The emotional impact of being myself:

Emotions and foreign language processing

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Abstract

Native languages are acquired in emotionally rich contexts, while foreign languages are typically acquired in emotionally neutral academic environments. As a consequence of this difference, it has been suggested that bilinguals' emotional reactivity in foreign language contexts is reduced as compared to native language contexts. In the current study we investigated whether this emotional distance associated with foreign languages could modulate automatic responses to self-related linguistic stimuli. Self-related stimuli enhance performance by boosting memory, speed and accuracy as compared to stimuli unrelated to the self (the so-called self-bias effect). We explored whether this effect depends on the language context, by comparing self-biases in a native and a foreign language. Two experiments were conducted with native Spanish speakers with a high level of English proficiency in which they were asked to complete a perceptual matching task where they associated simple geometric shapes (circles, squares and triangles) with the labels "you", "friend" and "other" either in their native or foreign language. Results showed a robust asymmetry in the self-bias in the native and foreign-language context: a larger self-bias was found in the native than in the foreign language. An additional control experiment demonstrated that the same materials administered to a group of native English speakers yielded robust self-bias effects that were comparable in magnitude to the ones obtained with the Spanish speakers when tested in their native language (but not in their foreign language). We suggest that the emotional distance evoked by the foreign language contexts caused these differential effects across language contexts. These results demonstrate that the foreign language effects are pervasive enough to affect automatic stages of emotional processing.

Keywords: emotional attachment; self-bias; foreign language effect; emotional distance

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If you talk to a man in a language he understands, that goes to his head. If you talk to him in his language, that goes to his heart. This quote from Nelson Mandela captures very well the idea that foreign language processing may elicit a reduced emotional response as compared to native language processing. As intuitively appealing as this idea might be, the current experimental evidence in its favor is less robust than one would like it to be. The current article aims at exploring this issue by assessing the effects of foreign language on emotional processing in an experimental context with reduced language processing load. More concretely, we will explore the differential effects that native and foreign languages have in making associations to the self.

Anecdotally, people report that they feel less emotionally reactive when using a foreign language as compared to a native language, making them "feel different" when immersed in a foreign language context (cf. Pavlenko, 2006). This anecdotal evidence has been experimentally supported by studies showing differential cognitive and psychophysiological reactivity to emotionally charged phrases in native and foreign languages, such as childhood reprimands, insults and endearments (e.g., Harris, 2004; Harris, Ayçiçegi, & Gleason, 2003; Puntoni et al., 2009). Hence, it has been suggested that foreign language emotional phrases elicit reduced emotional resonance in bilinguals as a function of the different link these statements have with autobiographical memories as compared to native language statements (see Caldwell-Harris, 2008; Marian & Neisser, 2000). This different emotional bond with words and phrases in different languages is thought to stem from the different contexts in which native and foreign languages are acquired (i.e., emotionally charged family environment vs. emotionally neutral academic environment).

On the other hand, most studies exploring emotional reactivity to single words in a native and foreign language have found it difficult to obtain robust foreign language effects. There is general agreement on the processing advantage associated with emotional words as compared to neutral words in a native language (see Kuperman, Estes, Brysbaert, & Warriner, 2014, and Pavlenko, 2012, for review), but as recently reviewed by Ponari et al. (in press), the chronometric evidence suggests that the effects induced by emotionally charged words are highly similar in foreign and native languages (e.g., Ayçiçegi-Dinn & Caldwell-Harris, 2009; Ferré, Sánchez-Casas, & Fraga, 2013). Ponari et al. suggested that the effects of emotion in foreign language single-word reading do not qualitatively differ from those obtained in a native language. A similar conclusion has also been drawn by electroencephalographic event-related studies, showing that the components (and their amplitudes) associated with emotion words were highly similar for native and non-native readers, with the only difference being a delay of around 50-100ms in the onset of emotion-induced effects between native and non-native readers, which was interpreted as a consequence of the cognitive load imposed by reading in a foreign language (e.g., Conrad, Recio, & Jacobs, 2011; Opitz & Degner, 2012). A potential explanation for the consistent foreign language effects found in experiments involving relatively long phrases with emotional content as compared to the difficulty in finding similar effects at the single-word level could be the different semantic and pragmatic features that individual emotional words may have in different languages (e.g., their different contextual diversity). In the current study, we investigated whether a foreign language experimental context modulates emotional attachment by using a paradigm with markedly reduced linguistic demands, which has been shown to tap into automatic emotional processing: the self-paradigm (see Sui, Yankouskaya, & Humphreys, 2015, for review).

Stimuli associated with the self are perceived as more salient than those associated with others, leading to the well-known self-bias in perception (e.g., Sui, He, & Humphreys, 2012). For example, associations between simple perceptual stimuli and verbal labels are remembered better when they involve the self than when they involve someone else. Simply put, it is easier to associate a stimulus with ourselves than with others (e.g., Kahneman, Knetsch, & Thaler, 1990; Locksley, Ortiz, & Hepburn, 1980; Rogers, Kuiper, & Kirker, 1977; Sui et al., 2012; Sui, Liu, Mevorach, & Humphreys, 2015; Sui, Rotshtein, & Humphreys, 2013; Sui, Sun, Peng, & Humphreys, 2014; Symons & Johnson, 1997). The pattern with which self-related stimuli are responded to resembles that elicited by reward-related stimuli, in that the perceptual focus is shifted to prioritize the processing of self-related stimuli over others. The nature and limits of these effects have been recently explored with the help of the self-paradigm, a task where participants are instructed to associate simple geometric shapes (e.g., a triangle, a circle and a square) with written labels that could directly relate to the self (e.g., "you"), to a relative or a close person (e.g., "mother" or "friend"), or to an unrelated person (e.g., "other"; see Frings & Wentura, 2014; Sui et al., 2012; 2013). After a short learning phase in which participants are presented with the correct pairings (e.g., triangle-"you"), they are required to complete a perceptual matching task discriminating whether or not the figures and the labels match (e.g., triangle-"you" vs. triangle-"other"). When considering the responses in the matching conditions, self-related stimuli are responded to faster and more accurately than self-unrelated stimuli, yielding the self-bias effect. Furthermore, stimuli related to someone with whom the participant has an emotional bond (e.g., mother, best friend) also yield faster and more accurate responses than stimuli fully unrelated to the self. This speaks of the striking self-imposed importance of the stimuli related to oneself, as they require very little time to undergo a sharp and rapid incline in their perceptual salience and preference in general. Thus, perceptual self-prioritization is the consequence of fast-acting emotional bindings between a simple linguistic tag (e.g., the word "you") and a given object (e.g., a geometric form).

In the current study we investigated whether the language of the words modulates the self-bias effect, thereby modulating the participants' overall emotional reactivity to self-related linguistic information. As argued, this effect taps into the system that regulates the emotion and reward induced by personal social significance, while at the same time it involves a reduced amount of linguistic information, restricted to three single-word labels. If foreign languages induce lower emotional resonance than native languages, then one should expect a significant reduction in the self-bias effect in a foreign language as compared to the native language. In Experiment 1A a group of native Spanish speakers completed a self-paradigm in their native language, while a different group of native Spanish speakers who were proficient in English completed the task in their foreign language. In Experiment 1B a group of native English speakers performed the same task in their native language for control purposes. In Experiment 2 a new group of native Spanish speakers who also spoke English completed a self-paradigm that randomly intermixed trials with labels in the native and foreign languages (i.e., within-group manipulation).

Experiments 1A/1B

Methods

Participants. Two groups of 39 native Spanish (L1) participants who were non-native English speakers were tested in Experiment 1A. All these bilinguals had a relatively high English (L2) level while still being non-balanced bilinguals. Their knowledge and use of English was assessed by using different methods (see Procedure). The results of this linguistic assessment demonstrated that our participants were significantly less proficient in their L2 than in their L1, and that they did not use their L2 in everyday social interactions (see Table 1). The first group (22 females) completed the task in Spanish and the second group (22 females) completed it in English. Participants were assigned to the groups in a random manner. These groups were matched for gender, age, IQ, and knowledge and use of English. In Experiment 1B, a group of 26 native English speakers (17 females) completed the same task in English. All participants had normal or corrected-to-normal vision and provided signed consent prior to the experiment, which was previously approved by the Ethics Committee of the BCBL.

-Insert Table 1 around here-

Materials and Procedure. Prior to completing the experimental task, the bilingual participants' English proficiency was assessed. First, participants completed a questionnaire in which they provided self-ratings of their overall English proficiency (1-to-10 scale), their estimated age of acquisition of English (in years), and the percentage of time they were exposed to English daily. Second, participants completed an English vocabulary test that included a battery of 77 drawings of common concepts (see Gollan et al., 2012, for a similar procedure). And third, participants completed an extensive structured interview to test their overall English fluency conducted by a native-like multilingual linguist. After the interview, the linguist rated each participant based on his or her performance (1-to-5 scale where 5 represents native-like competence and 1 corresponds to an extremely basic knowledge of English; see Table 1 for details).

The materials used in the experimental task were similar to those used by Sui et al. (2013). The stimuli were white unfilled geometric shapes (a circle, a triangle and a square; 263x263 pixels) and written labels (in English: “you”, “friend”, “other”; in Spanish: “tú”, “amigo/a”, “otro/a”) presented in white lowercase Courier New font against a black background (see Figure 1). In order to avoid effects derived from specific shape-label associations in the matching conditions, all combinations were counterbalanced across participants (i.e., 6 experimental lists were created). Each participant completed a total of 180 trials, of which 90 were matching and 90 were mismatching. Mismatching trials were constructed by rearranging the shapes and the words so that they did not match the learned associations. This way, 6 conditions with 30 items each were created: self-match, self-mismatch, familiar-match, familiar-mismatch, unfamiliar-match and unfamiliar-mismatch.

-Insert Figure 1 around here-

Items were presented using the Experiment Builder v. 1.10.1241 (SR Research, Ontario, Canada) on a 19-inch CRT screen (1024x768 at 100Hz), and a response box was used to collect responses. Participants were instructed to learn and remember three associations that were between one of the given geometric shapes (a triangle, a circle or a square) and a person (themselves, their best friend or a stranger). Subsequently they were told that during the experiment they would be seeing pairings of geometric shapes and labels that would either match or mismatch, and that they would need to indicate as quickly and accurately as possible whether or not the specific pair displayed matched the learned associations, and to do so by pressing the appropriate button on the response box. These instructions were always given in the language in which the experimental session was to be conducted. Prior to completing the experimental trials, participants completed a practice session consisting of 24 trials that was repeated in case they had an error rate higher than 30%.

At the beginning of each trial a fixation cross was presented in the middle of the screen for 500ms. Next, a shape-label pair was displayed above and below the fixation cross, respectively (see Figure 1). The stimuli stayed on the screen for a maximum time that randomly varied between 1200 and 1500ms, or until a response was given. Feedback was provided in the test language for 500ms indicating whether participants were accurate, inaccurate or too slow to respond. The inter-stimulus interval was set at 100ms. The experiment took approximately 7 minutes to complete. The order of presentation of the items was randomized across the participants, and two breaks were included after the 60th and 120th trials.

Results

Experiment 1A

ANOVAs were run on the latency and accuracy data corresponding to the critical match trials following a 3 (Shape Category: self|familiar|other) x 2 (Language Context: native|foreign) design. Pairwise comparisons were also run on the data corresponding to the mismatching trials collapsed across conditions in order to determine the presence or absence of a Language Context effect. Response times associated with erroneous responses and those above or below the cut-off points (mean±2.5SD in each condition for each participant) were removed from the latency analysis (1.55% vs. 1.79% of outliers in the native and foreign language contexts, respectively). Group-based means per condition are reported in Table 2 and a density plot of the RT distribution per condition is presented in Figure 2.

Matching trials. The general 3x2 ANOVA on the RTs showed a main effect of Shape Category [$F(2,152)=70.64$, $p<.001$, partial$\eta^2=.48$, $1-\beta=1$]. The main effect of Language Context was not significant [$F<1$, $p>.88$]. The interaction between these two factors was significant [$F(2,152)=8.42$, $p<.001$, partial$\eta^2=.10$, $1-\beta=.96$], suggesting differences in the magnitude of the effects between the two language contexts. A follow-up ANOVA to explore the self-bias effect (Shape Category: self|other; Language Context: native|foreign) showed that participants in both language contexts responded faster to the stimuli in the **Self** condition than to the stimuli in the Other condition [$F(1,76)=115.97$, $p<.001$, partial $\eta^2=.60$, $1-\beta=1$]. However, and crucially for present purposes, this self-bias effect was larger for participants completing the task in their native than in their foreign language [interaction: $F(1,76)=14.44$, $p<.001$, partial$\eta^2=.16$, $1-\beta=.96$]. Indeed, the magnitude of the self-effect in the native language was twice as large as in the foreign language (native: 114ms, [$t(38)=10.38$, $p<.001$]; foreign: 54ms, [$t(38)=4.89$, $p<.001$]). A similar ANOVA exploring the effects associated with the Familiar condition (Shape Category: familiar|other; Language Context: native|foreign) showed that participants also responded faster to the stimuli in the **Familiar** condition than in the Other condition [$F(1,76)=10.93$, $p=.001$, partial$\eta^2=.13$, $1-\beta=.90$], but a significant interaction showed that the familiar-effect was only present in the native context [$F(1,76)=5.02$, $p=.028$, partial$\eta^2=.06$, $1-\beta=.60$]. The difference between the latencies in the Familiar and the Other condition was of 43ms in the native context [$t(38)=4.50$, $p<.001$] and only of 8ms for the foreign context [$t<1$, $p>.50$].

The results for the error rates paralleled those for the RTs. In the general 3x2 ANOVA there was a significant main effect of Shape Category [$F(2,152)=30.36$, $p<.001$, partial$\eta^2=.28$, $1-\beta=1$], a negligible Language Context effect [$F<2$, $p>.17$], and a significant interaction between these two factors [$F(2,152)=3.69$, $p=.027$, partialη^2 =.05, 1-β=.67]. The follow-up 2x2 ANOVA exploring the self-bias effect showed that participants in both groups responded more accurately to the stimuli in the **Self** condition than to the stimuli in the Other condition [$F(1,76)=60.29$, $p<.001$, partialη^2=.44, 1-β=1], but that this self-effect was larger for participants completing the task in their native than in their foreign language [interaction: $F(1,76)=6.28$, $p=.014$, partialη^2=.08, 1-β=.70]. The difference between the percentage of errors in the Self and the Other condition was 10.68% in the native context [$t(38)=5.96$, $p<.001$] and 5.47% in the foreign context [$t(38)=5.18$, $p<.001$]. The 2x2 ANOVA to explore the familiar-bias also showed that participants responded more accurately to the stimuli in the **Familiar** condition than in the Other condition [$F(1,76)=15.00$, $p<.001$, partialη^2=.16, 1-β=.97], but in this case the interaction only approached significance [$F(1,76)=3.30$, $p=.073$, partialη^2=.04, 1-β=.43]. The difference between the percentages of errors in the Familiar and the Other condition was 7.10% in the native context [$t(38)=3.47$, $p=.001$] and 2.56% in the foreign context [$t(38)=1.78$, $p=.083$].

Mismatching trials. Response times to the mismatching trials were virtually identical in the native and foreign language contexts (729 vs. 728ms, respectively; [$t<1$, $p>.95$]). However, participants were somewhat more accurate when completing the task in their foreign than in their native language (error rates for the foreign and native language contexts, respectively: 6.98% vs. 9.23%; [$t(76)=1.88$, $p=.064$]).

-Insert Table 2 around here-

Experiment 1B

In this experiment, a group of native English speakers completed the task in their native language. ANOVAs were run on the latency and accuracy data for the match trials including the Shape Category factor (self|familiar|other). Response times associated with erroneous responses and those above or below the cut-off points (mean±2.5SD in each condition for each participant) were removed from the latency analysis (1.13% of outliers). Means per condition are reported in Table 2.

The RT analysis showed a main effect of Shape Category [$F(2,50)=58.31$, $p<.001$, partial$\eta^2=.70$, $1-\beta=1$]. Participants responded 124ms faster in the **Self** condition than in the Other condition [$t(25)=9.32$, $p<.001$]. They also responded 32ms faster in the **Familiar** than in the Other condition [$t(25)=2.55$, $p=.017$].

Parallel results were observed in the accuracy analysis. The main effect of Shape Category was significant [$F(2,50)=21.77$, $p<.001$, partial$\eta^2=.46$, $1-\beta=1$]. Participants responded 15.90% more accurately in the **Self** than in the Other condition [$t(25)=6.88$, $p<.001$]. They also responded 8.08% more accurately in the **Familiar** than in the Other condition [$t(25)=2.81$, $p=.01$].

Results from Experiment 1A revealed a self-bias effect in both language contexts. Importantly, when participants performed the task in their foreign language, the self-bias effect was significantly reduced both in latency and accuracy. Experiment 1B demonstrated that, when completing the same task in their native language, both Spanish participants and English participants showed very similar self-bias effects (114ms vs. 124ms, respectively). In contrast, this effect was reduced by more than a half (54 ms) when Spanish native speakers completed the task in their foreign language (English). Similarly, both groups completing the task in their native language showed comparable familiar-bias effects (43ms vs. 32ms, respectively), while the group completing the task in their foreign language showed a negligible familiar-bias effect (8ms). These results demonstrated that conducting this task in a foreign language yields a considerable reduction of self-bias effects, suggesting a diminished emotional reactivity in the foreign language context.

In Experiment 2 a new group of participants completed a similar task in a multilingual experimental context. In contrast to the previous experiment, here the participants were randomly presented with trials in their native and foreign languages. This bilingual setting would enable us not only to assess the replicability and robustness of the foreign language effects observed in Experiment 1, but also to explore the adaptability of the cognitive system to the rapidly-changing emotional resonance associated with each language.

Experiment 2

Methods

Participants. 48 native Spanish speakers with normal or corrected-to-normal vision and a level of proficiency in English similar to that of the participants tested in Experiment 1A (35 females, mean age of 24.08 years) completed the experiment (see Table 1 for details). Participants in Experiment 2 completed the same linguistic assessment used to estimate the English proficiency of participants in Experiment 1A.

Materials and Procedure. The same materials used in Experiment 1 were combined into a single multilingual version. Thus, the 180 trials involving Spanish labels used in the native language version of Experiment 1A and the 180 trials including English labels used in the foreign language version of Experiment 1A and in Experiment 1B were combined. Hence, this experiment consisted of 360 trials in total, out of which 180 had English labels and the other 180 had Spanish labels. The presentation of native- and foreign-language trials was randomized. The distribution of shapes and labels across the matching and mismatching conditions was the same as that used in the Experiment 1, and the same procedure was followed. All the instructions were given in the two languages. The experiment took approximately 14 minutes to complete.

Results

ANOVAs were run on the latency and accuracy data for the match trials following a 3 (Shape Category: self|familiar|other) x 2 (Language Context: native|foreign) design. Pairwise comparisons were also run on the data corresponding to the mismatching trials collapsed across conditions in order to determine the presence or absence of a Language effect. Response times associated with erroneous responses and those above or below the cut-off points (mean±2.5SD in each condition for each participant) were removed from the latency analysis (1.79% of outliers). Group-based means per condition are reported in Table 2 and a condition-based RT density plot is presented in Figure 2.

Matching trials. The general 3x2 ANOVA on the RTs showed a main effect of Shape Category [$F(2,94)=103.82$, $p<.001$, partial$\eta^2=.69$, $1-\beta=1$]. The main effect of Language was not significant [$F<1$, $p>.72$]. The interaction between these two factors was significant [$F(2,94)=9.79$, $p<.001$, partial$\eta^2=.17$, $1-\beta=.98$], revealing that the magnitude of the effects varied as a function of the language (native vs. foreign). A 2x2 ANOVA performed to explore self-bias effects (Shape Category: self|other; Language Context: native|foreign) showed that participants responded faster in the **Self** than in the Other condition [$F(1,47)=141.41$, $p<.001$, partial$\eta^2=.75$, $1-\beta=1$]. However, this self-effect was larger in the native (131ms) than in the foreign language (97ms) [interaction: $F(1,47)=17.88$, $p<.001$, partial$\eta^2=.28$, $1-\beta=.98$]. Still, the self-bias effect was significant in both language contexts [native language: $t(47)=12.63$, $p<.001$; foreign language: $t(47)=9.26$, $p<.001$]. A 2x2 ANOVA performed to explore familiar-bias effects (Shape Category: familiar|other; Language Context: native|foreign) showed that participants were also faster in the **Familiar** than in the Other condition [$F(1,47)=19.68$, $p=.001$, partial$\eta^2=.29$, $1-\beta=.99$]. This familiar-effect was virtually identical in both language contexts (33ms vs. 32ms for the native and foreign language contexts, respectively).

The analysis on the error rates following the general 3x2 design showed a significant main effect of Shape Category [$F(2,94)=37.60$, $p<.001$, partial $\eta^2=.44$, $1-\beta=1$], and no effect of Language nor an interaction [$Fs<1$, $ps>.41$]. Follow-up 2x2 ANOVAs showed that participants responded more accurately in the **Self** than in the Other condition [$F(1,47)=59.52$, $p<.001$, partial$\eta^2=.56$, $1-\beta=1$], and this self-bias effect was similar in the native and foreign language trials [11.11% vs. 8.82%, respectively; interaction: $F<1$, $p>.49$]. Similarly, participants responded more accurately to the stimuli in the **Familiar** than in the Other condition [$F(1,47)=26.12$, $p<.001$, partial$\eta^2=.36$, $1-\beta=.99$], and this familiar-bias effect was similar across languages [6.88% vs. 5.83%, respectively; interaction: $F<1$, $p>.61$].

Mismatching trials. Mismatching trials were responded to slightly more slowly in the native than in the foreign language (759ms vs. 753ms; [$t(47)=1.84$, $p=.072$]). No significant differences between languages were observed in the accuracy data (10.79% vs. 9.88% of errors, respectively; [$t<1.5$, $p>.13$]).

-Insert Figure 2 around here-

General Discussion

The aim of the current study was to explore the extent to which a foreign language evokes less emotional reactivity than a native language in bilinguals by means of employing the self-related stimuli. We approached this issue by assessing how emotionally biased associations are modulated by the foreign language contexts. In Experiments 1A and 1B we explored the magnitude of the self-bias effect in the native (Spanish and English) and foreign language contexts (English). Results replicated the well-known self-bias effect, showing faster and more accurate responses for self-related than to self-unrelated stimuli, both in native and foreign languages. Critically for our purposes, the size of the self-bias effect was significantly smaller when participants completed the task in their foreign language as compared to their native language. In Experiment 2 the linguistic context was manipulated within-participants in order to assess the reliability of the pervasive foreign language effect in the self-paradigm. Again, the self-bias effect was reduced in the foreign language trials as compared to the native language trials. Together, these results revealed that self-prioritization effects in perceptual matching are consistently reduced in foreign language contexts, providing compelling proof in support of the view that the affective neural mechanisms governing our emotions are modulated by linguistic contexts – namely, that they are less reactive in foreign language contexts.

The manipulation leading to the self-bias effect is based on the fact that assigning personal significance to perceptual stimuli rapidly alters the behavioral and neural reactions elicited by such stimuli and modifies their perceptual saliency (e.g., Sui et al., 2012, 2013, 2014). This modification is driven by automatic, emotion-mediated reactions that modulate perceptual associations (e.g., Moradi et al., in press). Following this view, our results revealed that these highly automatic, emotional reactions are lessened when the stimuli involve foreign language words, suggesting that the emotional reactivity to the foreign language stimuli is reduced as compared to the native language stimuli. Interestingly, this reduction in self-prioritization was found to be relatively stable across participants. The percentage of participants showing a self-bias in Experiment 1A was 92.3% in the native language context, compared to only 79.5% in the foreign language context. In Experiment 2 this difference was reduced (95.8% vs. 91.7%, respectively), but critically, 75% of participants (namely, 36 out of 48) showed larger self-bias effects in the native than in the foreign language trials, suggesting that this foreign language effect is robust (see Figure 2), and that it was the foreign language context that brought about this lesser emotional reactivity.

In clear contrast with the preceding studies exploring the foreign language effects with emotionally charged linguistically complex materials requiring relatively deep processing that may tap into different autobiographical memories (e.g., Ayçiçegi-Dinn & Caldwell-Harris, 2009; Harris, 2004; Harris, Ayçiçegi, & Gleason, 2003), the self-paradigm offers a valuable opportunity to explore the impact of the foreign language effects in an experimental context with reduced linguistic demands. While it is certainly undeniable that a foreign language virtually always elicits increased cognitive effort (e.g., Abutalebi, Cappa, & Perani, 2001; Perani et al., 1996), it should be kept in mind that the linguistic burden in this paradigm is restricted to three high-frequency words (e.g., "you", "friend", "other"). These repeatedly presented lexical items are sufficient to create a linguistic context but can barely involve an increased cognitive load in the foreign language conditions as compared to the native language conditions. In fact, when considering the data from the mismatching conditions, results did not reveal any language-related cost associated with the foreign language. In light of these results we posit that the foreign language effect presented here arises due to the language-dependent emotional resonance, being relatively free from any cognitive cost incurred by the processing of a foreign language.

The current study provides evidence in favor of the hypothesis of a certain level of emotional detachment (namely, reduced emotional reactivity) associated with foreign as compared to native languages. Native languages are acquired during childhood in familiar contexts, in an emotionally charged environment encompassing an entire span of human emotions, while the experiential circumstances in which foreign languages are learned (and used in) largely condition us to a more emotionally neutral if not restrained attitude (e.g., Dewaele & Pavlenko, 2002; Harris et al., 2003; Pavlenko, 2006; Schrauf, 2000). Hence, in comparison to native language contexts in which emotion-based processing is thought to prevail, foreign language contexts are associated with more rationally and logically biased processing due to the lesser emotional involvement they evoke. This lead some authors to hypothesize that this emotional distance could be responsible for the foreign language effects (see Duñabeitia & Costa, in press, for review). In fact, several studies have recently provided a body of evidence in favor of this view, showing that allegedly immutable human decisions in the scenarios in which heuristics tend to prevail (e.g., loss/gain-related problems and moral judgments) vary as a function of the language in which they are framed (see Costa et al., 2014a, 2014b; Keysar et al., 2012). The present study provides a strong piece of experimental evidence in favor of this view.

The precise process responsible for triggering the foreign language effect observed in the current study is not completely clear. On the one hand, one could argue that the contrasting self-bias effects are due to the different emotional resonance elicited by the words in the two languages (i.e., an item-level explanation; e.g., "tú" vs. "you"). On the other hand, it could be suggested that the foreign language effects are triggered by more global processes, such as the linguistic context imposed by a task being completed entirely in a native or foreign language (i.e., a task-level explanation). In Experiment 1A both explanations could account for the findings, given that the whole experimental context and the individual words were in either the native or the foreign language. However, in Experiment 2 participants were placed in a bilingual scenario at the task-level, and still significant (albeit smaller) differences between the magnitudes of the self-bias effects were found, providing partial support to the item-level explanation. The foreign language effect observed in Experiment 2 was much smaller than that observed in Experiment 1A, where both the task-level and the item-level linguistic contexts were univocal. Hence, we tentatively conclude that a single foreign-language word can induce certain emotional distance, but that the effects are magnified when accompanied by a more general linguistic context. These findings nicely match those from previous studies examining emotionality effects in within- or between-participants designs, which have suggested that foreign language effects are more easily found in experimental settings in which the language context of the whole task is manipulated rather than in settings in which native and foreign languages are mixed at the trial level (see Ayçiçegi-Dinn & Caldwell-Harris, 2009; Harris et al., 2003, for single words).

In sum, we employed the self-bias effect, an already established, highly automatic emotion-driven effect, in order to investigate bilinguals' different affective responses in native and foreign languages. Based on our results, we conclude that the use of a foreign language leads to differential emotion-based effects as compared to the use of a native language, and that this foreign language effect is highly pervasive and deeply established in the emotional processing system, as well as in the rewarding mechanisms that are a gateway to our emotion system. One of clearest differences between a foreign language and a non-native second language is that the former is typically learned in academic settings, reducing the chances of its use in everyday situations (e.g., Caldwell-Harris, 2014; Dewaele, 2010). Accordingly, we argue that the restricted contextual diversity associated with the use of foreign languages is responsible for the different emotional reactivity they elicit. Future studies are needed to examine whether similar effects would be observed in bilinguals whose use of L2 is not as contextualized. We conclude that there is a close link between language and emotion processing, and that the reduced emotional resonance elicited by foreign languages plays a major role in shaping even relatively orthogonal processes such as perceptual associations. In the Italian filmmaker Federico Fellini's words, *a different language is a different vision of life.*

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Table 1. Descriptive statistics of the linguistic and demographic factors of the different experimental groups tested in Experiments 1A, 1B and 2. The IQ score corresponds to the score obtained in a 6-minutes abridged version of the K-BIT intelligence test. The age of acquisition (AoA) of English corresponds to the estimated age (in years) at which participants acquired English, according to their self-reports. The English proficiency scores were calculated according to participants' self-ratings (on a 1-to-10 scale), and the English interview scores correspond to the interviewer's assessment of participants' fluency in an interview (on a 1-to-5 scale). The English vocabulary score corresponds to the number of correctly named pictures from a 77-drawings battery. Exposure to English corresponds to the self-reported percentage of time they were exposed to English in their daily lives.

	Age (in years)	IQ score	English AoA (in years)	English proficiency (1-to-10)	English interview (1-to-5)	English vocabulary (out of 77)	Exposure to English (% of time)
Experiment 1A							
Native Language	22.26 (3.04)	23.77 (2.89)	5.77 (2.45)	6.68 (1.36)	3.54 (0.55)	57.56 (8.21)	11.54 (8.44)
Foreign Language	23.05 (2.86)	24.23 (3.10)	6.08 (2.18)	6.67 (1.78)	3.56 (0.60)	58.79 (8.29	10.51 (8.26)
Experiment 1B	27.58 (5.81)	-	-	-	-	-	
Experiment 2	24.06 (5.02)	-	6.36 (2.72)	6.10 (1.61)	3.45 (0.50)	56.87 (7.77)	11.96 (10.03)

Table 2. Mean reaction times (in ms) and percentages of errors in each condition tested in Experiments 1A, 1B and 2. Standard deviations are provided in parentheses. Self-bias effects are calculated by subtracting the RTs and error rates in the Self conditions from those in the Other conditions. Familiar-bias effects are calculated by subtracting the RTs and error rates in the Familiar conditions from those in the Other conditions.

	Match trials					
	Self	Familiar	Other	**Self-bias**	**Familiar-bias**	Mismatching trials
Experiment 1A						
Native Language						
RTs	584 (63)	655 (68)	698 (79)	**114ms**	**43ms**	729 (68)
%Errors	3.68 (5.18)	7.26 (6.88)	14.36 (10.66)	**10.68%**	**7.10%**	9.23 (5.40)
Foreign Language						
RTs	614 (67)	660 (68)	668 (73)	**54ms**	**8ms**	728 (63)
%Errors	4.27 (4.39)	7.18 (5.44)	9.74 (7.11)	**5.47%**	**2.56%**	6.98 (5.18)
Experiment 1B						
RTs	609 (61)	701 (78)	733 (88)	**124ms**	**32ms**	779 (71)
%Errors	4.10 (3.17)	11.92 (9.67)	20.00 (12.04)	**15.90%**	**8.08%**	13.97 (6.81)
Experiment 2						
Native Language						
RTs	597 (59)	695 (68)	728 (77)	**131ms**	**33ms**	759 (60)
%Errors	3.06 (5.27)	7.29 (7.52)	14.17 (10.09)	**11.11%**	**6.88%**	10.79 (6.12)
Foreign Language						
RTs	618 (61)	683 (65)	715 (77)	**97ms**	**32ms**	753 (52)
%Errors	4.79 (5.00)	7.78 (6.16)	13.61 (11.46)	**8.82%**	**5.83%**	9.88 (5.97)

Figure 1. Examples of stimuli from Experiments 1A/B and Experiment 2. The labels appeared either in Spanish or English, depending on the linguistic context of the experiment.

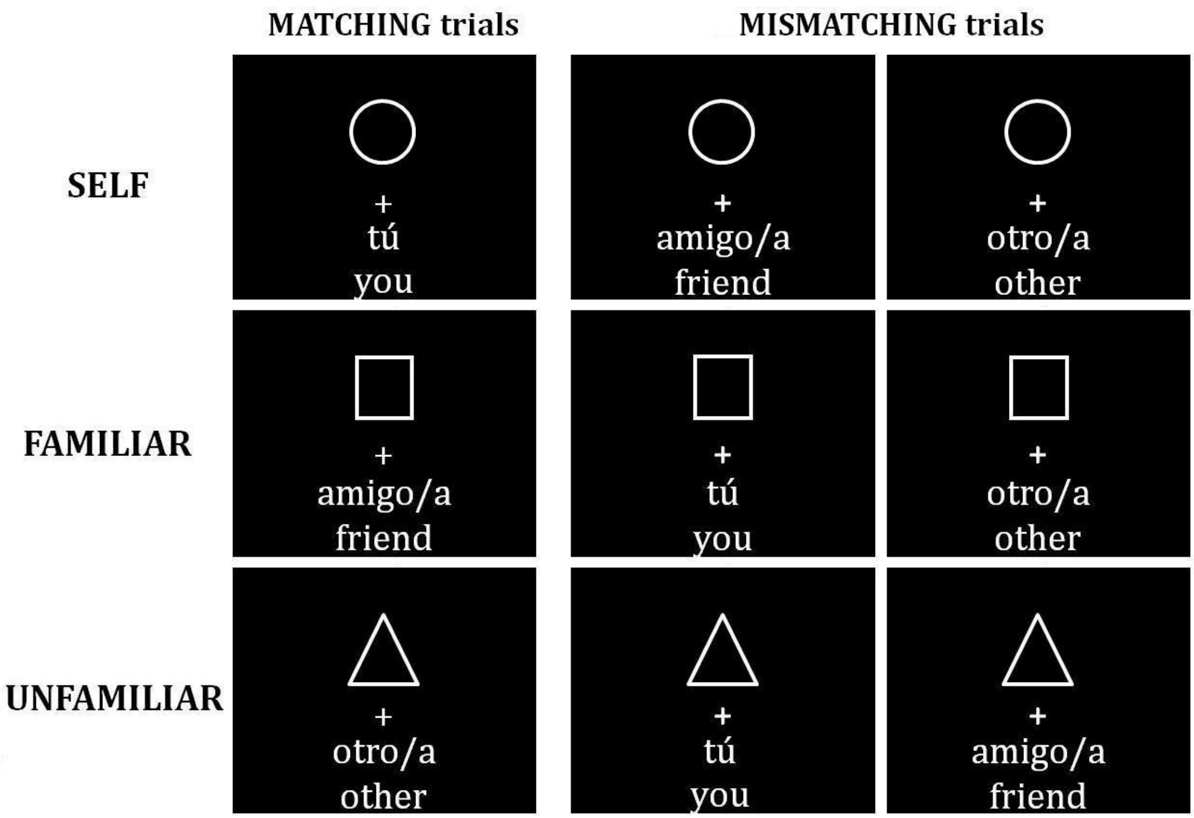

Figure 2. Left panel: Density plots of the RT distribution in 50ms-bins per condition for Experiments 1A and 2. Right panel: Magnitudes of the self-bias effects in the native (black) and foreign (grey) language trials for each participant.