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How does foreign language affect the estimates of temporal distance?

By Changchun (Giselle) YANG

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Faculty Advisor: Boaz Keysar, Zeynep Aslan Sisman

Preceptor: Claire Watson

Email: giselleyang@uchicago.edu

Student ID: 12332449

Abstract

Multilinguals think and feel the world differently when they use their foreign languages: they tend to have less emotional reactions and think more deliberately and rationally. One potential explanation proposed by previous studies is that foreign languages create a greater subjective feeling of distance. However, there is no empirical evidence supporting this idea. This study, therefore, aimed to investigate whether foreign languages attenuate the subjective feeling of distance by specifically focusing on the domain of temporal distance. Participants (N = 217) were asked to recall two personal events that happened during their high school years either in their native or foreign language and were tasked to judge the temporal distance of the event. The results showed that when they used their foreign language to recall and recite the memories, participants gave greater estimates of temporal distance compared to when they used their native tongue. This finding held even when controlling for the potential influences of other factors such as objective distance, emotionality, fluency, and vividness of imagery. This study contributes to research on the interaction of language and thought, showing that the status of language (native versus foreign) can influence how people judge temporal distances.

Keywords: Foreign languages, psychological distance, temporal distance

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How does foreign language affect the estimates of temporal distance?

As the rate of globalization and accessibility of the internet increases, people are more likely to communicate with people who speak different languages. Multilinguals tend to use foreign languages across different contexts such as on business, diplomatic occasions, or social occasions for more efficient communication. Foreign languages have become more crucial in recent years. Noteworthy, previous studies pointed out that multilinguals think and feel differently while using a foreign language relative to their native language (Caldwell-Harris, 2014; Grosjean, 2010; Keysar, Hayakawa & An, 2012). To be more specific, people's emotional reactions and decision biases attenuate when they use foreign languages (Caldwell-Harris, 2014). This shows that using foreign languages alters multilinguals' cognition and therefore it may influence how people communicate with others in foreign languages. Therefore, investigating why people think and feel differently in their foreign languages is profound. Researchers proposed that these effects might be because foreign languages create a greater subjective feeling of distance (Costa et al., 2014; Hayakawa et al., 2016; Keysar et al., 2012). However, previous studies have not found empirical evidence supporting this idea; the question of whether foreign languages create a greater subjective feeling of distance remains unclear. In order to fill this gap, this study aims to investigate whether using foreign languages results in a greater subjective feeling of distance.

Numerous studies have shown that using a foreign language attenuates emotional reactions (Caldwell-Harris, 2014; Caldwell-Harris, 2015; Dewaele, 2004, 2010; Dewaele & Nakano, 2013; Dewaele & Salomidou, 2017; Harris et al., 2003; Pavlenko, 2005a, 2005b). For example, Caldwell-Harris (2015) found that bilinguals reported that they felt weaker emotional reactions when they used their foreign language as compared to their native language. This phenomenon occurs across different contexts that evoke emotional

resonances, such as arguing with others, talking about embarrassing topics, or even expressing love (Caldwell-Harris, 2015). Several psychophysiological studies have also found this phenomenon. To be more specific, Harris et al. (2004) investigated people's autonomic arousal when they read or heard words that can evoke emotional reactions, such as words related to insults, endearment, or taboo, in their native language or foreign languages. They found that presenting these words in participants' foreign languages led to smaller skin conductance amplitudes as compared to their native language. A similar result was also found in another psychophysiological study conducted by Caldwell-Harris and Ayçiçeği-Dinn (2009). They measured participants' skin conductance responses when participants listen to emotional phrases in their foreign language or native language. They revealed that when Turkish participants who learned English as their foreign language heard emotional phrases in English, their skin conductance responses are lower than when phrases are presented in their native language. Anooshian and Hertel's study (1994) also demonstrated that people tend to recall more emotional words only when they use their native language; however, this tendency had not been found in foreign languages. This implies that foreign languages are less likely to evoke emotions compared to native languages. These findings, therefore, show that foreign languages elicit less intense emotional reactions compared with a native language.

Foreign languages also affect how people make decisions: bilingual speakers tend to make more rational and utilitarian decisions in a foreign language as compared to their native tongue (Costa et al., 2014; Hadjichristidis et al., 2019; Hayakawa et al., 2016; Keysar et al., 2012). Previous studies indicated that the reason for the observed effect is people think more deliberately and rationally in foreign languages rather than following their intuitive, automatic, and fast thoughts. Following intuitions can result in decision-making biases that

distort judgment such as the framing effect which is a cognitive bias where people make decisions according to whether possible choices are presented with positive or negative connotations (Levin et al., 1998). These decision-making biases would be attenuated by using foreign languages (Costa et al., 2014; Keysar et al., 2012). Previous studies have supported this idea. For instance, Keysar et al. (2012) revealed that foreign languages influence the framing effect. To illustrate, people tend to be risk-seeking if choices are framed as losses and risk-averse if they are framed as gains, however, this framing effect is diminished if choices are presented in foreign languages (Keysar et al., 2012; Tversky & Kahneman, 1991). In addition, people tend to make more utilitarian decisions when they use their foreign languages. This idea is supported by research conducted by Costa et al. (2014): they found that people are more willing to sacrifice one life to save five while using their foreign language. These findings suggest that using foreign languages indeed affects how people make decisions and reduces decision-making biases.

Previous studies have shown that foreign languages attenuate emotional resonances and decision-making biases, however, the reason contributing to this effect remains unclear. One potential hypothesis frequently proposed in the literature that can explain the effects of foreign languages on reduced emotional resonance and decision biases is that foreign languages result in a greater psychological distance (Costa et al., 2014; Hayakawa et al., 2016; Keysar et al., 2012). It suggests that languages will influence how people perceive the world by changing their subjective judgments about how distant they feel from a target event or an object.

To be more specific, foreign languages create a subjective feeling of increased distance from stimuli eliciting emotional resonances and this increased distance reduces people's emotional reactions to events. This subjective feeling also predisposes people to

feel they are more psychologically distant from the task of making decisions and consequently, they think more deliberatively and rationally rather than following their intuitive thoughts. Overall, the hypothesis is that foreign languages create a greater subjective sense of distance which is reflected in their emotional reactions and decision-making processes. This hypothesis has been frequently applied as a possible mechanism for explaining the impact of foreign languages on decision-making and emotional reactions. However, previous studies had not found any empirical evidence supporting that foreign languages indeed generate a greater subjective feeling of distance. This research, therefore, aims to fill the gap and investigate whether there is evidence showing that foreign languages result in a greater subjective sense of distance.

The subjective feeling about whether something is close or far away from the self, here and now, is defined as the psychological distance (Trope & Liberman, 2010). As people cannot directly experience the past, the future, other people's perspectives, and other places, they need to transcend the immediate situation and form abstract mental construal of psychologically distant objects to make predictions, remember the past, consider hypothetical alternatives to reality, and imagine others' responses (Trope & Liberman, 2010). The perception of when an event occurs, where it occurs, to whom it occurs, and whether it occurs is the psychological distance (Trope & Liberman, 2010). Psychological distance has four dimensions, including temporal distance, spatial distance, social distance, and hypotheticality (Trope & Liberman, 2010). This research will specifically focus on temporal distance which refers to the extent to which recalled past events or future events distant from the present in time (Bar-Anan et al., 2006; Trope & Liberman, 2003).

The perceived temporal distance of an event is affected by emotional intensity: if people feel emotionally intense about an event, they perceive that event as less temporally

distant (Van Boven et al., 2010). As the emotional intensity rises, people feel the event is closer to the present time. This idea is supported by the results of 5 experiments conducted by Van Boven et al. (2010). They asked participants to retrieve and delineate an embarrassing moment emotionally or neutrally. Then, participants were required to rate how far away they feel from the event. The results revealed that when participants described the embarrassing event emotionally, they felt less psychologically distant from the event (Van Boven et al., 2010). This finding implies that emotionality indeed reduces perceived temporal distance. Van Boven and colleagues also demonstrated that the level of intensity of emotional reactions moderates the perceived temporal distance. To be more specific, they assigned participants either to dance in front of the audience as performers or watch others dancing as the audience. Participants who were performers had a higher level of emotional intensity as compared to audiences (Van Boven, Loewenstein, & Dunning, 2005). This result revealed that performers felt less psychologically distant from the dancing than the audience who felt less emotionally intense about the dancing (Van Boven et al., 2010). It implies that as emotional intensity increases, people are more likely to feel less psychologically distant from the event.

Moreover, perceptual fluency, which is the ease with which people think about events, also influences temporal distance: the easier people think about an event, the closer they perceive it temporally (Van Boven et al., 2010). This shows that as perceptual fluency increases, perceived temporal distance is reduced. This association had been found in Alter and Oppenheimer's study (2008) which reported that low perceptual fluency creates a greater distance. The underlying mechanism of this effect might be that people perceive close events more fluently than distant events (Alter & Oppenheimer, 2008). To illustrate, people are more likely to be exposed to events that are closer in time, and repeated

exposure to closer events would increase perceptual fluency (Alter & Oppenheimer, 2008). Unkelbach (2006) also revealed that if people processed a stimulus less fluently, they would regard this stimulus as old, which means the stimulus that was processed less fluently would be viewed as more temporally distant from the present. This finding implies that reduced perceptual fluency indeed generates a greater temporal distance.

The estimated temporal distance can also be impacted by the vividness of mental imagery, which refers to representations of sensory experiences, including touch and sight, without an external stimulus (Pearson et al., 2015). More specifically, if the mental image of an event is less vivid, people would feel more temporally distant from the event. Trope and Liberman (2010) argued that people would form abstract mental construal of distant events and construct more concrete mental constructions of closer objects. Based on this idea, events or objects that are presented with more details are felt more psychologically close. Noteworthy, vivid mental images contain more details, and they tend to be more concrete. Therefore, mental imagery with a higher level of vividness should be felt as more psychologically close to now. In addition, Elder et al. (2017) also found that the estimation of temporal distance was affected by mental imagery, which is also called sensory imagery. They asked participants to read a restaurant review including descriptions that can trigger either proximal or distal sensory imagery and then recorded participants' perceived temporal distance. Proximal sensory imagery contains senses such as touch and taste, whereas distal sensory imagery includes senses such as sight or hearing (Elder et al., 2017). The result revealed that sensory imagery which includes senses such as taste and touch generated lower estimates of temporal distance compared with that only contains hearing or sight (Elder et al., 2017). As imagery that includes taste and touch tends to be more vivid than those with hearing or sight, it decreases the estimated temporal distance. The visual

perspective of mental imagery could also affect estimated temporal distance: using the first-person perspective might decrease the temporal distance. If people form mental imagery from a first-person perspective, they would be more involved in the event and therefore generate a sense of closeness. In contrast, forming mental imagery with a third-person perspective would create an increased temporal distance.

Interestingly, research shows that these factors, i.e., emotional intensity, perceptual fluency, and the vividness of imagery, are also affected by foreign language use. As discussed above, previous studies revealed that foreign languages attenuate emotional intensity (Caldwell-Harris, 2014; Caldwell-Harris, 2015; Dewaele, 2004, 2010; Dewaele & Nakano, 2013; Dewaele & Salomidou, 2017; Harris et al., 2003; Pavlenko, 2005a, 2005b). Moreover, emotionality would be reduced if people use languages that are acquired later in life. This is because languages learned later in life are less likely to be connected with emotional systems as compared to language learned at an early age (Caldwell-Harris, 2014). To illustrate, emotional regulation systems develop in early childhood and therefore languages learned early in life are closely correlated with emotional systems (Bloom & Beckwith, 1989; Caldwell-Harris, 2014). Notably, foreign languages are usually acquired at a later age (Gass & Mackey, 2014). Therefore, emotional intensity can be reduced by foreign languages. Dewaele (2010) also stated that emotional resonance would be weaker if people use a language that is learned through classroom learning. This is because classroom learning is usually emotionally neutral, and it cannot provide people with emotionally varied situations which could connect languages and emotions closely (Brase & Mani, 2017). As foreign languages are usually learned in a classroom context rather than via immersion or real-life context, people tend to have less emotional reactions while using foreign languages. Apart from that, emotional resonance would also be weaker if a speaker is less proficient in a

language. Harris et al. (2006) reported that emotionality was lower when multilinguals use a less proficient foreign language rather than a more proficient native language. This suggests that a less proficient foreign language indeed evokes fewer emotions. Languages that are used less frequently would also elicit less emotional resonance, as more frequent usage would result in more communication which could evoke emotions in human social lives (Caldwell-Harris, 2009, 2014; Degner et al., 2011). Based on this idea, lower usage frequency is less likely to result in communications with emotional reactions. Most of the time, foreign languages are used less frequently than native languages (Caldwell-Harris, 2015). Therefore, using foreign languages would reduce emotional resonance, since foreign languages are usually acquired at a later age, learned through classroom learning, less proficient, and used less frequently. Based on previous studies, the emotional intensity will be attenuated as temporal distance increases and it will be reduced by foreign language use. These findings suggest that it is very likely that emotionality is able to mediate the effect of foreign languages on decreasing temporal distance.

Foreign languages are also associated with perceptual fluency: people tend to find it difficult to think about an event if they use foreign languages. The possible association is based on the idea that because speakers are usually less proficient in a foreign language than in their native language, a higher cognitive load would be induced when people use their foreign languages. The increased cognitive load while processing foreign language can be found in a study conducted by Hasegawa et al. (2002). They revealed that bilinguals' volume of activation was increased in most of the cortical regions when they used their foreign language. This implies that processing a foreign language requires more cognitive effort. The increased cognitive load may prevent people from retrieving events easily, as it may distract people from the retrieval of events. Moreover, as foreign languages are used

less frequently and less fluently, the unfamiliarity of foreign languages may predispose people to pay more attention to correcting grammar, finding vocabulary, or avoiding errors. Therefore, people's attention on retrieving events would be distracted by forming correct sentences in their foreign language. It seems reasonable that people would find it more difficult to recount events in their foreign language.

The vividness of imagery can also be influenced by using foreign languages: the experienced vividness of imagery would be reduced when people recall memories in their foreign languages. This idea is supported by Hayakawa and Keysar's (2018) research which found that mental imagery is reduced by using foreign languages. They revealed that participants reported the mental imagery of sensory memories was less vivid when they used a foreign language relative to a native language (Hayakawa & Keysar, 2018). A similar result had also been found by Jansson and Dylman (2021). In Jansson and Dylman's study, they asked fifty native Swedish speakers whose second language is English to recall a negative episodic memory in their native language. Then, participants were asked to recall the same memory in their native language or foreign language and rate their experienced vividness of imagery. The result showed that participants who were asked to recall the memory in their foreign language reported that the experienced vividness of imagery was decreased. This finding implies that using foreign languages to recall memories can reduce the vividness of imagery. The reason for this reduction might be people are less likely to get access to sensory memories which work as necessary components for creating mental imagery when they use foreign languages (Hayakawa & Keysar, 2018). To illustrate, foreign languages usually result in higher cognitive loads which prevent people from recalling sensory memories (Costa et al., 2019). Moreover, Jia et al. (2017) revealed that increasing cognitive load would attenuate the vividness of imagery. This is based on the idea that

constructing mental images requires cognitive effort (McGill & Anand, 1989). More specifically, when people are under a high cognitive load, they would ignore some necessary details for forming a vivid mental image (Jia et al., 2017). The increased cognitive effort would also distract people's attention from forming vivid mental imagery (Petrova & Cialdini, 2005; Petrova & Cialdini, 2018). Therefore, people's capability to form vivid mental images would be diminished by the increased cognitive load (Jia et al., 2017).

Based on the results of the previous research, emotionality, perceptual fluency, the vividness of imagery, and visual perspectives will affect the temporal distance. These factors would also be influenced by foreign languages. Therefore, the effect of foreign languages on temporal distance might be mediated by these factors. However, there is no evidence supporting this potential mechanism. In this study, we measured those covariates, including emotional intensity, perceptual fluency, the vividness of imagery, and visual perspective to investigate whether the potential mediation mechanism can explain the effect of foreign languages on reducing temporal distance.

In addition, it seems reasonable that a greater distance can explain why multilinguals think and feel the world differently. However, previous studies had not found evidence supporting foreign languages create a greater estimate of distance. This study particularly focused on the estimated temporal distance and asked the participants to retrieve events either in their native or foreign language to investigate whether foreign languages indeed generate a greater estimated temporal distance. It is hypothesized that participants report a greater temporal distance when they recall events in their foreign language relative to their native language.

Method

Participants

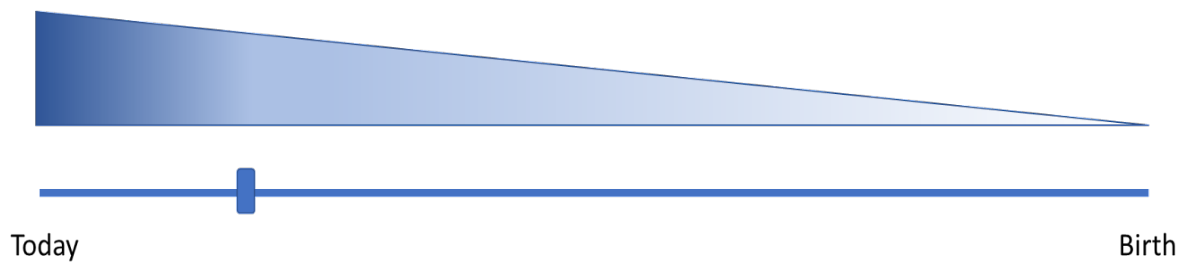
We offered the study until we recruited 300 participants. Participants who (a) are native Chinese speakers, (b) whose nationality is Chinese, (c) were born in China, (d) are currently residing in China, (e) do not speak English at home with their family while growing up, (f) do not have anybody in their immediate family who is a native speaker of English, (g) never lived in a country where English is the main language more than 12 months (excluding college education), and (h) know English as a second language were eligible to participate in the study. 83 participants did not satisfy the criteria and we removed those participants. We collected data from 217 Chinese-English bilinguals ($M_{age} = 22.39$, $SD = 4.03$, 141 females). 124 participants completed the recall task in their native language (i.e., Chinese) and 93 participants completed the task in their foreign language (i.e., English). On average, participants indicated that they started learning English at the age of 8 ($SD = 2.89$) and the average English language proficiency of the sample was 6.42 ($SD = 1.67$, $range = 9.00$).

Task

Participants were asked to recall two personal events that happened during their high school years (see Appendix A). One of the events was an event that made them feel embarrassed and the other one was an event that made them feel angry. The order of these two recall tasks was counterbalanced across participants. After the recall task, participants were shown a timeline that represents their lifetime (shown in Figure 1), where the right end represents their birth (the day that they were born) and the left end represents today (the day that they fill out the survey). They were asked to respond to a temporal distance question: 'Imagine that the timeline below represents their lifetime. How far would you locate the event that you just recalled from today?'

Figure 1.

Timeline represents lifetime



For each one of the events recalled, participants were also asked to answer questions examining the emotional intensity felt at the time of the event as well as when recalling the event (“How embarrassed/angry did you feel when this event happened?” 1= Not at all embarrassed/angry, 7= Very embarrassed/angry; “While remembering this event right now, how intense or strong is the feeling of embarrassment/anger?” 1 = not at all embarrassed/angry, 7 = very embarrassed/angry), the perceptual fluency of the recall processes (“How difficult or easy was it to recall this event?” 1 = very difficult, 7 = very easy), the vividness of the imagery of the memory (“How clear was the image of the memory of the event that you just recalled?” 1 = not at all clear, 7 = very clear’), and visual perspective of their mental imagery (“When remembering the event, do you see the event through your own eyes or as an outside observer?” 1=own eyes, 5=outside observer). After participants answered all other memory-related questions, we also asked participants to report the objective distance of the event (the year in which the event happened).

Procedure

Participants were randomly assigned to complete the recall task either in their native language (i.e., Chinese) or foreign language (i.e., English). After they finished the recall task, participants filled out a survey that includes questions about their demographic information and foreign language learning history.

Results

Some participants in the foreign language group wrote memories in their native language and some in the native language group wrote memories in their foreign language. The analysis below was conducted with the whole data testing all participants without removing results from participants who wrote memories in the incorrect language condition. This is because even though these participants wrote memories in the incorrect language, they still read the whole survey in the language condition they were assigned to. Thus, we chose to show the results based on the whole data. However, we also re-ran the analysis with the data which deleted answers from participants who did not complete the questionnaire in the language condition they were assigned to (see Appendix B). The results that were conducted on data with these participants removed are the same as that based on the whole data.

We, first of all, compared the age, age of English language acquisition, and English language proficiency of the participants between groups to check if the randomization worked. Neither of these variables differed between the two language groups.

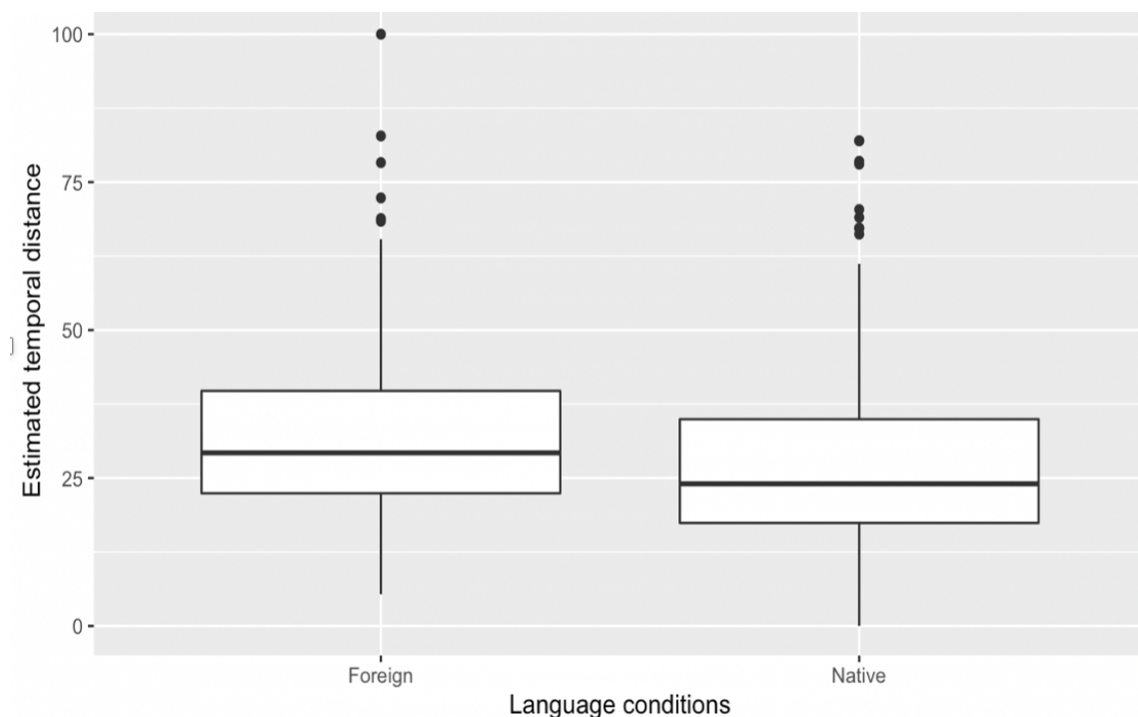
To test our hypothesis, we compared participants' estimates of temporal distance for embarrassment memories between two language groups to examine if the language in which they retrieved and retold their memories affected the distance of the event from "here and now". We used the Mann-Whitney U test to compare the differences between groups when the distributions did not satisfy the normality condition.

Regarding results based on embarrassment memories, temporal distance estimates of the participants in the foreign language group ($Mdn = 29.3$) were significantly higher than that of participants in the native language group ($Mdn = 24.0$), $U = 4559$, $p < .01$, $r = .21$ (see Figure 2). However, the objective distance of the memories that were told by the

participants in the foreign language group ($Mdn = 5.0$, $range = 21$) was not significantly different from the memories of the participants in the native language group ($Mdn = 5.0$, $range = 21$), $U = 5348$, $p = 0.36$. The objective distance was calculated by subtracting the year that the participants reported from 2022 (the year in which the study was conducted) to calculate the objective time past between the event happened and today.

Figure 2

Estimated temporal distance for embarrassment memories

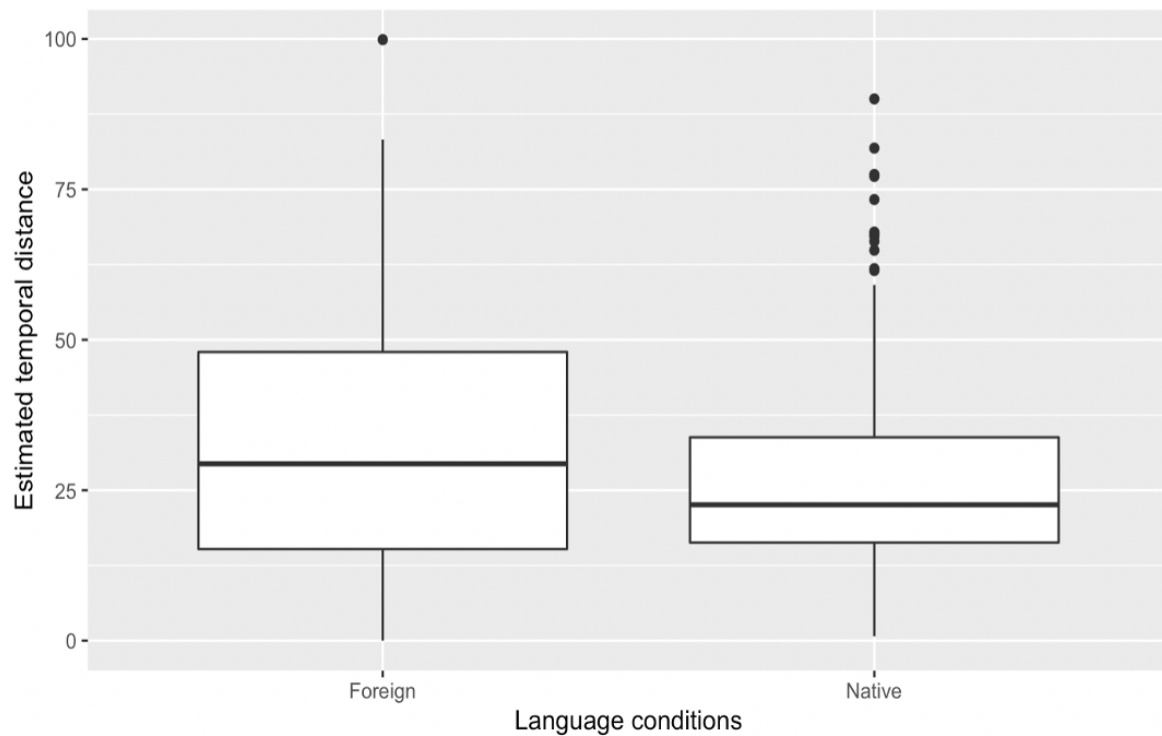


In terms of results based on angry memories, temporal distance estimates of the participants in the foreign language group ($Mdn = 29.4$) were significantly higher than that of participants in the native language group ($Mdn = 22.6$), $U = 4793$, $p < .05$, $r = .17$ (see Figure 3). The objective distance of the memories that were told by the participants in the foreign language group ($Mdn = 5.0$, $range = 21$) was not significantly different from the memories of the participants in the native language group ($Mdn = 5.0$, $range = 21$), $U = 5007$, $p = 0.09$).

The objective distance was also calculated by subtracting the year reported from the current year (2022).

Figure 3

Estimated temporal distance for anger memories



The observed results might have been explained in two alternative ways: (1) it is possible that participants simply remember and report events that happened objectively further in the past while using their foreign language; (2) it is also likely that people perceive events as more temporally distant in their foreign language even though objectively it should not be more distant. Therefore, we did a second analysis to control for the objective distance of the events to investigate whether people tend to recall events that happened objectively further in the past, or they just *feel* the events happened more distant while recalling events in their foreign language. We also added age to the analysis. This is because participants of different ages experienced different lengths of time between retrieved events and now. To be more specific, as participants were required to recall memories of

their high school years, the period between the end of high school and now is different for participants of different ages.

We conducted a linear regression model to see if the temporal distance estimates of the two language groups are still significantly different from each other after controlling for the effects of participants' ages and the objective distance of their memories. Results of the linear regression analysis for embarrassment memories indicated that language condition, age and objective distance together explained a significant variance in participants' estimated temporal distance, $F(3, 213) = 13.0, p < .05, R^2 = .15, R^2_{\text{Adjusted}} = .14.$). While age did not significantly predict participants' estimated temporal distance, objective distance ($B = 1.24, p < .05$) and group ($B = -5.60, p < .05$) are significant predictors. This shows that the effect of language condition remains significant even after controlling for the effects of age and objective distance of the event.

The linear regression analysis for angry memories also shows that language condition, age, and objective distance together explained significant variance in participants' estimated temporal distance, $F(3, 213) = 12.2, p < .05, R^2 = .15, R^2_{\text{Adjusted}} = .14.$). Age did not significantly predict participants' estimated temporal distance. However, objective distance ($B = 1.13, p < .05$) and group ($B = -5.22, p < .05$) are significant predictors for estimated temporal distance. This suggests that the effect of language condition remains significant even after controlling for the influences of age and the objective distance of the event.

We have checked if there is a difference between the two language conditions concerning emotionality (both at the time of the event and at the time of recall), perceptual fluency, the vividness of imagery, and visual perspectives for embarrassment memories. The results show that only the emotionality at the time of the event for embarrassment memories was significant: Emotionality at the time of the event while retrieving

embarrassment memories in the foreign group was significantly different from participants in the native group), $U = 4774$, $p < .05$, $r = .17$. We also have checked if there is a difference between the two language conditions with respect to emotionality (both at the time of the event and at the time of recall), perceptual fluency, visual perspective, and vividness of imagery for anger memories. The results show that none of those variables was significant. Therefore, we added emotionality at the time of the event for the embarrassment memories to the regression model to see if that wipes out the condition effect.

The linear regression analysis for embarrassing memories which added emotionality at the time of the event indicates that language condition, age, objective distance, and emotional intensity at the time of the event together explained significant variance in participants' estimated temporal distance, $F(4, 212) = 9.71$, $p < .05$, $R^2 = .16$, $R^2_{\text{Adjusted}} = .14$). Age and emotionality at the time of the event did not significantly predict participants' estimated temporal distance. However, objective distance ($B = 1.25$, $p < .05$) and group ($B = -5.67$, $p < .05$) are still significant predictors for estimated temporal distance. This shows that the effect of language condition remains significant even after controlling for the effects of age, objective distance of the event, and emotionality at the time of the event during recalling embarrassment memories.

The results show that regarding both embarrassment memories and anger memories, participants in foreign language groups gave a greater temporal distance estimate than those in native language groups. The linear regression analysis for embarrassment and angry memories shows that the effect of languages remains significant even after controlling for age, objective distance of the event, and emotionality at the time of the event. Regarding emotionality (at the time of the event and at the time of recall), perceptual fluency, the vividness of imagery, and visual perspectives, only emotionality at

the time of the event was significantly different between the two language groups and this is the case for only the embarrassment memories.

Discussion

The results support the hypothesis that foreign languages indeed result in a greater estimate of temporal distance: foreign languages impose a 'mindset' that causes people to apply the altered sense of distance to their judgments of actual temporal distance. People give a greater estimated temporal distance when they recall the events in their foreign language as compared to their native language. The result shows that language has an independent effect on the temporal distance which cannot be explained by emotionality or other factors (objective distance, perceptual fluency, the vividness of imagery, and visual perspectives). This finding suggests that foreign languages might also create a greater psychological distance. It implies that an increased temporal distance may explain why multilinguals think and feel differently while using foreign languages. However, our study cannot fully support this relationship. Future studies that can test this hypothesis directly could be conducted. In addition, the results show that the two language groups do not differ in terms of perceptual fluency, the vividness of mental imagery, and visual perspective. It suggests that language manipulation did not generate a difference between two language conditions with regard to these factors. Regarding emotional reactions, we found mixed results: only emotionality at the time of the recall of embarrassment memories was reduced by using a foreign language; the expected reduction in emotional reactions to anger memories (at the time of the recall and at the time of the event) had not been found.

The finding contributes to the research on foreign languages and psychological distance by showing a causal relationship between language status (native versus foreign) and judgments of temporal distance. It provides profound empirical evidence supporting

that foreign languages generate a greater estimate of temporal distance, which has not been found in previous studies. The previous study conducted by Rahimi and Tavakoli (2016) only investigated whether being bilingual versus monolingual influences how people judge temporal distances. It cannot provide evidence for the causal relationship between foreign languages and estimates of temporal distance. However, in our study, we only recruited bilinguals and asked them to retrieve events either in their foreign language or native language, which would ensure participants think in and speak their native or foreign language during the experiment. This study design shows manipulating the language of processing can change the way people perceive temporal distances. Therefore, this study shows there is a causal relationship between foreign languages and temporal distance.

In addition, the finding of foreign languages' attenuation of temporal distance might also indicate that foreign languages reduce psychological distance since temporal distance is one aspect of psychological distance. This study only tests the relationship between foreign languages and temporal distance judgments. However, as reviewed before, psychological distance also has other dimensions such as spatial distance, social distance, and hypotheticality. Whether foreign languages can affect other psychological distance dimensions remains unclear. Future studies can test whether the use of a foreign versus native language also influences these other dimensions to provide a more complete picture of the relationship between foreign languages and psychological distance.

Unlike previous findings in the literature, we could not find a difference between native and foreign language conditions in terms of emotionality, fluency, the vividness of the imagery of the memories, and visual perspectives. To be more specific, we found mixed results regarding emotional reactions: only emotionality (at the time of the event) of embarrassment memories was reduced by foreign language use, while the expected

reduction in emotional reactions to anger memories (at the time of the recall and at the time of the event) had not been found. On the one hand, the reduced emotional reactions at the time of the event while retrieving embarrassment memories show that foreign languages attenuate emotionality. This finding supports the hypothesis that people feel they are more distant from stimuli eliciting emotional resonances while using foreign languages. It provides potential evidence for why foreign languages attenuate one's emotional reactions: it is perhaps due to the greater temporal distance created by foreign languages. On the other hand, we did not find that the two language groups differ in emotional reactions (at the time of the recall and at the time of the event) to anger memories and to embarrassment memories (at the time of the recall). This finding shows that whether foreign languages indeed attenuate emotional reactions become controversial.

The inconsistency between findings in our study and previous studies might be because we use Chinese and English as two language conditions, while previous studies used other languages. Chinese participants' English proficiency has increased in recent years and the higher proficiency may elicit more emotional reactions to events in English (Shuo, 2020). English has become a more popular language that is regarded as necessary for Chinese people, as it is a compulsory subject that Chinese people should learn for the university entrance examination (Wan & Gao, 2021). Cheng (2008) and Jin and Cortazzi (2006) stated that a higher level of English proficiency represents students are more likely to receive a better education. Apart from that, a higher level of English proficiency is also a prerequisite for well-paid jobs, and it ensures a higher probability of being employed (Fang, 2018; Haidar & Fang, 2019). The importance of English renders Chinese people to make more effort to learn English. Therefore, Chinese-English speakers nowadays are more likely to have a higher level of proficiency in English than before. Moreover, the higher proficiency may elicit more

emotional reactions to events in English. To be more specific, the increased proficiency in foreign languages strengthens the connection between languages and the conceptual store, which is the repository of meanings that contains emotional reactions to words and phrases (Harris et al., 2006). A stronger link between proficiency in a certain language and conceptual store represents that this kind of language is more likely to elicit a stronger emotional reaction. The positive correlation between English proficiency and emotional reactions to events might explain why the two language groups in our study do not differ in emotional reactions.

Other potential explanations for the inconsistency between findings in our study and previous studies may be the nature of the stimuli we used. In previous studies, participants' emotional reactions were measured immediately via self-reports or physiological responses after they were shown emotional words or phrases. However, in our study, we do not measure participants' immediate emotional reactions. Rather, participants were given time to retrieve the event and reflect on it before answering questions related to emotional reactions. The time given to participants might be a factor wiping out differences between two language groups in emotionality. Apart from that, the inconsistency also might be because we only include a few questions relating to these factors including emotionality, perceptual fluency, the vividness of mental imagery, and visual perspective, the limited number of questions might not be able to show the relationship between foreign languages and these factors. In future studies, whether these factors would be reduced while using foreign languages can be investigated by implementing more detailed measures.

One alternative explanation of our findings can stem from *the language-dependent recall* hypothesis. Because participants were asked to retrieve memories during their high school years, those events were most probably encoded in Chinese which is their native

language. However, participants in the foreign language group retrieved their memories in their foreign language. The language they used in encoding is different from that used in retrieval. The mismatch of languages in encoding and retrieval might make it more difficult for people to retrieve events in their foreign language. Moreover, participants might think and retrieve memories automatically in their native language even though they were asked to retrieve events in their foreign language. Then they might translate recalled memories and describe them in their foreign language. As Chinese usually learn English by translating Chinese into English rather than understanding English directly, they might have a custom of translating events from Chinese to English before describing them in English (Liao, 2006). The process of translation might make recalling and delineating events in foreign languages more complicated, and therefore perceptual fluency can be reasonably expected to decrease. However, we did not find that the two language groups differ in perceptual fluency. This shows that even though there is a mismatch between languages used in encoding and that used in retrieval, people might not devote more cognitive effort to translating from their native language to foreign languages. However, our study only includes one question relating to perceptual fluency which might not be able to reveal the relationship between perceptual fluency and languages. In future studies, more detailed measures investigating how fluent the process of retrieving events can be applied to further investigate this relationship.

One of the limitations of this study is that some participants did not complete the questionnaire in the language condition to which they were assigned. More specifically, some participants in the foreign language group mistakenly wrote memories in their native language and some in the native language group wrote memories in their foreign language. The analysis in this study was conducted with the whole data which does not remove results

from participants who wrote memories in the incorrect language condition. Not removing results from participants who did not write memories in the correct language conditions might affect the results and lead to some biases. Writing memories in their native language might represent those participants retrieving memories in their native language. Those participants who wrote memories in incorrect language conditions, therefore, might not successfully retrieve their memories in the language they were asked to use. In future studies, biases can be reduced or eliminated by ensuring participants write memories in the language condition they are assigned. Moreover, future studies can also apply a more sophisticated measurement that can ensure participants retrieve events using the language in which they are asked to. Another limitation is that among participants who completed the questionnaire, the number of participants in the native language condition is higher than that in the foreign language condition. The unequal number of participants in two language conditions might lead to some biases in this study. Future studies can reduce this bias by ensuring the number of participants in two language conditions is the same.

Despite these limitations, our finding contributes to the research on the interaction between language and thought. As our study shows that bilinguals who use their native language and those who use a foreign language give different estimates of temporal distance, it implies that using different kinds of languages affects people's thought and cognitive processing. Therefore, it seems plausible that there might be two separate kinds of conceptual categories and perceptual processing for two kinds of languages in bilinguals' minds. When people use their foreign language, the categories and processing which is generated by their foreign language are activated. In contrast, using a native language activates the conceptual categories and perceptual processing specifically produced by the native language. This finding is aligned with the Linguistic Relativity Hypothesis: people think

in the way imposed by the language they speak, and the structures of languages affect how people think (Lucy,1997). However, our study did not focus on the specific structures or characteristics of languages. Rather, it examined the status of language and it found that if the same person speaks different languages, their cognition will be altered. This finding implies that the status of language influences multilinguals' thought and cognitive processing. Moreover, it suggests that thinking in foreign languages rather than just learning a new foreign language affects estimates of temporal distance and therefore influences cognitive processing. This finding facilitates how we understand the language-thought interaction in perceptual domains (Kurinski & Sera, 2011).

This finding also provides implications for the alibi provision. Alibi provision refers to people giving evidence that they were somewhere else when the crime took place to assert they could not have committed the crime (Olson & Wells, 2004). Our finding implies that people using their foreign languages to retrieve events may give estimates of temporal distance which is greater than the objective distance. This might cause multilinguals to give an inaccurate estimate of temporal distance in the alibi provision. The inaccurate alibi will render the police think that the suspect is lying. Considering the finding of our study, criminal investigators should take the language effect on alibi provision into consideration. When they ask multilinguals to retrieve when a certain event happened, they can be aware that suspects' estimates of temporal distance might be increased by using foreign languages. Thus, it might be better for them to ask suspects to answer questions in their native language to make sure they provide an accurate alibi.

In conclusion, this study reveals that a foreign language indeed has an independent effect on estimated temporal distance: people give greater estimates of temporal distance when they use their foreign language. It shows that the effect of foreign languages on

temporal distance is not affected by factors such as emotionality, perceptual fluency, and the vividness of imagery. This suggests a potential mechanism for why people think and feel differently (i.e. having reduced emotional reactions and thinking more deliberately and rationally) when they are using their foreign language.

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Appendix A

Question Prompts

EMBARRASSMENT:

Please take a minute and try to remember a personal event that happened during your **high school years** that made you feel **embarrassed, ashamed or socially awkward**. The memory has to be about a **specific and precise event**. This means that the event should have happened in a **specific place and at a specific time**. It should have lasted a few minutes or hours but *not* more than a day.

Please describe the event in as much **detail as possible**. Try to write at least three sentences.

ANGER:

Please take a minute and try to remember a personal event that happened during your high school years that made you feel **so angry that you wanted to explode**. The memory has to be about a **specific and precise event**. This means that the event should have taken place in a **specific place and at a specific time**. It should have lasted a few minutes or hours but *not* more than a day.

Please describe the event in as much **detail as possible**. Try to write at least three sentences.

Appendix B

Result after removing participants who did not complete the questionnaire in the language condition they were assigned to

We collected data from 185 Chinese-English bilinguals ($M_{age} = 22.5$, $SD = 4.03$, 116 females). 118 participants completed the recall task in their native language (i.e., Chinese) and 67 participants completed the task in their foreign language (i.e., English). On average, participants indicated that they started learning English at the age of 8 ($SD = 3.01$) and the average English language proficiency of the sample was 6.48 ($SD = 1.69$).

We used the Mann-Whitney U test to compare the differences between groups when the distributions did not satisfy the normality condition. Regarding results based on embarrassment memories, temporal distance estimates of the participants in the foreign group ($Mdn = 30.9$) were significantly higher than that of participants in the native language group ($Mdn = 24.2$), $U = 3218$, $p < .05$, $r = .19$. However, the objective distance of the memories that were told by the participants in the foreign group ($Mdn = 5.0$, range = 21) was not significantly different from the memories of the participants in the native group ($Mdn = 5.0$, range = 21), $U = 3793$, $p = 0.64$. Participants reported the actual date that the event happened, and we subtracted that year reported from 2022 to calculate the objective time past between the event happened and today.

In terms of results based on angry memories, temporal distance estimates of the participants in the foreign group ($Mdn = 26.0$) were significantly higher than that of participants in the native language group ($Mdn = 22.8$), $U = 3498$, $p < .05$, $r = .12$. The objective distance of the memories that were told by the participants in the foreign

group ($Mdn = 5.0$, range = 21) was not significantly different from the memories of the participants in the native group ($Mdn = 5.0$, Range = 21), $U = 3651$, $p = 0.39$). The objective distance was also calculated by subtracting the year reported from the current year (2022).

We conducted a linear regression model to see if the temporal distance estimates of the two groups are still significantly different from each other after controlling for the effects of participants' ages and the objective distance of their memories. Results of the linear regression analysis for embarrassment memories indicated that language condition, age and objective distance together explained a significant variance in participants' estimated temporal distance, $F(4, 180) = 8.11$, $p < .05$, $R^2 = .15$, $R^2_{Adjusted} = .13$). While age did not significantly predict participants' estimated temporal distance, objective distance ($B = 1.22$, $p < .05$) and group ($B = -5.51$, $p < .05$) are significant predictors. This shows that the effect of language condition remains significant even after controlling for the effects of age and objective distance of the event.

The linear regression analysis for angry memories also shows that language condition, age and objective distance together explained a significant variance in participants' estimated temporal distance, $F(3, 181) = 11.3$, $p < .05$, $R^2 = .16$, $R^2_{Adjusted} = .14$). Age did not significantly predict participants' estimated temporal distance. However, objective distance ($B = 1.58$, $p < .05$) and group ($B = -4.76$, $p < .05$) are significant predictors for estimated temporal distance. This suggests that the effect of language condition remains significant even after controlling for the influences of age and the objective distance of the event.

We have checked if there is a difference between the two language conditions concerning emotionality (both at the time of the event and at the time of recall), perceptual fluency, the vividness of imagery, and visual perspectives for embarrassment memories. The results show that there is no difference between the two language conditions with respect to these factors.