Consumer Nostalgia Based on Brain Evoked Potential

Xianghua Xiao

ABSTRACT
In order to use event-related potentials (ERPs) to reveal the neural mechanism of brain evoked potential analysis of consumers’ nostalgic implicit preferences, this study selects the major consumers of nostalgic consumption, the post-80s, as samples and adopts a combination of behavioral experiments and brain evoked potential analysis experiments to study the consumers’ nostalgic preferences. It holds that nostalgic products are more likely to induce participants’ P2 component of brain evoked potential response to resource allocation, that is, nostalgic products are more able to attract consumers’ attention unconsciously than the modern products. It is concluded that the N2 amplitude induced by the connection reaction of nostalgic products and negative sentiment vocabulary is significantly higher than that induced by its connection response with positive sentiment vocabulary. In addition, brain N2 component may be an indicator of implicit association test.

Key Words: Nostalgia, Consumer, Electroencephalogram Analysis

DOI Number: 10.14704/nq.2018.16.5.1418

Introduction
Event-related potentials (ERPs) are a special type of brain evoked potentials (Tan et al., 2015), referring to the detectable bioelectric reactions generated in the nervous system and the corresponding parts of the brain that give the nervous system specific stimulus, or enable the brain to process the stimulus, and have a relatively fixed time interval (lock-time relationship) and a specific phase with the stimulus. Brain electrophysiological changes in the brain during cognitive processes are reflected by brain evoked potentials from the cranial surface through the superposition averaging technique. Event-related potentials are considered to be "windows" for "peeping" psychological activities, because of its close relationship with cognitive processes. The development of neuroelectrophysiology provides a new method and approach for studying the process of brain cognitive activity. Classical ERPs include P1, N1, P2, N2, and P3 (P300). Among them, P1, N1, and P2 are exogenous (physiological) components of ERPs (Sharma et al., 2015), which are affected by the physical properties of the stimulus. N2 and P3 are endogenous (psychological) components of ERPs (Rietdijk et al., 2014), which are not affected by the physical properties of the stimulus and are related to the mental state and attention of the subjects. The concept of ERPs now shows an expanding trend. In a broad sense, ERPs include N4 (N400), Mismatch Negativity (MMN) (Yu et al., 2015), and Comtingent negative variation (CNV), etc. (Heath et al., 2015). Many social cognitive activities occur or attitude is generated in a rapid way. Compared to self-reporting or behavioral experimentation, ERPs have potential advantages in studying these cognitive processes because their time-differentiation rate is in milliseconds.

At present, there is a new trend in the field of IAT related research. Researchers combine...
ERPs with IAT or an experimental paradigm similar to IAT (Xiao et al., 2015). ERP-IAT is also mainly applied to study attitudes (Fleischhauer et al., 2014). A combination of ERP and IAT is also used to study white people’s perception of different racial faces. The study takes white people as subjects, and selects images of yellow, black, and white people as materials, including two IAT experiments (yellow and white; black and white). The traditional IAT test is physiologically based on the assumption of the neural network model, and reflects the neural network connection strength of conceptual words and attribute words under compatible tasks and incompatible tasks through the reaction time. In the experimental process, if we can add brain evoked potential signal detection, we can find the difference of brain evoked potential waveform under the compatible tasks and incompatible tasks through the ERPs technology, so as to reveal the mechanism of brain evoked potential analysis of the implicit preference of different racial faces reflected by the implicit association test from the neurophysiological perspective. In a published study, ERPs techniques were used to study the brain evoked potential mechanism of IAT (Casio et al., 2015). For example, Williams and Themanson used ERP - IAT to study the implicit attitudes of normal subjects towards homosexuality and heterosexuality. ERP-IAT technology has been gradually applied to the researches on social cognition (Pan et al., 2014) and social attitude (Van et al., 2014).

Nostalgic consumption is an emerging interdisciplinary field. Based on the review of literature at home and abroad and with references to the relevant theoretical research results of consumer nostalgia and psychology, sociology, marketing, and economics in Western countries, this study analyzes the mental mechanism of consumer nostalgia preference from the surface to the interior, combining with the technical advantages of event-related potentials (ERPs), which is highly scientific and innovative. It is a hot topic in the current theoretical field, as how to effectively measure consumer nostalgia. This study reveals the neural mechanism of consumer nostalgia preference through event-related potential technology (ERPs), and proposes the assumption of measuring consumer nostalgia inclination from the level of brain evoked potential activity, which is not only a highlight of this research, but also a breakthrough of the past research.

Methods
Implicit emotion IAT experiment: In the experiment, the target categories are nostalgic/modern products, and the attribute categories are emotional attribute words (positive/negative). In order to guarantee the quality of the experiment, the concept of target category in this study is presented in the form of pictures. In the first part of the experiment, press the "F" key in response to either the pictures of the nostalgic products or to the positive words, and press the "J" key in response either to the modern products or to the negative words. In the second part, a new discrimination reaction is performed, in which press "F" key for negative words, and "J" key for positive words. The four parts are randomly presented through experimental procedures. The response time difference between the initial connection task and the opposite connection task is taken as an index. The experimental procedures are shown in Table 1.

<table>
<thead>
<tr>
<th>Joint task</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial joint task</td>
<td>Nostalgic products (pictures) + positive (vocabulary)</td>
</tr>
<tr>
<td>The opposite connection task</td>
<td>Nostalgic products (pictures) + negative (vocabulary)</td>
</tr>
</tbody>
</table>

Table 2. IAT-ERPs experimental tasks and brain evoked potential marking

<table>
<thead>
<tr>
<th>Task</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target picture identification task</td>
<td>Nostalgic products (Mark1)</td>
</tr>
<tr>
<td>Attribute word discrimination task 1</td>
<td>Positive vocabulary</td>
</tr>
<tr>
<td>Initial joint task</td>
<td>Nostalgia + positive (mark3)</td>
</tr>
<tr>
<td>Attribute word discrimination task 2</td>
<td>Passive vocabulary</td>
</tr>
<tr>
<td>The opposite connection task</td>
<td>Nostalgia and negativity (mark4)</td>
</tr>
</tbody>
</table>
Stereotype IAT experiment: In this experiment, the original emotion attribute words are replaced by commodity attribute words (positive / negative), such as fragile, durable, fake, counterfeit and so on. The other experimental steps are basically the same, and the response time difference between the initial connection task and the opposite connection task is also used as the inspection index.

Electroencephalogram (brain evoked potential) signal Marking: brain evoked potential is marked when the picture is presented from -200ms to 1000ms, with a total of 4 types of marks. The process is shown in Table 2.

Results and Discussions

Difference Analysis of brain evoked potential induced by stimulus types (nostalgic or modern pictures)

In this study, the latency and peak values of N2, P2, P3, and N3 are analyzed by repeated measurement variance analysis of three factors (high, low nostalgia group)×2 (nostalgic, modern stimulus)×3 (brain area). As a result, no significant effect on the data has been found. Statistical significance is found only at the mean peak and latency of P2.

There is a significant difference in the P2 amplitude induced by the nostalgic picture stimulus and that induced by the modern picture stimulus of the high-nostalgia group and the low-nostalgia group. The results of repeated measures analysis of variance showed that the main effects of stimulus type (nostalgic, modern pictures) on P2 average amplitude are significant (F(1, 28)=12.766, p<0.05), and the P2 wave peak induced by nostalgic stimulus is significantly higher than that induced by modern pictures. The interaction between stimulus type and the degree of nostalgia is significant for the latency of P2 (F(1, 28) = 7.687, p<0.05). The higher the degree of nostalgia of the subjects, the greater the difference in P2 average wave peaks induced by nostalgic pictures and modern pictures. For the two groups of subjects, the P2 wave peak induced by the nostalgic picture is significantly higher than that of modern pictures (p<0.05). The higher the degree of nostalgia for subjects, the higher the average peak value of P2 induced by nostalgic images, and the lower the average peak value of P2 induced by modern pictures.

The main effects of stimulus type (nostalgia, modern pictures) on P2 latency are significant (F (1,28)=9.453, p<0.01). The P2 latency induced by nostalgia is significantly shorter than that induced by modern pictures. The main effects of nostalgia (F(1, 28)=0.32, p>0.05) and brain (F(2, 28)=16.043, p<0.05) on the latency of P2 are not obvious. The interaction between the type of stimulus and the nostalgia degree of the test group on the latency of P2 is significant (F(1, 28)=34.053, p<0.001). The results show that the higher the degree of nostalgia, the greater the difference of P2 latency induced by nostalgia pictures and modern pictures, the higher the degree of nostalgia induced by nostalgia pictures, the shorter the P2 latency induced by nostalgia pictures, and the longer the P2 latency induced by modern pictures.

Difference analysis of brain evoked potential induced by compatible and incompatible tasks in implicit emotional IAT test

In this study, the latency and the average peak value of the three brain evoked potential components of N1, N2, and N3 distributed in the prefrontal lobe are analyzed by repeated measurement variance analysis of three factors, 2 (joining tasks: compatible and incompatible tasks)×2 (nostalgia: high and low nostalgia groups)×2 (Electrode points: FP1, FP2). The results show the connection tasks, nostalgia degree, and electrode electricity do not have a prominent main effects and interactive effects on the latency and average wave peak value of N1 and P2 brain evoked potential components, as shown in Figure 1. It is found that the connection task has a significant main effect on the average peak value of the N2 component, and the electrode and the nostalgia have a significant effect.
interactive effect on the average wave peak value, and there is no other significant effects.

![Figure 2](image1.png)

**Figure 2.** Interaction of electrode and nostalgia degree with average wave amplitude group

As shown in Figure 3, the degree of nostalgia of subjects (F(1, 28)=2.143, p>0.05) and electrode points (F(1, 28)=4.439, p>0.05) have significant main effect on N2 average, and no other significant effect shows, as shown in Table 3.

### Difference analysis of brain evoked potential induced by compatible and incompatible tasks in stereotype IAT experiment

From the average waveforms induced by the subjects in the stereotype experiment with compatible tasks and incompatible tasks, it can be found that there is no significant difference in N1, P2, and N2 induced by the prefrontal lobe. Repeated measurement analysis of variance of three factors, 2(connection tasks: compatible and incompatible tasks)×2(nostalgia: high and low nostalgia groups)×2(electrode points: FP1, FP2) show that there is no significant main effect and interaction between the connection task, the degree of nostalgia and the electrode point on the latency and the average wave peak value of three brain evoked potential components, as shown in Table 4.

### Conclusion and Prospects

Through the analysis data of brain evoked potential, it is found that brain evoked potential component P2 of consumers induced by nostalgic pictures is significantly different from that induced by modern pictures. The higher the nostalgia degree is, the more obvious the difference will be. That's, the stimulation of nostalgic products induces brain evoked potential analysis responses that distinguish from those induced by modern products. The peak latency is shorter and the average amplitude is higher. It shows that nostalgic products can attract consumers' attention in the first time, and the higher the consumer's nostalgic tendency is, the easier for him to be attracted by nostalgic products. The N2 amplitude induced by the connection reaction of nostalgic products and negative sentiment vocabulary is significantly higher than that induced by its combination with positive sentiment vocabulary. It shows that the brain N2 component may be the response indicator of the IAT effect of the implicit association test.
References


