



Behavioral Experiment and Event-related Potentials Experimental Study of the Psychological Mechanism of Art Aesthetic Processing

Feng Xue*

ABSTRACT

To explore the behavioral experiment and event-related potentials experimental study of the psychological mechanism of art aesthetic processing. The college students are taken as experimental subjects and influence produced by art aesthetic processing through the behavioral experiment and time-correlation potentials experiment. The clarity, beauty and content availability of art works exert significant impact on the processing fluency of art works and the interaction effect among these three factors is significant. The higher the processing fluency of works, the greater the aesthetic preference obtained. The aesthetic preference is influenced by the processing fluency of art works. The higher the processing fluency, the higher the preference level. The clarity, beauty and content availability of art works all affect the processing fluency of works. The greater the beauty of works, the higher the processing fluency, and thus it can be recognized more quickly.

Key Words: Psychological Mechanism of Art Aesthetic Processing, Behavioral Experiment, Event-related Potential Experiment

DOI Number: 10.14704/nq.2018.16.6.1673

NeuroQuantology 2018; 16(6):227-231

227

Introduction

The physiological and psychological aesthetic model has landmark significance in the field of aesthetic psychology. The physiological psychological aesthetic model believes that the appreciation of an art work will change the arousal of aesthetes. The aesthetic preference will be influenced by the change in arousal of aesthetes, and the reason for the change in arousal is that the appreciation of art works will bring pressure for aesthetes to understand the meaning of art works. If the aesthetes can smoothly process the work, then the pressure can be reduced and the arousal can also be reduced so that the aesthetes can obtain aesthetic pleasure and aesthetic preference from the sudden change of arousal. The physiological psychological aesthetic model gives a good explanation for the

generation mechanism of positive aesthetic emotions, but it cannot explain some of the common phenomena in the aesthetic process (Cinzia *et al.*, 2009). For example, although sometimes the appreciation of art works brings negative emotions to the aesthetes, they still think that these art works can bring aesthetic feelings.

Researches have found that although the preference rating obtained by the color cards of various colors are different, in the same color system, the preference of the subjects towards, the color cards all presents the same rule. That is, the higher the prototype degree of the color cards the higher the preference rating obtained by the color cards. Researches of aesthetic psychology also explore the impact of prototype degree on facial aesthetic preference. The researchers ask

Corresponding author: Feng Xue

Address: Zhengzhou University of Light Industry, Zhengzhou 450000, China

e-mail ✉ 2463simonxuefeng@sina.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 7 March 2018; **Accepted:** 3 May 2018



the subjects to evaluate the artificial synthetic faces with different prototype degree and the results show that the higher the prototype degree of faces, the higher the aesthetic preference rating obtained (Brattico *et al.*, 2013). In short, people are very likely to be influenced by the effect of prototype preference, and usually the faces with high prototype degree with clear facial features are more popular. Researches have also found that there is significant interaction effect between the performance style of and the prototype of art works. Studies have shown that the impact of prototype degree on individuals is particularly significant in terms of the aesthetic preference of three-dimensional art works. There are significant differences in the aesthetic preference score obtained by three-dimensional art works with different prototype degree. The aesthetic preference score of three-dimensional art works with high prototype degree is significantly higher than that of three-dimensional art works with low prototype degree, but the prototype preference effect is influenced by the art knowledge of the subjects.

From the generation of aesthetic psychology in the 20th century, psychologists have tried to interpret the aesthetic psychological mechanism by various schools of theories such as psychoanalysis, gestalt and behaviorism. However, no clear answer has yet been obtained. The study of aesthetic psychology started from an objective perspective and aimed to confirm the influencing factors of aesthetic appreciation. The study has found that balance, symmetry and clarity are the main influencing factors of aesthetic appreciation (Verstegen, 2016). The current research on aesthetic psychology pays close attention to the impact of individual differences of aesthetes on aesthetic appreciation and supports the subjective construction viewpoint: aesthetic appreciation is the subjective interpretation of art works by the aesthetes.

Aesthetic emotional experience and aesthetic judgment. The model believes that aesthetic emotional experience and aesthetic judgment are relatively independent. The aesthetic cognitive processing of art works by aesthetes will affect the aesthetic emotional experience. Successful aesthetic cognitive processing often brings positive aesthetic emotional experience while failing aesthetic cognitive processing often brings negative aesthetic emotional experience. In short, the aesthetic emotional experience is seriously

affected by the results of the aesthetic cognitive processing in the early stage. However, aesthetic judgment is not necessarily affected by the success or failure of aesthetic cognitive processing. The knowledge and experience of aesthetes have great impact on aesthetic judgment. Some scholars classify the aesthetic judgment into happiness-oriented and cognition-oriented. They believe that the aesthetes without artistic knowledge are more inclined to make happiness-oriented aesthetic judgment. The aesthetic judgment of this type of aesthetes is influenced by the aesthetic emotional experience to a large extent and whether the aesthetic emotional experience is pleasant or not is the criterion for their aesthetic judgment. They tend to give higher aesthetic evaluation of the art work when their aesthetic emotional experience is pleasant and they tend to give lower aesthetic evaluation of the art work when their aesthetic emotional experience is unpleasant (Maynard, 2016).

Methods

Event-related potentials

Event-related potentials refer to the potential changes induced in the corresponding brain regions when the outside world gives a particular stimulus to the individual sensory system or a certain part of the brain. This particular stimulus is often referred to as an event. Researchers have multiple types of classification of ERPs and the commonly used classification is to divide ERPs into exogenous components and endogenous components. Exogenous components are the early components of stimuli produced by the human brain and the impact of physical properties of the stimuli such as intensity, type and frequency is particularly prominent (Phelps *et al.*, 2005), like the P50, N1 of audition and the c1 and P1 of vision. Endogenous components are closely related to the process of individual cognitive mental processing, reflecting the psychological processing process, which reflects the processing process of attention, memory and thinking, such as CNV, p300, and N40. Endogenous components are rarely affected by the physical characteristics of the stimulus (The main characteristics of the endogenous and exogenous components of event-related potentials are shown in Table 1 below).



Table 1. The main characteristics of the endogenous and exogenous components of event-related potential

Exogenous ERP component	Endogenous ERP components
Short incubation period (maximum 100ms)	Peak and latency changes (100ms to several seconds)
Different sensory modalities, different scalp distribution.	The distribution of scalp can vary according to the operation.
The latency and amplitude depend on the physical stimulus parameters.	Evoked responses are not strictly determined by the stimulus.
High individual stability.	Rely on tasks, instructions, or experiment Settings.

Table 2. Comparison of microelectrode measurement, blood dynamic measurement and electromagnetic measurement

	Measurement		
	Micro-electrode	Hemodynamics	Electro-magnetic
Noninvasive	poor	good	optimal
Spatial resolution	optimal	good	More bad
Temporal resolution	optimal	poor	optimal
cost	More expensive	expensive	Don't you

With the development of science, more and more physiological measurement technology has been used in psychological researches and the currently used psychophysiological techniques mainly include microelectrode measurement (single cell, multicellularity and local field potentials recording), hemodynamic measurement and electromagnetic measurement. These techniques are compared from the perspective of non-invasive, spatial resolution, time resolution and cost, as is shown in Table 2.

Experimental hypothesis

The recognition reaction time of art works is related to the preference evaluation of art works obtained. The shorter the recognition reaction time of the art work by aesthetes, the higher the preference rating given to the art work. The clarity, content availability and beauty of the work will affect the aesthetic preference of aesthetes through the impact on the processing fluency of the art work (Reber *et al.*, 2004).

Experimental methods

Thirty college students are selected for this experiment, half males and half females. These students do not receive any artistic training and have normal eyesight or corrected eyesight. They are all right-handed and none of them have participated in related experiments. The subjects are voluntary to participate in this experiment and all participants are paid RMB 30 after the completion of experiment 3. During the experiment, subjects will sit comfortably in the well-lit laboratory. The experimental procedures are presented on the Hps700 laptop through the E-prime 2.0 software. At the beginning of the experiment, the instruction will be displayed on the screen, requiring the subjects to immediately press the Y key once they recognize the object in

the painting and to press the R key if they do not recognize the object (Leder *et al.*, 2004).

Subjects will rest for 10 minutes to progress into Experiment 2 after the completion of Experiment 1. The same stimulus is used in Experiment 2 as in Experiment 1, but the stimulus is presented in different order. Each picture will be presented for 1000ms. After 1000ms, the picture will disappear. The subjects are required to make a five-grade aesthetic evaluation of the picture by pressing the key. The 1 represents significantly unattractive and 5 represents significantly attractive. The subjects make choices based on their own preference. After the scoring, the subjects will move on to the next trial. Also, the subjects are required to make the aesthetic judgment as soon as possible. Practices are conducted before the formal experiment and the number of practices is controlled by the subjects, which is based on full understanding of the instruction (Chatterjee, 2011).

Results and discussion

Experimental results

According to the experimental procedure, if the subjects cannot make the recognition reaction in 500ms, the reaction procedure will automatically skip to the next trial. Therefore, when discussing the recognition reaction of the subjects, the recognition reaction time of the subjects when they make the unrecognizable judgment will be converted to 500ms. Meanwhile, the reaction time when the subjects make the unrecognizable judgment is reserved, which is used to study the processing time of the subjects when they make the unrecognizable judgment (Burke, 2015). Matched with the beauty, clarity and content availability of art works, altogether 18 experimental conditions are constituted. The average recognition reaction



time and preference score under each condition are shown in Table 3.

The simple effect analysis shows that generally, the greater the clarity, the shorter the recognition reaction time. The interaction effect between the beauty and the content availability is extremely significant at the factory $(4,116)=8.755$, $P<.001$. The simple effect analysis shows that there is significant effect between the content availability and beauty in two levels. The specific content is shown in Table 4.

Matched with the beauty, clarity and content availability of art works, altogether 18 experimental conditions are constituted. Table 5 shows the preference score for each condition. The correlation analysis is conducted on the recognition reaction time and evaluation scores of the subjects, $r=-.255$, $P=.000$, indicating significant negative correlation. This shows that the slower the cognitive processing of art works, the lower the preference score. The test is performed on the average of the evaluation score of recognizable pictures and unrecognizable pictures and the results show that there is a significant difference between these two, $P=.002$. The score of unrecognizable pictures (2.61 points) is significantly lower than that of recognizable pictures (3.08 points) (The impact of beauty and clarity on the evaluation of the preference of art works is shown in Table 6).

Discussion

The results of the study show that the clarity, beauty and content availability of art works exert significant impact on the processing fluency of art works, and the interaction effect among these three factors are significant. The higher the processing fluency of art works, the greater the aesthetic preference obtained. ERP data confirms a positive correlation between processing fluency and high aesthetic preference (Nami *et al.*, 2011). The first stage of aesthetic processing is to perceive art works. This stage of processing is similar to that of ordinary perceptual processing and there is no aesthetic emotion in the process. At the end of the stage, the aesthetes make the judgment on whether the art work is worthy of further appreciation. At this time, the aesthetic emotion is generated. If the art work is defined as worthy of aesthetic appreciation, the aesthetes will continue to invest in psychological resources to process it. At the completion of this stage, the aesthetes produce a representation of the art work. Afterwards, the aesthetic processing progresses into the final stage - the stage of aesthetic judgement. At this stage, the aesthetes evaluate the art work based on the representation and consciously experience the aesthetic emotions.

Table 3. The average recognition response of different beauty, content and clarity

Content accessibility	Beautiful degree					
	beautiful		general		Not beautiful	
	clear	Is not clear	clear	Is not clear	clear	Is not clear
High	1402.61ms	3544.33ms	2443.65ms	2355.01ms	2984.70ms	3262.35ms
medium	3075.96ms	1747.00ms	2538.77ms	3765.17ms	2827.72ms	3222.78ms
low	2784.43ms	3239.48ms	3055.33ms	2500.31ms	2261.62ms	3487.23ms

Table 4. Effects of content availability and beauty on recognition of works

Low availability degrees			Accessible in the degree of			High availability degrees		
beautiful	general	Not beautiful	beautiful	general	Not beautiful	beautiful	general	Not beautiful
3002.36ms	2758.83ms	2835.41ms	2465.95ms	3198.27ms	2973.51ms	2536.67ms	2497.25ms	3158.58ms

Table 5. Preference scores of different beauty, comprehensibility and articulation

Can understand the degree of	Beautiful degree					
	beautiful		general		Not beautiful	
	clear	Is not clear	clear	Is not clear	clear	Is not clear
High	3.76	3.50	2.99	3.00	2.93	2.75
medium	2.93	2.80	2.73	2.69	2.48	2.73
low	2.98	2.67	2.58	2.98	2.46	2.61

Table 6. Influence of beauty and clarity on the evaluation of work preferences

Preference evaluation score	Not beautiful		general		beautiful	
	clear	not clear	clear	not clear	clear	not clear
	2.676	2.715	2.723	2.953	3.278	3.065



Conclusions and outlooks

This experiment takes the explicit classification paradigm and picture perception paradigm as the experimental paradigm and the psychological mechanism of aesthetic processing is explored using behavioral technique and ERP technique. The aesthetic preference is influenced by the processing fluency of art works. The higher the processing fluency, the greater the preference degree. The clarity, beauty and content availability will all affect the processing fluency of art works. The greater the beauty of art works, the higher the processing fluency, and thus it can be recognized more quickly. The aesthetes produce the classification gist of whether this art work is worth further aesthetic processing based on clarity, beauty and content availability, and then the gist is further processed to produce the aesthetic preference of the art work.

References

- Brattico E, Pearce M. The neuroaesthetics of music. *Psychology of Aesthetics Creativity and the Arts* 2013; 7(1): 48-61.
- Burke M. The neuroaesthetics of prose fiction: pitfalls, parameters and prospects. *Frontiers in Human Neuroscience* 2015; 9: 442.
- Chatterjee A. Neuroaesthetics: a coming of age story. *Journal of Cognitive Neuroscience* 2011; 23(1): 53-62.
- Cinzia DD, Vittorio G. Neuroaesthetics: a review. *Current Opinion in Neurobiology* 2009; 19(6): 682-87.
- Leder H, Belke B, Oeberst A, Augustin D. A model of aesthetic appreciation and aesthetic judgments. *British Journal of Psychology* 2004; 95(4): 489-508.
- Maynard P. 'Neuroaesthetics', Gombrich, and Depiction. *British Journal of Aesthetics* 2016; 56(2): 191-201.
- Nami MT, Ashayeri H. Where neuroscience and art embrace; The Neuroaesthetics. *Basic and Clinical Neuroscience* 2011; 2(2): 6-11.
- Phelps EA, Ledoux JE. Contributions of the amygdala to emotion processing: from animal models to human behavior. *Neuron* 2005; 48(2): 175-87.
- Reber R, Schwarz N, Winkielman P. Processing fluency and aesthetic pleasure: is beauty in the perceiver's processing experience. *Personality and Social Psychology Review* 2004; 8(4): 364-82.
- Verstegen I. An Introduction to neuroaesthetics: the neuroscientific approach to aesthetic experience, artistic creativity, and arts appreciation ed. by Jon O. Luring (review). *Leonardo* 2016; 49(3): 277-78.