

Article

What Heritage Bilinguals Tell Us about the Language of Emotion

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Abstract: Variation in the language experience of bilinguals has consequences for cognitive and affective processes. In the current study, we examined how bilingual experience influences the relationship between language and emotion in English among a group of Spanish–English heritage bilinguals on an emotion–memory task. Participants rated the emotionality of English taboo, negative and neutral words and then completed an unexpected recognition test. To account for language experience, data were gathered on the participants’ language dominance and proficiency. Results showed emotion–memory effects in the Spanish–English heritage bilinguals’ English (the societal language): taboo words were recognized significantly better than neutral words, while the emotionality of negative words carried over and significantly affected the recognition of preceding neutral words. Furthermore, such effects were modulated by language dominance scores with more pronounced emotion–memory effects in more English-dominant bilinguals. The findings contribute to a growing body of evidence showing that emotions are not necessarily restricted to the first acquired home language. Critically, for heritage speakers, there is often a shift in language dominance from the home language to the societal language. The present study demonstrates that the effects of emotion on memory are seen in the acquired societal language.

Keywords: language experience; heritage bilinguals; emotion

Citation: Vargas Fuentes, Nicole A., Judith F. Kroll, and Julio Torres. 2022. What Heritage Bilinguals Tell Us about the Language of Emotion. *Languages* 7: 144. <https://doi.org/10.3390/languages7020144>

Academic Editors: Alexandra S. Dylman, Mariko Kikutani, Juana M. Licerias and Raquel Fernández Fuertes

Received: 23 November 2021

Accepted: 13 May 2022

Published: 6 June 2022

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1. Introduction

Bilingualism is a complex experience. Bilinguals differ in the way they acquire, use, and interact with each of their languages depending on a range of factors, including the linguistic demands imposed by the environment (Beatty-Martínez et al. 2020; Green and Abutalebi 2013; Gullifer and Titone 2020). Bilinguals differ not only in the age at which they acquire each language and how proficient they may be in each language, but in the requirements to use the two languages in different contexts and with different interlocutors. Recent studies have shown that this variation in bilingual experience affects language processing in each of the bilingual’s two languages and at every level of language processing (for reviews see Kroll et al. 2021; Zirnstein et al. 2019).

In this paper, we revisit claims about bilingualism and emotion that consider the variation in early bilingual experience with regards to the societal language that differs or is used in conjunction with a family language. Although the evidence is mixed, the central finding in past research is that bilinguals seem to process emotion more intensely in their native language than in a second language (e.g., Caldwell-Harris 2015). While this may be an accurate characterization for late sequential bilinguals, for whom the native language may also function as the dominant language, some past research has examined emotion and bilingualism among early bilinguals, those who have acquired both languages in childhood (Harris et al. 2006). The studies on early bilinguals show that the native language does not always reveal an emotional advantage. Early bilinguals may process their two languages with similar emotion (Harris 2004; Harris et al. 2006; Sutton et al. 2007). In the

present study, we build on the past research by focusing on heritage bilinguals who, as a group, present a somewhat different profile than either early or late bilinguals. We examine memory in heritage bilinguals, who grew up speaking a family/home language that is not a majority language in the society at large but who typically became dominant speakers of the majority language. The focus in the present work is on how heritage bilinguals process and remember emotional language in the societal language, while considering how different aspects of the heritage bilingual experience influence their performance. In what follows, there is first a review of this literature and then a report of studies that examine the way that emotion words are processed and remembered. In this initial report, the focus is only on these processes in the societal language in which they are embedded. To anticipate the findings, the data suggest that heritage bilinguals reveal effects of emotion in the societal language (English) but that the effects we report appear to be modulated by their language experience. We then consider the implications for a more dynamic account of how bilingualism, and language more generally, engages emotion.

1.1. Emotion and Bilingualism

The emotional difference that bilinguals describe between their languages has been well documented through the use of self-reports (Dewaele and Nakano 2013; Vélez-Uribe and Rosselli 2019; Dewaele 2004), behavioral measures (e.g., skin conductance: Caldwell-Harris et al. 2011; Jankowiak and Korpál 2018; Eilola and Havelka 2010), autobiographies (Marian and Kaushanskaya 2008; Larsen et al. 2002; Kinginger 2004) and in other experimental tasks (e.g., the Stroop task: Eilola and Havelka 2010; Sutton et al. 2007; Grabovac and Pléh 2014; Okada et al. 2019). The most frequent claim is that the native or first language (L1) is a stronghold for emotions due to early childhood development. Childhood is an enriching emotional experience during which individuals encounter new emotions and form long-lasting relationships (e.g., family). At the same time, the linguistic system in the native language develops in parallel with the emotion regulation system (Caldwell-Harris 2015). Thus, there is a strong link between the development of emotion concepts and the newly acquired words that refer to them. On this account, early age of acquisition is critical for the development of the link between language and emotions. In the case of the second language (L2), the hypothesis is that emotional words may be processed semantically but do not reveal the automatic affective processing available to words in the L1 (Pavlenko 2012).

Attenuated emotionality in L2 has been documented across various cognitive domains. For example, differences have been reported in decision-making behavior (Keysar et al. 2012; Costa et al. 2014; Cipolletti et al. 2016), where bilinguals make more rational decisions about moral judgments when using their non-native language. A primary explanation for this foreign-language effect in decision making relies on the reduced emotionality felt in the foreign language, which leads to less emotionally-based decisions. Inhibitory control has also been studied regarding the interaction between emotion and bilingualism. Fan et al. (2018) found reduced Stroop effects in the L2 of Chinese–English bilinguals using a face-word emotional Stroop task. Others (e.g., Winskel 2013) have also reported similar reduced Stroop effects in bilinguals' processing of emotional words in their L2.

While the age of acquisition account may be compelling in the case of late bilinguals with a 'clearly' defined dominant native language, caution should be taken when generalizing to all bilingual populations. For example, a pertinent question relates to whether one would expect similar results for bilinguals who acquired both languages early in life. To test this claim, Harris (2004) measured the skin conductance of Spanish–English bilinguals with different language backgrounds while they listened and/or saw taboo words, reprimands, endearments, insults, and emotional expressions. While both bilinguals reported learning Spanish as a first language and English as a second, some of these bilinguals were classified as early learners of English since they were either born in the U.S. or immigrated at an early age (before 7 years old). The other group of Spanish–English bilinguals were classified as second language learners who grew up in a Spanish-speaking country. Although

the term *heritage bilingual* or *heritage speaker* was never utilized by Harris (2004), it is our understanding that these bilinguals can be characterized as such. These results showed a greater difference between the L1 and L2 for the late learner group, but no such difference for the early learner group.

Other studies have reported similar levels of emotionality across early bilinguals' two languages (Sutton et al. 2007; Grabovac and Pléh 2014). Sutton et al. (2007) examined the emotional Stroop effect in Spanish–English bilinguals residing in the U.S. On average, their participants reported beginning to speak English at 4.9 years and Spanish at 1.9 years. They also reported speaking and reading English more than Spanish which the authors took to indicate that they were most likely dominant and more proficient in their L2. Once again, these characteristics seem to generally align with the experience of heritage bilinguals. The authors found no significant differences in the presence of the Stroop effect in Spanish and English. The findings of both Harris (2004) and Sutton et al. (2007) suggest that early bilinguals process emotion in both of their languages. In both studies, the researchers claim that participants' proficiency levels in both languages may account for the emotional link. In other domains, age of acquisition has been shown to be confounded with proficiency (Steinhauer 2014), making conclusions about the factors that determine bilingual performance complex. Given that different measures of emotional processing have been used in different studies and that the characterization of the bilinguals themselves has typically relied on categorical assignment of speakers as early or late bilinguals (Beatty-Martínez and Titone 2021), we were motivated in the present study to exploit the variation in heritage speakers and to focus on memory, a core cognitive process.

We next consider additional evidence that has been reported in experiments that examine memory for emotional experience.

1.2. Emotion, Bilingualism, and Memory

Past research on language and emotion has used a range of tasks that include automatic responses in skin conductance, behavioral measures of the Stroop effect, and higher-level decision making. While it is beyond the scope of the present report to consider how or why the effects of emotion may differ depending on processing goals, here we consider these effects for memory, a domain that has been examined with respect to emotion for both monolingual and bilingual speakers (see Altarriba 2014 for a review on the topic).

Independent of language, the memory enhancement of emotional stimuli, otherwise known as the *emotion–memory effect*, is a well-documented phenomenon (Hamann 2001; Kensinger and Corkin 2003b; Strongman and Russell 1986). Emotional valence seems to trigger specific cognitive and neural mechanisms that promote greater attention during encoding and enhanced memory (Hamann 2001). The enhancement to memory has been hypothesized to reflect evolutionary factors since emotions may be important in guiding decisions in a context that poses immediate or potential danger (Levine and Pizarro 2004).

One of the first studies to document differences in the emotion–memory effect in bilinguals was conducted by Anooshian and Hertel (1994). In their study, late Spanish–English bilinguals (half of them English native speakers and the other Spanish native speakers) rated emotional and neutral words in both languages on the following dimensions: emotional intensity, difficulty in pronunciation and implied activity (i.e., how much activity was inherent in the meaning of a particular word). Later, the participants completed an unexpected free recall test. Emotion words were better recalled in the native language of the bilinguals. Given that both sets of bilinguals reported to be fluent in both languages, the differences in terms of emotionality were attributed to an early age of acquisition. Subsequent studies have reported similar results (Saraiva et al. 2021).

Most studies reporting differences in the emotionality of the bilingual's two languages assume that the L1 is an inherently more emotional language than non-native languages. However, studies in which no differences have been found have questioned that assumption. Ayçiçeği and Harris (2004) extended the paradigm used by Anooshian and Hertel (1994) to (1) compare recognition vs. recall test, and (2) to include the use of taboo words

and reprimand phrases that participants were likely to have encountered. They recruited late Turkish–English bilinguals living in the U.S. and found comparable emotion–memory effects in both languages. Furthermore, they even found stronger emotion–memory effects in the L2 for negative words. The difference between positive words across languages was less pronounced. It is important to note that these participants had very distinct ages of acquisition in Turkish and English and reported not to be as fluent in English. However, they had experienced a shift in their language environment (i.e., their move to the U.S.) which immersed them in English as the L2. These findings cannot be explained solely by age of acquisition and require a consideration of proficiency and immersion context as previously stated.

The incongruence of emotion–memory effects found in the L2 may also be partially due to sample characteristics. A number of studies have begun to document emotion–memory effects in early bilinguals. For example, Ferré et al. (2010) examined the emotion–memory effect in early Spanish–Catalan and late Spanish–English bilinguals and sought to identify the effect of language dominance, type of learning context, age of acquisition, and language similarity on such an effect. Their participants rated the pleasantness of positive, negative, and neutral words in both of their languages and then completed a free recall test. They found that across both languages, there was a similar emotion–memory effect. Most importantly, they found that none of the previously mentioned variables (e.g., age of acquisition) significantly modulated the emotion–memory effect. Ferré et al. (2010) attributed these results to their bilinguals' high proficiency, thereby determining that proficiency is the contributing factor to making a second language more emotional.

While the findings of Ferré et al. (2010) dismiss the effect of language dominance, it is important to consider how this variable was measured. They collected language history information using a detailed questionnaire in which participants rated competence in the language, frequency of use, and preference of use through a 7-point scale. Furthermore, they completed a verbal fluency task for which participants were required to write as many words as they could with words that began with certain letters. Using the combined scores of their questionnaire and verbal fluency, participants were categorized as L1 or L2 dominant. Currently, there are different validated and more nuanced methods of measuring language dominance, such as the Bilingual Language Profile (Birdsong et al. 2012). These innovative measures provide the opportunity to assess language dominance as (1) a multidimensional construct and (2) as a continuum instead of a categorical variable. Furthermore, studies using the Bilingual Language Profile in paradigms other than memory, have found significant effects of language dominance on the emotion–language link.¹

Another potential reason for the incongruence of an emotion–memory effect in the bilingualism literature has to do with the experimental designs. While examining single words is certainly insightful, emotion–memory effects go beyond the processing of isolated words. For example, emotional stimuli cannot only benefit from better memory recall, but also affect the recall of adjacent neutral stimuli. This is referred to as an emotional carry-over effect (Schmidt and Schmidt 2016) or emotional memory enhancement (Dunsmoor et al. 2019). Focusing on the 'suspended' effects of emotional words on memory might unravel differences as to how bilinguals, especially early bilinguals who seem to have less differences across their languages, are processing emotional stimuli in their languages.

In the current study, we considered the importance of variation in language experience in the link between language and emotion. We used a battery of different measures (e.g., Bilingual Language Profile) to capture different dimensions of the language experience such as proficiency and language dominance. Furthermore, we sought validated paradigms in which emotion may be assessed for appropriate measures that can capture the variation in language experience that may differ across distinct groups of bilingual speakers. In particular, we extended an emotion–memory paradigm that has been used with monolingual speakers and that also permitted us to investigate the emotion effect beyond single word processing. The paradigm, detailed in the next section, assesses the carryover effects of emotion word processing onto neutral stimuli.

1.3. Emotion-Memory Paradigm

In the present study, a memory paradigm developed by [Schmidt and Schmidt \(2016\)](#) was used to examine emotional processing and recognition. Aside from the typical memory enhancement related to emotion words, various studies have demonstrated how emotion–memory effects may *carry over* to non-emotional stimuli using a variety of tasks and paradigms ([Tambini et al. 2017](#); [Guillet and Arndt 2009](#); [Hadley and MacKay 2006](#)). Emotional carryover effects (also referred to as spillover effects) do not always occur in experimental paradigms ([Anderson et al. 2006](#)). [Schmidt and Schmidt \(2016\)](#) conducted a series of experiments using a memory paradigm to better understand which experimental conditions led to such carryover effects. They presented English monolinguals with a series of word triplets where the word in the middle position was either a taboo (e.g., shit), negative (e.g., sad) or neutral word (e.g., apron). The first and third words were always neutral concrete words. Participants were tasked with rating the emotionality of a given word using a Likert scale. At the end of the session, participants completed a memory test on all the words they had seen in the experimental task.

In a series of six experiments, [Schmidt and Schmidt \(2016\)](#) manipulated the length of the rating Likert scale (2, 3 vs. 5 point), the main experimental task (rating vs. just reading the words), the stimulus onset asynchrony (SOA), and the nature (recognition vs. recall), immediateness (after the rating task or after each triplet) and the instructions (incidental vs. intentional) of the memory test. Across all experimental designs, taboo words showed superior recognition over the neutral words. The same was not found in the case of the non-taboo negative words. Regarding the instances where they found an emotional carryover effect, results mostly showed poorer recognition of words *following* taboo words in comparison to words following neutral words. Overall, Schmidt and Schmidt provided a structure of a paradigm sufficiently sensitive to detect emotion–memory effects within the emotional words and across adjacent neutral stimuli. To our knowledge, this kind of emotional carryover paradigm has never been tested with bilinguals.

1.4. Emotion Processing in Heritage Bilinguals

As previously stated, age of acquisition and proficiency have been considered two of the most influential factors determining the link between language and emotion. However, the relationship between language and emotion may not necessarily be a matter of age of acquisition or proficiency alone. There is variation in bilinguals' language experience, and while age of acquisition and proficiency are important factors, other aspects, such as features of the bilingual's language environment, can potentially determine shifts in the emotionality of a given language. To address this issue, the language experience of heritage language bilinguals was investigated as a way to better understand the processing of emotional language in the societal language.

Heritage bilinguals are speakers or signers of a minority(-ized) language (e.g., Spanish in the US) to which they have an ancestral connection as well as a societal language (e.g., English in the U.S.). In the U.S. context, heritage bilinguals make up the majority of the bilingual population ([American Academy of Arts and Sciences 2017](#)). Due to the demands of their environment, heritage bilinguals typically undergo a language dominance shift, where the societal language becomes dominant ([Kupisch and Rothman 2018](#)). This language dominance shift makes them an interesting population to study the link between language and emotion. While their heritage language may be limited to their home and ethnolinguistic community, potentially a critical hub for emotional development, they not only become dominant in the societal language, but also hold affective relationships with others (e.g., friends) in that language.

Considering the early age of acquisition account with heritage bilinguals, one might expect either stronger emotionality linked to the heritage language or to both languages, depending on whether they have early language exposure. On the other hand, considering the proficiency account, one might expect heritage bilinguals to demonstrate a stronger emotionality in the societal language. Nonetheless, the debate concerning early age of

acquisition versus proficiency might not completely characterize their affective experiences in both languages. Other components (e.g., shift in language environment) may provide a more nuanced understanding of how a language becomes emotional. Studying heritage bilinguals will not only test the main two accounts in the emotion–bilingualism research, but also begin to identify those aspects of language experience that hold more weight in strengthening the language–emotion link.

Therefore, to further examine the interplay of emotion and bilingualism, the present study used the emotional carryover memory paradigm employed by [Schmidt and Schmidt \(2016\)](#) to examine whether Spanish–English heritage bilinguals exhibit the typical emotion–memory effects in their non-heritage language, English. If so, [Schmidt and Schmidt’s \(2016\)](#) results should be replicated with (1) higher emotional rating for taboo and negative words, (2) superior recognition of taboo words and (3) a carryover effect from taboo words to following neutral words. Failure to replicate such findings might indicate discrepancies in the automatic processing of emotional words in the English of heritage speakers compared to English monolinguals. However, the presence of emotion effects, both in the rating and/or recognition tasks, will evidence a link between emotions and the English of our heritage bilinguals.

We also sought to investigate whether aspects of the language experience of heritage bilinguals modulate such emotion effects. Because it is so important to properly characterize our sample, we used a range of measurements (discussed later in details) that investigated different dimensions of the bilingual experience. In particular, we incorporated questionnaires and tasks aimed at measuring language dominance and proficiency, which are proxies to study the effect of variation in bilingual language experience. If language proficiency better predicts emotion effects in the experimental task, then this provides further evidence for the proficiency account in the literature. However, if language dominance turns out to be a better predictor, it means that there are other components of the bilingual language experience (e.g., shift in the language environment) that come into play in the language–emotion link.

2. Methods

2.1. Participants

Spanish–English heritage bilinguals ($N = 54$), out of which 43 self-identified as females, were recruited from a mid-size public university in Southern California. The average age of the participants was 21.76 years ($SD = 3.50$). The average age of acquisition for Spanish was 0.28 years of age ($SD = 1.23$) and 4.79 years ($SD = 3.46$) for English. The vast majority of participants reported having experience with both languages prior to entering formal schooling. While participants reported more frequent use of English ($M = 81.63$, $SD = 18.55$) than Spanish ($M = 19.59$, $SD = 18.62$) with friends, the reverse is true for their language use at home. With family, participants reported using more Spanish ($M = 62.24$, $SD = 28.66$) than English ($M = 37.96$, $SD = 28.21$). On self-rated proficiency levels, participants rated themselves overall higher in English ($M = 5.66$, $SD = 0.61$) than in Spanish ($M = 4.77$, $SD = 1.28$).

2.2. Experimental Design

2.2.1. Emotional Rating Task

For the emotional rating task, the same words (18 taboo, 18 negative, and 18 neutral) used in the [Schmidt and Schmidt \(2016\)](#) study were used, with the exception of one of the taboo words (chink), since there was a concern that participants would not understand its meaning. Instead, an additional taboo word that has been used in other studies ([Ayçiçeği-Dinn and Caldwell-Harris 2009](#)) was included (see Table A1 in Appendix A for full list of words). For the neutral target words, 108 words were taken from the English Lexicon Project ([Balota et al. 2007](#)) following the same criteria used by [Schmidt and Schmidt \(2016\)](#). All target words were 4–6-letter-long neutral concrete words (concreteness rating 600–700)

with a [Kučera and Francis \(1967\)](#) written frequency rating of 1 to 90 and a familiarity rating of 500 to 700.

The modulators and the neutral targets were randomly divided into two sets with 27 modulators (9 taboo, 9 negative, and 9 neutral) and 54 neutral targets. Participants only saw one of the two sets, while the other set served as foils in the surprise recognition test. The 54 neutral targets were also randomly divided such that half of them appeared preceding the modulator while the other half followed the modulator and counterbalanced their position between participants. This foil and counterbalancing procedure resulted in 4 different position counterbalancing conditions (2 list type [recognition target vs. foils] $\times$ 2 neutral target position [preceding vs. following]).

Participants were shown words on a screen and asked to rate the emotionality of each word on a scale of 1 (not emotional) to 3 (very emotional) using the keys 'J' 'K' 'L' on their keyboard. Words were presented one by one in a series of triplets. The first and third word were always neutral target words whereas the second word, which we will refer to as the modulator, was either a taboo, negative or neutral word. Following the findings of [Schmidt and Schmidt \(2016\)](#), we did not control for the stimulus onset asynchronies (SOA). After participants rated each word, the next one in the triplet appeared. The sequence of triplets and the appearance of neutral target words within that triplet were completely randomized.

Once each word in the triplet was rated, participants completed three trials of an arrow task where they indicated the direction of the arrow by pressing either the 'J' or 'L' key for left and right, respectively. This task was designed to be an emotional timeout between triplets, which would restrict any carryover effect from the modulator within that triplet. To ensure attention in the arrow task, participants received feedback in each trial. In the end, each participant saw a total of 27 triplets with 9 modulators from each type (taboo, negative, and neutral). The emotional rating task was administered through the *FindingFive* platform ([FindingFive Team 2019](#)). See [Figure 1](#) for a visual representation of the emotional rating task.

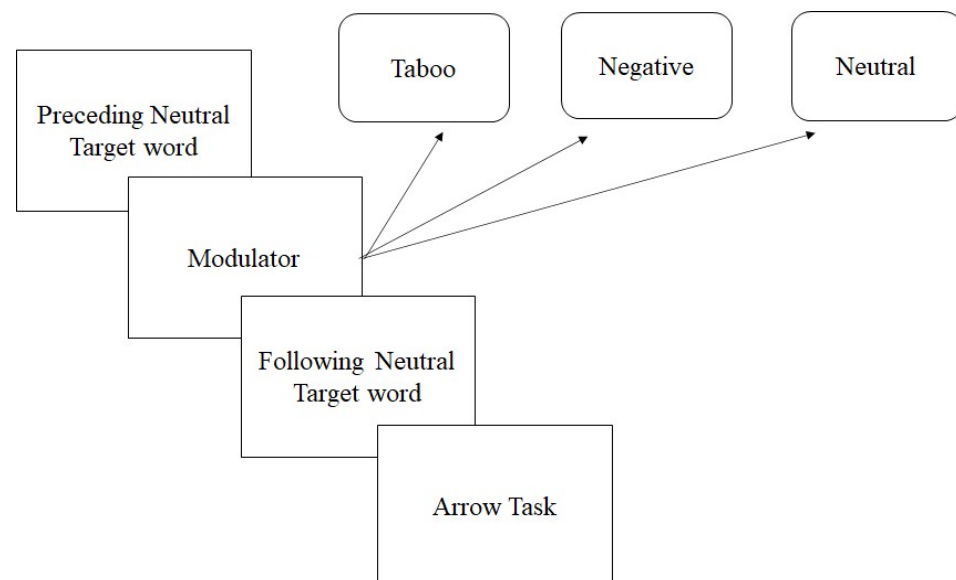


Figure 1. Visual representation of emotional rating task.

2.2.2. Recognition Test

Following the emotional rating task, participants completed a non-linguistic math distractor task, which provided auditory and visual feedback to ensure attention, and then participants proceeded to complete a surprise recognition test. Participants were instructed to indicate whether they recognized the word on the screen as one they previously rated

using their keyboard to answer ‘Yes’ (‘J’) or ‘No’ (‘L’). While they received feedback in the math distractor task, they did not receive any feedback in the recognition test.

The performance of the participants in the recognition test was calculated using their response to the actual words they rated vs. the foils (false hits). Thus, accuracy was the result of the number of words they correctly recognized divided by the number of words of that type (e.g., all participants saw 9 taboo words; X number of correctly recognized taboo words divided by 9) minus the proportion of false hits (incorrectly recognized words) for that same word type.

2.3. Measuring Language Dominance and Language Proficiency in Bilinguals

The literature on bilingualism includes intensive discussion about how to best capture language experience. Those aspects of experience that have been examined in the past include language dominance, language proficiency, and language exposure (see [Peña et al. 2021](#)). The current study, focused on language proficiency and language dominance to assess variation in the studied bilingual population. Even though terms such as language dominance and language proficiency are quite common in the literature, there is not a consensus regarding their definition. [Thomas \(1994\)](#) characterized language proficiency as an individual’s overall ability and competence to perform in a second language. In general terms, language proficiency can be understood as what a speaker is capable of doing, such as listening, speaking, reading and writing across their languages. Both subjective (i.e., self-reports) and objective measures (e.g., elicited imitation task) have been used to extract information about language proficiency.

Some researchers consider language dominance as the relative proficiency and usage of a bilingual’s two languages across different contexts and the ease with which bilinguals access their languages (e.g., [Birdsong 2014](#); [Silva-Corvalán and Treffers-Daller 2015](#)). For example, a bilingual might be highly proficient in both languages but due to the demands of the environment, become more dominant in one over the other. A general consensus is that language dominance is a multidimensional construct, which comprises different features associated with the bilingual experience, such as age of acquisition, attitudes and domains of language use among others ([Birdsong 2014](#)). Importantly, given that bilingualism is a complex phenomenon, these dimensions that characterize language dominance are continuous and not categorical ([Luk and Bialystok 2013](#)). Therefore, the current study used a battery of tasks associated with language dominance and/or proficiency to best characterize the language experience of the participants.

2.3.1. Bilingual Language Profile Questionnaire

The Bilingual Language Profile ([Birdsong et al. 2012](#)) is a free online questionnaire that provides a language dominance index based on participants’ responses to questions across four different dimensions—language history, language use, language proficiency and language attitudes. Previous studies have shown the effectiveness of the Bilingual Language Profile questionnaire in capturing variation in language dominance, such as how Spanish dominant bilinguals produced more Spanish tap–trill features like those found in most monolingual Spanish speakers ([Amengual 2016](#)).

The Bilingual Language Profile ([Birdsong et al. 2012](#)) was used as the language background questionnaire to measure language dominance. The questionnaire uses a series of questions centered around different aspects of the bilingual language experience to calculate each participant’s language dominance in relation to their two languages. In this study, a higher positive number indicates more English dominance, while a negative number indicates more Spanish dominance. A score near 0 indicates more balanced bilingualism across both languages. The scores can range from −218 to 218 points. Furthermore, a subset questions of self-rated proficiency in different language skills (i.e., writing, reading, speaking, and understanding) was used as a distinct measure of proficiency. In the end, data extracted from the Bilingual Language Profile were considered *subjective* measures of

both language dominance and proficiency. In the next two sections, we detail the *objective* measures of these two constructs.

2.3.2. Verbal Fluency Task

Recognizing that different measures of language proficiency and language dominance may provide distinct information that may serve to better characterize bilingual speakers, we used a range of different tasks in the present study. For example, a verbal fluency task aims to assess verbal ability and, more specifically, lexical access ability (Shao et al. 2014). Unlike self-report tasks, verbal fluency requires participants to produce as many exemplars as possible in a fixed amount of time. However, unlike other language production measures of proficiency (e.g., picture naming), production is entirely determined by the speaker. By definition, there is no maximum score to be achieved during this task since it depends on the participant's vocabulary and lexical retrieval ability. More than proficiency *per se*, verbal fluency has been shown to be sensitive to the dynamics of language use and the regulation of the two languages across contexts (Linck et al. 2009; Van Assche et al. 2013; Zirnstein et al. 2018). Given that verbal fluency is also sensitive to shifts in language dominance, it was included as an *objective* measure of language dominance.

In the verbal fluency task, participants were instructed to type as many exemplars of a named semantic category (e.g., fruits) that they could produce in 60 s. The verbal fluency task was completed in single-language blocks with the dominant language of the participant performed first to control for language order effects (Kroll et al. 2008). Verbal fluency was coded as the number of unique and accurate exemplars in each category. Spelling was not taken into account. In the end, it was the relative score (i.e., English score–Spanish score) that was calculated from the verbal fluency task. The reason for using relative scores instead of absolute raw scores is two-fold. First, individuals differ in the speed of lexical retrieval. That is, some participants may produce fewer words under 60 s, which may not reflect their overall proficiency in the language but rather individual differences in lexical retrieval and/or typing speed. For example, someone who scores an average of 20 words in English and Spanish cannot be said to be less proficient than someone that scores an average of 40 in both languages. The second reason pertains to our goal of objectively measuring language dominance through language production. Participants who are more balanced will have a smaller difference in score in comparison to those who are more English dominant (i.e., higher positive scores) or Spanish dominant (i.e., lower negative scores).

2.3.3. Elicited Imitation Task

The elicited imitation task was used as an objective measure of language proficiency (e.g., Ortega 2000; Ortega et al. 2002; Bowden 2016; Solon et al. 2019). In this task, participants must listen and repeat a number of sentences that differ according to syntactic complexity. The premise is that participants with higher levels of proficiency are more capable of parsing and understanding the sentences. In a recent meta-analysis of 60 independent effect sizes, Kostromitina and Plonsky (2021) reported that the elicited imitation task is a reliable measure of language proficiency. Furthermore, another major strength of the elicited imitation task is that it is available in multiple languages, which allows for cross-linguistic comparisons.

The elicited imitation task consisted of 36 audio recorded sentences that increased in syntactic complexity, ranging from 7 to 27 syllables (e.g., Ortega et al. 2002; Solon et al. 2019). Participants listened to each sentence, and after a two second pause, a 0.5 s tone indicated to the participants to repeat the sentence. Each sentence was coded for repetition of idea units and target-like grammatical forms. In coding each sentence, four points were granted for perfect repetition of the sentence; three points for preserving the meaning of the sentence with changes in the grammar that did not affect the meaning; two points for repetition of more than half of the sentence with changes that make the content inexact and

incomplete; and one point for repetition of less than half of the sentence with important content left out. Participants could receive a total of 144 points.

2.4. Experiment Procedure

This study was conducted in two sessions. In the first session, all participants completed the Bilingual Language Profile (Birdsong et al. 2012), which was adapted to the Finding Five platform, and the emotional rating task (emotional rating, math task and recognition test). A subset of participants ($n = 33$) returned for a second session in which they completed an assortment of language tasks. Based on their language dominance scores, participants completed a verbal fluency task in both languages and the elicited imitation task (Ortega et al. 2002) in their non-dominant language to gauge dominance and proficiency respectively.

2.5. Data Trimming

Given our interest in heritage speakers, data from participants who reported acquiring Spanish after the age of 7 years were excluded. A participant who reported learning English at 18 years old was also excluded since their experience may be more in tune with the experience of L2 speakers of English than Spanish–English heritage speakers. Furthermore, participants who failed to reject more than half of neutral foil items in the recognition test were also excluded. We based the exclusion criteria on the neutral target foils because they made up most of the foil items (i.e., 54).

2.6. Data Analysis

We analyzed the data using linear mixed effect models from the lme4 R-package (v.1.1-27.1, Bates et al. 2015) in Rstudio (version 4.1.0) (R Core Team 2020). First, a baseline model was created, which consisted of predicting accuracy in the recognition test by the interaction between position (preceding, middle, and following) and modulator (taboo, negative, and neutral). The purpose of this baseline model was to replicate the model used in Schmidt and Schmidt (2016). Since they did not test bilinguals, their model did not include language experience variables. The alternative models, in contrast, expand the baseline model by including as predictors both the subjective and objective measures of language dominance (i.e., Bilingual Language Profile and verbal fluency) and proficiency (i.e., self-reported proficiency and EIT). The use of different models with either one- or multi-dimensional constructs and/or subjective or objective measures grants us the opportunity and compare to directly test hypotheses related to participants' bilingual experience. Furthermore, we also tested a model which included age of acquisition of English as a predictor, given its relevance as an important factor in the bilingualism and emotion literature.

A likelihood-ratio test (Brown 2021) using the ANOVA function in the lmerTest R-package (v. 3.1-3, Kuznetsova et al. 2017) was conducted to compare all alternative models to the baseline (see Table 1 for all the results). In the end, the model with multi-dimensional subjective construct of language dominance, which is extracted from the Bilingual Language Profile, as a predictor of accuracy turned out to be the best fit for the data ($X^2(1, N = 54) = 18.99, p = 0.03$). The subsequent sections detail the results based on this model.

Table 1. ANOVA analysis comparing alternative models to baseline model.

Model	AIC	X^2	df	p
Age of Acquisition	−187.26	15.06	9	0.09
Self-reported proficiency	−186.50	14.29	9	0.11
Elicited Imitation Task	−101.80	15.915	9	0.07
Verbal Fluency	−113.06	5.76	9	0.76
Bilingual Language Profile	−191.21	18.99	9	0.03 *

Baseline model includes position and modulators as the only fixed effects. Age of acquisition refers to the age participants reported to have started learning English. * $p < 0.05$.

3. Results

3.1. Emotional Rating

We first examined whether taboo and negative words were rated as more emotional than the neutral words. Results revealed that negative words had the highest emotional rating ($M = 2.40$, $SD = 0.49$) and were significantly rated higher than both neutral ($M = 1.22$, $SD = 0.38$; $t(110) = 14.94$, $p < 0.001$) and taboo words ($M = 1.90$, $SD = 0.49$; $t(110) = 6.26$, $p < 0.001$). The difference between taboo and neutral words was also significant ($t(110) = 8.67$, $p < 0.001$). Therefore, both taboo and negative words were significantly rated as more emotional than neutral words.

3.2. Recognition of Emotional Words versus Neutral Words

We analyzed the recognition of only the words in the middle position (i.e., modulators) to address whether emotional words (i.e., taboo and negative) were recognized better than neutral words (see Figure 2). The findings showed that taboo words ($M = 0.72$, $SD = 0.17$) were recognized significantly better ($b = 0.17$, $t = 4.234$, $p < 0.001$, 95% CI [0.09, 0.24]) than neutral words ($M = 0.55$, $SD = 0.27$), but this was not the case for negative words ($M = 0.53$, $SD = 0.28$). That is, there were no significant differences in recognizing negative versus neutral words ($b = 0.03$, $t = -0.7$, $p = 0.48$, 95% CI [-0.13, 0.06]). These findings partially showed that emotional words were better recognized than neutral words, as participants only better recognized taboo words. Thus, there was an emotion–memory effect in relation to taboo words but not negative words.

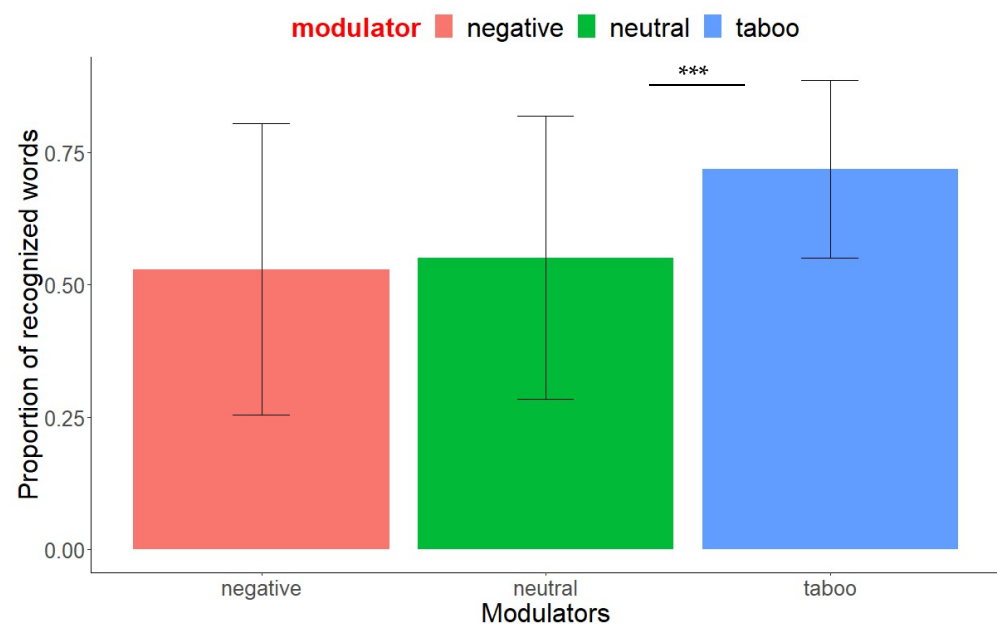


Figure 2. Recognition of only modulator words. *** $p < 0.001$.

3.3. Recognition of Preceding and Following Neutral Words

Next, we investigated the recognition of the neutral words in the first and third positions of the triplet (see Figure 3). That is, the neutral words preceding and following modulators. There was no significant difference ($b = 0.004$, $t = 0.162$, $p = 0.87$, 95% CI [-0.045, 0.054]) between words preceding taboo modulators ($M = 0.56$, $SD = 0.22$) and neutral modulators ($M = 0.55$, $SD = 0.18$). Likewise, no significant difference was found between words preceding negative modulators ($M = 0.55$, $SD = 0.26$) and neutral modulators ($b = 0.004$, $t = -0.162$, $p = 0.87$, 95% CI [-0.054, 0.046]). We also found no significant difference in the case of the neutral words following taboo modulators ($M = 0.60$, $SD = 0.24$; $b = -0.01$, $t = -0.42$, $p = 0.68$, 95% CI [-0.07, 0.04]) and negative modulators ($M = 0.62$, $SD = 0.22$; $b = 0.01$, $t = 0.38$, $p = 0.71$, 95% CI [-0.05, 0.07]) when compared to neutral

modulators ($M = 0.61$, $SD = 0.28$). Therefore, the results suggest that emotional words had no effect on the recognition of neutral words preceding or following them.

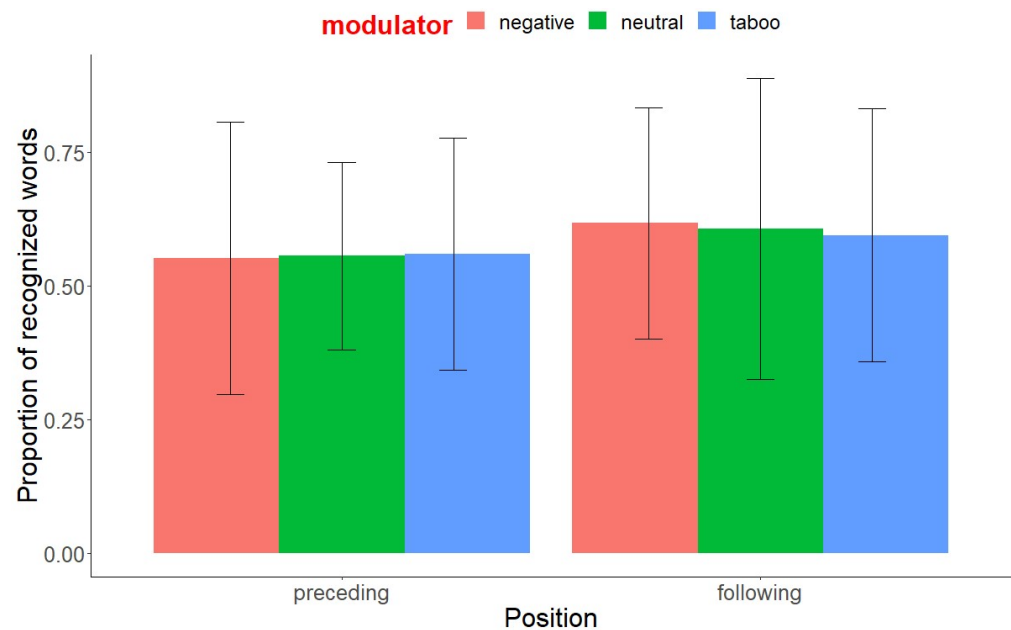


Figure 3. Recognition of neutral targets by position and modulator.

3.4. The Role of Language Dominance and Proficiency

Prior to addressing the role of language experience, we report the descriptive statistics for the Bilingual Language Profile questionnaire, verbal fluency and elicited imitation task scores. The average score in the language dominance calculated by the Bilingual Language Profile questionnaire was 29.92 ($SD = 42.53$; $Max. = 150.47$, $Min. = -62.30$). In the verbal fluency score, the average score for English was 49.48 words ($SD = 9.43$; $Max. = 68$, $Min. = 32$) and for Spanish was 38.27 words ($SD = 9.2$; $Max. = 59$, $Min. = 18$). Finally, the average score for the elicited imitation task was 122.37 ($SD = 14.41$; $Max. = 141$, $Min. = 86$). Table 2 summarizes the results of each language proficiency and dominance task.

Table 2. Results from the language dominance and proficiency tasks.

Measure	Mean	SD	Min.	Max.
Bilingual Language Profile	29.29	42.53	−62.30	150.47
Elicited Imitation Task	122.37	14.41	141	86
Verbal fluency				
English	49.48	9.43	32	68
Spanish	38.27	9.20	18	59
Self-reported proficiency				
Spanish	18.7	4.79	2.0	24
English	22.65	1.68	24	18

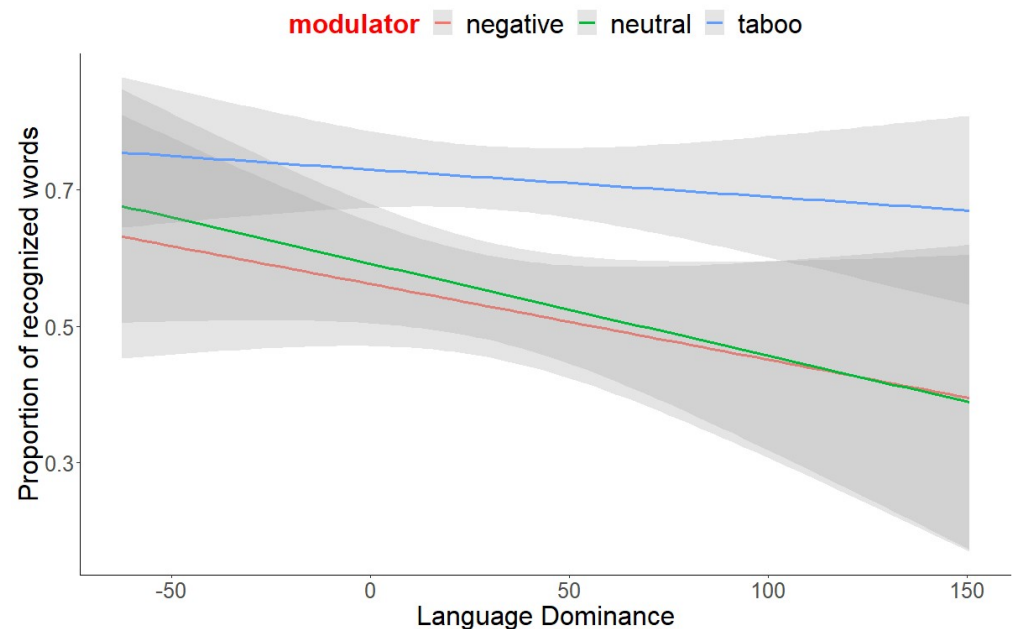
Furthermore, a correlation analysis was conducted to better understand the relationship between language dominance and proficiency. Table 3 presents the results from the correlation analysis for both the self-reported proficiency in English and Spanish, the verbal fluency raw score for English and Spanish plus the relative score (English–Spanish verbal fluency), the elicited imitation task score, and the language dominance score calculated by the Bilingual Language Profile questionnaire. We reiterate the fact that the best mixed effect model to fit the data included language dominance as measured by the Bilingual Language Profile questionnaire but not any of the language proficiency measures.

Table 3. Correlation matrix of language dominance and proficiency measures.

	Verbal Fluency				Self-Reported Proficiency		Language Dominance
	EIT	Spanish	English	Relative	Spanish	English	
EIT	—	—	—	—	—	—	—
Verbal fluency							
Spanish	0.21 **	—	—	—	—	—	—
English	0.22 **	0.68 ***	—	—	—	—	—
Relative	0.01	−0.38 ***	0.43 ***	—	—	—	—
Self-reported proficiency							
Spanish	−0.02	0.31 ***	0.28	−0.04	—	—	—
English	−0.06	−0.08	0.16 **	0.29 ***	0.04	—	—
Language Dominance	−0.08	−0.21 **	−0.08	0.16 **	−0.78 ***	0.22 ***	—

Spanish and English verbal fluency scores represent the absolute number of words participants typed. The relative verbal fluency score is the difference between the English and the Spanish score. ** $p < 0.01$ *** $p < 0.001$.

We analyzed the effect of language dominance on the recognition of modulators (see Figure 4). The findings revealed that language dominance, as measured by the Bilingual Language Profile questionnaire, significantly modulated participants' overall performance in the recognition test ($b = -0.10$, $t = -3.009$, $p = 0.003$, 95% CI $[-0.16, -0.03]$). That is, higher English dominant participants did overall worse in the recognition test. However, when considering the recognition of emotional words (i.e., taboo and negative modulators) in comparison to neutral modulators, language dominance was found not to be a determining factor. Language dominance did not significantly interact with the recognition of taboo modulators ($b = 0.04$, $t = 1.03$, $p = 0.31$, 95% CI $[-0.04, 0.12]$) nor negative modulators ($b = 0.01$, $t = 0.26$, $p = 0.80$, 95% CI $[-0.07, 0.09]$) when compared to neutral modulators.

**Figure 4.** Recognition of modulator words given language dominance.

The last analysis examined whether language dominance influenced the recognition of neutral words preceding and following emotional modulators vis-à-vis neutral modulators. Analyzing the neutral words following modulators, no significant interaction was found between language dominance and words following taboo modulators ($b = 0.03$, $t = 1.00$,

$p = 0.33$, 95% CI $[-0.03, 0.08]$) nor those following negative modulators ($b = 0.05$, $t = 1.80$, $p = 0.07$, 95% CI $[-0.004, 0.11]$). However, there were significant interactions in the analysis of neutral words preceding modulators. Language dominance significantly interacted with neutral words preceding negative modulators ($b = -0.07$, $t = -2.92$, $p = 0.004$, 95% CI $[-0.12, -0.02]$) and with those preceding taboo modulators ($b = -0.05$, $t = -2.06$, $p = 0.04$, 95% CI $[-0.01, -0.003]$).

Further analysis revealed that high English dominance had a significant effect in the recognition of the neutral words preceding negative modulators ($b = -0.08$, $t = -2.18$, $p = 0.03$, 95% CI $[-0.15, -0.008]$). In other words, the more English dominant the participants were, the worse they recognized neutral words preceding negative modulators in comparison to neutral modulators (see Figure 5). The same interaction with high English dominance was not found in the case of neutral words preceding taboo modulators ($b = -0.05$, $t = -1.34$, $p = 0.18$, 95% CI $[-0.12, 0.02]$). On the other hand, examining the lower end of the language dominance spectrum, there was a marginally significant interaction between low English dominance and the recognition of neutral words preceding negative modulators ($b = 0.07$, $t = 2.00$, $p = 0.054$, 95% CI $[-0.004, 0.14]$) and no significant interaction with neutral words preceding taboo modulators ($b = 0.06$, $t = 1.57$, $p = 0.12$, 95% CI $[-0.01, 0.13]$).

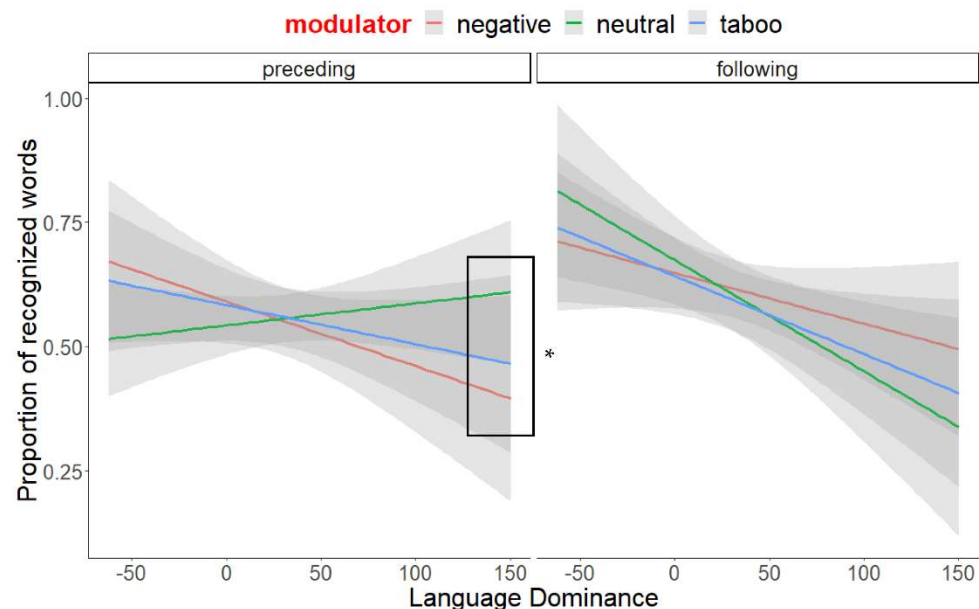


Figure 5. Recognition of neutral targets by position, modulator and language dominance. * $A p < 0.05$ was found when comparing neutral targets preceding negative modulators vs. those preceding neutral modulators.

In sum, the bilinguals in the present study rated taboo and negative words as more emotional than the neutral words. The findings also demonstrated that Spanish dominant heritage bilinguals significantly recognized more neutral words in the recognition test, in comparison to English dominant participants. While language dominance did not significantly influence the recognition of the modulators, it mattered when considering the recognition of the words in the first and third position—that is, words preceding and following modulators. Bilinguals who were highly English dominant had reduced recognition of neutral words preceding negative modulators than preceding neutral modulators. The same did not occur in the case of the bilinguals who were less dominant in English.

4. Discussion

In this study, we aimed to determine whether Spanish–English heritage bilinguals demonstrated the typical emotion–memory effects in their societal language, English. Fur-

thermore, we asked whether differences in language dominance and language proficiency mediated such effects. We used a memory paradigm (Schmidt and Schmidt 2016), the Bilingual Language Profile questionnaire (Birdsong et al. 2012), verbal fluency (Shao et al. 2014) and an elicited imitation task (Ortega et al. 2002) to address these research questions. Specifically, we investigated the recognition of emotional words and their potential effect on the recognition of surrounding neutral words. Overall, the results suggest that there are emotion–memory effects when Spanish–English heritage bilinguals are presented with emotional words in English, and importantly, that a couple of these emotion–memory effects were modulated by their language dominance.

First, we considered how Spanish–English heritage bilinguals rated the emotionality of taboo, negative and neutral words in English. Participants rated negative words as the most emotional followed by taboo and neutral words, respectively. These findings contrast with the Schmidt and Schmidt (2016) English monolinguals who rated taboo words as the most emotional word type. This discrepancy puts into question the potential distinction of taboo words as a category in the general emotion vocabulary. While emotion vocabulary may differ between languages and some words may not have direct equivalents in all languages (Dewaele and Pavlenko 2002; Pavlenko 2008), taboo words may represent an even more linguistically and culturally specific set of emotion words. Negative words, however, may map onto abstract representations of equivalent emotional concepts across both languages and their respective physiological reactions. The three categories of taboo words included in this study, expletives (e.g., shit), derogatory terms (e.g., slut), and taboo topics (e.g., incest), will greatly differ across cultures, and bilinguals may not acquire and/or relate to those words to the same extent in another language as negative words. Even though the participating heritage bilinguals were mostly English dominant, which is typical in this population, their cultural upbringing in a Spanish-speaking household may explain their lesser emotional ratings of taboo words in English. However, future research needs to confirm these potential differences in the acquisition and processing of taboo words in bilinguals across both languages.

The second analysis considered the typical emotion–memory effect in which emotional words, in this case, taboo and negative words, are better remembered than neutral words. The data shown in Figure 2 replicated that effect for taboo words but not for negative words. This is in line with Schmidt and Schmidt’s (2016) study in which they also found a superior recognition of taboo words over neutral words but not for the negative words. The lack of a memory advantage for negative words might be due to the presence of the taboo words. In general terms, while taboo and negative words are characterized as having high emotional valence, taboo words tend to evoke a higher arousal (Pavlenko 2008). Therefore, the presence of the highly arousing and emotional taboo words in the same experimental context might have lessened the emotional reaction to negative words (Schmidt and Schmidt 2016).

When we examine the aggregated results, we failed to replicate an emotional carryover effect. Taboo and negative words did not affect the recognition of neutral words either preceding or following them. One possible explanation as to why we found no emotional carryover effects may have to do with the nature of the main experimental task. Ayçiçeği-Dinn and Caldwell-Harris (2009) reported that experimental designs affect whether or not emotion–memory effects are observed in bilinguals. They used four different tasks to examine whether different levels of processing affected the presence of emotion–memory effects across languages. Their tasks, from shallower to deeper processing, were a letter counting, emotional rating, word association and translation task. Overall, they saw a recall advantage for positive and taboo words over the neutral words, but not for negative words, across all tasks. However, the differences between languages varied across tasks. Both languages showed similar emotion–memory effects in both the letter counting and word association task, while emotion–memory effects were found in the L1 (Turkish) in the emotional rating task and stronger in the L2 (English) in the translation task. Thus, it may be that the use of an emotional rating task provided deep enough processing to

see the usual emotion–memory effect (i.e., superior recognition of emotional words) but too shallow of a processing to see emotional carryover effects (i.e., affected recognition of adjacent neutral items).

A critical finding in the present study concerns individual differences. The results showed that emotion–memory effects were not uniform but depended on language dominance. Higher English dominance correlated with lower performance in the recognition test. That is, English dominant participants recognized fewer words that they saw in the entire experiment. We consider two possible accounts for this apparently counterintuitive finding. First, the presentation of both taboo and negative words in the experiment might have created an overall emotional context for the more English dominant participants. Emotional distress has been found to hinder the performance of working memory (Kensinger and Corkin 2003a) which could account for the poor performance in the recognition test. The Spanish-dominant bilingual speakers in the current study may have not had the same emotional reaction as their English-dominant peers, and therefore, their working memory resources were more attuned to store words for later recall in the recognition test.

A second explanation is related to the well-known effects of word frequency on recognition memory. Although individuals may be able to recall high frequency words more accurately than low frequency words, the opposite pattern holds for recognition. High frequency words are less likely to be recognized than low frequency words (Glanzer and Adams 1985). In a study with Spanish–English bilinguals, Francis and Gutiérrez (2012) compared the use of a non-dominant language to the low frequency recognition advantage. The lower familiarity participants may have with L2 words can be analogous to the processing of low frequency words given the relationship between familiarity and the frequency a speaker encounters a word. However, these two accounts are not mutually exclusive. English dominant participants' recognition performance may have been impacted by the emotional context, while Spanish dominant participants benefited from the reduced familiarity with English words. However, given the fact that language proficiency measures (both EIT and self-reported data) were not significant predictors, the low familiarity account may not be sufficient to explain the observed individual differences. Within the constraints of the present study, future research will be needed to discriminate between these accounts.

In terms of participants' superior recognition of taboo modulators over neutral modulators, we saw no influence of language dominance. We expected the difference between taboo and neutral words to be more pronounced in the more English dominant speakers. However, the fact that participants may differ in their language dominance in English but still present emotion–memory effects means they all have had sufficient affective socialization in the language which fosters that emotion–language link. This aligns with other studies, where emotion effects have been found in the societal language (Ayçiçeği and Harris 2004; Ayçiçeği-Dinn and Caldwell-Harris 2009; Fan et al. 2018).

The effect of language dominance was reliable in the analysis of the adjacent (preceding and following) neutral words. The more dominant English speakers showed worse recognition of neutral words preceding negative modulators. That is, more English dominant bilinguals experienced an emotional carryover effect with respect to neutral words that occurred *before* negative words. The same was not found for participants at the other end of the language dominance spectrum as measured by the Bilingual Language Profile. While we found an emotional carryover effect, the results do not align perfectly with Schmidt and Schmidt (2016). In their study, they found more consistent emotional carryover effects in taboo modulators hindering the recognition of following neutral words. The difference in the type of modulator that induced the carryover effect can be explained by the found differences in emotional ratings. In the case of Schmidt and Schmidt (2016), taboo modulators were rated as the most emotional of all modulator words and it was taboo words that induced an emotional carryover effect. In contrast, our participants rated negative words as the most emotional of all word types. Thus, we found an *emotional* carryover effect for the words considered to be most emotional for our participants. The fact that negative words but not taboo words hindered the recognition of adjacent neutral words

puts into question whether the mechanism that gave taboo words an emotion–memory effect (i.e., greater recognition) is the same as the one behind negative words inducing an emotional carryover effect. As previously noted, while negative words may map onto existing semantic categories across languages, taboo words are inherently culturally sensitive and may exist as language-dependent semantic categories. If so, the dual representation of negative words across languages may imply a stronger emotional link which permits for an emotional carryover effect to occur. Meanwhile, the superior recognition of taboo words could be due to novelty effects added to the emotional arousal of those words.

While the objective of this study was not centered on furthering the understanding of memory effects, we wish to address the observed difference between the direction of the carryover effect in Schmidt and Schmidt (2016) and this study. Even though they found more evidence for hindering effects to following neutral words, they also found effects toward preceding items in some of their experimental manipulations. Furthermore, the literature regarding emotional carryover is inconsistent in terms of the direction and effect (i.e., hindering or enhancement) of the carryover effect (Schmidt and Schmidt 2016; Knight and Mather 2009). Thus, the discrepancy between the current results might be a consequence of slight differences in our experimental design (e.g., online testing and sample characteristics), but are not a true cause of concern for the goals of this study.

Finally, findings regarding the measures of language dominance (Bilingual Language Profile and verbal fluency) and language proficiency (self-report and elicited imitation task) suggest that these are different constructs and dimensions of bilingual language experience. This claim is supported by the absence of a significant correlation among the different measurements. Also of relevance, the statistical model comparisons between both proficiency measures, the objective measure of language dominance (i.e., verbal fluency) and the baseline did not account for significant individual differences in the data. Language dominance as calculated by the Bilingual Language Profile, operationalized as a multidimensional construct, was found to modulate a few of the emotion–memory effects in the data consistent with past studies reporting significant effects of language dominance using the same questionnaire (Wong and Ng 2018; but see Ferré et al. 2010). While we do not discredit the value of other language proficiency and dominance measures in characterizing bilingual populations, current findings showcase the value of measures that account for different aspects of the bilingual experience in a more nuanced manner; especially those considering a multi-dimensional perspective to the bilingual language experience.

Language proficiency did not play a significant role in emotion–memory effects. That is, proficiency in itself was not enough to capture heritage language bilinguals' engagement with emotional language. Further, language dominance as measured by the verbal fluency task did not suffice to explain the present data. The findings of the current study suggest that engaging with emotional language goes beyond acquiring early proficiency in two languages, which includes access to lexical items and the parsing of sentences that differ in syntactic complexity, as tested in the verbal fluency test and elicited imitation task, respectively. Instead, it is a constellation of dimensions that must be considered in bilinguals' varied experiences, and these must also take into account factors such as language use and language attitudes, as measured by the Bilingual Language Profile questionnaire. Along these lines, then, while it is critical that heritage bilinguals have lexical representations of emotion words across both languages in their lexicon, it may be more relevant when and to what extent they access these emotion words that make a significant difference on their emotion processing. It can depend on the type of communicative events and interlocutors with whom they interact across different language environments. More specifically, heritage bilinguals may use emotional language more frequently in their heritage language to engage with family members in a number of sensitive situations that can evoke strong emotions. This is plausible given that our results demonstrated that our heritage bilingual participants significantly used Spanish more often with their families.

To probe deeper into these dynamics, future research must examine these emotion–memory effects across both of heritage bilinguals’ languages and with different memory paradigms. For example, it will be important to use the current paradigm but to directly test the heritage language—Spanish. Comparing both languages of heritage bilinguals allows us to assess whether the shift in language dominance is conducive to a greater, lesser, or equal emotionality within the languages. It is possible that the societal language becomes emotional with no repercussions to the strong link between the home language and emotions. That is, heritage bilinguals will show automatic processing and strong emotional reaction to emotional words in their home language. If so, we might also expect a lesser (or no) modulating effect of language dominance. On the other hand, the language dominance shift could lead to a more dynamic exchange of the stronghold of emotions. With greater use, proficiency, and immersion in the societal language, Spanish–English heritage bilinguals may become more emotional in their English than in their Spanish. Furthermore, the use of neurocognitive techniques (e.g., event-related potentials) might provide a more nuanced picture of the interaction between emotion and language in bilinguals. The sensitive nature of such techniques can probe further than behavioral results and show differences in the processing of emotional words across both languages.

5. Limitations and Conclusions

This study has a number of limitations. First, we did not test this memory paradigm with the home heritage language (i.e., Spanish) of these bilinguals. Therefore, the question remains as to what happens to the home language especially in relation to the observed effects of language dominance in English, the societal language. In the future, we plan to test both languages to assess the presence of emotional memory effects and their relation across the home and societal languages. However, the lack of testing in the heritage language does not diminish the current findings which provide further evidence that heritage bilinguals can show expected emotion–memory effects (i.e., higher recognition of emotion words) in their non-heritage language, English, and also deviate from the behavior of English monolinguals (i.e., emotional carryover occurred for negative words instead of taboo words).

Another limitation of this study was that we did not control for other potential individual differences that may affect performance in the recognition test (e.g., excluding participants with ADHD). We plan to address these limitations in future research. Thus, the fact that we have found emotion effects in the societal language of heritage bilinguals, despite not fully controlling for cognitive differences, would seem to suggest that the results we report may underestimate the presence of emotion effects in the societal language. It is also important to note that there are many other factors that are beyond the scope of the current study but that may influence the results. For example, [Bauer and Altarriba \(2008\)](#) found gender differences in how English native speakers rate the emotionality of concrete words. Females rated concrete words as more emotional than males. However, they found no difference in their rating of emotional words. Given the disproportionate female to male ratio in the present study, representative of psychological undergraduate pool, we were unable to address gender differences in our sample. Previous studies, such as [Caldwell-Harris and Ayçiçeği-Dinn \(2009\)](#), have found non-statistically significant trends that hint at gender differences in L2 emotion word processing, but further work is needed. Aside from potential gender differences, there are other variables that need to be considered for future research, such as the role of cultural identity, that may reveal differences into how bilinguals process emotional language.

Using a memory paradigm, we sought to investigate whether Spanish–English heritage bilinguals showed the expected emotion effects in English and whether those effects were mediated by their language dominance and proficiency. Critically, we were able to replicate the emotion–memory effect such that taboo words were recognized better than neutral words. However, we did not find an effect of emotional words affecting the recognition of adjacent neutral words. The present findings go beyond past research in

demonstrating that language dominance modulated the emotion–memory effects. Bilinguals who were more dominant in the societal language, English, revealed poorer overall performance in the recognition test and lower recognition over words preceding negative modulators (emotional carryover effect). The current study showcases the need for sensitive measurements to characterize variation in language experience to better understand the tasks that we use to assess language and memory.

Author Contributions: Conceptualization, N.A.V.F., J.F.K. and J.T.; Formal analysis, N.A.V.F., J.F.K. and J.T.; Investigation, N.A.V.F., J.F.K. and J.T.; Methodology, N.A.V.F., J.F.K. and J.T.; Supervision, J.F.K. and J.T.; Writing—original draft, N.A.V.F., J.F.K. and J.T.; Writing—review and editing, N.A.V.F., J.F.K. and J.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of University of California—Irvine (Protocol#2019-5424 approved 10 June 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data from this study can be made available upon request to the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. List of modulators by word type.

Negative Words	Taboo Words	Neutral Words
1. abuse	1. anus	1. apron
2. anger	2. asshole	2. belt
3. cancer	3. bitch	3. cap
4. crash	4. breast	4. coat
5. cruel	5. cock	5. dress
6. death	6. dick	6. fur
7. doom	7. dildo	7. jacket
8. fail	8. dyke	8. nylons
9. grief	9. fuck	9. parka
10. guilt	10. nigger	10. purse
11. hate	11. piss	11. robe
12. kill	12. pussy	12. shirt
13. misery	13. queer	13. shoes
14. pain	14. rape	14. shorts
15. panic	15. shit	15. skirts
16. rage	16. slut	16. slip
17. shock	17. vagina	17. socks
18. sorrow	18. whore	18. watch

Note

- ¹ For example, [Wong and Ng \(2018\)](#) tested the moral behavior of early English–Mandarin bilinguals in Singapore in both their languages and found that “the more dominant participants were in their tested language, the larger the difference between their personal and impersonal dilemma response choice”. Therefore, language dominance as measured by the Bilingual Language Profile was significantly correlated to a higher emotional response. Although a different paradigm, this contrasts the findings of [Ferré et al. \(2010\)](#). Research is needed to see whether the Bilingual Language Profile provides a more nuanced and careful measure of language dominance in relation to emotion–memory effects in bilinguals.

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