch, consistent with activation-based accounts of lexical processing. The present research, using Japanese Katakana script, a syllabic script, demonstrates that lexical decision latencies were slower when targets were primed by word neighbour primes but not when targets were primed by nonword neighbour primes. Both results have clear parallels with previous research using Indo-European languages and therefore suggest that lexical competition is also an important component of word recognition processes in languages that do not employ the Roman alphabet.

Keywords: Masked priming; Neighbour priming; Word recognition; Orthographic neighbours.

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The idea that visual word identification is driven by a competitive activation process has a long history, and over the past three decades a considerable number of studies have provided support for this view. The competition principle, itself, is incorporated into most activation-based models; for example, the interactive-activation model (McClelland & Rumelhart, 1981), the multiple read-out model (Grainger & Jacobs, 1996), and more recent variants (e.g., Davis, 2003), in that all of these models assume that there is competition among the activated lexical representations during reading. That is, these models assume that the lexical representation of a word and the lexical representations of orthographically similar words (the word's "neighbours") are activated during the identification process, and that, once activated they compete with one another through a process involving mutual inhibition. The word being read is assumed to be identified only after the competition has been resolved.

In empirical tests of these models, the definition of an orthographic neighbour adopted by Coltheart, Davelaar, Jonasson, and Besner (1977) has typically been used; namely, those words that are created by changing one letter of a target word while maintaining letter positions (e.g., *case*, *ease*, and *vast* are all orthographic neighbours of *vase*). Recent studies, however, suggest that this definition is too narrow and that the lexical units of other visually similar words are also relevant to the process (e.g., words sharing the initial syllable, words that are of different lengths, words that differ at two letter positions; Carrieras & Perea, 2002; De Moor & Brysbaert, 2000; Janack, Pastizzo, & Feldman, 2004, respectively). Regardless of the exact definition of an orthographic neighbour, in all the models, the relative frequencies of a word and its neighbours are important in determining how quickly the lexical competition is resolved. Words with higher-frequency neighbours are presumed to experience much more competition/inhibition because higher-frequency neighbours are powerful competitors. Words without higher-frequency neighbours, on the other hand, experience much less competition/inhibition and, as a consequence, their identification is largely unaffected by the presence of lower-frequency neighbours.

MASKED PRIMING USING NEIGHBOUR PRIMES

Results from the masked priming paradigm (Forster & Davis, 1984) provide some of the most convincing evidence for the lexical competition process embodied in activation-based models. In this task, a trial consists of the presentation of a forward mask ("XXXX"), a prime word (typically presented for less than 60 ms, and therefore not consciously available to participants), and a target word. Participants respond to the target, in most experiments by making a speeded lexical decision (see Kinoshita & Lupker, 2003, for a review).

Segui and Grainger (1990) were the first to use the masked priming paradigm to look for evidence of the lexical competition predicted by activation-based models. They reasoned that presenting a word prime that was a neighbour of the target would preactivate the prime's lexical unit, significantly increasing its ability to compete with the target. A high-frequency neighbour prime and low-frequency target pair (e.g., *blue*-*BLUR*) would be most likely to produce interference relative to when the prime and target are unrelated (e.g., *care*-*BLUR*), whereas a low-frequency neighbour prime and high-frequency target pair (e.g., *blur*-*BLUE*) would not be expected to produce much interference because the prime would not be a strong competitor even when preactivated. Consistent with these predictions, Segui and Grainger found that lexical decision latencies were significantly slower when low-frequency word targets were primed by high-frequency neighbours than when they were primed by unrelated words, whereas the latencies to high-frequency word targets primed by low-frequency neighbours were not different than the latencies to those targets primed by unrelated words.[1]

Segui and Grainger's (1990) experiments used French stimuli, but inhibitory neighbour priming effects have also been reported in other languages, including Dutch (e.g., Brysbaert, Lange, & Van Wijnendaele, 2000; De Moor & Brysbaert, 2000; Drews & Zwitserlood, 1995), Spanish (Carreiras & Duñabeitia, 2009; Duñabeitia, Perea, & Carreiras, 2009), and English (e.g., Davis & Lupker, 2006; Nakayama, Sears, & Lupker, 2008). Note, however, that all of the studies that have used the masked neighbour priming paradigm to study inhibitory neighbour priming have used Indo-European languages, languages using the Roman alphabet. To some extent, this situation stems from the fact that the original activation-based model, the interactive-activation model (McClelland & Rumelhart, 1981), was based on the English lexicon and, hence, incorporated letter units for Roman letters. Nonetheless, if the concepts of lexical units and lexical competition, concepts which comprise the core architectural assumptions of activation-based models, are not language dependent, then inhibitory neighbour priming effects should also exist in languages not based on Roman letters. The present research used the masked priming paradigm to look for evidence of an inhibitory neighbour priming effect in Katakana, a Japanese nonalphabetic script.

[1] Although predicted by activation-based models, inhibitory priming effects are difficult for parallel distributed processing (PDP) models to accommodate because these models do not incorporate discrete lexical representations (e.g., Seidenberg & McClelland, 1989; Plaut, McClelland, Seidenberg, & Patterson, 1996). That is, because, in PDP models, there are no abstract units corresponding to words, there are no lexical representations for a prime to preactivate and, hence, there would be no competition among activated lexical representations. Thus, there is no obvious mechanism by which a word prime could produce delayed responding to an orthographically similar target. Indeed, the most straightforward prediction of PDP models is that neighbour primes will produce facilitory priming by activating sets of units that the prime and target share.

Katakana is normally used to transcribe words that originated in foreign languages, although it is also used for animal and plant names. Katakana characters do not carry any meaning in themselves; each character represents a phoneme or a combination of phonemes, termed a *mora*. Except for vowels (ア/a/, イ/i/, ウ/u/, エ/e/, and オ/o/) and some exceptions (e.g., ン/N/, キャ/kja/, and ビョ/bjo/, etc.), most Katakana characters consist of one consonant and one vowel (e.g., カ/ka/, キ/ki/, マ/ma/, and ミ/mi/). In essence, this fact means that not only does Katakana not use Roman letters, but it is also a syllabic rather than an alphabetic script.

One piece of evidence that is consistent with the idea that there are similarities in the lexical processing of Katakana and English words was reported recently by Perea and Pérez (2009). Using a masked priming paradigm with a 50 ms prime duration, Perea and Pérez showed that Katakana transposed-character nonword primes significantly facilitated target identification (a.ri.me.ka–a.me.ri.ka, アリメカ–アメリカ) in comparison to control primes in which the transposed characters were replaced (a.ka.ho.ka–a.me.ri.ka, アカホカ–アメリカ). This result is consistent with the results of English studies on transposed-letter priming (e.g., the transposed prime *jugde* primes the target *judge* in comparison to the replacement-letter prime *judpe*; for a review, see Perea & Lupker, 2003). The implication is that, despite their different orthographies and despite the fact that the characters in the two languages represent different linguistic components (i.e., letters vs. morae), similar lexical processes may underlie the visual recognition of Katakana words and English words.

What should also be noted, however, is that a study by Zhou, Marslen-Wilson, Taft, and Shu (1999) suggests that neighbour inhibition in masked priming tasks is not universal. Specifically, in Chinese, neighbour primes (i.e., two-character compound Chinese word primes that share one character with their targets) facilitate, rather than inhibit, target processing. The purpose of our experiment was to determine whether Katakana, which, as noted, is a syllabary, will behave like alphabetic languages (e.g., English) or like ideographic languages (e.g., Chinese). Using the masked priming paradigm, low- and high-frequency Katakana targets were primed by lower- and higher-frequency neighbours of the target in Experiment 1A. An inhibitory neighbour priming effect from higher-frequency neighbour primes would suggest that lexical competition also plays a role in the processing of Katakana words. In Experiment 1B, the same set of Katakana targets were primed by nonword neighbour primes and by orthographically unrelated nonword primes. Based on the results from previous masked priming studies using stimuli with many neighbours (Forster, 1987; Forster, Davis, Schoknecht, & Carter, 1987; Perea & Rosa, 2000), we expected that any effect of nonword neighbours would be either null or slightly facilitory.

EXPERIMENT 1

Method

Participants

The participants were 117 undergraduate students from Waseda University (Tokyo, Japan). Fifty-eight of the participants were shown targets primed by words (Experiment 1A) and 59 were shown targets primed by nonwords (Experiment 1B). All participants were native speakers of Japanese.

Stimuli

The stimuli for Experiment 1A were Katakana words of two to four characters in length. All of these words had many orthographic neighbours (with a mean of 28.8 neighbours; the number of orthographic neighbours was calculated using the NTT database; Amano & Kondo, 2000). We defined orthographic neighbours in the standard fashion (i.e., Coltheart et al., 1977), as words that are created by changing one Katakana character while holding other characters constant. For example, レベル (re.be.ru, level) and ノベル (no.be.ru, novel) were considered Katakana orthographic neighbours, as were センター (se.n.ta.a, centre) and セーター (se.e.ta.a, sweater). Note that because Katakana is a syllabary, the phonologies of orthographic neighbours typically differ by two or more phonemes.

Forty pairs of orthographic neighbours were selected as the critical stimuli (the descriptive statistics for these stimuli are shown in Table 1). For each pair, each neighbour served as either a prime or a target depending on the condition the pair was assigned to. The two stimuli in a pair had the same number of characters. One member of the neighbour pair was much higher in normative frequency ($M = 61.7$) than the other ($M = 1.1$).[2] The neighbour pairs were divided into four groups that had similar mean word frequencies and word lengths. Two of the groups were used to create the orthographically related conditions, one involving the high-frequency member of the pair as the prime with the low-frequency member of the pair as the target. For the other group, the prime–target pairings were reversed. Unrelated prime–target pairs were created in the other two groups by re-pairing primes and targets, such that the unrelated primes did not share any characters with their targets. Unrelated primes had the same number of characters as their targets. Thus, there were four prime–target conditions: (1) high-frequency neighbour prime–low-frequency target (e.g., センター–セーター); (2)

[2] Normative frequencies were based on the NTT database (Amano & Kondo, 2000), which provides frequency counts based on a corpus of approximately 300 million words. The normative frequencies reported here are per million words, created by dividing the reported frequencies by 300.

TABLE 1
Mean normative frequency (per million occurrences) and number of neighbours of stimuli used in Experiment 1A

Stimulus characteristic	*Neighbour prime*	*Unrelated prime*	*Target*
	High-frequency prime–low-frequency target		
	センター (se.n.ta.a, centre)	トラック (to.ra.k.ku, truck)	セーター (se.e.ta.a, sweater)
Normative frequency	61.7 (43.9)	61.7 (43.9)	1.1 (1.2)
Number of neighbours	28.4 (20.3)	28.4 (20.3)	29.1 (23.0)
	Low-frequency prime–high-frequency target		
	セーター (se.e.ta.a, sweater)	トラップ (to.ra.p.pu, trap)	センター (se.n.ta.a, centre)
Normative frequency	1.1 (1.2)	1.1 (1.2)	61.7 (43.9)
Number of neighbours	29.1 (23.0)	29.1 (23.0)	28.4 (20.3)
	High-frequency prime–nonword target		
	モデル (mo.de.ru, model)	ラジオ (ra.ji.o, radio)	カデル (ka.de.ru)
Normative frequency	25.2 (2.9)	25.2 (2.9)	–
Number of neighbours	25.3 (19.5)	25.3 (19.5)	20.3 (17.1)
	Low-frequency prime–nonword target		
	オーダー (o.o.da.a, order)	アルペン (a.ru.pe.n, alpine)	イーダー (i.i.da.a)
Normative frequency	0.8 (0.1)	0.8 (0.1)	–
Number of neighbours	27.3 (23.9)	27.3 (23.9)	23.8 (23.2)

Note: Standard deviations in parenthesis.

high-frequency unrelated prime–low-frequency target (e.g., トラック–セーター); (3) low-frequency neighbour prime–high-frequency target (e.g., セーター–センター); and (4) low-frequency unrelated prime–high-frequency target (e.g., トラップ–センター). For each neighbour pair, only one member of the pair was presented to a participant. This was accomplished by creating four counterbalancing lists, with the assignment of groups to conditions counterbalanced across participants.

Forty nonword targets of two to four characters in length and with many neighbours ($M = 22.1$) were created for the lexical decision task. Each nonword was paired with an orthographic neighbour with a large neighbourhood ($M = 26.3$). Twenty nonwords were paired with high-frequency neighbours ($M = 25.2$) and the other 20 were paired with low-frequency neighbours ($M = 0.8$). To create the priming conditions for the nonwords, the 20 high-frequency neighbour prime–nonword target pairs were divided into two groups (of size 10) of similar word frequencies and neighbourhood size, and the 20 low-frequency neighbour prime–nonword target pairs were divided into two groups (of size 10) in a similar fashion. Unrelated prime–nonword target pairs were created by re-pairing the primes and targets such that the unrelated primes did not share any characters with their targets. Unrelated primes had the same character lengths as their targets. There were two counterbalancing lists for nonword targets. (The word stimuli used in Experiment 1A are listed in the Appendix; the nonword stimuli are available from the authors upon request.)

For Experiment 1B, Katakana targets were primed by nonword neighbours or by unrelated nonwords. The same prime–target pairs used in Experiment 1A were presented, with the exception of four pairs that were replaced because of high error rates in Experiment 1A (greater than 60% for the prime or the target); these pairs were replaced with pairs with similar lexical characteristics.[3] The descriptive statistics for the stimuli used in Experiment 1B are shown in Table 2. Nonword neighbour primes differed from the targets at one character position, and had the same character lengths and a similar number of neighbours as their targets ($M = 25.1$). The neighbour pairs were divided into four groups that had similar mean word frequencies and word lengths. Two of the groups were used to create the orthographically related conditions (one involving the high-frequency member of the pair as the target and the other involving the

TABLE 2
Mean normative frequency (per million occurrences) and number of neighbours of stimuli used in Experiment 1B

Stimulus characteristic	*Neighbour prime*	*Unrelated prime*	*Target*
	Nonword prime–low-frequency target		
	セルター	トラッコ	セーター
	(se.ru.ta.a)	(to.ra.k.ko)	(se.e.ta.a, sweater)
Normative frequency	–	–	1.3 (1.2)
Number of neighbours	25.1 (19.8)	25.1 (19.8)	29.5 (23.5)
	Nonword prime–high-frequency target		
	セルター	トラッコ	センター
	(se.ru.ta.a)	(to.ra.k.ko)	(se.n.ta.a, centre)
Normative frequency	–	–	60.4 (44.6)
Number of neighbours	25.1 (19.8)	25.1 (19.8)	28.7 (20.1)
	Nonword prime–nonword target		
	リデル	ラーオ	カデル
	(ri.de.ru)	(ra.a.o)	(ka.de.ru)
Normative frequency	–	–	–
Number of neighbours	23.3 (19.8)	23.3 (19.8)	22.1 (20.2)

Note: Standard deviations in parenthesis.

[3] The replaced pairs were テロ - ベロ, ガス - トス, ガット - マット, and スポーツ - スポーク. These pairs were replaced by テロ - ソロ, ガス－キス, セット - マット, and ブランド - ブレンド.

low-frequency member of the pair as the target; e.g., for the neighbour pair セーター, se.e.ta.a, sweater and センター, se.n.ta.a, centre, either セーター or センター was presented to a single participant, but not both). Unrelated prime–target pairs were created in the other two groups by re-pairing primes and targets, such that the unrelated primes did not share any characters with their targets. Unrelated primes had the same number of characters as their targets. Thus, there were four prime–target conditions: (1) nonword neighbour prime–low-frequency target (e.g., セルター – セーター); (2) nonword unrelated prime–low-frequency target (e.g., トラッコ – セーター); (3) nonword neighbour prime–high-frequency target (e.g., セルター – センター); and (4) nonword unrelated prime–high-frequency target (e.g., トラッコ – センター). There were four counterbalancing lists, and the assignment of groups to conditions was counterbalanced across participants.

The nonword targets used in Experiment 1B were the same as those used in Experiment 1A. Forty nonword neighbours were created to prime these targets. The nonword neighbour primes had the same character lengths and a similar number of neighbours ($M = 23.3$) as the targets. Because all the nonword targets were primed by a nonword (either by a neighbour or an unrelated nonword), there was no manipulation of prime frequency. To create the priming conditions for the nonwords, the 40 neighbour pairs were divided into two groups (of size 20) of similar neighbourhood sizes. Unrelated prime–nonword target pairs were created by re-pairing primes and targets, such that the unrelated primes did not share any characters with their targets. Unrelated primes had the same character lengths as their targets. There were two counterbalancing lists for nonword targets. (The word stimuli used in Experiment 1B are listed in the Appendix; the nonword stimuli are available from the authors upon request.)

Apparatus and procedure

Each participant was tested individually. The experiment was programmed using the DMDX software package (Forster & Forster, 2003) and stimuli were presented on 21-inch video display driven by a Pentium-class microcomputer. Primes were presented in a smaller font than targets in order to minimise the physical overlap between primes and targets (in most other languages minimising physical overlap is accomplished by using different letter cases for the primes and targets, e.g., a lowercase prime and an uppercase target; however, a case manipulation is not possible with Katakana script).

Each trial began with the presentation of a fixation marker (+) in the centre of the display for 500 ms. A visual mask (####) then appeared in the centre of the display for 500 ms, followed by the prime. The prime was presented for 50 ms and was immediately replaced by the target. Participants were instructed to quickly and accurately indicate whether the target was a word or not by pressing one of two buttons (labelled *word* and *nonword*) on a response box placed in front of them. The existence of the prime was not mentioned. The target remained on the screen until a response was made. Each participant completed 16 practice trials prior to the experimental trials to familiarise themselves with the lexical decision task (these practice stimuli were not used in the experimental trials). The order in which the experimental trials were presented was randomised separately for each participant.

Results

Table 3 shows the mean response latencies and errors for targets primed by words (Experiment 1A). Table 4 shows the mean response latencies and errors for targets primed by nonwords (Experiment 1B).

Targets primed by words (Experiment 1A). Data from participants with overall error rates greater than 20% were excluded from all analyses ($n = 2$).[4]

TABLE 3
Experiment 1A: mean lexical decision latencies (response times, in ms) and percentage errors for word and nonword targets primed by words

	Word targets			
Prime type	*Prime–target frequency*			
	High–low		*Low–high*	
	RT	*Errors*	*RT*	*Errors*
Neighbour	624	24.1	558	5.3
Unrelated	607	16.6	548	3.4
Difference	−17	−7.5	−10	−1.9
	Nonword targets			
	Prime frequency			
	High		*Low*	
	RT	*Errors*	*RT*	*Errors*
Neighbour	622	5.4	626	6.8
Unrelated	630	5.0	638	6.8
Difference	8	−0.4	12	0

[4] The four prime–target pairs listed in Footnote 3 were excluded from all analyses due to high error rates (greater than 60% for the prime or the target).

TABLE 4
Experiment 1B: mean lexical decision latencies (RT, in ms) and percentage errors for word and nonword targets primed by nonwords

Prime type	*Word targets*			
	Target frequency			
	Low		*High*	
	RT	*Errors*	*RT*	*Errors*
Neighbour	594	15.7	547	5.5
Unrelated	600	13.6	547	3.2
Difference	6	−2.1	0	−2.3
	Nonword targets			
	RT		*Errors*	
Neighbour	614		5.4	
Unrelated	631		5.8	
Difference	17		0.4	

Response latencies less than 300 ms or greater than 1,400 ms were treated as outliers and were excluded from all analyses (0.2% of responses latencies for word targets and 0.4% for nonword targets). For the word data, response latencies of correct responses and error rates were submitted to a 2 (prime type: neighbour prime and unrelated prime) × 2 (target frequency: high and low frequency) factorial analysis of variance (ANOVA). In the subject analysis (F_s), both factors were within-subject factors; in the item analysis (F_i), prime type was a within-item factor and target frequency was a between-item factor.

The effect of prime type was significant in the analysis of response latencies, $F_s(1, 55) = 4.25$, $p < .05$, $MSE = 2{,}330.3$, partial $\eta^2 = 0.07$; $F_i(1, 70) = 5.93$, $p < .05$, $MSE = 1{,}630.6$, partial $\eta^2 = 0.08$, and also in the analysis of errors, $F_s(1, 55) = 10.52$, $p < .01$, $MSE = 118.0$, partial $\eta^2 = 0.16$; $F_i(1, 70) = 10.30$, $p < .01$, $MSE = 79.3$, partial $\eta^2 = 0.13$. Responses were slower and more error prone when targets were primed by orthographic neighbours (591 ms, 14.7%) than when they were primed by unrelated words (578 ms, 10.0%). There was a significant effect of target frequency in the response latency analysis, $F_s(1, 55) = 94.82$, $p < .001$, $MSE = 2{,}284.5$, partial $\eta^2 = 0.63$; $F_i(1, 70) = 38.29$, $p < .001$, $MSE = 5{,}289.9$, partial $\eta^2 = 0.35$, as well as in the error analysis, $F_s(1, 55) = 144.35$, $p < .001$, $MSE = 99.9$, partial $\eta^2 = 0.72$; $F_i(1, 70) = 26.42$, $p < .001$, $MSE = 343.3$, partial $\eta^2 = 0.27$.

Responses to high-frequency targets were faster than responses to low-frequency targets (553 ms vs. 616 ms), and fewer errors were made to high-frequency targets (4.4% vs. 20.4%). There was no interaction between prime type and target frequency in the analysis of response latencies (both Fs < 1), with similar inhibition effects from high-frequency neighbour primes (17 ms) and low-frequency neighbour primes (10 ms). For error rates the interaction between prime type and target frequency was significant in the item analysis, $F_i(1, 70) = 4.02$, $p < .05$, $MSE = 79.3$, partial $\eta^2 = 0.05$, although not in the subject analysis, $F_s(1, 55) = 2.79$, $p = .10$, $MSE = 159.2$, partial $\eta^2 = 0.05$. Follow-up analyses of the item means revealed that the 7.5% inhibition effect from high-frequency neighbour primes was statistically significant, $t_i(35) = 2.88$, $p < .01$, $SEM = 2.7$, whereas the 1.9% effect from low-frequency neighbour primes was not, $t_i(35) = 1.43$, $p > .10$, $SEM = 1.3$.[5]

Targets primed by nonwords (Experiment 1B). To be consistent with Experiment 1A, data from participants with overall error rates greater than 20% were excluded from all analyses ($n = 3$) and response latencies less than 300 ms or greater than 1,400 ms were treated as outliers (0.1% of responses latencies for word targets and 0.4% for nonword targets).[6]

For word targets, the data were analysed in the same manner as in Experiment 1A. Unlike the situation in Experiment 1A, the effect of prime type was not significant in the response latency analysis (both Fs < 1). As can be seen in Table 4, responses to words primed by nonword neighbours were not any slower than responses to words primed by unrelated words. In the error analysis the effect of prime type was marginally significant, $F_s(1, 55) = 3.31$, $p = .07$, $MSE = 82.7$, partial $\eta^2 = 0.06$; $F_i(1, 76) = 2.94$, $p = .09$, partial $\eta^2 = 0.04$, with slightly higher error rates for targets primed by neighbours (10.6%) than for targets primed by unrelated primes (8.4%). There was a significant effect of target frequency in the response latency analysis, $F_s(1, 55) = 87.04$, $p < .001$, $MSE = 1{,}585.1$, partial $\eta^2 = 0.61$; $F_i(1, 76) = 23.87$, $p < .001$, $MSE = 5{,}824.3$, partial $\eta^2 = 0.24$, as well as in the error analysis, $F_s(1, 55) = 70.64$, $p < .001$, $MSE = 84.2$, partial $\eta^2 = 0.56$; $F_i(1, 76) = 19.48$, $p < .001$, $MSE = 219.6$,

[5] For the nonword targets primed by words (see Table 3), the ANOVA factors were prime type (neighbour prime and unrelated prime) and prime frequency (high-frequency prime and low-frequency prime). Both factors were within-subject factors in the subject analysis; in the item analysis prime type was a within-item factor and prime frequency was a between-item factor. The only significant result was in the analysis of response latencies, with a significant effect of prime type in the subject analysis, $F_s(1, 55) = 4.54$, $p < .05$, $MSE = 1{,}275.6$, partial $\eta^2 = 0.08$; $F_i(1, 38) = 3.72$, $p = .06$, $MSE = 616.4$, partial $\eta^2 = 0.09$. Targets primed by neighbours were responded to faster (624 ms) than targets primed by unrelated words (634 ms).

[6] Two low-frequency targets (エイド and カーゴ) had high error rates (greater than 60%). These targets were excluded from all analyses to be consistent with the treatment of targets with high error rates in Experiment 1A.

partial $\eta^2 = 0.20$. Responses to high-frequency targets were faster than responses to low-frequency targets (547 ms vs. 597 ms) and fewer errors were made to high-frequency targets (4.4% vs. 14.7%). There was no interaction between prime type and target frequency for either response latencies (both Fs < 1) or for errors (both Fs < 1).[7]

Combined analyses of Experiments 1A and 1B. The word data from the two experiments were analysed together to confirm that the priming effects differed as a function of prime type (word or nonword), given the different pattern of results from word primes (an inhibitory priming effect) and nonword primes (a null priming effect).[8] In the response latency analysis, the two-way interaction between prime lexicality (word prime and nonword prime) and prime type (neighbour prime and unrelated prime) was significant, $F_s(1, 110) = 4.24$, $p < .05$, $MSE = 2{,}100.5$, partial $\eta^2 = 0.04$; $F_i(1, 68) = 3.95$, $p = .05$, $MSE = 1{,}114.4$, partial $\eta^2 = 0.06$. This interaction confirmed that word and nonword primes produced different priming effects, namely, a 14 ms inhibitory priming effect for word neighbour primes and a 3 ms facilitory priming effect for nonword neighbour primes (averaged across high- and low-frequency targets). For error rates, the interaction between prime lexicality and prime type was not significant (all ps $> .10$).

Discussion

The contrast between the results of Experiments 1A and 1B suggests that the inhibitory neighbour priming effect reported in Indo-European languages also exists in Japanese Katakana. Lexical decision latencies to word targets were significantly slower and more error prone when targets were primed by orthographic neighbours than when they were primed by unrelated words, whereas this was not true when the same targets were primed by orthographic neighbours that were nonwords. This outcome makes sense if the inhibitory neighbour priming effect from word primes is due to lexical competition. Because nonword primes do not have lexical representations, they have a very limited ability to produce lexical competition/inhibition. What should also be noted is that the null priming effect from nonword primes is not unusual. In previous masked priming studies in English, when nonword neighbours prime

[7] For nonword targets (see Table 4), the data were analysed with single factor ANOVAs with two levels (prime type: neighbour vs. unrelated). The effect of prime type was significant in the response latency analysis, $F_s(1, 55) = 12.98$, $p < .001$, $MSE = 668.1$, partial $\eta^2 = 0.19$; $F_i(1, 39) = 8.72$, $p < .01$, $MSE = 763.9$, partial $\eta^2 = 0.18$. Targets were rejected as nonwords significantly faster when a nonword neighbour preceded them (614 ms) than when an unrelated nonword did (631 ms). In the error analysis the effect of prime type was not significant (both Fs < 1).

[8] The analyses were based on the items that were analysed both in Experiments 1A and 1B (34 low-frequency items and 36 high-frequency items).

targets there is typically a facilitory priming effect when the words have few neighbours (e.g., Davis & Lupker, 2006; Forster, 1987; Forster et al., 1987; Perea & Rosa, 2000) and a null effect or a slight inhibition effect when the words have many neighbours (e.g., Forster, 1987; Forster et al., 1987; Perea & Rosa, 2000). Because the Katakana targets we used all had many neighbours ($M = 29.1$), the null priming effect observed was therefore not unexpected.

One other result of note was that responses to targets were inhibited by neighbour primes regardless of relative prime–target frequency. This outcome is consistent with recent studies that have used English stimuli with many neighbours (Davis & Lupker, 2006; Nakayama et al., 2008) and Spanish stimuli with many neighbours (Carreiras & Duñabeitia, 2009). Nakayama et al. found that the inhibition effect interacts with neighbourhood size and the prime–target frequency relationship—when words have few neighbours, there is inhibition from higher-frequency neighbour primes but not from lower-frequency neighbour primes, whereas when words have many neighbours there is inhibition from both higher- and lower-frequency neighbour primes.

In Experiment 2 we tested for an inhibitory neighbour priming effect in Katakana using a new set of targets and primes. Whereas prime lexicality was manipulated between subjects in Experiment 1, in Experiment 2 prime lexicality was manipulated within subjects, producing a more stringent test of the impact of prime lexicality on neighbour priming (see Davis & Lupker, 2006). Because low-frequency targets produced the largest inhibition effect in Experiment 1A and the most evidence of facilitation in Experiment 1B, in Experiment 2 we used only low-frequency targets.

EXPERIMENT 2

Participants

The participants were 36 undergraduate students from Waseda University (Tokyo, Japan), none of whom participated in Experiment 1. All participants were native speakers of Japanese.

Stimuli

The descriptive statistics for these stimuli are shown in Table 5. The stimuli were Katakana words of three to five characters in length. The average number of neighbours for these stimuli was 6.7 (Amano & Kondo, 2000). Sixty low-frequency Katakana words ($M = 1.6$ occurrences per million) were selected as targets. Each target (e.g., サーカス, sa.a.ka.su, circus) was primed by either a high-frequency word neighbour ($M = 40.3$ occurrences per million; e.g., サービス, sa.a.bi.su, service) or a nonword orthographic neighbour (e.g., サーロス, sa.a.ro.su). The targets had the same number of characters as their

TABLE 5
Mean normative frequency (per million occurrences) and number of neighbours of stimuli used in Experiment 2

	Word		*Nonword*		
Stimulus characteristic	*Neighbour prime*	*Unrelated prime*	*Neighbour prime*	*Unrelated prime*	*Target*
	Word and nonword prime–word target				
	サービス (sa.a.bi.su, service)	イメージ (i.me.e.ji, image)	サーロス (sa.a.ro.su)	ルメージ (ru.me.e.ji)	サーカス (sa.a.ka.su, circus)
Normative frequency	40.3 (37.2)	40.3 (37.2)	–	–	1.6 (1.7)
Number of neighbours	6.7 (3.8)	6.7 (3.8)	6.5 (3.4)	6.5 (3.4)	6.7 (3.8)
	Word and nonword prime–nonword target				
	パターン (pa.ta.a.n, pattern)	チャンス (cha.n.su, chance)	マターン (ma.ta.a.n)	チャンホ (cha.n.ho)	シターン (shi.ta.a.n)
Normative frequency	35.0 (46.8)	35.0 (46.8)	–	–	–
Number of neighbours	4.6 (4.4)	4.6 (4.4)	4.8 (4.5)	4.8 (4.5)	5.2 (4.4)

primes. As was done in Experiment 1, unrelated prime–target pairs were created by re-pairing the neighbour pairs. Unrelated primes and targets did not have an overlapping character at the same character position. There were four prime–target conditions: (1) high-frequency neighbour prime–low-frequency target (e.g., サービス–サーカス); (2) high-frequency unrelated prime–low-frequency target (e.g., イメージ–サーカス); (3) nonword neighbour prime–low-frequency target (e.g., サーロス–サーカス); and (4) nonword unrelated prime–low-frequency target (e.g., ルメージ–サーカス). For each target, only one type of prime was presented to a participant. Thus, there were four counterbalancing lists, with 15 items per condition. The assignment of groups to conditions was counterbalanced across participants.

Sixty nonword targets of three to six characters in length were created. The mean number of neighbours for the nonwords was 5.2. Each nonword (e.g., シターン) was paired with either a word neighbour ($M = 35.0$ occurrences per million, e.g., パターン) or a nonword neighbour (e.g., マターン). Unrelated prime–nonword target pairs were created by repairing the neighbour pairs. There were four counterbalancing lists for nonword targets. (The word stimuli are listed in the Appendix; the nonword stimuli are available from the authors upon request.)

Apparatus and procedure

These were the same as used in Experiment 1.

Results

Table 6 shows the mean response latencies and errors for targets primed by words and by nonwords. To be consistent with Experiment 1, response latencies less than 300 ms or greater than 1,400 ms were treated as outliers and were excluded from all analysis (0.1% of responses latencies for word targets and 0.3% for nonword targets).[9] Response latencies of correct responses and error rates were submitted to a 2 (prime lexicality: word prime and nonword prime) × 2 (prime type: neighbour prime and unrelated prime) factorial ANOVA. In the subject (F_s) and item analysis (F_i) these factors were within-subject and within-item factors, respectively.

The critical statistical test was the interaction between prime lexicality and prime type, which was significant in the response latency analysis by subjects and by items, $F_s(1, 35) = 12.72$, $p < .01$, $MSE = 853.9$, partial $\eta^2 = 0.27$; $F_i(1, 56) = 11.36$, $p < .01$, $MSE = 2{,}148.9$, partial $\eta^2 = 0.17$. As can be seen in Table 6, there was a 28 ms inhibitory priming effect for word neighbour primes and a small (6 ms) facilitory priming effect for nonword neighbour

[9] Three targets (スパート, ポピー, and インサート) were excluded from all analyses because of high error rates (greater than 60%).

TABLE 6
Experiment 2: mean lexical decision latencies (RT, in ms) and percentage errors for word targets and nonword targets primed by words and by nonwords

Prime type	*Word targets*			
	Word primes		*Nonword primes*	
	RT	*Errors*	*RT*	*Errors*
Neighbour	603	14.4	584	12.7
Unrelated	575	4.7	590	5.6
Difference	−28	−9.7	6	−7.1
	Nonword targets			
Neighbour	629	4.8	613	4.4
Unrelated	652	5.7	649	5.4
Difference	23	0.9	36	1.0

primes, replicating the pattern of priming effects observed in Experiment 1. The only other significant effect was the main effect of prime type in the error analysis, $F_s(1, 35) = 46.24$, $p < .001$, $MSE = 55.4$, partial $\eta^2 = 0.57$; $F_i(1, 56) = 36.65$, $p < .001$, $MSE = 109.3$, partial $\eta^2 = 0.40$, and, by items in the response latency analysis, $F_s(1, 35) = 2.81$, $p = .10$, $MSE = 1{,}519.9$, partial $\eta^2 = 0.07$; $F_i(1, 56) = 4.41$, $p < .05$, $MSE = 3{,}039.9$, partial $\eta^2 =$ 0.07. Averaged across prime lexicality, responses were slower and more error prone when targets were primed by orthographic neighbours (594 ms, 13.6%) than when they were primed by unrelated words (583 ms, 5.2%). That is, although for response latencies the effect of prime type was qualified by the Prime Lexicality × Prime Type interaction, for error rates it was not. As can be seen in Table 6, for word targets, both word- and nonword-related primes led to higher error rates than did unrelated primes.[10]

Discussion

The results of Experiment 2 clearly show that word neighbour primes produce significant inhibitory priming, whereas nonword neighbour primes

[10] For nonword targets (see Table 6), the effect of prime type was significant in the response latency analysis, $F_s(1, 35) = 24.78$, $p < .001$, $MSE = 1{,}281.7$, partial $\eta^2 = 0.42$; $F_i(1, 59) = 25.69$, $p < .001$, $MSE = 2{,}384.1$, partial $\eta^2 = 0.30$, with faster responses to nonwords primed by neighbours (621 ms) than to nonwords primed by unrelated primes (651 ms). The effect of prime lexicality was marginally significant in the subject analysis, $F_s(1, 35) = 3.71$, $p = .06$, $MSE =$ 980.0, partial $\eta^2 = 0.10$; $F_i(1, 59) = 2.71$, $p = .11$, $MSE = 1{,}572.8$, partial $\eta^2 = 0.04$. No other effects were significant (all ps $> .10$).

produce, at most, a small facilitory priming effect. As noted, the small facilitory priming effect from nonword Katakana primes for low-frequency word targets with many neighbours is consistent with the results reported in previous form priming studies using alphabetic languages (Forster et al., 1987; Perea & Rosa, 2000).

One other result of interest is the inhibition effect in the error rates when nonword neighbours primed words. Recall that in Experiment 1B there was also a small inhibition effect in the error rates when nonword neighbours primed words. These inhibitory effects from nonword neighbours are not unique to Katakana words because other investigators have reported the same effect when nonword neighbours prime English words with many neighbours (Forster, 1987; Forster et al., 1987). According to the simulations reported by Davis (2003), the inhibitory effect is due to the fact that nonword neighbours have some limited ability to inhibit word targets, albeit indirectly, by partially activating the lexical representations of a target word's neighbours (see Davis, 2003, for a detailed account of this process in activation-based models). As activation-based models predict though, this inhibitory effect from nonword neighbour primes is always much weaker than the effect from word neighbour primes and is seldom observed in response latency data because the inhibition created is swamped by the facilitory effects produced by lexical preactivation.[11,12]

[11] In our experiments the primes and targets were always matched for number of characters. Note that matching for number of characters does not necessarily match for number of syllables; in fact, for approximately 35% of the prime–target pairs, the prime and target differed in the number of syllables, though in almost all cases (91%) this was a one-syllable difference (e.g., the prime had two syllables and the target had three). Note that this situation is common in the masked neighbour priming studies using English stimuli as well (e.g., Davis & Lupker, 2006; Forster, Davis, Schoknecht, & Carter, 1987; Nakayama et al., 2008). Our post-hoc analyses indicated that there were no differences in the priming effects for the prime–target pairs that differed in the number of syllables and for those that did not.

[12] We carried out a post-hoc analysis to determine if the magnitude of the inhibitory priming effect varied significantly depending on the position of the replaced character in the neighbour pair. The stimuli were divided into two groups: (1) neighbour pairs where the initial character was replaced (e.g., /re.be.ru/ and /no.be.ru/), and (2) neighbour pairs where another character position was replaced (e.g., /se.e.ta.a/ and /se.n.ta.a/, /ke.e.su/ and /ke.e.ki/). For Experiment 1A, the priming effect for low-frequency targets was 29 ms when the initial character was replaced and 20 ms when another character was replaced; for the high-frequency targets the priming effects were 11 ms and 9 ms, respectively. (These analyses were based on the item means.) For Experiment 2 the two priming effects were identical (36 ms). These analyses indicate that the magnitude of the inhibitory priming effect does not change depending on the position of the replaced character in the neighbour pair. This outcome is consistent with results reported by Janack et al. (2004), who found that the size of the inhibition effect from neighbour primes was not significantly different for neighbour pairs that differed in the initial letter (e.g., "mast-cast") and neighbour pairs that differed in the last letter ("cash-cast").

GENERAL DISCUSSION

The purpose of these experiments was to determine if the inhibitory neighbour priming effect reported when using Indo-European languages such as English, French, Dutch, and Spanish (e.g., Carreiras & Duñabeitia, 2009; Davis & Lupker, 2006; De Moor & Brysbaert, 2000; Drews & Zwitserlood, 1995; Duñabeitia et al., 2009; Nakayama et al., 2008; Segui & Grainger, 1990) would be observed for words in a language that not only doesn't use Roman letters but also is, in fact, not based on letters at all. Using Japanese Katakana, a syllabic-based language, we found that lexical decision latencies to word targets were significantly slower and more error prone when targets were primed by orthographic neighbours than when they were primed by unrelated words. Such was not the case, however, when using nonword primes. Our results therefore suggest that lexical competition is not a concept that is restricted to lexical processing for readers of Indo-European alphabetic languages. Instead, our results suggest that lexical competition is a more universal phenomenon, occurring in languages that employ distinctively different writing systems.

What should be noted, of course, is that, although English and Katakana are obviously quite different, they do share some characteristics. Specifically, they share the fact that activating higher-level representations depends on the identification of a relatively restricted set of characters and that the correct calculation of relative character positions within a word is crucial for successful word identification. It is likely that it is these particular parallels between languages that led to the present results paralleling those in other languages, as well as leading to Perea and Pérez (2009) obtaining transposed-character priming effects in Katakana that nicely parallel the transposed-letter priming effects obtained in English (Perea & Lupker, 2003, 2004).

These characteristics of Katakana are characteristics that it shares with other syllabaries as well (e.g., Korean and Thai). Thus, it seems likely that processing in these languages would also be based on lexical competition and that they would also show inhibitory neighbour priming effects. In contrast, for languages that do not involve such character-to-word level mappings (e.g., ideographic Chinese), such may not be the case. Indeed, as noted, Zhou et al. (1999) reported that orthographic neighbours facilitate, rather than inhibit, target processing. They suggested that the facilitation effect is due to the fact that each character has its own lexical unit, implying that lexical representations and processing must be somewhat different in Chinese than in alphabet-based languages. An interesting implication is that, when using Kanji, another type of Japanese script which, like Chinese, is ideographic, one would not obtain inhibitory neighbour priming. If so, a further implication would be that successful reading in Japanese must require Japanese readers to maintain two somewhat distinct sets of lexical structures and processes.

The present research has established that the inhibitory neighbourhood priming effect reported in Indo-European languages also exists in Katakana. An important question for future research will be to determine whether or not the lexical competition assumption also characterises processing in other languages/writing systems.

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APPENDIX

Word targets and primes used in Experiment 1A

HF neighbour prime	*HF unrelated prime*	*LF target*	*LF neighbour prime*	*LF unrelated prime*	*HF target*
メーカー	スタート	ビーカー	ビーカー	スマート	メーカー
ホテル	クラス	ホイル	ホイル	ケーキ	ホテル
ケース	ホテル	ケーキ	ケーキ	ポット	ケース
スタート	メーカー	スマート	スマート	ビーカー	スタート
ホール	ビデオ	ホース	ホース	クラゲ	ホール
プロ	デモ	トロ	トロ	デマ	プロ
ビデオ	ポスト	ロデオ	ロデオ	ホース	ビデオ
ポスト	ケース	ポット	ポット	ロデオ	ポスト
クラス	ホール	クラゲ	クラゲ	ホイル	クラス
デモ	プロ	デマ	デマ	トロ	デモ
センター	トラック	セーター	セーター	トラップ	センター
ドル	テロ	ヒル	ヒル	ベロ	ドル
トップ	データ	リップ	リップ	ゲート	トップ
データ	ソフト	デルタ	デルタ	リップ	データ
コスト	ブーム	ダスト	ダスト	ブーケ	コスト
テロ	ドル	ベロ	ベロ	ヒル	テロ
ソフト	ルート	ソファ	ソファ	デルタ	ソフト
トラック	センター	トラップ	トラップ	セーター	トラック
ルート	トップ	ゲート	ゲート	ソファ	ルート
ブーム	コスト	ブーケ	ブーケ	ダスト	ブーム
アジア	バブル	アジト	アジト	カーゴ	アジア
サービス	スポーツ	サーカス	サーカス	スポーク	サービス
ビル	カネ	ビリ	ビリ	カス	ビル

EXPERIMENT 1A (*Continued*)

HF neighbour prime	*HF unrelated prime*	*LF target*	*LF neighbour prime*	*LF unrelated prime*	*HF target*
スポーツ	サービス	スポーク	スポーク	サーカス	スポーツ
バブル	リーグ	ダブル	ダブル	アジト	バブル
ニュース	サッカー	ジュース	ジュース	ハッカー	ニュース
カネ	ビル	カス	カス	ビリ	カネ
カード	アジア	カーゴ	カーゴ	リング	カード
リーグ	カード	リング	リング	ダブル	リーグ
サッカー	ニュース	ハッカー	ハッカー	ジュース	サッカー
チーム	エイズ	チーク	チーク	ノベル	チーム
テーマ	ファン	パーマ	パーマ	ファー	テーマ
コメ	ガス	コケ	コケ	トス	コメ
レベル	チーム	ノベル	ノベル	コーン	レベル
エイズ	コース	エイド	エイド	チーク	エイズ
ファン	テーマ	ファー	ファー	パーマ	ファン
ガス	コメ	トス	トス	コケ	ガス
コース	レベル	コーン	コーン	エイド	コース
ルール	ガット	ツール	ツール	マット	ルール
ガット	ルール	マット	マット	ツール	ガット

Note: HF, high frequency; LF, low frequency.

Word targets and primes used in Experiment 1B

Neighbour prime	*Unrelated prime*	*LF target*	*HF target*
トーカー	スハート	ビーカー	メーカー
ホッル	ケーレ	ホイル	ホテル
ケーレ	ポキト	ケーキ	ケース
スハート	トーカー	スマート	スタート
ホート	クラリ	ホース	ホール
スロ	デム	トロ	プロ
モデオ	ホート	ロデオ	ビデオ
ポキト	モデオ	ポット	ポスト
クラリ	ホッル	クラゲ	クラス
デム	スロ	デマ	デモ
セルター	トラッコ	セーター	センター
レル	ツロ	ヒル	ドル
セップ	ベート	リップ	トップ
デンタ	ソフン	デルタ	データ
アスト	ブーボ	ダスト	コスト
ツロ	レル	ソロ	テロ
ソフン	デンタ	ソファ	ソフト
トラッコ	セルター	トラップ	トラック
ベート	セップ	ゲート	ルート
ブーボ	アスト	ブーケ	ブーム
アジキ	カーレ	アジト	アジア
サールス	ブウンド	サーカス	サービス
ビコ	カハ	ビリ	ビル
ブウンド	サールス	ブレンド	ブランド
モブル	リッグ	ダブル	バブル
ビュース	モッカー	ジュース	ニュース
カハ	ビコ	カス	カネ
カーレ	アジキ	カーゴ	カード
リッグ	モブル	リング	リーグ
モッカー	ビュース	ハッカー	サッカー
チーコ	エイネ	チーク	チーム
セーマ	ファト	パーマ	テーマ
コホ	ビス	コケ	コメ
カベル	チーコ	ノベル	レベル
エイネ	コーヘ	エイド	エイズ
ファト	セーマ	ファー	ファン
ピス	コホ	キス	ガス
コーヘ	カベル	コーン	コース
ジール	クット	ツール	ルール
クット	ジール	マット	セット

Note: HF, high frequency; LF, low frequency.

Word targets and primes used in Experiment 2

Word neighbour prime	*Word unrelated prime*	*Nonword neighbour prime*	*Nonword unrelated prime*	*Target*
アジア	パイプ	アジク	ソイプ	アジト
シェア	モデル	シゲア	モフル	シニア
モデル	シェア	モフル	シゲア	モラル
パイプ	アジア	ソイプ	アジク	レイプ
シリーズ	サミット	シゴーズ	ケミット	シューズ
アパート	サービス	クパート	サーロス	スパート
イメージ	サッカー	ルメージ	テッカー	ダメージ
スタイル	ポイント	スヘイル	コイント	スマイル
ストップ	ライバル	スボップ	ライール	スキップ
ポスター	ストップ	デスター	スボップ	シスター
ポイント	スタイル	コイント	スヘイル	ペイント
ライバル	アパート	ライール	クパート	ライフル
サービス	イメージ	サーロス	ルメージ	サーカス
サッカー	シリーズ	テッカー	シゴーズ	ロッカー
サミット	ポスター	ケミット	デスター	リミット
クラブ	ピアノ	クラホ	ピアク	クラゲ
ソフト	レベル	ソフコ	メベル	ソファ
レベル	ソフト	メベル	ソフコ	ラベル
ピアノ	クラブ	ピアク	クラホ	ピアス
コンサート	パーティー	ベンサート	レーティー	インサート
パーティー	コンサート	レーティー	ベンサート	ダーティー
スーパー	トラック	シーパー	トラモク	ペーパー
スタート	センター	スホート	センモー	スカート
スピード	タクシー	スコード	ヅクシー	スペード
センター	チェック	センモー	チョック	センサー
タクシー	スピード	ヅクシー	スコード	セクシー
チェック	スーパー	チョック	シーパー	チャック
トラック	ニュース	トラモク	フュース	トランク
トラブル	スタート	トラケル	スホート	トラベル
ニュース	トラブル	フュース	トラケル	ジュース
ゲリラ	バブル	キリラ	バキル	ゴリラ
バブル	ゲリラ	バキル	キリラ	バジル
コピー	マニラ	セピー	トニラ	ポピー
マニラ	コピー	トニラ	セピー	バニラ
マンション	プログラム	オンション	ニログラム	テンション
プログラム	マンション	ニログラム	オンション	キログラム
フランス	ショック	フレンス	ショッロ	フェンス
マイナス	シーズン	マイナポ	モーズン	マイナー
メーカー	キューバ	ソーカー	キュール	ポーカー
メンバー	オープン	ゴンバー	オーキン	ナンバー
ラウンド	マイナス	ラウンフ	マイナポ	ラウンジ
オープン	フランス	オーキン	フレンス	オーブン
キューバ	メーカー	キュール	ソーカー	キュート
シーズン	メンバー	モーズン	ゴンバー	レーズン
ショック	ラウンド	ショッロ	ラウンフ	ショップ

EXPERIMENT 2 (*Continued*)

Word neighbour prime	*Word unrelated prime*	*Nonword neighbour prime*	*Nonword unrelated prime*	*Target*
ゴルフ	ホテル	モルフ	ホスル	ウルフ
ホテル	ゴルフ	ホスル	モルフ	ホタル
スキー	リスク	スキバ	カスク	スキル
リスク	スキー	カスク	スキバ	デスク
バランス	デパート	バヌンス	デキート	バカンス
デパート	バランス	デキート	バヌンス	デザート
ブランド	エンジン	ブランハ	ムンジン	ブランク
ブロック	コメント	ブキック	アメント	ブラック
グループ	リーダー	グソープ	カーダー	グレープ
コメント	グループ	アメント	グソープ	セメント
リーダー	キャンプ	カーダー	キャリプ	オーダー
インフレ	リポート	インフチ	リマート	インフラ
エンジン	ブランド	ムンジン	ブランハ	ニンジン
キャンプ	インフレ	キャリプ	インフチ	キャップ
リポート	ブロック	リマート	ブキック	リピート