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On national flags and language tags: Effects of flag-language congruency in bilingual word recognition☆

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ABSTRACT

French-English bilinguals performed a generalized lexical decision experiment with mixed lists of French and English words and pseudo-words. In Experiment 1, each word/pseudo-word was superimposed on the picture of the French or UK flag, and flag-word congruency was manipulated. The flag was not informative with respect to either the lexical decision response or the language of the word. Nevertheless, lexical decisions to word stimuli were faster following the congruent flag compared with the incongruent flag, but only for French (L1) words. Experiment 2 replicated this flag-language congruency effect in a priming paradigm, where the word and pseudo-word targets followed the brief presentation of the flag prime, and this time effects were seen in both languages. We take these findings as evidence for a mechanism that automatically processes linguistic and non-linguistic information concerning the presence or not of a given language. Language membership information can then modulate lexical processing, in line with the architecture of the BIA model, but not the BIA + model.

How might non-linguistic information concerning the presence of one or another language affect language comprehension in bilinguals? In the present study we examine this issue by presenting national flags to our bilingual participants while they performed a simple word recognition task with mixed lists of words from their two languages. National flags provide a strong association between a non-linguistic object and a given language, at least for certain nations such as the UK and France. In the present study we examine whether such strong associations can modulate linguistic processing even in conditions where the non-linguistic language cue is uninformative with respect to the nature of the linguistic information being processed for the task at hand.

One particular theoretical framework for bilingual language processing predicts such automatic, irrepressible, non-linguistic influences on language comprehension in bilinguals. That is the Bilingual Interactive Activation (BIA) model (Grainger & Dijkstra, 1992; see also Grainger, Midgley, & Holcomb, 2010, for a developmental extension of this model; and Léwy & Grosjean, 2008, for an interactive-activation account of spoken language comprehension in bilinguals). For the present purposes, the key concept within the overall framework of the BIA-model is the notion of a language node, introduced in order to replace the notion of a language tag that had been popularized in the 1970s (e.g., Albert & Obler, 1978; see Green, 1998, for a model that continues to apply the notion of language tag). Just like a language tag, language nodes provide a signal that the word being processed is a word in a given language. That is, language nodes provide information about language membership, and with language nodes this is done probabilistically as opposed to the all-or-none manner of language tags. Crucially, unlike language tags, language nodes are no longer strictly linguistic information processors, since they can receive information concerning the probability that a given linguistic stimulus belongs to language x, and this input can come from both linguistic and non-linguistic sources (Schwartz & van Hell, 2012). Language nodes integrate information from multiple sources about the presence or not of a given language, and automatically modulate the activity of lexical representations in one or the other language as a function of language node activity. The BIA-model therefore predicts that non-linguistic information concerning the presence of a given language should automatically influence the processing of linguistic information in that language.[1]

In the present study we test the prediction of the BIA-model that non-linguistic information can modulate the processing of linguistic information in bilinguals via the key modulatory role of language nodes. What is the evidence to date that non-linguistic information can

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[1] Note that this prediction is not made by the BIA + model (Dijkstra & van Heuven, 2002). In this version of the family of BIA-models, language nodes become simple language tags that do not receive input from non-linguistic sources and cannot modulate activity in lexical representations.

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impact on the relative ease with which a bilingual can process words in that language or the other language? Some evidence along these lines has been obtained in studies investigating the effect of people as language cues (for a review, see Hartsuiker, 2015). Molnar, Ibáñez-Molina, and Carreiras (2015) showed Basque-Spanish bilinguals video fragments of six people who spoke Basque, Spanish or both. In a second phase, the bilingual participants had to perform a lexical decision task based on video fragments in which the same six people produced words/pseudo-words. The results showed a performance decrease when those who only spoke Basque or Spanish in the initial video fragment, produced a word in the language than they had not used in the initial video. While this was only the case for participants who were early bilinguals, it does provide evidence that interlocutor identity can be used as a cue to prepare for processing linguistic information in a given language (see Martin, Molnar, & Carreiras, 2016, for ERP evidence in line with this).

Further evidence has been found in studies examining the effect of interlocutor identity on language production in bilinguals in situations involving communication with persons via a computer interface (Woumans et al., 2015; Zhang, Morris, Cheng, & Yap, 2013). Woumans et al. (2015), for example, first let bilinguals (Dutch-French; Spanish-Catalan) get acquainted with several people using one or the other language. In the next phase, participants saw the same people produce words. The task of the participants was to produce an associated word in the same language. The results showed an effect of the compatibility of the language used in the two phases of the experiment, but only during the first trials. This was seen as evidence that interlocutor identity can be used as a language cue during bilingual language production. Though, this association disappears when it becomes clear that the person is not a stable language cue (i.e., when it becomes clear that they speak both languages). Using a racial cue to language identity, Zhang et al. (2013) reported that Chinese-English bilinguals interacted more fluently in English when they saw a Caucasian face than an Asian face. A similar finding was reported by Li, Yang, Scherf, and Li (2013), who found that picture naming was influenced by the race (Asian or Caucasian) of the person holding the frame containing the to-be-named picture.

Evidence that the association of a person with a given language, either via racial cues or by prior experience, can be used to prepare for speaking a given language is an important finding, but does not provide direct evidence for an automatic influence of non-linguistic cues on the processing of linguistic information in bilinguals. This is because such cues can be used to voluntarily prepare for processing information in a given language (i.e., I think this person can only speak Spanish, therefore I expect to hear Spanish). More directly relevant for the present study, is another observation of Zhang et al. (2013), who reported that Chinese-English bilinguals spoke more fluently in English about cultural icons associated with the USA (e.g., Mount Rushmore) than when speaking about a cultural icon associated with China (e.g., the Great Wall of China). In a similar vein, Jared, Pei Yun Poh, and Paivio (2013) reported that Chinese-English bilinguals living in Canada named pictures of objects faster when the to-be-named object was culturally associated with the naming language. Thus, for example, a picture of a typical Canadian mailbox was named faster in English than in Chinese, and the opposite was found for a typical Chinese mailbox.

However, this influence of cultural associations on spoken language fluency could simply be due to participants having learned to speak about a given object more via the associated language than via the other language, and these findings might not speak to the issue of non-linguistic control of linguistic processing (see Jared et al., 2013, for an explanation of their findings along these lines). It was therefore important to demonstrate that exposure to culturally associated images also affected speaking about culture-neutral images. Zhang et al. (2013) provided such a test, but unfortunately, this was only done after the participants had first described the culture-laden images, and the effect could therefore be linguistic in nature and not due to automatic non-linguistic influences on the processing of linguistic information (see Hartsuiker, 2015, for a further critique of this study).

In the present study we provide an arguably stronger test of the automatic influence of non-linguistic information associated with a given language on the processing of linguistic information in bilinguals. We use national flags as among the non-linguistic stimuli that have the strongest association with a given language. We use the generalized lexical decision task (e.g., Grainger & Beauvillain, 1987; Thomas & Allport, 2000) as one of the simplest tasks that requires the processing of linguistic information without explicitly requiring access to knowledge about the language associated with that linguistic information. Finding an influence of non-linguistic cues to language membership with this particular task would therefore constitute strong evidence for the automatic processing of such cues during language comprehension in bilinguals. Furthermore, given that each word/pseudo-word was associated equally often with the two flags during the experiment, the information carried by the flag stimulus could not be explicitly used to improve performance.

It is important to note that in the present study the flag stimuli had zero predictive value with respect to the language of the target word. This is a very different situation compared with all prior research using flag stimuli as cues for language membership, where the flag is artificially used to specify the language that participants should employ when processing ambivalent stimuli (e.g., picture naming: Calabria, Branzi, Marne, Hernández, & Costa, 2015; Prior & Gollan, 2013). In this prior research, participants used the flag stimuli voluntarily in order to prepare for linguistic processing in a given language, whereas in the current experiment we are interested in the more automatic, reflexive activation of language membership information from national flags. Here, a useful analogy is the well-known distinction between endogenous (voluntary) and exogenous (reflexive) orienting of attention (Müller & Rabbitt, 1989; Posner, 1980; Theeuwes, 1991). Unlike endogenous orienting, exogenous orienting is fast-acting and operates independently of cue validity, hence the conditions used in the present experiment in order to examine the impact of national flags as exogenous cues to language membership. In sum, in the present study we are interested in knowing whether or not national flags can automatically influence linguistic processing in bilinguals, which is a very different situation from one where flags are used to artificially induce processing in a given language.

1. Experiment 1

1.1. Method

1.1.1. Participants

Twenty native speakers of French with expertise in English as a second language participated in this experiment (three males; average age of 21 years). Prior to the experiment, the participants filled in a questionnaire about their French and English proficiency, regarding their age-of-acquisition, the average percentage of current language use and during childhood, and rated their level of speaking, writing, and reading skills in French and English on a 7-point scale, with one being very bad and seven being very good (see Table 1). After the experiment they also completed a vocabulary test for both languages: LexTALE-French (Brysbaert, 2013) and LexTALE-English (Lemhöfer & Broersma, 2012).

1.1.2. Stimuli

50 French words that were not cognates with English (mean frequency[2] = 5.73 Zipf; New, Pallier, Ferrand, & Matos, 2001), 50 English words that were not cognates with French (mean fre-

[2] The Zipf scale expresses frequencies as log10 occurrences per billion (van Heuven, Mandera, Keulers, & Brysbaert, 2014).

Table 1
Overview of information concerning participants' use and knowledge of French and English: self-estimated age-of-acquisition; self-estimated percentage of time spent speaking each language during childhood and currently; self-rated scores for speaking, writing and reading ability in each language; LexTALE-French and LexTALE-English vocabulary scores (standard deviations between brackets).

	Experiment 1		Experiment 2	
	French	English	French	English
Age-of-acquisition	0.4 (0.9)	9.4 (2.9)	0.4 (0.6)	10.5 (2.3)
% used during childhood	92.5 (9.7)	7.5 (9.7)	90.5 (14.0)	9.5 (14.0)
% currently used	83.5 (13.1)	16.5 (13.1)	79.0 (19.4)	21.0 (19.4)
Speaking	6.6 (0.6)	4.4 (1.2)	6.4 (0.8)	3.8 (0.9)
Writing	6.4 (0.7)	4.2 (1.2)	6.1 (0.8)	3.7 (1.0)
Reading	6.6 (0.7)	4.6 (1.2)	6.6 (1.0)	4.5 (1.2)
LexTALE	89.9 (5.9)	71.1 (9.0)	88.7 (5.3)	68.3 (7.2)

quency = 5.31 Zipf; Brysbaert & New, 2009), and 50 pseudo-words were presented in green to contrast with the flag colors (3.0–4.6 cm × 0.8 cm). The pseudo-words consisted of French-English cognates, where one letter was changed into another letter to make a pronounceable letter string that was neither a word in French nor in English. The French words, English words, and pseudo-words all contained between 4 and 6 letters. Half of these stimuli were presented superimposed on the picture of a French flag, and the other half superimposed on the picture of a British flag (both flags were 4.7 cm × 2.9 cm). Each word and pseudo-word was presented equally often on a French flag and a British flag across participants

1.1.3. Procedure

Prior to the experiment, the instructions were presented in French, with an emphasis on both speed and accuracy. This was followed by a practice block of 10 trials and an experimental block of 150 trials. The presentation order of the words was completely random, intermixing trials from all experimental conditions. Participants had to perform a generalized lexical decision task (i.e., indicate whether the presented string of letters is a word in either French or English or not). To this end, they pressed the buttons "f" and "j", on an AZERTY keyboard. The assignment of the keys (e.g., press "f" when it is a word and "j" when it is a pseudo-word) was counterbalanced across participants. Each trial started with a fixation cross (1000 ms) and was followed by the written word on top of a flag that stayed visible until a response was registered. Participants were instructed to ignore the flag and to respond as rapidly and as accurately as possible whether the letters formed a word (either French or English) or not.

1.1.4. Design

In the analysis of responses to word stimuli, the independent variables were the language of the written words (French – L1 vs. English – L2) and the congruency of the flag with the language of the written word (congruent vs. incongruent) in a 2 × 2 factorial design. In the pseudo-word analysis, the independent variable was flag (French vs. UK). The dependent variables in both analyses were reaction time (RT) and error rate. We used a Latin-square design such that each target word and pseudo-word was tested in the two flag conditions but with different participants, and each participant saw the complete set of word and pseudo-word targets, half with the French flag and half with the UK flag.

1.2. Results

RTs faster than 50 ms and slower than 2000 ms, were excluded from RT analyses, as were errors. Together this resulted in the exclusion of 2.5% of the RT data for the word stimuli and 12.6% of the RT data for the pseudo-word stimuli.

Table 2
Mean reaction time in milliseconds (RT) and error rates (PE) in percentages (SD in parentheses) as a function of flag-language congruency (congruent vs. incongruent) and language (French vs. English) in the flag-word interference paradigm of Experiment 1.

Languages	Congruent	Incongruent	Congruency effect
Reaction times			
French	593 (76)	650 (63)	57
English	658 (68)	656 (87)	− 2
Error rates			
French	1.2 (2.7)	1.6 (2.0)	0.4
English	2.0 (4.0)	2.8 (4.1)	0.8

1.2.1. Words

An analysis of variance (ANOVA) of the RT data revealed a significant effect of language, $F_1(1, 19) = 13.60$, $p < 0.01$, $\eta_p^2 = 0.417$; $F_2(1, 98) = 14.19$, $p < 0.001$, $\eta_p^2 = 0.126$, indicating slower responses during English trials (657 ms) than during French trials (622 ms; see Table 2). Importantly, the effect of language congruency was significant, $F_1(1, 19) = 10.41$, $p < 0.01$, $\eta_p^2 = 0.354$; $F_2(1, 98) = 10.07$, $p < 0.01$, $\eta_p^2 = 0.093$, with slower responses during language incongruent trials (653 ms) than during language congruent trials (626 ms). The interaction was also significant, $F_1(1, 19) = 9.99$, $p < 0.01$, $\eta_p^2 = 0.345$; $F_2(1, 98) = 9.39$, $p < 0.01$, $\eta_p^2 = 0.087$, with a substantial congruency effect for French (L1) words (57 ms; $t(19) = 5.11$, $p < 0.001$), whereas there was no congruency effect for English (L2) words (− 2 ms; $t < 1$).

An ANOVA of the error data revealed no significant effect of language, $F_1(1, 19) = 2.57$, ns., $\eta_p^2 = 0.119$; $F_2(1, 98) = 1.16$, ns., $\eta_p^2 = 0.012$, language congruency, or the interaction, $Fs < 1$.

1.2.2. Pseudo-words

A direct comparison of the impact of the French vs. British flag did not show a significant difference in RT for the pseudo-words, $t(19) = 1.70$, ns., although the overall RTs did show that participants responded slower to pseudo-words with the UK flag (909 ms) than with the French flag (879 ms). This pattern became significant in the error rates, $t(19) = 2.76$, $p < 0.05$, with more errors produced when the pseudo-words were presented with the UK flag (0.5%) than when they were presented with the French flag (0.3%).

1.3. Discussion

French-English bilinguals were slower to recognize words in their L1 (French) when these were superimposed on a picture of the UK flag compared with the French flag, whereas no effect of flag-language congruency was found in responses to L2 (English) words. The observed effect of flag-language congruency could be driven by inhibitory or facilitatory processes or a combination of the two, but for the present purposes, the key observation is the congruency effect, which clearly indicates that a national flag that is strongly associated with a given language can influence the processing of linguistic stimuli.[3] Nevertheless, the fact that this was only observed for French (L1) words can be explained by assuming that the flag stimuli exerted a predominantly inhibitory influence on word processing, and that the UK flag is more visually salient than the French flag. Thus, the UK flag would inhibit processing of French (L1) words more than the French flag inhibits processing of English (L2) words, due to its greater visual saliency.

[3] Because of the potential theoretical impact of this finding, we decided to perform a direct replication of Experiment 1 with a larger sample of stimuli in order to increase power (70 stimuli per condition). The replication was successful, with a significant effect of congruency for French (L1) words (congruent (593ms) vs. incongruent (620ms), $t(19) = 3.09$, $p = 0.006$) and a non-significant effect for English (L2) words (congruent (630ms) vs. incongruent (636ms), $t(19) = 0.61$, ns.).

2. Experiment 2

The first aim of Experiment 2 was to replicate the effects of flag-language congruency found in Experiment 1 using a priming paradigm and a different group of participants. Furthermore, by presenting the flag stimuli prior to word stimuli at a 150 ms SOA we aimed to reduce the potential influence of differences in visual saliency in the two flags by providing more time for processing the flag prior to presentation of word targets.

2.1. Method

2.1.1. Participants

Twenty native speakers of French with relatively high levels of experience with English as a foreign language participated in this experiment (9 male; average age of 24.1 years). None had participated in Experiment 1. The same questionnaire as used in Experiment 1 was presented to the participants, as were LexTALE-French (Brysbaert, 2013) and LexTALE-English (Lemhöfer & Broersma, 2012) (see Table 1).

2.1.2. Stimuli, procedure, and design

The stimuli, procedure, and design were identical to Experiment 1, except for two differences. The main difference was that the flags were not presented simultaneously with the written words/pseudo-words, but prior to them. A trial then consisted of a fixation cross (1000 ms), followed by a flag (100 ms). Following a short delay (50 ms) the written word was presented. The latter would stay visible until a response was registered, identical to Experiment 1. A second difference concerns the stimuli, which were presented in black, not green as in Experiment 1, and were slightly smaller (1.4–2.1 cm × 0.4 cm) than in Experiment 1.

2.2. Results

We used identical outlier criteria and error definitions as in Experiment 1, which resulted in the exclusion of 2.5% of the RT data for the *word stimuli*, and 18.7% of the RT data for the *pseudo-word stimuli*.

2.2.1. Words

An ANOVA of the RT data revealed a significant effect of language, $F_1(1, 19) = 16.62$, $p < 0.001$, $\eta_p^2 = 0.467$; $F_2(1, 98) = 25.62$, $p < 0.001$, $\eta_p^2 = 0.207$, indicating slower responses during English trials (667 ms) than during French trials (610 ms; see Table 3). Importantly, the effect of language congruency was significant, $F_1(1, 19) = 4.81$, $p < 0.05$, $\eta_p^2 = 0.202$; $F_2(1, 98) = 5.03$, $p < 0.05$, $\eta_p^2 = 0.049$, with slower responses during language incongruent trials (649 ms) than during language congruent trials (628 ms). The interaction was not significant, $Fs < 1$.

An ANOVA of the error data revealed a significant effect of language, $F_1(1, 19) = 5.12$, $p < 0.05$, $\eta_p^2 = 0.212$; $F_2(1, 98) = 4.63$, $p < 0.05$, $\eta_p^2 = 0.045$, indicating a larger error rate during English trials (1.8%) than during French trials (0.3%). The effect of language congruency, $Fs < 1$, and the interaction, $F_1(1, 19) = 1.20$, ns., $\eta_p^2 = 0.060$; $F_2 < 1$, were not significant.

Table 3
Mean reaction time in milliseconds (RT) and error rates (PE) in percentages (SD in parentheses) as a function of flag-language congruency (congruent vs. incongruent), and language (French vs. English) in the flag-priming paradigm of Experiment 2.

Language	Congruent	Incongruent	Congruency effect
Reaction times			
French	598 (125)	622 (116)	24
English	658 (113)	676 (104)	18
Error rates			
French	0.2 (0.9)	0.4 (1.2)	0.2
English	2.2 (4.2)	1.4 (2.7)	− 0.8

2.2.2. Pseudo-words

A direct comparison of the impact of the French vs. British flag showed a significant difference in RT, $t(19) = 2.15$, $p < 0.05$, with slower responses to pseudo-words after the UK flag (959 ms) than when they were presented after the French flag (926 ms). This pattern did not reach significance with the error rates, $t(19) = 1.27$, ns., although responses to pseudo-words that were presented after the UK flag (0.6%) were more erroneous than when they were presented after the French flag (0.5%).

2.3. Discussion

Experiment 2 replicated the flag-language congruency effects seen in Experiment 1 with a priming procedure as opposed to the flag-word interference paradigm used in Experiment 1. In Experiment 2 the flag stimuli were briefly presented before the word/pseudo-word stimuli, and this time statistically equivalent effects of flag-language congruency were found in both languages. Pseudo-words also showed the same interference from the UK flag compared with the French flag that was observed in Experiment 1, with the effect being significant in the RT data in Experiment 2.

3. General discussion

In two experiments we demonstrated that flag-language congruency influenced performance in a generalized lexical decision task performed by French-English bilinguals. In Experiment 1, words (French and English) and pseudo-words were superimposed on a picture of either the French or the UK national flag in a novel flag-word interference paradigm, and responses were faster to French (L1) words when they were presented with the French flag compared with the UK flag. On the other hand, there was no significant effect of flag-language congruency on performance to English (L2) words. In Experiment 2, flag stimuli were presented prior to words and pseudo-words at a 150 ms SOA, and responses to both French and English words were faster in the congruent flag condition. We take this as evidence that non-linguistic stimuli that are strongly associated with a given language can automatically influence processing of linguistic stimuli via the mechanisms involved in regulating lexical activity in the different languages of bilinguals. The language nodes of the BIA-model constitute one such mechanism.

How can such language nodes explain the flag-language congruency effects seen in the present study? The general idea is that language nodes integrate information concerning the presence of a given language, or the likelihood that a given language will be present, and this information can be derived from both linguistic and non-linguistic sources. This information processing occurs automatically such that even when the flag stimulus is uninformative with respect to the language of the target word, the language associated with the flag automatically influences processing of the target word. In the framework of the BIA-model, the flag stimulus activates the associated language node (e.g., the "English" language node for the UK flag), and this activation causes a global inhibition of lexical activity in the other language. Inhibition of lexical activity in one language slows processing of words in that language and facilitates processing of words in the other language.[4] The same mechanism can explain why speaker

[4] The relative contribution of inhibitory and facilitatory processes to the flag-language congruency effect could be estimated by using a "neutral" flag condition. Choice of an appropriate neutral flag, is not however straightforward, if one aims to match for factors such as familiarity and visual complexity. We nevertheless piloted an experiment using the Czech flag as the neutral condition using the procedure of Experiment 1, and again replicated the congruency effect for French (L1) words: congruent (590ms) vs. incon-

identity (i.e., knowing that a given person will speak in a given language) can be used to prepare for processing in a given language (Martin et al., 2016; Molnar et al., 2015), and how images associated with a given language (e.g., the specific form a Chinese mailbox) can facilitate speaking in that language (Jared et al., 2013; Zhang et al., 2013).

What is the explanation for the asymmetrical flag-language congruency effects seen in Experiment 1, but not in Experiment 2? One possible explanation is that the UK flag is more salient or has a stronger association with the English language, and therefore exerts a stronger interference when processing French words than the French flag does during the processing of English words. It is also possible that the greater flag-language congruency effect seen in L1 (French) could be due to mechanisms linked to processing mixed lists of words from two languages by bilingual persons. One such mechanism would be the list-wide inhibition of L1 lexical representations in order to facilitate processing of L2 representations (e.g., Gollan & Ferreira, 2009; for a discussion of this effect, see Declerck, Thoma, Koch, & Philipp, 2015). Within the framework of the BIA-model, this inhibitory process would be boosted by the presence of the L2-associated flag via an increase in activation of the L2 language node. Thus the combined influence of list-wide inhibition of L1 words and flag-induced interference would be the cause of the flag-language congruency effects seen with L1 words only. However, the fact that symmetrical flag-language congruency effects were seen using a priming procedure in Experiment 2, where flags were presented before the word and pseudo-word stimuli, is more in favor of the flag saliency explanation. Providing the flag stimuli with a head start in processing would enable both flags, independently of their saliency or the strength of their association with a given language, to exert an influence on the subsequent processing of target words. The fact that the size of the flag-language congruency effect in French (L1) was substantially smaller in Experiment 2, further suggests that such effects are relatively short-lived, and that with greater SOAs, the effects would likely disappear. This is in line with the hypothesized exogenous nature of such influences, as mentioned at the end of the Introduction.

Language nodes are also implemented in the BIA+ model of bilingual language processing (Dijkstra & van Heuven, 2002), and although they are not used to regulate lexical activity in this model (no top-down connections from language nodes to lexical representations), they can modulate behavior by affecting decision criteria, that is, criteria used to perform the task at hand (cf. Grainger & Jacobs, 1996). The problem, however, with this explanation is the use of the generalized lexical decision task in the present study. This implies that the decision to be taken is one of lexical status independently of language, and therefore that the decision system in the BIA+ model should ignore language node activity for this specific task. The same argument was used by Grainger et al. (2010) to dismiss an account of language switching effects observed in generalized lexical decision as being driven by executive control processes (i.e., the task-schemas in Green's (1998) model and the BIA+ model, Dijkstra & van Heuven, 2002). Furthermore, the fact that the flag stimuli were neither predictive of lexical status, nor predictive of the language of the target word, renders highly implausible any account of the observed effects in terms of decision-level mechanisms.

Finally, the fact that performance to pseudo-word stimuli was poorer in the presence of the UK flag compared with the French flag can be explained by a greater drop in the overall lexical activity generated by word stimuli in the presence of the UK flag. This would arise via the hypothesized inhibitory influence the UK flag exerts on L1 words, plus the fact that L1 words are those that generate the greatest lexical activity, and therefore contribute the most to overall lexical activity. This drop in the overall lexical activity generated by word stimuli would then cause an increased difficulty in discriminating pseudo-words from words.

In conclusion, the present study is the first to demonstrate an influence of national flags on visual word recognition in bilinguals. The observed effects go beyond prior observations of an influence of non-linguistic stimuli on the processing of linguistic stimuli by bilinguals in two important ways. First, contrary to prior research, the non-linguistic stimuli (i.e., the flags) could not be used in a voluntary manner to predict the language of the to-be-processed linguistic stimuli. Second, the effects were observed for the first time in a language comprehension task that did not require knowledge of language membership (i.e., generalized lexical decision). Our results therefore suggest that language membership information can be automatically activated by linguistic and non-linguistic stimuli alike, and most likely via a common mechanism such as the language nodes of the BIA-model.

(*footnote continued*)
gruent (621ms), $t(17) = 2.51$, $p = 0.022$. Mean RT in the neutral flag condition was 602ms, and this did not differ significantly from either the congruent or the incongruent conditions. These finding should be taken with caution, however, given that the Czech flag is clearly not as familiar as either the UK or the French flag for the French-English bilinguals tested in this study.

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