

“Why Does ‘No’ Imply ‘Negative Emotion’ ? –Emotional Representation in Negation Process- ing (Post-print)”

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Abstract

Employing the Affective Misattribution Procedure (AMP) and the classic affective priming paradigm (BFP), negative or affirmative words were prefixed to Chinese disyllabic neutral nouns to constitute “no/have XX” phrases as priming materials, with neutral Russian words or Chinese emotional words serving as target materials, to examine the emotional representation of Chinese negation processing. In Experiment 1’s AMP paradigm, stimulus onset asynchrony (SOA) durations of 200 ms and 500 ms were employed, and the results demonstrated that negative phrases elicited a significantly higher probability of negative responses compared to affirmative phrases; in Experiment 2’s BFP paradigm, negative phrases similarly primed a higher probability of negative responses than affirmative phrases. The experimental findings indicate that negation itself carries negative valence, and that negation processing is embodied through negative emotion.

Full Text

Why Does “No” Imply “Negative Emotion” ? Emotional Representation in Negation Processing

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Abstract

Using the Affect Misattribution Procedure (AMP) and the classic Bona Fide Pipeline (BFP) paradigm, this study investigated emotional representation in

Chinese negation processing by adding negation or affirmation words before two-syllable neutral nouns to create “you/meiyou (have/no) XX” phrases as priming materials, with neutral Russian words or Chinese emotional words as targets. In Experiment 1’s AMP paradigm with stimulus onset asynchronies (SOAs) of 200 ms and 500 ms, negative phrases elicited significantly higher probabilities of negative responses than affirmative phrases. In Experiment 2’s BFP paradigm, negative phrases similarly primed higher probabilities of negative responses. These results demonstrate that negation itself carries negative valence and that negation processing is embodied through negative emotion.

Keywords: negation; emotion; embodiment; affective misattribution procedure; Bona Fide Pipeline

Classification Code: B842

Negation, as a linguistic phenomenon, exists in all human communication systems and permeates every level of language processing. Psychological research on negation has primarily focused on its processing mechanisms, yielding different theoretical perspectives. The main approaches include stage theories of negation processing, which can be divided into two types: one-step processing models that simulate the actual state of affairs during initial negation comprehension (Anderson, Huette, Matlock, & Spivey, 2010; Gao, Lu, & Ma, 2011), and two-step processing models that first simulate the negated state of the negated event before transitioning to simulation of the actual state (Kaup, Lüdtke, & Zwaan, 2006; Kaup, Yaxley, Madden, Zwaan, & Lüdtke, 2007; Chen et al., 2014; Cui et al., 2016). Recently, Gao, Lu, and Cui (2017) integrated previous models of negation processing and proposed a three-stage processing theory—the inhibition-rumination-reinhibition hypothesis.

However, there is no consensus on how the results of negation processing are represented—whether through propositional symbols, perceptual symbols, or emotion. Propositional symbol theory posits that negation is an explicit logical symbol, a label for truth-value conversion (Mayo, Schul, & Burnstein, 2004; Khemlani, Orenes, & Johnson-Laird, 2012). In contrast, embodied theories argue that negation processing is realized through concrete perceptual symbols (Kaup et al., 2006; Kaup et al., 2007; Anderson et al., 2010). These represent opposing viewpoints, each with its own merits. Rather than further exploring these perspectives and their respective experiments, the present study examines another special form of psychological representation in negation processing—emotion.

Embodied theory suggests that abstract concepts are largely metaphorical, with understanding achieved through mapping from familiar concrete concepts. Whether emotion itself is an abstract or concrete concept remains debated, leading to two research orientations within the embodied theory framework. The first treats emotion as an abstract concept and studies its embodiment, arguing that emotion, like cognition and thought, is grounded in sensorimotor experience and can be understood through concrete concepts such as distance, vertical space, and temperature (Havas, Glenberg, & Rinck, 2007; Williams

& Bargh, 2008a; Lü & Lu, 2013; Williams & Bargh, 2008b). The second orientation treats emotion as embodied experience parallel to perception and action (Vermeulen, Niedenthal, & Luminet, 2007; Oosterwijk et al., 2012). Kousta, Vinson, and Vigliocco (2009) found that abstract words carry more emotional load, proposing an embodied theory of abstract representation—that abstract concepts are grounded in internal states, particularly emotion (Kousta, Vigliocco, Vinson, Andrews, & Del Campo, 2011). Emotional association ratings for abstract words can predict activation in the rostral anterior cingulate cortex (rACC), which is associated with emotional processing (Vigliocco et al., 2014), a finding supported by numerous studies (Moffat, Siakaluk, Sidhu, & Pexman, 2015; Siakaluk, Knol, & Pexman, 2014; Yao et al., 2016). These results consistently demonstrate that abstract concept processing is closely associated with emotion and that abstract concepts can be embodied through emotion.

Can negation, like general abstract concepts, be represented through emotion during processing? This study adopts the second research orientation to examine emotional representation in negation processing—a question not previously explored. However, relevant theoretical and empirical studies provide reference points. On one hand, research has demonstrated that negation can influence emotional word processing (Deutsch, Kordts-Freudinger, Gawronski, & Strack, 2009; Herbert, Deutsch, Sütterlin, Kübler, & Pauli, 2011; Herbert, Deutsch, Platte, & Pauli, 2013). On the other hand, individuals' emotional states also affect negation processing (Haran, Mor, & Mayo, 2011), indicating an interactive relationship between negation and emotion. In pragmatic theory, negation is considered to “imply that something is different, unusual, or violates existing expectations” (Jordan, 1998). “Contrary to expectations” refers to an internal state of “unexpectedness” associated with emotional change (Oosterwijk, Mackey, Wilson-Mendenhall, Winkielman, & Paulus, 2015). Research has confirmed that “unexpectedness” makes people feel uncomfortable (Mendes, Blascovich, Hunter, Lickel, & Jost, 2007). Although these studies did not directly investigate emotional representation in negation, they are heuristic for the present research.

To investigate emotional representation in negation processing, we can draw on two affective priming paradigms used in related research. One is the classic Bona Fide Pipeline (BFP) paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986), also referred to by some researchers as Sequential Evaluative Priming (EP) (Nosek, Hawkins, & Frazier, 2011; Gawronski & Houwer, 2014). The other is the Affect Misattribution Procedure (AMP) (Payne, Cheng, Govorun, & Stewart, 2005). Deutsch et al. (2009) used these two affective priming paradigms to explore the automaticity of negation processing. In both paradigms, the prime “affirmation/negation + emotional word” (e.g., a [no] friend or a [no] disease) was presented for 200 ms, followed by the target. In the AMP paradigm, Chinese pictographs served as targets and were immediately followed by a masking stimulus, with participants judging the valence of the target. In the BFP paradigm, emotional words served as targets (positive words like “music,” negative words like “war”) without masking, with the target disappearing only after participants

made their valence judgment. The main differences between the two paradigms lie in three aspects of the target: first, the clarity of valence differs—targets in AMP are ambiguous, while those in BFP have clear, explicit valence; second, presentation duration differs—targets in AMP are presented for 100 ms, while in BFP they remain until response; third, masking is present in AMP but absent in BFP.

Although both AMP and BFP are implicit measurement methods, they reflect different implicit cognitive processing mechanisms (Nosek et al., 2011). Deutsch and Gawronski (2009) compared these paradigms, noting that in AMP, targets (e.g., pictographs) are meaningless to participants, presented briefly, and followed by masking, forcing participants to rely more on primes when judging target valence. Thus, AMP measures show that affect elicited by primes is (mis)attributed to targets, reflecting a misattribution mechanism. In contrast, BFP priming effects reflect response-interference (RI) mechanisms—when prime and target valences differ, they elicit opposing response tendencies, creating interference. Deutsch et al. (2009) found negation effects in AMP, where “no party” primed more negative responses, but not in BFP. They reasoned that in AMP, targets are judged based on primes, allowing more prime processing and thus revealing negation effects. In BFP, the weak association between prime and target, combined with the target’s clear semantics, means participants can focus attention on the target without attending to the prime, limiting semantic integration and valence conversion between negation words and emotional target words. If interference from primes can still be detected under these conditions, showing matching or mismatching effects dominated by prime emotion, then BFP would be more implicit than AMP and measure more automatic negation processing.

Deutsch et al. (2009) used negation + emotional words (e.g., friend/disease) as materials, demonstrating valence conversion effects in negation processing but not addressing the form of emotional representation. To better examine emotional representation in negation processing, the present study adopts Deutsch et al.’s (2009) affective priming paradigms but changes the prime materials to “negation + neutral words.” This approach not only investigates whether negation processing is embodied through emotion but also eliminates contamination from emotional words in primes. Using two different affective priming paradigms, this study addresses the following questions:

1. **Does negation processing involve emotional representation, and if so, is the valence positive or negative?** Based on previous research, we predict that negative emotional representation will emerge in negation processing in both AMP and BFP paradigms when using negated and affirmed neutral words as primes.
2. **Is emotional representation in negation processing temporally stable?** Time has always been an important variable in negation processing research, showing that the focus of negation shifts with processing time. Will emotional representation be affected by time? This study employs

two different stimulus onset asynchronies (SOAs: prime presentation time + interstimulus interval). Specifically, prime presentation time is 200 ms, with interstimulus intervals (ISIs) of 0 ms and 300 ms, resulting in SOAs of 200 ms and 500 ms.

3. Is emotional representation in negation processing automatic?

Both AMP and BFP provide indirect, implicit observation of primes. Compared to AMP, BFP allocates more limited processing resources to primes, making it more implicit. If emotional representation in negation is automatic, it should be unaffected by processing resources and detectable in both paradigms.

Experiment 1: Emotional Representation in Negation Processing Under the Affect Misattribution Procedure

Using affirmative and negative versions of Chinese two-syllable neutral noun phrases as priming materials and Russian words as targets, this experiment employed the affect misattribution procedure to preliminarily explore emotional representation in negation processing. Additionally, the interval between prime and probe has been an important variable in negation research. Following Deutsch et al.'s (2009) AMP paradigm with 200 ms prime presentation, we investigated whether negation's emotional representation changes with extended ISI, affecting valence judgments of targets. To further probe negative priming effects, Experiment 1 included two ISI conditions (0 ms and 300 ms), corresponding to two SOA conditions (200 ms and 500 ms).

Method

Participants Eighty undergraduate students from North China University of Science and Technology (22 male, 58 female; mean age = 20.36 ± 1.88 years) were randomly assigned to two groups: one completed the SOA = 200 ms condition, the other the SOA = 500 ms condition. All participants had no Russian language learning experience, had normal or corrected-to-normal vision, were native Chinese speakers without reading or visual recognition difficulties, and three reported being left-handed. None had participated in material evaluation for this study.

Materials Chinese Two-Syllable Neutral Word Database. We selected 1,200 two-syllable nouns with neutral valence and wide frequency distribution from the Modern Chinese General Word List (CLDC-LAC-2003-001). These nouns were embedded in Chinese sentences with the structure “somewhere has/does not have something.” Nouns that could not function as “somewhere” or “something” in this structure were removed, leaving 359 nouns. Following the dimensions of Chinese lexical affective information established by Wang, Zhou, and Luo (2008), we evaluated each noun on five dimensions: valence (pleasantness), arousal (calm to excited), dominance (controlled to dominant),

familiarity (unfamiliar to familiar), and concreteness-abstractness (very concrete to very abstract), using 9-point scales where 1 represented the lowest level and 9 the highest. Considering Vigliocco et al.'s (2014) finding that lexical valence correlates with concreteness, we included concreteness-abstractness as the fifth dimension. Additionally, 40 two-syllable nouns with valence ratings between 4.5 and 5.5 from the Chinese Affective Words System (CAWS) established by Wang et al. (2008) were directly included in the neutral word database and also rated on concreteness-abstractness to match newly evaluated words.

Sixty-eight undergraduate students (18 male, 50 female; ages 18-23) completed the affective evaluation of Chinese two-syllable neutral words via an online questionnaire (<http://www.sojump.com/jq/7966944.aspx>). Completion times ranged from 34 to 100 minutes; seven participants with completion times under 40 minutes were excluded, yielding 61 valid questionnaires (90% retention rate). The Cronbach's reliabilities for valence, arousal, dominance, familiarity, and concreteness-abstractness were 0.995, 0.997, 0.991, 0.994, and 0.768, respectively; split-half reliabilities were 0.924, 0.963, 0.868, 0.895, and 0.675, respectively, indicating reliable measurement. A database of Chinese two-syllable neutral nouns was established with valence ranging from 4.5 to 5.5; descriptive data are presented in Table 1. This database provides foundational materials for experimental stimuli.

Priming Materials. From the established database, we selected 96 words that could form “you/meiyou (have/no) + noun” phrases (e.g., “guanjia” [housekeeper], “zhuozi” [table]). These yielded 96 affirmative phrases (e.g., “you guanjia” [have housekeeper]) and 96 negative phrases (e.g., “meiyou guanjia” [no housekeeper]) as experimental priming materials. Selected materials had the following characteristics ($M \pm SD$): word frequency = 164.11 ± 348.03 , valence = 4.89 ± 0.21 , arousal = 4.37 ± 0.32 , dominance = 5.04 ± 0.57 , familiarity = 5.68 ± 0.80 , concreteness-abstractness = 3.62 ± 0.42 , meeting experimental requirements.

To avoid scale attenuation effects (ceiling or floor effects), we selected 32 positive nouns with valence > 7 (e.g., “zijin” [funds]) and 32 negative nouns with valence < 3 (e.g., “emo” [demon]) from Wang et al.'s (2008) affective word database. These were combined with “you/meiyou” to form corresponding affirmative or negative phrases as filler materials.

The 96 experimental neutral words, 32 positive filler words, and 32 negative filler words were each combined with “you” and “meiyou” to create 160 affirmative and 160 negative phrases. These 320 phrases were divided into two sets (A and B) by polarity (affirmative/negative), with 160 phrases per set (80 affirmative, 80 negative versions). Sixty-seven college students who did not participate in the formal experiment rated phrase fluency on a 1-5 scale (1 = very unnatural, 5 = very natural). The rating groups comprised 33 participants for Set A and 34 for Set B (12 male, 54 female; mean age = 19.58 ± 2.60 years). Results showed no significant difference in fluency ratings between affirmative (4.07 ± 0.41) and negative (4.10 ± 0.36) versions ($F > 1$).

Polarity and valence of experimental and filler materials were matched using a Latin square design to create two priming sets. Each participant saw only one set, with each noun presented once in either affirmative or negative version. This yielded 96 experimental phrases (48 affirmative, 48 negative) and 64 filler phrases (16 affirmative-positive, 16 negative-positive, 16 affirmative-negative, 16 negative-negative). To prevent fatigue, materials were divided into four blocks of 40 trials each, with 24 experimental and 16 filler phrases per block; each block contained 20 affirmative and 20 negative phrases, with 24 neutral, 8 positive, and 8 negative valence items.

Neutral Russian Word Database. From a list of 1,200 common Russian words, we selected 400 six- to seven-letter words. Two groups of college students who did not participate in the formal experiment rated the pleasantness of these words on a 9-point scale (1 = very unpleasant to 9 = very pleasant). Group 1 had 45 participants (30 male, 15 female; mean age = 20.98 ± 0.92 years); Group 2 had 43 participants (27 male, 16 female; mean age = 20.77 ± 1.01 years). Eighty-eight questionnaires were collected; five participants with self-reported Russian proficiency > 40 (on a 100-point scale) and ten participants with $> 80\%$ duplicate responses were excluded, yielding 73 valid questionnaires (83% retention rate). The mean pleasantness rating was 4.89 ± 0.26 . We selected 160 Russian words with pleasantness between 4.85 and 5.15 as target words ($M = 4.99 \pm 0.90$).

Design and Procedure The experiment used a 2 (phrase polarity: affirmative vs. negative) \times 2 (SOA: 200 ms vs. 500 ms) mixed design, with phrase polarity as a within-subjects factor and SOA as a between-subjects factor.

Each participant was presented with 160 phrases (96 experimental, 64 filler) divided into four blocks, with random presentation within each block.

Participants sat 50-80 cm from the computer screen. Each trial began with a 500 ms fixation cross “+”, followed by a 200 ms blank screen. The prime (affirmative or negative Chinese two-syllable noun phrase in 30-point Arial font) was then presented for 200 ms. For SOA = 200 ms, the target appeared immediately after the prime; for SOA = 500 ms, a 300 ms blank screen preceded the target. Targets were six- to seven-letter Russian words presented in 50-point Arial bold for 100 ms, followed by a 450 \times 450 pixel black-gray mask. Participants judged whether the Russian word was pleasant or unpleasant. Half the participants pressed “5” on the numeric keypad for “pleasant” and “a” for “unpleasant”; the other half used the opposite mapping. Participants were instructed that the Chinese phrase was merely a signal and to avoid letting it influence their judgments of the Russian words. There was no inter-trial interval. Brief rest periods were provided after every 40 trials. The entire experiment lasted approximately 7-10 minutes.

Results and Analysis

In the AMP paradigm, the dependent variable is typically the probability of pleasantness responses due to target ambiguity (Gawronski & Yang, 2015; Payne et al., 2005). We calculated each participant's probability of negative ("unpleasant") responses under each condition. Following Bar-Anan and Nosek (2014), who noted that AMP is susceptible to extreme data, we adopted Deutsch et al.'s (2009) recommendation to exclude participants with overall negative response probabilities $>80\%$ or $<20\%$. This resulted in excluding two participants in the SOA = 200 ms condition; all 40 participants in the SOA = 500 ms condition were retained (see Table 2). Repeated measures ANOVA was conducted on phrase polarity and SOA conditions.

A 2×2 design was used for analysis: in subject-based analysis (F1), phrase polarity was a within-subjects factor and SOA was between-subjects; in item-based analysis (F2), both were within-items factors. Results showed a significant main effect of polarity: $F(1, 77) = 78.08$, $p < 0.001$, $\eta^2 = 0.51$; $F(1, 95) = 122.32$, $p < 0.001$, $\eta^2 = 0.44$. Negative phrases primed higher probabilities of negative responses than affirmative phrases. The main effect of SOA was not significant: $F(1, 77) = 0.06$, $p = 0.80$; $F(1, 95) = 3.88$, $p = 0.050$. The interaction was not significant: $F(1, 77) = 0.01$, $p = 0.922$; $F(1, 95) = 2.20$, $p = 0.140$.

Discussion

The results indicate that negative neutral words primed higher probabilities of negative responses than affirmative neutral words, and this effect did not change with extended intervals between prime and target. Because targets were ambiguous, participants' responses largely represented misattribution to primes. Since neutral words themselves lack specific valence, differences in response probability can only be attributed to the difference between affirmation and negation. We infer that negation has a higher negative response tendency than affirmation, or that negation words themselves carry negative emotion, consistent with our hypothesis. Additionally, using two SOAs (200 ms and 500 ms) yielded no differences, suggesting that negation's negative emotional representation is temporally stable.

These results come from the AMP paradigm. However, Deutsch et al. (2009) found different results for negated emotional words in the BFP paradigm. Deutsch and Gawronski (2009) attributed this difference to AMP reflecting misattribution mechanisms while BFP reflects response-interference mechanisms. BFP is more likely to reflect resource limitations on prime processing. In AMP, the ambiguous neutral Russian targets cause participants to rely heavily on prime valence for judgments. Although this process is unintentional, primes receive more processing. In BFP, the target's emotional words have salient valence, making valence judgments rely primarily on the target while primes cause interference, especially when valences conflict. Participants must

consciously resist this interference, allocating far fewer processing resources to primes than in AMP. Experiment 1 demonstrated that in AMP, where primes receive relatively more processing resources, negation is represented through negative emotion. Can this result be replicated in BFP under low-resource conditions? Experiment 2 uses the BFP paradigm to explore emotional representation in negation under limited processing resources.

Experiment 2: Emotional Representation in Negation Processing Under the Bona Fide Pipeline Paradigm

Method

Participants Eighty-nine undergraduate students from North China University of Science and Technology (53 male, 36 female; mean age = 18.84 ± 0.83 years) were randomly assigned to two groups: one completed the SOA = 200 ms condition, the other the SOA = 500 ms condition. Participants had normal or corrected-to-normal vision, were native Chinese speakers without reading or visual recognition difficulties, and eight reported being left-handed. None had participated in material evaluation or Experiment 1.

Materials Priming materials were identical to Experiment 1. Targets were 80 Chinese two-syllable nouns with positive valence and 80 with negative valence, with 48 used as experimental materials and 32 as fillers. All target words were selected from CAWS (Wang et al., 2008). Word frequency and emotional dimension analyses are shown in Table 3 .

As Table 3 shows, target words differed significantly in valence, meeting experimental requirements.

Polarity and valence of priming and target materials were matched using a Latin square design to create two priming sets. Each participant saw only one set, with each noun presented once in either affirmative or negative version. This yielded 96 experimental priming phrases (48 affirmative, 48 negative), each corresponding to 24 positive and 24 negative target words. The 64 filler priming phrases comprised positive and negative words (32 each), combined with “you/meiyou” to create affirmative and negative phrases: 16 affirmative-positive, 16 negative-positive, 16 affirmative-negative, and 16 negative-negative, corresponding to 8 positive and 8 negative target words each. To prevent fatigue, materials were divided into four blocks of 40 trials each, balanced for prime polarity, valence, and target valence.

Design and Procedure The experiment used a 2 (phrase polarity: affirmative vs. negative) \times 2 (SOA: 200 ms vs. 500 ms) \times 2 (target valence: positive vs. negative) mixed design, with phrase polarity and target valence as within-subjects factors and SOA as a between-subjects factor. The dependent variable was the probability of negative responses to target emotional words.

Each participant was presented with 160 phrases (96 experimental, 64 filler) divided into four blocks, with random trial order within each block.

Participants sat 50-80 cm from the screen. The procedure followed the classic BFP paradigm. Each trial began with a 500 ms fixation cross “+”, followed by a 200 ms blank screen. The prime (affirmative or negative Chinese neutral two-syllable noun phrase) was presented for 200 ms in 30-point red Arial font. For SOA = 200 ms, the target appeared immediately after the prime; for SOA = 500 ms, a 300 ms blank screen preceded the target. Targets were Chinese positive or negative nouns (e.g., “zijin” [funds]/ “emo” [demon]) presented in 50-point blue Arial bold font until participants judged whether the target was pleasant or unpleasant. Half the participants pressed “5” for “pleasant” and “a” for “unpleasant”; the other half used the opposite mapping. Participants were instructed that the Chinese phrase was merely a signal and to avoid letting it influence their judgments. The practice block included 20 trials with feedback on accuracy and reaction time. There was no inter-trial interval. Brief rest periods were provided after every 40 trials. The entire experiment lasted approximately 8 minutes.

Results and Analysis

No participants were excluded based on the criterion of negative response probability >80% or <20%. Negative response probabilities and accuracy rates under different priming conditions are shown in Table 4 .

To compare with AMP results, we conducted repeated measures ANOVA on negative response probability with phrase polarity (affirmative vs. negative), SOA (200 ms vs. 500 ms), and target valence (positive vs. negative). Results showed a significant main effect of phrase polarity: negative phrases primed higher probabilities of negative responses than affirmative phrases, $F(1, 88) = 6.67$, $p < 0.05$, $p^2 = 0.07$; $F(1, 95) = 22.94$, $p < 0.001$, $p^2 = 0.20$. The main effect of SOA was not significant: $F(1, 88) = 0.25$, $p = 0.621$; $F(1, 95) = 0.48$, $p = 0.491$. The main effect of target valence was significant: $F(1, 88) = 1219.70$, $p < 0.001$, $p^2 = 0.93$; $F(1, 95) = 3505.08$, $p < 0.001$, $p^2 = 0.97$. The interaction between phrase polarity and SOA was not significant: $F(1, 88) = 0.00$, $p = 0.966$; $F(1, 95) = 0.16$, $p = 0.691$. The interaction between phrase polarity and target valence was not significant: $F(1, 88) = 0.01$, $p = 0.906$; $F(1, 95) = 0.03$, $p = 0.874$. The interaction between SOA and target valence was not significant in subject analysis, $F(1, 88) = 2.48$, $p = 0.119$, but significant in item analysis, $F(1, 95) = 24.48$, $p < 0.001$, $p^2 = 0.21$. Simple effects analysis revealed that for positive targets, negative response probability was significantly higher at SOA = 200 ms than at SOA = 500 ms, while for negative targets, negative response probability was significantly lower at SOA = 200 ms than at SOA = 500 ms. The three-way interaction approached significance: $F(1, 88) = 3.92$, $p = 0.051$, $p^2 = 0.04$; $F(1, 95) = 3.52$, $p = 0.064$, $p^2 = 0.04$. Further simple-simple effects analysis showed that at SOA = 200 ms, the main effect of sentence pattern approached significance in subject analysis,

$F(1, 42) = 3.64, p = 0.063, p^2 = 0.08$, and was significant in item analysis, $F(1, 95) = 9.22, p < 0.01, p^2 = 0.09$. The main effect of target valence was significant: $F(1, 42) = 723.55, p < 0.001, p^2 = 0.95$; $F(1, 95) = 2864.80, p < 0.001, p^2 = 0.97$. The interaction between sentence pattern and target valence was not significant: $F(1, 42) = 2.06, p = 0.159$; $F(1, 95) = 0.93, p = 0.339$. At SOA = 500 ms, the main effect of sentence pattern approached significance in subject analysis, $F(1, 45) = 3.15, p = 0.083, p^2 = 0.07$, and was significant in item analysis, $F(1, 95) = 21.05, p < 0.001, p^2 = 0.18$. The main effect of target valence was significant: $F(1, 45) = 556.19, p < 0.001, p^2 = 0.93$; $F(1, 95) = 3195.56, p < 0.001, p^2 = 0.97$. The interaction between sentence pattern and target valence was not significant: $F(1, 45) = 1.94, p = 0.170$; $F(1, 95) = 2.40, p = 0.13$.

BFP results still showed that negative phrases primed more negative responses than affirmative phrases.

Deutsch et al. (2009) distinguished AMP and BFP as implicit measurement methods, arguing that BFP provides more limited processing resources and is thus more implicit. To verify the effect of processing resources on negation's emotional representation, we compared Experiments 1 and 2 using a 2 (phrase polarity: affirmative vs. negative) \times 2 (measurement method: AMP vs. BFP) design, with phrase polarity as a within-subjects factor and measurement method as between-subjects. To compare negative responses across paradigms, we first converted negative response probabilities to Z-scores: in AMP, negative and affirmative priming data were 1.60 ± 2.01 and -1.86 ± 2.06 , respectively; in BFP, they were 0.73 ± 2.28 and -0.27 ± 2.27 . Repeated measures analysis revealed a significant main effect of polarity: $F(1, 166) = 63.18, p < 0.001, p^2 = 0.28$; $F(1, 95) = 882.73, p < 0.001, p^2 = 0.90$. The main effect of measurement method was not significant: $F(1, 166) = 3.81, p = 0.053$; $F(1, 95) = 0.00, p = 0.995$. The interaction between polarity and measurement method was significant: $F(1, 93) = 19.25, p < 0.001, p^2 = 0.10$; $F(1, 95) = 974.89, p < 0.001, p^2 = 0.91$. Simple effects analysis showed that in AMP, negative priming elicited significantly more negative responses than affirmative priming: $t(77) = 8.84, p < 0.001, \text{Cohen's } d = 1.70$; $t(37) = 30.80, p < 0.001, \text{Cohen's } d = 3.96$. Similarly, in BFP, the difference reached significance: $t(37) = 2.51, p < 0.05, \text{Cohen's } d = 0.44$; $t(37) = 4.78, p < 0.001, \text{Cohen's } d = 0.07$.

Discussion

Using the BFP paradigm with clearly valenced Chinese emotional words as targets instead of ambiguous Russian words in AMP, Experiment 2 still detected more negative responses primed by negative neutral phrases than affirmative phrases. The main effect of time interval was not significant, indicating that the negative priming tendency from negative phrases remained stable between 200 ms and 500 ms. Comparing negative priming effects across paradigms revealed that negative phrases primed more negative responses than affirmative phrases in both AMP and BFP. This demonstrates that the negative response tendency

primed by negation is not only temporally stable but also stable across different affective priming paradigms. This suggests that even under limited processing resources, negative neutral words still exert negative valence priming effects. This not only indicates that negation itself carries negative valence but also that this representation is automatically activated in affective priming paradigms.

General Discussion

Two experiments demonstrated that negative neutral words primed more negative responses than affirmative neutral words, indicating that negation itself carries negative valence and can be embodied through negative emotion. Experiment 1 used the non-conscious misattribution paradigm (AMP) with negative and affirmative neutral phrases as primes and ambiguous neutral Russian words as targets, finding that negative phrases primed substantially more negative responses than affirmative phrases, with relative stability lasting at least 500 ms. Experiment 2 used the BFP paradigm with clearly valenced Chinese emotional words as targets and still found that negative phrases primed more negative responses than affirmative phrases, with temporal stability in negation's negative priming effect.

Negative Emotional Representation in Negation Processing

The logic of the Affect Misattribution Procedure is that when people encounter an attitude object, they generate positive or negative evaluative responses. Even when judging an ambiguous target, primes influence evaluative bias, showing that attitudes toward primes are projected onto ambiguous targets. As Payne et al. (2005) argued, positive or negative influences from primes on symbolic judgments can be used to infer people's responses to primes. In Experiment 1, differences in negative response probabilities to ambiguous Russian words were influenced by primes—negative versus affirmative neutral phrases—while neutral words themselves lack specific valence. This allows us to infer that valence judgment differences were caused by “negation” and “affirmation” themselves, or that negation itself carries negative valence and can be embodied through negative emotion.

Experiment 2 used the BFP paradigm with clearly valenced targets and similarly detected higher negative response probabilities from negative priming. This indicates that target valence judgments were influenced by negative primes, with negation itself having more salient valence than neutral words. Notably, the increase in negative response probability was unaffected by target word valence—both positive and negative word judgments were influenced by negative priming, enhancing negative response probability. This aligns with AMP results. BFP results further demonstrate that the emotional valence of negative neutral words persists despite response interference.

To prevent response bias, both experiments included filler priming materials combining extreme-valence emotional words with “meiyou” and “you.” Sta-

tistical analysis of filler materials yielded results consistent with Deutsch et al. (2009): “negative-negative” primed more positive responses, while “negative-positive” primed more negative responses. This confirms that responses in both experiments were valid and rule out the possibility of uniform response biases. In data processing, participants with uniform responses >80% were excluded, further ensuring result reliability.

Some research suggests that negation processing is more difficult than affirmation, requiring more attentional resources and longer processing time (Khemlani et al., 2012). Could the increased negative responses under negative priming conditions be attributed to processing difficulty? Since both affective priming paradigms require rapid responses, creating time pressure, could this pressure cause participants to make more negative valence judgments? We argue this interpretation is untenable. First, numerous studies have demonstrated that negation processing can be completed subliminally (van Gaal et al., 2014; Armstrong & Dienes, 2013) or within extremely brief timeframes (Feroni & Semin, 2013; Autry & Levine, 2014). Second, in Experiment 1, when SOA was extended to 500 ms—generally considered the semantic integration stage of negation (Jiang et al., 2014)—negative priming still increased negative response probability, which cannot be explained by processing difficulty. Therefore, we can conclude that negative phrases in primes were processed, and the enhanced negative response tendency reliably reflects negation itself.

Our two experiments demonstrate that negative phrases prime more negative responses than affirmative phrases, indicating that negation itself carries negative emotion and can be embodied through emotion. This conclusion can also be explained by pragmatic theory of negation, which posits that negation violates original expectations—that is, it violates schemas held by people based on prior knowledge or current context. Negation disrupts processing fluency, interrupts readers’ or listeners’ existing expectations, interferes with ongoing thought and activity, and triggers attention redirection to things contrary to original expectations or initiates searches for new possible models. As can be seen, “unexpectedness” destroys people’s need for expectations and structure (Gawronski & Strack, 2012), makes them feel threatened and uncomfortable (Mendes et al., 2007), and triggers negative affect and more extensive processing (Alter, Oppenheimer, Epley, & Eyre, 2007; Topolinski, 2014). These results support Kousta and colleagues’ theory of emotional representation of abstract concepts—that abstract concepts like negation can be represented through emotion. The emotional embodiment theory emphasizes that abstract concepts evoke more emotional responses because emotional experience and development play more important roles in acquiring abstract concepts (Kousta et al., 2011; Vigliocco et al., 2014). Zwaan (2008) also argued that negation words like “no” activate experiential instances associated with “no” input (e.g., don’t keep a dog), where all experience traces related to “no” can trigger goal activation by environmental states, but the execution process toward the goal is frustrated. Thus, the activation pattern of negation is the emotional state of “frustration” associated with expectation violation. According to embodied theory, negation

processing involves re-enacting negation experiences, which means re-enacting the “frustrated internal psychological state.”

Temporal Stability of Emotional Representation in Negation Processing

Experiment 1 used two SOAs in the AMP paradigm (200 ms and 500 ms) and found no significant main effect of SOA or interaction with phrase polarity. This indicates that negative phrases primed higher negative response probabilities than affirmative phrases under both SOA conditions, reflecting that negation’s negative valence representation did not change with time extension. Similarly, in Experiment 2’s BFP paradigm, negative phrases primed higher negative response probabilities than affirmative phrases under both SOA conditions, demonstrating temporal stability of negation’s negative emotional representation. In summary, the priming effects of negative neutral phrases in both AMP and BFP paradigms persisted at least 500 ms after prime presentation, showing temporal stability.

In semantic priming research, SOA is an important influencing factor (Hill, Ott, & Weisbrod, 2005; Eddy & Holcomb, 2010), with SOA extension generally enhancing deep semantic processing of primes within 700 ms. Unlike semantic priming, emotional priming effects are generally considered to not exceed 300 ms (Hermans, Spruyt, & Eelen, 2003), though some reports show persistence to 600 ms (Li, Bai, & Shen, 2007). The present study used affective priming paradigms. With prime presentation time held constant, both long and short SOAs showed that negative phrases primed more negative emotion than affirmative phrases. This consistency indicates that as semantic processing depth increases, the emotional valence representation of negation and affirmation does not change accordingly, reflecting temporal stability of negation’s emotional representation.

Automaticity of Emotional Representation in Negation Processing

Experiment 1 using AMP demonstrated negative emotional representation in negation processing, and Experiment 2 using BFP replicated this result. Post-hoc comparison of negative responses across paradigms revealed no significant main effect of measurement method, meaning AMP and BFP did not differ significantly in negative responses. As noted, although both AMP and BFP measure unconscious processing, their mechanisms differ, with BFP being more implicit. Detecting negative response tendencies from negative phrases in both paradigms suggests that emotional representation in negation processing is unaffected by paradigm demands, indicating automatic activation. Specifically, in AMP, the ambiguous Russian target’s valence is heavily influenced by primes, with no interference between prime and target processing, allowing primes to receive more unintentional processing. In BFP, the clearly valenced Chinese emotional targets require participants to resist prime influence when making valence judgments (Deutsch & Gawronski, 2009), limiting prime processing and

making measurement more implicit. In this study, primes “negative neutral words” and “affirmative neutral words” received more processing in AMP than in BFP. According to automatic emotion processing theory, if negation itself is emotional, both AMP and BFP should detect negation’s emotional representation. Even in the resource-limited BFP paradigm, negative emotional representation was detected, further supporting automatic implementation of emotional representation in negation processing. However, some research indicates that increased task load or distractors can reduce emotional processing (Mitchell et al., 2007; Tobias et al., 2015), meaning processing resources can limit emotion processing. Thus, BFP might fail to detect negation’s emotional representation (Deutsch et al., 2009). Our results, however, show that BFP still detected negative response tendencies from negation, indicating that emotional representation in negation processing is not constrained by processing resources, supporting automatic emotion processing theory. This further demonstrates that negative responses from negative neutral words belong to negation itself—that negation carries valence that is automatically activated in emotional tasks.

This study provides only preliminary exploration of emotional representation in simple declarative negation; further research is needed to investigate emotional embodiment representation in other forms of negation processing.

Conclusions

Two affective priming experiments yielded three conclusions:

1. Negation processing is represented through negative emotion, or negation can be embodied through negative emotion.
2. Emotional representation in negation processing is temporally stable, consistently appearing during both inhibitory and rumination stages of negation processing.
3. Negative emotional representation in negation processing shows automatic tendencies.

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