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Original Paper

The Automatic Processing of Emotion-label Words and Emotion-laden Words in Chinese-English Bilinguals

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Abstract

Two core controversies persist in the research on the automatic processing of emotional words. The first centers on how emotion-label words and emotion-laden words differentially modulate the automatic processing. The second concerns whether the automatic processing of emotional words in a second language (L2) can attain native-like automaticity and efficiency. To examine these questions, the present study employed an emotional Stroop task with 31 Chinese-English bilinguals of upper-intermediate proficiency. Results demonstrated a cross-language positivity advantage, reflected in faster responses to positive than to negative and neutral words. Critically, word type significantly moderated this valence effect: it was robust for emotion-label words but attenuated for emotion‑laden words. Reaction-time data further indicated no significant disadvantage for L2 relative to L1 processing, suggesting that upper intermediate L2 proficiency can support near-native automatic access to emotional words. Notably, however, accuracy patterns diverged across languages: a negativity bias emerged in L1, whereas L2 processing exhibited a positivity bias. Together, these findings underscore that even among upper intermediate bilinguals, automatic emotional processing remains sensitive to lexico-semantic distinctions, highlighting the need for theoretical models to incorporate such subtleties in bilingual emotion representation.

Keywords

emotion-label words, emotion-laden words, emotional stroop task, automatic processing, bilingual

1. Introduction

Emotional words constitute a lexical category capable of conveying both conceptual meanings and affective content (Ortony et al., 1987; Vinson et al., 2014; Hoemann & Barrett, 2019). Currently, various classifications of emotion words exist, among which the distinction between emotion-label words and emotion-laden words has garnered significant attention (Tang et al., 2023; Betancourt et al., 2024; Wu & Zhang, 2025). Specifically, emotion-label words directly express emotional states (e.g., "happy", "sad"), whereas emotion-laden words carry emotional connotations without directly expressing them (e.g., "sunshine", "punishment"). Accumulating evidence indicates distinct cognitive and neural mechanisms underlying these two categories of emotional words (Liu et al., 2023; Wu & Zhang, 2020; Zhang et al., 2020). For instance, employing a lexical decision task, Zhang et al. (2020) observed that negative emotion-label words elicited larger N170 amplitudes compared to negative emotion-laden words, whereas for positive stimuli, emotion-laden words induced larger N170 amplitudes than emotion-label words. These findings suggest a divergence in the early processing of these word types, which is significantly modulated by emotional valence.

Theoretically, the dual-process model posits two distinct systems: an implicit, automatic system and an explicit, reflective system (Abbassi et al., 2011; Liu et al., 2023). This study focuses on the former, which supports rapid and involuntary processing. Within this implicit domain, the mechanism of automatic emotion processing is explained by two competing theoretical accounts: the automatic vigilance hypothesis and the positivity superiority effect. The automatic vigilance hypothesis proposes that negative stimuli, as signals of potential threat, involuntarily capture and narrow attention, thereby slowing subsequent cognitive processing (Pratto & John, 1991). However, In contrast, the positivity superiority effect posits that positive stimuli receive preferential processing, leading to faster and more efficient responses (Kazanas & Altarriba, 2015; Scott et al., 2014). This advantage can be explained by complementary theoretical accounts. The density hypothesis proposes that positive information is represented within a more densely interconnected associative network in memory, enabling faster lexical access and retrieval than negative or neutral information (Unkelbach et al., 2008). Furthermore, the Broaden-and-Build Theory suggests that positive affective states broaden an individual's attentional scope, which may enhance cognitive flexibility and facilitate conflict resolution in demanding tasks such as the emotional Stroop (Fredrickson, 2001; Liu et al., 2018). Thus, emotional valence may modulate processing speed in divergent directions: slowing it down via vigilance or speeding it up via facilitation.

In L1 contexts, although the automaticity of emotional words processing is well established, how it is modulated by emotional valence remains contested (Franken et al., 2009; Lei et al., 2017; Winskel, 2013; Imbir et al., 2015; Hinojosa et al., 2015; Chen et al., 2015). Specifically, some lines of evidence support a positivity advantage in automatic lexical access. For instance, Imbir et al. (2015) recorded ERPs while Polish native speakers read emotional words and found that positive words elicited larger

Early Posterior Negativity (EPN) amplitude—a component linked to automatic emotional encoding—than negative words, suggesting enhanced automatic processing of positive stimuli. Conversely, other studies report a robust negativity bias, indicating that negative words are prioritized in early, automatic stages (Nasrallah et al., 2009; Wang & Bastiaansen, 2014). Nasrallah et al. (2009), using a masked affective categorization paradigm with exposures as brief as 22-33 ms, demonstrated that negative words were categorized more accurately and with higher valence sensitivity than positive words. Critically, this advantage was independent of lexical frequency, arousal, or valence extremity, pointing to a fundamental perceptual and automatic processing preference for negative content. Thus, the L1 literature reveals a consistent tension between these two opposing biases, highlighting that emotional valence exerts a potent yet inconsistent moderating influence on the automaticity of word processing.

Research on the automatic processing of emotional words in a L2 also provides evidence for automaticity, often indicating a heightened automatic response to negative stimuli. (Grabovac & Plć h, 2014). Grabovac and Plć h (2014) employed an emotional Stroop paradigm using negative, positive, and neutral valence words in Hungarian and Serbian. Their results revealed that negative words elicited significantly longer reaction times than neutral words, indicating their automatic activation. However, empirical research examining how emotional valence modulates the automatic processing of emotional words in a second language remains relatively scarce. A critical limitation in both L1 and L2 literature is the tendency to conflate emotion-label and emotion-laden words when examining these valence effects. Consequently, it remains unclear whether the reported valence asymmetries are universal or specific to certain word types.

Concurrently, researchers have focused on whether L2 automatic processing in emotional words can reach a level commensurate with that of L1. The empirical evidence on this issue remains divergent. Some studies suggest that the automaticity of L2 emotion word processing is on par with that of the native language (Ahn & Jiang, 2023; Winskel, 2013; Grabovac & Plć h, 2014), while others indicate that L2 processing does not attain the same level of efficiency as in L1 (Fan et al., 2017; Degner et al., 2012). For example, Ahn and Jiang (2023), using an emotional Stroop task, found that adult L2 learners overall showed similar interference effects as native speakers. Notably, however, this parity was mediated by language exposure, emerging only among learners with higher daily L2 use frequency. However, Fan et al. (2017) sought to examine the automatic extraction of emotional words presented in both the L1 and L2 among late Chinese-English bilinguals during a facial expression recognition task. The results revealed the strength of the emotional face-word Stroop effect was markedly greater in L1 than in L2, confirming attenuated emotionality in L2 processing.

The inconsistency in findings across studies may stem from key methodological limitations. First, a systematic failure to distinguish between lexical categories of emotional words—emotion-label versus emotion-laden words—likely obscures underlying processing differences. Prior research indicates that

emotion-label words are processed more rapidly and automatically than emotion-laden words (Zhang et al., 2020; Zhang et al., 2025). For instance, Kazanas and Altarriba (2015) employed both masked and unmasked priming paradigms and consistently found shorter reaction times for emotion-label words, suggesting they benefit from greater accessibility in the mental lexicon due to their direct referential link to affective states. Second, inadequate control of participant-related variables further complicates cross-study comparisons. Empirical evidence shows that factors such as L2 proficiency modulate automatic processing efficiency, with higher proficiency linked to more native-like access (Elston-Güttler et al., 2005). Additionally, gender differences have been documented, with females often exhibiting heightened sensitivity to negative emotional stimuli compared to males (Qin et al., 2018; Haro et al., 2025).

To address these gaps, the present study investigated the automatic processing of emotion-label and emotion-laden words in L1 and L2 using an emotional Stroop task. The participants were upper-intermediate female Chinese-English bilinguals. This population was selected to provide a rigorous test of the cross-linguistic generality of emotional effects: the substantial typological distance between Chinese (logographic) and English (alphabetic) languages extends the investigation beyond cognate or closely related language pairs. Furthermore, focusing on high-proficiency learners and a single gender helps control for the potentially confounding effects of proficiency and gender-related differences in emotional sensitivity, thereby offering a clearer window into the core mechanisms of automatic processing. The emotional Stroop task serves as the primary measure of automaticity. In this paradigm, participants are required to name the ink color of a word while attempting to ignore its meaning. The core logic is that if a word's emotional content is activated automatically, it will interfere with, or facilitate, the color-naming response. Traditionally, the effect manifests as interference—slower reaction times (RTs)—typically attributed to the attentional capture by salient, often threat-related, stimuli. However, evidence also supports a facilitation effect—faster RTs—particularly for positive stimuli. Thus, the emotional Stroop effect is a sensitive behavioral index that captures not only the presence but also the direction of automatic emotional processing.

Therefore, the study aims to investigate: (1) Is the automatic processing of emotion words influenced by valence and word type? and (2) Can the automatic processing of emotion words in L2 reach a level comparable to that in L1? To address the second question, the same participants will perform the task in both English (L2) and Chinese (L1) to establish a comparative baseline.

2. Method

2.1 Participants

The participants consisted of 31 female graduate students majoring in English from a university in Qingdao, China, all of whom had passed the Test for English Majors-Band 8 (TEM-8), a national proficiency examination for English majors in China. All participants were right-handed, had normal or

corrected-to-normal vision, and reported no history of brain injury or neurological disorders. Scores on the Beck Depression Inventory (BDI) indicated that all participants scored below 10, reflecting a normal, positive mood state with no moderate or severe depressive symptoms (Beck et al., 1996). Prior to the experiment, written informed consent was obtained from each participant, and monetary compensation was provided upon completion of the study. All participants completed the online LexTALE test, an assessment of English vocabulary knowledge, with scores no lower than 70% (M = 75.38%, SD = 5.62). Based on the scoring criteria of the test, their performance corresponded to the B2 level of the Common European Framework of Reference for Languages (CEFR), indicating that the participants were upper intermediate second language proficiency. The language experience and proficiency questionnaire revealed that participants' daily exposure to Chinese (M = 68.26%, SD = 0.14) was significantly higher than their exposure to English (M = 25.44%, SD = 0.11), $t(30) = 9.207$, $p < .001$. According to the questionnaire, none of the participants had immersion experience in an English-speaking environment. They had all learned English in traditional classroom settings in China, starting between the ages of 8 and 10, with a formal learning duration of 11 to 12 years.

2.2 Materials

A total of 180 experimental stimuli were employed in the study, comprising two independent sets of 90 Chinese words and 90 English words. The stimuli for each language were categorized into three valence conditions: positive, negative, and neutral (N=30 per category). The positive and negative categories were further subdivided into emotion-label words and emotion-laden words (n=15 per sub-category), while the neutral words served as a baseline control. A separate group of 30 participants, who did not take part in the main experiment, rated the valence, arousal, and familiarity of the selected materials using a 5-point Likert scale (ranging from 1 to 5: 1 indicating extremely negative, lowest arousal, and least familiar; 5 indicating extremely positive, highest arousal, and most familiar).

The Chinese stimuli were selected from the Chinese Affective Words System (CAWS; Luo & Wang, 2004; Yi et al., 2015) and Liu et al. (2025). To minimize lexical variability, word length was held constant by restricting all items to disyllabic words. Statistical analyses of the normative ratings confirmed the validity of the affective manipulations. A one-way ANOVA revealed a significant main effect of valence ($p < .001$), with positive words rated significantly higher than neutral words, and neutral words higher than negative words (ps < .001). Crucially, no significant differences in valence intensity were found between emotion-label and emotion-laden words within either the positive or negative categories (ps > .05). Regarding arousal, both positive and negative words were rated as significantly more arousing than neutral controls (ps < .001), while arousal levels remained well-matched between the label and laden sub-categories (ps > .05).

Table 1. Descriptive Statistics of Valence and Arousal Ratings for Chinese Emotional and Neutral Words

Word type	Mean Valence (SD)	Mean Arousal (SD)
Positive Label Words	4.17（0.21）	4.53（0.23）
Positive Laden Words	4.07（0.41）	4.23（0.47）
Negative Label Words	2.09（0.90）	4.63（0.16）
Negative Laden Words	1.98（0.83）	4.59（0.35）
Neutral Words	3.23（0.35）	1.91（0.74）

The English stimuli were independently selected from the database compiled by Warriner et al. (2013). Statistical results showed that positive, negative, and neutral words differed significantly from each other in valence (all ps < .001). There were no significant differences in valence between positive emotion-label words and positive emotion-laden words, or between negative emotion-label words and negative emotion-laden words (all ps > .05). Significant differences in arousal were found between positive and neutral words, as well as between negative and neutral words (both ps < .001). However, arousal did not differ significantly across the four categories of emotional words (all ps > .05). No significant differences were observed in familiarity or word length (measured by the number of letters) among the five word categories (all ps > .05).

Table 2. Descriptive Statistics of Valence, Arousal, Familiarity, and Word Length for English Emotional and Neutral Words

Word Type (English)	Mean Valence (SD)	Mean Arousal (SD)	Mean Familiarity (SD)	Mean Word Length (SD)
Positive Label Words	4.03（0.30）	4.49（0.32）	4.79（0.26）	6.87（2.03）
Positive Laden Words	4.17（0.32）	4.20（0.55）	4.91（0.30）	6.93（1.16）
Negative Label Words	2.16（0.81）	4.61（0.30）	4.93（0.25）	7.33（1.99）
Negative Laden Words	2.13（0.78）	4.52（0.36）	4.89（0.29）	6.40（1.35）

Neutral Words	3.17（0.29）	1.93（0.72）	4.80（0.34）	6.87（1.14）

2.3 Procedure

This study employed an emotional Stroop task to investigate the automatic processing of emotional words. In each trial, a fixation cross was first presented at the center of the screen for 600 milliseconds, followed by the presentation of a target word (font: Times New Roman, size: 50). The participants' primary task was to identify the color of the word quickly and accurately while ignoring its semantic content, responding via key press: the "Z" key for blue, the "V" key for green, and the "M" key for red. To eliminate potential errors arising from systematic key-press biases, the mapping between colors and response keys was fully counterbalanced across participants. The experiment followed a self-paced design, whereby each trial terminated only after the participant's response, immediately followed by the onset of the next trial.

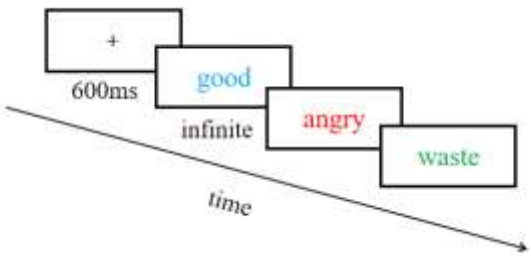


Figure 1. Experimental Procedure

Prior to the formal experiment, participants first reviewed the on‑screen instructions while the experimenter provided a detailed explanation of the procedure and requirements. Subsequently, they were asked to verbally summarize the task to ensure full comprehension before proceeding to the practice phase. The practice session consisted of 15 words, and participants were required to achieve an accuracy rate of at least 80% in order to advance to the main experiment. The formal experiment comprised a total of 90 words and lasted approximately 15 minutes in total, including both the preparatory and the experimental phases.

3. Result

3.1 Analysis of Accuracy Data

For emotion-label words, a 2 (Language: Chinese/English) × 3 (Valence: positive/negative/neutral) repeated-measures ANOVA was conducted.

The results revealed no significant main effect of valence [$F(2, 60) = 0.442$, $p = .604$, potential $n2 = .015$] , nor was the main effect of language significant [$F(1, 30) = 0.198$, $p = .660$, potential $n2 = .007$]. However, a significant interaction between language and valence was observed [$F(2, 60) =$

3.495, p = .037, potential n2 = .108]. Follow-up simple effects analysis revealed an asymmetric pattern of emotion processing across the two language contexts: in the Chinese condition, recognition accuracy for negative label words (M = 0.996) was significantly higher than that for positive label words (M = 0.980); whereas in the English condition, accuracy for negative words (M = 0.980) was lower than that for positive words (M = 0.987). These findings suggest that language background significantly modulated the processing advantage associated with emotional valence.

For emotion-laden words, the repeated-measures ANOVA revealed that none of the effects reached statistical significance: the main effect of language [F(1, 30) = 0.111, p = .741, potential n2 = .004], the main effect of valence [F(1, 30) = 1.583, p = .217, potential n2 = .052], and the interaction between language and valence [F(2, 60) = 0.345, p = .710, potential n2 = .012]. These results indicate highly stable accuracy rates for emotion-laden words, showing no marked language advantage or emotional bias.

3.2 Analysis of Reaction Time

In the data analysis, error trials as well as reaction time data exceeding three standard deviations from the mean in each condition were excluded, accounting for 3% of the total data. The distribution of reaction times across experimental conditions is presented in Figure 2.

To investigate the automatic processing of emotion-label words, a 2 (Language: Chinese, English) × 3 (Valence: Positive, Negative, Neutral) repeated-measures ANOVA was conducted on color-naming response times. The results revealed a significant main effect of emotional valence [$F(2, 60) = 12.043$, $p < .001$, potential n2 = .286]. Post hoc comparisons indicated that RTs for positive words were significantly faster than those for neutral ($p < .001$) and negative words ($p = .001$), reflecting a positive facilitation effect. No significant difference was found between negative and neutral words ($p = 1.000$). The main effect of language was not significant [$F(1, 30) = 0.019$, $p = .890$], suggesting comparable processing speed in L1 and L2. Furthermore, the interaction between language and valence was not significant [$F(2, 60) = 1.887$, $p = .160$], indicating that the facilitation pattern for positive words was consistent across both languages.

Regarding emotion-laden words, a significant main effect of emotional valence was observed [$F(2, 60) = 3.336$, $p = .042$, potential n2 = .100]. However, post hoc comparisons with Bonferroni correction revealed no statistically significant differences between specific valence conditions (ps > .05), although a marginal trend was observed where positive words were processed faster than negative words (mean difference = -15.10 ms, $p = .063$). The main effect of language [$F(1, 30) = 0.273$, $p = .605$, potential n2 = .009] and the language × valence interaction [$F(2, 60) = 2.185$, $p = .121$, potential n2 = .068] were both non-significant. These findings indicate that bilingual participants processed emotion-laden words efficiently across both languages, with a valence pattern roughly parallel to (but weaker than) that of emotion-label words.

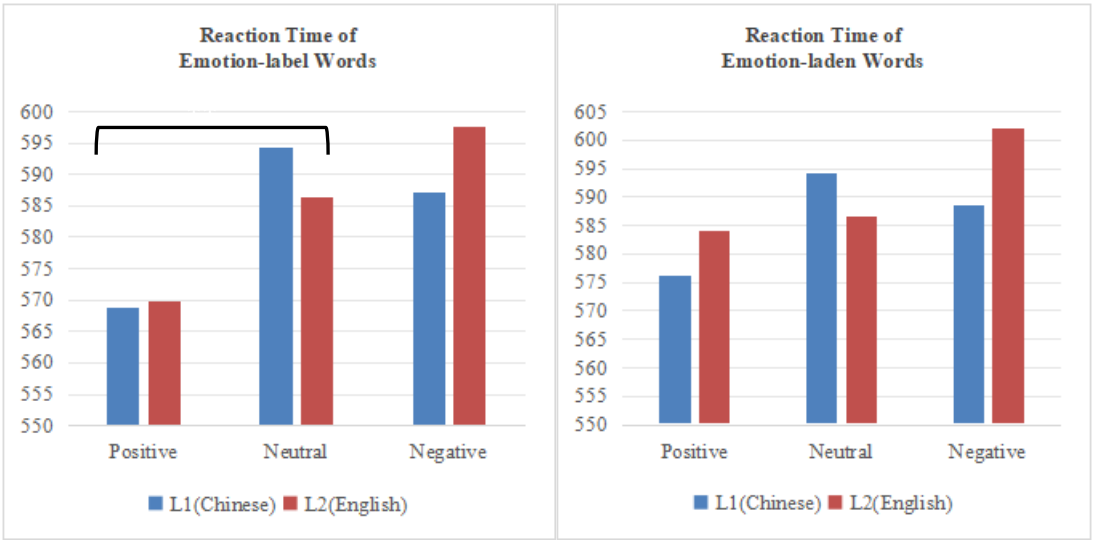


Figure 2. Reaction Time of Emotion-label Words and Enmotion-laden Words

4. Discussion

The present study examined the automatic processing of emotion words in Chinese-English bilinguals, with a specific focus on distinguishing between emotion-label and emotion-laden words.

First, the results indicate that highly proficient bilinguals show cross-linguistic consistency in automatic emotion processing, characterized by a stable positivity bias. Reaction-time data revealed a consistent facilitation effect for positive words, regardless of language of presentation. Critically, however, this positivity bias was modulated by word type. For emotion-label words, a strong main effect of valence emerged, with post-hoc comparisons confirming significantly faster responses to positive words compared to both negative and neutral words. In contrast, for emotion-laden words, the difference between positive and negative words was only marginally significant. This facilitation patterns align with the Positivity Superiority Effect and the Density Hypothesis proposed by Unkelbach et al. (2008), which posits that positive information is processed faster due to its higher density and interconnectivity in the mental lexicon. From a cognitive perspective, this result also supports the Broaden-and-Build Theory (Fredrickson 2001). Unlike negative stimuli, which typically elicit attentional narrowing and interference, positive emotion-label words likely broadened participants' cognitive-attentional scope, thereby facilitating conflict resolution in the Stroop task and leading to accelerated color-naming performance.

In addition, these findings provide further empirical support for the mechanisms underlying the automatic processing of emotional words in both L1 and L2. Regarding native language, the present study is consistent with the findings of Imbir et al. (2015) and Chen et al. (2015), indicating that positive emotional words elicit a larger Early Posterior Negativity (EPN) amplitude compared to neutral words. However, a critical divergence emerges in L2 domain when comparing our results for

emotion-laden words with previous immersion-based studies. Grabovac and Pléh (2014), who specifically examined emotion-laden words in early bilinguals within an L2-dominant environment, reported classic interference for negative stimuli. In contrast, our data revealed no negative interference for laden words, but rather a trend toward positive facilitation. This discrepancy can be explained by the role of acquisition and usage context, as underscored by Ahn and Jiang (2023). Their work demonstrates that the magnitude of the emotional Stroop effect is predicted not merely by proficiency, but importantly by the frequency of daily L2 use. Participants in Grabovac and Pléh's study acquired emotion-laden words in naturalistic, survival-relevant settings, where such terms likely accrued strong embodied and threat-related associations capable of triggering automatic vigilance (Pavlenko, 2012). Conversely, our participants were EFL learners in an academic setting with limited daily L2 exposure. According to the Emotional Context of Learning hypothesis (Harris et al. 2006), classroom-acquired laden words often remain disembodied—they retain semantic meaning but lack the visceral arousal forged through lived experience. Consequently, the positive-focused nature of academic input likely strengthened semantic access for positive laden words, while the lack of immersive threat-experiences prevented the automatic vigilance response.

Beyond the specific effects of valence, a critical theoretical contribution of this study lies in the observed dissociation between emotion-label and emotion-laden words. While label words elicited a strong valence effect, the effect for laden words was markedly attenuated. Emotion-label words, which directly denote affective states, permit immediate and automatic access to their emotional content. In contrast, emotion-laden words are thought to activate emotion indirectly via semantic mediation—accessing conceptual meaning prior to its associated affect. This additional semantic step introduces greater cognitive load and processing complexity, which appears to dilute the immediacy and strength of automatic emotional activation, thereby accounting for the weaker valence effect observed for laden words. This dissociation provides empirical support for the processing distinctions highlighted by Kazanas and Altarriba (2015). Using priming paradigms, they reported a significant main effect of word type, with faster responses to emotion-label than emotion-laden words. They attributed this speed advantage to the direct access nature of label words, which allows for immediate affective activation. Conversely, emotion-laden words rely on semantic mediation, a process that incurs a temporal cost. The present results extend this logic to the temporal dynamics of the Emotional Stroop task. The rapid, direct processing of emotion-label words allowed their positive valence to exert strong and significant facilitation on color-naming. For emotion-laden words, however, the inherent delay caused by semantic mediation likely attenuated the online impact of valence, preventing the reaction-time difference between positive and negative stimuli from reaching full statistical significance.

Secondly, the results demonstrate that upper intermediate proficient bilinguals achieve considerable efficiency in the automatic processing of emotional words across their languages. Specifically, neither

the main effect of language nor the interaction between language and emotional valence reached statistical significance, regardless of whether emotion-label words or emotion-laden words were examined. This pattern indicates that for these learners, the putative "emotional distance" of the L2 is substantially reduced, leading to convergent automatic affective processing in L1 and L2. Theoretically, these convergence align with the Emotional Context of Learning Hypothesis (Pavlenko, 2012), which proposes that as L2 proficiency grows and the language is used in affectively rich contexts, its lexicon becomes more deeply integrated with the conceptual-emotional system, enabling L2 words to evoke resonance comparable to L1 words. What's more, these findings provide robust empirical support for the Revised Hierarchical Model (RHM; Kroll & Stewart, 1994). According to the RHM, increasing proficiency strengthens direct links between L2 lexical forms and a shared conceptual store. In the initial stages of L2 acquisition, learners rely heavily on L1 translation equivalents to access meaning. However, for the upper intermediate proficient bilinguals in this study, the absence of a language effect suggests that the L2-to-concept connections have become sufficiently strong and direct, reaching a level of functional equivalence with L1-concept links. While the original RHM primarily focused on neutral semantic processing, the current data extends its reach to the affective domain, suggesting that emotional connotations are part of the shared conceptual representations that both languages can access with equal automaticity. This aligns with the Equivalence Hypothesis within the RHM framework, suggesting that at advanced stages, the cognitive effort required for semantic and emotional integration no longer differs significantly between the two languages (Kroll & Tokowicz, 2005).

Empirically, the comparable efficiency across languages observed in our study also resonates with research on early bilinguals. For instance, Grabovac and Pléh (2014) reported similar emotional activation speed across languages in early Hungarian-Serbian bilinguals, suggesting that balanced linguistic experience fosters convergent affective processing. More importantly, the absence of a language effect in our data highlights the critical role of linguistic immersion and competence, corroborating Ahn and Jiang's (2023) argument that the automaticity of L2 emotional processing is fundamentally moderated by frequency of L2 use. Together, these lines of evidence indicate that high proficiency can bridge the affective gap between languages, enabling emotional words—both labels and laden—to directly access shared conceptual-affective representations without relying on L1 mediation. However, our results diverge from those of Fan et al. (2017), who found that although late Chinese–English bilinguals showed emotional Stroop effects in both languages, the effect remained significantly weaker in L2 than in L1. This discrepancy may be explained by the proficiency-use discrepancy: even advanced learners in formal instructional settings may lack sufficient daily emotional engagement in the L2, thereby limiting the development of deep emotional embodiment. Furthermore, methodological differences likely contribute to the contrasting outcomes. Fan et al. (2017) employed the Face—Word Stroop task, where the interference arises from the competition between a word and a facial expression. Since facial affect processing is evolutionarily prioritised and rapid, it may

overshadow the processing of L2 words, which typically entail slower lexical access than L1, thereby making the L2 effect appear significantly weaker. In contrast, the classic Emotional Stroop task used in the present study involves a single integrated stimulus where the emotional word is the direct carrier of the target color. This integration, combined with the absence of a biologically dominant competitor like a face, may have allowed the emotional content of L2 words to capture attention more effectively, thus revealing an equivalent magnitude of emotional activation across languages.

Thirdly, analysis of accuracy data revealed distinct cross-linguistic modulatory patterns in affective processing. Despite a general ceiling effect attributable to the relative simplicity of the color-naming task, a significant Language × Valence interaction emerged specifically for emotion-label words. For these words, L1 responses exhibited a clear negativity bias—a pattern consistent with deeply embodied emotional representations and survival-oriented defensive mechanisms in the native language. In contrast, L2 processing for the same word type showed a significant positivity advantage, aligning with the facilitation observed in reaction times. Together, these findings underscore that automatic bilingual processing is multidimensional: temporal efficiency can converge across languages, yet the underlying affective resonance may retain fundamental language-specific qualities.

Despite its contributions, the present study has several limitations that should be noted. First, although we attributed the divergence from immersion‑based findings to differences in learning context, our sample consisted solely of late EFL learners in an academic setting. Without directly comparing these learners with bilinguals from naturalistic immersion environments, the claim that classroom-acquired emotion-laden words are more disembodied remains inferential. Future studies should adopt a cross-contextual design to empirically examine how acquisition setting modulates the automaticity of emotion-laden word processing. Second, while the emotional stroop task used here effectively captures attentional bias, its reliance on conflict resolution limits specific inferences about the very early, automatic stages of processing. Future research should therefore employ Event-Related Potentials (ERPs) to complement the behavioral findings and directly trace the neurocognitive time course. For instance, ERP measures could determine whether the dissociation between emotion-label and emotion-laden words observed in our reaction-time data is reflected in modulations of early components such as the Early Posterior Negativity (EPN). Clarifying this neural chronology would significantly advance our understanding of how different emotional word types gain automatic access in the bilingual mind. Finally, although valence and word frequency were controlled, the potential interaction between valence and arousal was not systematically examined. High- and low-arousal positive words could elicit distinct automatic responses. Future research should orthogonally manipulate valence and arousal to determine whether the L2 positivity advantage is driven by affective valence, arousal, or their interaction.

5. Conclusion

By distinguishing between emotion-label and emotion-laden words, the current study provides critical insights into the automaticity of affective processing among upper intermediate proficiency Chinese-English bilinguals. The findings demonstrate that automatic affective activation is not uniform but is finely modulated by word type, emotional valence, and language experience.

Three main conclusions can be drawn. First, the results provide empirical support for a theoretical dissociation between emotion-label and emotion-laden words in bilingual processing. Strong valence effects emerged for label words, whereas responses to laden words were markedly weaker, consistent with the view that directly denoting an emotion facilitates rapid automatic access, whereas laden words—reliant on semantic mediation—elicit slower and less automatic affective activation.

Second, a cross-linguistic positivity advantage was observed, challenging the predominance of the negativity bias often reported in monolingual studies. This suggests that in non‑threatening contexts such as academic settings, positive words benefit from richer conceptual connections and broader attentional scope, in line with the Broaden‑and‑Build Theory.

Third, the data reveal a notable convergence between L1 and L2 in terms of processing speed among advanced learners, supporting the Revised Hierarchical Model's claim that L2 words can directly access shared conceptual‑affective representations. However, accuracy patterns diverged: L1 showed a negativity bias, whereas L2 exhibited a positivity bias. This dissociation indicates that while processing efficiency can become similar across languages, the qualitative nature of emotional embodiment remains shaped by acquisition context.

In summary, bilingual emotional processing reflects a dynamic interplay between language proficiency and the affective setting of learning. Theoretical models should therefore distinguish between the attainment of native-like speed and the development of native-like emotional grounding, particularly when the L2 is acquired in instructional rather than immersive environments.

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References

Abbassi, E., Kahlaoui, K., Wilson, M. A., & Joanette, Y. (2011). Processing the emotions in words: The complementary contributions of the left and right hemispheres. *Cognitive, Affective, & Behavioral Neuroscience*, *11*(3), 372-385. https://doi.org/10.3758/s13415-011-0034-1

Ahn, S., & Jiang, N. (2023). Can adult learners sense L2 emotional words automatically? The role of L2 use on the emotional Stroop effect. *Second Language Research*, *39*(4), 1265-1278. https://doi.org/10.1177/02676583221131256

Altarriba, J. (2006). Cognitive approaches to the study of emotion-laden and emotion words in monolingual and bilingual memory. *Bilingual Education and Bilingualism*, *56*, 232. https://doi.org/10.21832/9781853598746-011

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *BDI-II: Beck Depression Inventory manual* (2nd ed.). Psychological Corporation.

Betancourt, Á. A., Guasch, M., & Ferré, P. (2024). What distinguishes emotion-label words from emotion-laden words? The characterization of affective meaning from a multi-componential conception of emotions. *Frontiers in Psychology*, *15*, 1308421. https://doi.org/10.3389/fpsyg.2024.1308421

Chen, P., Lin, J., Chen, B., Lu, C., & Guo, T. (2015). Processing emotional words in two languages with one brain: ERP and fMRI evidence from Chinese-English bilinguals. *Cortex*, *71*(34), e4-e8. https://doi.org/10.1016/j.cortex.2015.06.002

Degner, J., Doycheva, C., & Wentura, D. (2012). It matters how much you talk: On the automaticity of affective connotations of first and second language words. *Bilingualism: Language and Cognition*, *15*(1), 181-189. https://doi.org/10.1017/S1366728911000095

Elston-Güttler, K. E., Paulmann, S., & Kotz, S. A. (2005). Who's in control? Proficiency and L1 influence on L2 processing. *Journal of Cognitive Neuroscience*, *17*(10), 1593-1610. https://doi.org/10.1162/089892905774597245

Fan, L., Xu, Q., Wang, X., Xu, F., Yang, Y., & Lu, Z. (2017). The automatic activation of emotion words measured using the emotional face-word Stroop task in late Chinese-English bilinguals. *Cognition and Emotion*, *32*(2), 315-324. https://doi.org/10.1080/02699931.2017.1303451

Franken, I. H., Gootjes, L., & van Strien, J. W. (2009). Automatic processing of emotional words during an emotional Stroop task. *NeuroReport*, *20*(8), 776-781. https://doi.org/10.1097/WNR.0b013e32832b02fe

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*(3), 218. https://doi.org/10.1037/0003-066X.56.3.218

Grabovac, B., & Plén, C. (2014). Emotional activation measured using the emotional Stroop task in early Hungarian-Serbian bilinguals from Serbia. *Acta Linguistica Hungarica*, *61*(4), 423-441. https://doi.org/10.1556/ALing.61.2014.4.3

Haro, J., Hinojosa, J. A., & Ferré, P. (2025). The influence of individual differences in the processing of words expressing discrete emotions: data from a large-scale study. *Scientific Reports*, *15*(1), 25036. https://doi.org/10.1038/s41598-025-10310-9

Hinojosa, J. A., Mercado, F., Albert, J., Barjola, P., Peláez, I., Villalba-García, C., & Carretié, L. (2015). Neural correlates of an early attentional capture by positive distractor words. *Frontiers in Psychology*, *6*, 24. https://doi.org/10.3389/fpsyg.2015.00024

Hoemann, K., Xu, F., & Barrett, L. F. (2019). Emotion words, emotion concepts, and emotional development in children: A constructionist hypothesis. *Developmental Psychology*, *55*(9), 1830. https://doi.org/10.1037/dev0000686

Imbir, K. K., Jarymowicz, M. T., Spustek, T., Kuś, R., & Żygierewicz, J. (2015). Origin of emotion effects on ERP correlates of emotional word processing: the emotion duality approach. *PLOS ONE*, *10*(5), e0126129. https://doi.org/10.1371/journal.pone.0126129

Kazanas, S. A., & Altarriba, J. (2015). The automatic activation of emotion and emotion-laden words: Evidence from a masked and unmasked priming paradigm. *American Journal of Psychology*, *128*(3), 323-336.

Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, *33*(2), 149-174. https://doi.org/10.1006/jmla.1994.1008

Kroll, J. F., & Tokowicz, N. (2005). Models of bilingual representation and processing: Looking back and leading forward. In J. F. Kroll & A. M. B. de Groot (Eds.), *Handbook of bilingualism: Psycholinguistic approaches* (pp. 531-553). Oxford University Press.

Lei, Y., Dou, H., Liu, Q., Zhang, W., Zhang, Z., & Li, H. (2017). Automatic processing of emotional words in the absence of awareness: The critical role of P2. *Frontiers in Psychology*, *8*, 592. https://doi.org/10.3389/fpsyg.2017.00592

Liu, J., Fan, L., Tian, L., Li, C., & Feng, W. (2023). The neural mechanisms of explicit and implicit processing of Chinese emotion-label and emotion-laden words: Evidence from emotional categorisation and emotional Stroop tasks. *Language, Cognition and Neuroscience*, *38*(10), 1412-1429. https://doi.org/10.1080/23273798.2022.2093389

Liu, J., Fan, L., Zhang, X., & Xu, Z. (2025). Affective and psycholinguistic norms for 1200 two-character Chinese words. *International Journal of Applied Linguistics*. https://doi.org/10.1111/ijal.12829

Liu, X., Yang, Y., Jiang, S., & Li, J. (2018). The facilitating effect of positive emotions during an emotional Stroop task. *NeuroReport*, *29*(11), 883-888. https://doi.org/10.1097/WNR.000000000001048

Luo, Y. J., & Wang, Y. N. (2024). *Chinese Affective Words System* (CAWS). Institute of Psychology, Chinese Academy of Sciences.

Nasrallah, M., Carmel, D., & Lavie, N. (2009). Murder, she wrote: enhanced sensitivity to negative word valence. *Emotion*, *9*(5), 609. https://doi.org/10.1037/a0016305

Ortony, A., Clore, G. L., & Foss, M. A. (1987). The referential structure of the affective lexicon. *Cognitive Science*, *11*(3), 341-364. https://doi.org/10.1207/s15516709cog1103_4

Pavlenko, A. (2008). Emotion and emotion-laden words in the bilingual lexicon. *Bilingualism: Language and Cognition*, *11*(2), 147-164. https://doi.org/10.1017/S1366728908003283

Qin, J., Shi, Z., Ma, Y., & Han, S. (2018). Gender and neural substrates subserving implicit processing of death-related linguistic cues. *Cognitive Processing*, *19*(1), 63-71. https://doi.org/10.1007/s10339-017-0847-0

Scott, G. G., O'Donnell, P. J., & Sereno, S. C. (2014). Emotion words and categories: Evidence from lexical decision. *Cognitive Processing*, *15*(2), 209-215. https://doi.org/10.1007/s10339-013-0589-6

Tang, D., Fu, Y., Wang, H., Liu, B., Zang, A., & Kärkkäinen, T. (2023). The embodiment of emotion-label words and emotion-laden words: Evidence from late Chinese-English bilinguals. *Frontiers in Psychology*, *14*, 1143064. https://doi.org/10.3389/fpsyg.2023.1143064

Unkelbach, C., Fiedler, K., Bayer, M., Stegmüller, M., & Danner, D. (2008). Why positive information is processed faster: The density hypothesis. *Journal of Personality and Social Psychology*, *95*(1), 36. https://doi.org/10.1037/0022-3514.95.1.36

Vinson, D., Ponari, M., & Vigliocco, G. (2014). How does emotional content affect lexical processing? *Cognition and Emotion*, *28*(4), 737-746. https://doi.org/10.1080/02699931.2013.851068

Wang, L., & Bastiaansen, M. (2014). Oscillatory brain dynamics associated with the automatic processing of emotion in words. *Brain and Language*, *137*, 120-129. https://doi.org/10.1016/j.bandl.2014.07.011

Winskel, H. (2013). The emotional Stroop task and emotionality rating of negative and neutral words in late Thai-English bilinguals. *International Journal of Psychology*, *48*(6), 1090-1098. https://doi.org/10.1080/00207594.2013.793800

Wu, C., & Zhang, J. (2020). Emotion word type should be incorporated in affective neurolinguistics: A commentary on Hinojosa, Moreno and Ferré (2019). *Language, Cognition and Neuroscience*, *35*(7), 840-843. https://doi.org/10.1080/23273798.2019.1696979

Wu, C., & Zhang, J. (2025). Emotion word is an ambiguous concept: dividing, defining, and connecting emotion-label words and emotion-laden words. *Cognition and Emotion*, 1-15. https://doi.org/10.1080/02699931.2025.2551080

Yi, S., He, W., Zhan, L., Qi, Z., Zhu, C., Luo, W., et al. (2015). Emotional noun processing: An ERP study with rapid serial visual presentation. *PLOS ONE*, *10*(11), e0118924. https://doi.org/10.1371/journal.pone.0118924

Zhang, J., Wu, C., Yuan, Z., & Meng, Y. (2020). Different early and late processing of emotion-label words and emotion-laden words in a second language: An ERP study. *Second Language Research*, *36*(3), 399-412. https://doi.org/10.1177/0267658318804850

Zhang, K., Ran, Y., Yang, Y., & Gu, F. (2025). Neural processing differences between Chinese emotion-label and emotion-laden words revealed by visual event-related potentials. *International Journal of Psychophysiology*, 113232. https://doi.org/10.1016/j.ijpsycho.2025.113232