



# Neural Correlates of Consumers Perceiving the Stereotypes of Brand Personality: An Event-Related Potentials Study

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## ABSTRACT

Behavioral studies show that the personalities of Chinese traditional and fashionable brands are obviously different, namely a stereotype of personality. It is unclear how the personality evaluations of those brands are processed. This paper aims to explore the neural activities associated with words describing the brand names and its personality evaluations using event-related potentials (ERPs). A word-pair paradigm is used, the first word is a brand name from one of two categories (traditional and fashionable category), and the second word is a personality evaluation either in clemency or trend dimension (the special personality of Chinese brands). Recipients are asked to judge whether the personality evaluations are consistent with the brand names, while ERPs are recorded synchronously. Through the behavior data of reaction times and ERPs components, the analysis demonstrated a decreased N400 and enhanced LPP elicited by the traditional brands under clemency dimension compared with the fashionable brands, and by the fashionable brands under trend dimension compared with the traditional brands. We conclude that N400 serves as an index of a mismatch between the stereotypes of the brand and its personality evaluations, while LPP reflects the consumers' emotional attitudes in the process of the recalling of brand personality. The results verify the stereotypes of brand personality from the perspective of neural activities, and shed new light on the cultivation, monitoring and evaluation of brand personality.

**Key Words:** Brand personality, Stereotypes, Emotional attitude, N400, LPP

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## Introduction

Brands are considered to have humanized charms. The human characteristics associated with the brands are defined brand personality (Aaker, 1997). For many years, researchers have paid great attention to the dimensions of brand personality (Kurt *et al.*, 2016; Deborah *et al.*, 2017). The widely accepted brand dimensions scale contains five dimensions: sincerity, exciting, reliable, sophisticated and ruggedness. Many international well-known brands show a stable style and personality under the subtle marketing strategy of the company, such as

Coca-Cola, Chanel and Ford, have long been deeply imprinted in the hearts of consumers, forming a unique personality, which is a stereotype.

In the context of cultural differences, brand personalities present some specific dimensions. Interestingly, for specific brands, sincerity and excitement dimension are often treated as opposite relationships (Aaker *et al.*, 2004). Based on Aaker's research, Chinese scholars propose a new personality model from the perspective of Chinese traditional culture. Specifically, the model mainly contains three dimensions: clemency, trend and elegance.

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They find that some old brands show distinct clemency characteristics similarly to the sincerity personalities, but lowly evaluated in the exciting and sophisticated dimension; conversely, some novel brands which called fashionable brands, display obvious trend characteristics, which are consistent with the exciting dimension of personality (Huang and Lu, 2003; He and Cong, 2008). Therefore, the stereotypes of brand personality manifest an obvious difference between the Chinese traditional and fashionable brands. However, when the personality evaluation is mismatched or inconsistent with the brand names, the consumer's cognitive response to the stereotypes of brand personality and the internal process of the evaluative attitudes are still unclear.

Prior studies show that stereotype is an automatic and implicit cognitive process closely related to the memory of semantic associations (Amodio, 2008). In recent years, the neural mechanisms of stereotype are explored based on cognitive neuroscience in gender (White *et al.*, 2009), migrant workers and white-collar workers (Wang *et al.*, 2010), black and white groups (Eric *et al.*, 2014). Among them, N400 is one of the feasibility indicators of stereotypes and prejudice in the near future. In the field of neuromarketing, scholars have conducted extensive explorations on the N400 component, and find that N400 is not only reflects the semantic conflicts, but also includes the common cognitive conflicts (Nedelko *et al.*, 2017). In a semantic experiment of the brand association, different amplitudes of N400 are elicited when stimuli nouns are consistent/inconsistent with a brand at the end of the sentence, suggesting that a closer association may result in a smaller N400 amplitude, and vice versa. It seems that those inconsistent features are not closely related to the concept of the target group in the individual's memory. Thus, for the personality stereotype of the brands from traditional and fashionable categories, we speculate that when the personality evaluations are inconsistent with the brand names, a complex cognitive conflict will be formed with semantic priming, accordingly causing large amplitude N400.

Similar to the N400, the late positive component P600 is initially sensitive to stereotype violations (Osterhout *et al.*, 1997; Gonzalez *et al.*, 2008). However, some researches indicate that the N400 plays a regulatory role in stereotype incongruities (White *et al.*, 2009). When the prime and target stimulus share a valence but not necessarily a meaning, evaluative

priming is evident, which has a great effect on the LPP (Eric *et al.*, 2014). In Osterhout and colleagues' results, the N400 may be hidden in the larger LPP. So we assume that the N400 reflects a stereotype-inconsistent effect, and than the LPP reflects the other special processes. Different brands are associated with different traits. Products of unknown brands are more related to negative evaluations, while the well-known brands with positive evaluations induce larger LPC amplitude, showing the consumers' implicit attitudes towards different brands (Thomas *et al.*, 2013). The LPP is sensitive to the motivation and emotional valence, reflecting the attitudes of the consumers (Ma *et al.*, 2018). It is worth noting that the LPP reflects a cognitive process of categorizing assessment in the later decision stages (Jin *et al.*, 2015; Chen *et al.*, 2010). For the stereotype of the brands in different categories, when the personality evaluations of brand names are consistent with its categorizing criterion (or the expectation), we suspect that obvious evaluative priming occurred in addition to semantic priming. Specifically, if the personality evaluations of the brand are similar to the expectation, the highly perceived fit may trigger larger LPP amplitude, which is closely related to the brand's emotional attitude.

## Materials and Methods

### Participants

Twenty right-handed healthy undergraduate females (most undergraduate females know much more about the decorative clothing brands than male) participated in this experiment. They had normal or corrected-to-normal visual acuity, and recruited from the sophomore and junior classes in the same major. No volunteers reported a history of neurological or mental diseases. Written informed consent was obtained from all subjects before the formal experiment. Data from four subjects were excluded, two for excessive artifacts during EEG recording and two for a relatively low familiarity of some brands in their self-reports, resulting in 16 valid subjects aged 20.2 (19-22) years.

### Stimulus materials

The stimuli consisted of 200 word pairs (10 brand names × 20 personality evaluations). The first word (Stimulus 1) was the brand name selected from one of two categories (traditional category or fashionable category), and each category consisted of 5 brand names. All the brands were chosen from forty famous brands of decorative clothing on the China



Brand Network (<https://www.chinapp.com>) and Well-known Trademark List of the China Trademark Office. These brand names, HODO, Heng Yuanxiang, Lao Fengxiang, Nan Jiren and Double Star belong to traditional category, others such as La Chapelle, Ledin, Metersbonwe, Handu Clothing and Belle belong to fashionable category. A previous 5-point Likert scale test of the brands familiarity showed that the participants (different from the EEG participants) had similar familiarity with these brands. The second word (Stimulus 2) was the personality evaluations selected from 40 candidate words used to describe the Chinese traditional and fashionable brands (Aaker, 1997; Huang and Lu, 2003; He and Cong, 2008). A questionnaire was conducted on 80 students in the same grade to evaluate the extent to which words met the dimensions of clemency and trend. Finally 20 words were selected as the personality evaluations (Table 1). Thus, the following four stimulus conditions were existed in our experiment: Traditional brand-Clemency personality evaluation (TC); Traditional brand-Trend personality evaluation (TT); Fashionable brand-Clemency personality evaluation (FC); Fashionable brand-Trend personality evaluation (FT).

**Table 1.** Selected word of the personality evaluations.

Clemency personality evaluations	Trend personality evaluations
Sincere, kindness, steady, classical, affable, reliable, softhearted, friendly, peaceful, down-to-earth	Unique, exciting, trendy, cool, daring, vigorous, spirited, up-to-date, imaginative, distinctive

### Procedure

Participants sat comfortably in a closed laboratory 70 cm away from the screen. They were provided a keyboard to respond. All stimuli were made up of 3 Chinese characters on average, set in white Song style Chinese characters with 24 point font on a black background. The stimuli pictures were classified into four blocks of 50 trials and presented in a pseudorandom order on the screen with a visual angle of  $2.8^\circ \times 2.3^\circ$ . Each trial began with a fixation cross against a black background for 500 ms. Then the Stimulus 1 (brand names) was appeared for 1000 ms, followed by a blank screen for 300-500 ms randomly before the Stimulus 2 (personality evaluations) was presented for 2000 ms, during which participants had to perform a button response to determine if the Stimulus 2 were consistent with the Stimulus 1. The left button means accepted and the right button means unaccepted. The button was balanced within

the participants. The formal experiment started after 8 practice trials and lasted about 25 minutes.

### Electroencephalogram (EEG) recording and analysis

EEG was recorded (band pass 0.01-100 Hz, sampling rate 500 Hz) with a Brain actiCHamp amplifier (Brain Products GmbH, Munich, Germany), using an electrode cap with 64 Ag/AgCl electrodes according to the extended international 10-20 system and referenced to linked mastoids (TP9 and TP10). Fpz was served as the ground site, while the former reference Cz was reinstated as an additional data channel. Eye movements were monitored with supra- and infra-orbitally electrodes and with electrodes on canthi. Electrode impedance was kept below 5 k $\Omega$ . A 16 Hz (24 dB/octave) digital low pass filter was applied off-line to the continuous EEG data (Jin *et al.*, 2015; Chen *et al.*, 2010). Trials with peak-to-peak deflections exceeding  $\pm 100 \mu V$  and other artifacts were excluded using BrainVision Analyzer 2.1 software. The EEG data were extracted from -200 to 800 ms time-locked to the onset of the task stimulus, with the pre-stimulus period used as the baseline. At least 35 sweeps for each condition remained, which were adequate to achieve stable and reliable measurements of N400 and LPP (Luck, 2005). ERP waveforms were averaged for every participant in 4 conditions (TC, TT, FC and FT).

According to previous reports (White *et al.*, 2009; Wang *et al.*, 2010; Jin *et al.*, 2015) and the visual observation of the grand average waveforms, we averaged the ERP amplitudes of N400 component of the 330-450 ms time window from six electrode sites (FC3, FCz, FC4, C3, Cz, and C4) and LPP component of the 450-600 ms time window from nine electrode sites (C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4). A two (brand names: traditional and fashionable category)  $\times$  two (personality evaluations: clemency and trend dimension)  $\times$  six (nine) electrode sites within-subjects repeated measures analysis of variance (ANOVA) was used to analyze the component N400 (LPP). The Greenhouse-Geisser correction was applied for the violation of the assumption of sphericity in the appropriate parts of the ANOVA (uncorrected degrees of freedom were reported with  $\epsilon$  and the corrected *p*-values).

## Results and Discussion

### Behavioral results

Behavioral data of the reaction time (RT) shows that the main effect for the brand names [ $F(1,15) = 1.922, p = 0.186$ ] and the personality evaluations



[ $F(1,15) = 1.437, p = 0.249$ ] are not significant. However, the interaction between the brand names and the personality evaluations is significant [ $F(1,15) = 55.860, p = 0.001$ ]. For a more intuitive comparison, we consider the impact of different brand categories on fixed dimensions of the personality evaluation. The simple effect analysis shows when the brand names are evaluated in clemency dimension, participants have a significant shorter RT of the traditional brand names than of the fashionable brand names [ $F(1,15) = 6.104, p = 0.026$ ]. When the brand names are evaluated in trend dimension, it shows a notable

main effect [ $F(1,15) = 27.147, p = 0.001$ ]. Conversely, the RT of the traditional brand names is significant longer than of the fashionable brand names (See Fig. 1).

**ERP results**

As shown in the grand-average waveforms (See Fig. 2), the ANOVA analysis for N400 amplitude reveals a significant main effect of the brand names [ $F(1,15) = 8.848, p = 0.009$ ] and electrode [ $F(5,75) = 44.638, p = 0.018, \epsilon = 0.514$ ], while the personality evaluations is not significant [ $F(1,15) = 3.268, P = 0.283$ ]. But the interaction of the brand names and

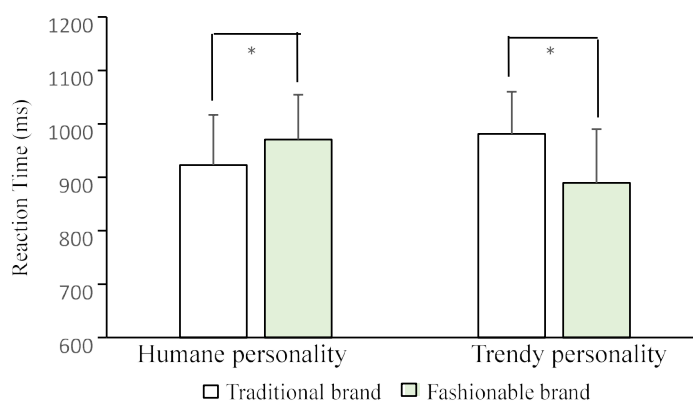


Figure 1. Behavioral result of reaction time under four conditions.

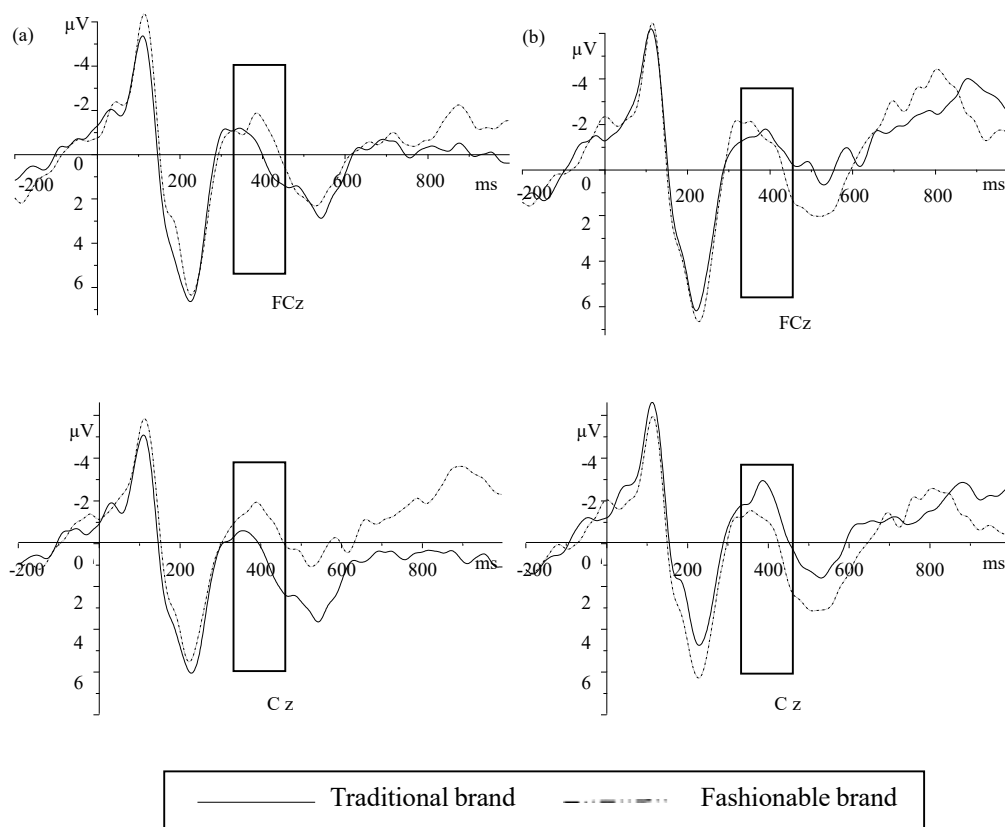


Figure 2. Grand-average ERP of the N400 in different conditions from 2 midline electrodes (Fcz and Cz). (a) comparison between TC and FC; (b) comparison between TT and FT; the solid line represents the traditional brand, whereas the dashed line represents the fashionable brand.



the personality evaluations is significant [ $F(1,15) = 74.539, p = 0.001$ ]. Therefore, the two factors' simple effect analysis reveals that the N400 mean voltage (negative polarity: larger voltage value means smaller amplitude) of the traditional brand names evaluated in clemency personality dimension are enormously larger than in trend dimension [ $F(1,15) = 20.246, p = 0.001$ ]. If the personality evaluations are fixed with respect to trend dimension, the N400 mean voltage of traditional brand names is slightly smaller than fashionable brand names. The result also illustrates that the effect of brand names is

marginally significant [ $F(1,15) = 3.362, p = 0.087$ ].

As presented in Fig. 3, for LPP amplitude, the ANOVA analysis shows a significant main effect of brand names [ $F(1,15) = 5.383, p = 0.035$ ], personality evaluations [ $F(1,15) = 17.000, p = 0.001$ ] and electrode [ $F(8,120) = 16.648, p = 0.001$ ]. There is a significant interaction effect between the brand names and personality evaluations [ $F(1,15) = 20.385, p = 0.001$ ]. Also the interaction of the three is significant [ $F(8,120) = 3.035, p = 0.014$ ]. The simple effect analysis indicates that the LPP mean voltage

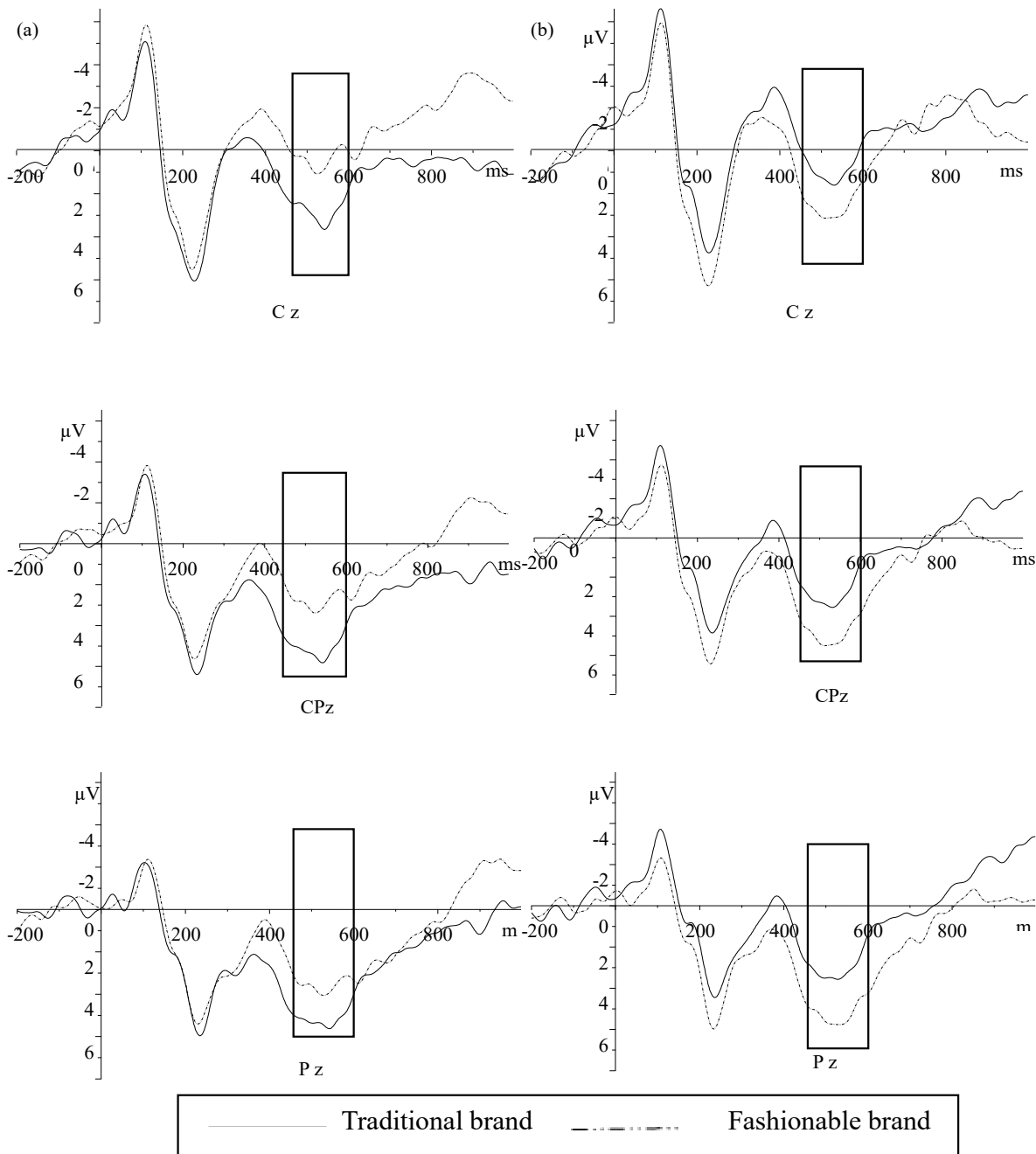


Figure 3. Grand-average ERP of the LPP in different conditions from 3 midline electrodes (Cz, CPz and Pz). (a) comparison between TC and FC; (b) comparison between TT and FT; the solid line represents the traditional brand, whereas the dashed line represents the fashionable brand.



(positive polarity: larger voltage value means larger amplitude) of the traditional brand names evaluated in clemency dimension is considerably larger than fashionable brand names [ $F(1,15) = 161.809, p = 0.001$ ]. If the personality evaluations are fixed with respect to trend dimension, the N400 mean voltage of the traditional brand names is significantly smaller than the fashionable brand names. It shows that the effect of brand names is significant [ $F(1,15) = 179.832, p = 0.001$ ].

## Discussion

The current study reproduces and extends the previous research. Behavioral results of the RT show that when the personality evaluations are inconsistent with the brand names, the RT of subjects is longer for the high cognitive load and task difficulty. Regarding ERP results, the word pair of brand names and personality evaluations induces a N400 component, which is consistent with previous studies of the brain's reflection of cognitive conflict. We guess that the evaluations of brand personality require consumers to recall and extract the characteristics of the brand names in their long-term memories. If the presented personality evaluations are inconsistent with the stereotypes of brands, semantic conflicts or cognitive mismatches appear, resulting in different N400 amplitudes along with the degree of the conflicts. In addition, our result shows that the LPP amplitude of the traditional brand names evaluated in clemency dimension is larger than in trend dimension; while the LPP amplitude of the fashionable brand names evaluated in clemency dimension is smaller than in trend dimension. Because of the N400, the LPP does not show the effect of stereotype violations. What's more, prior studies show that the LPP is related to motivation and emotional valence (Ferrari *et al.*, 2011; Jin *et al.*, 2017). The more similar the evaluations of the brand are to its expectations, the more positive emotions of the consumers are perceived. We believe that the personality evaluations of brand include not only semantic/associative relationships, but also evaluative relationships related to the consumers' emotional attitudes. Besides, compared to the N400 induced by complex conflicts under semantic priming, we boldly guess that the LPP is driven by separate neural mechanisms under evaluative priming, which is related to the evaluative relationships between the brands and its personalities.

## Conclusions

This study is an in-depth exploration of previous researches, which reveals, to some extent, the internal cognitive mechanism of consumers' stereotypes of brand personality. From the brain level, consumers show obvious stereotypes of personality during the process of the brand cognition. It is confirmed that the personalities of some Chinese brands exist in opposite relationships. Through the analysis of the behavioral data and EEG data, the following conclusions were drawn: (1) Participants require more time to think and confirm the matching of the personality evaluations under the obvious conflict conditions with a higher cognitive load, which is basically consistent with the interpretation of ERP. (2) N400 can be used as an effective indicator of the semantic or cognition conflicts between the brand and its personality evaluations. The large N400 amplitude reflects a greater conflict of the stereotypes of brand. (3) In the later stage, a clear LPP is induced if the personality evaluations are consistent with the stereotypes of brand, which reflects a more refined processing of the recalling of the brands' characteristics related to emotional attitudes. Overall, this ERP research provides more detailed evidence of cognitive neural process of the stereotypes of brand personality, which might benefit future marketing studies.

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