



# A Visual Cognition Test-Based Study on the Choice Blindness Persistence: Impacts of Positive Emotion and Picture Similarity

Huayan Huangfu<sup>1,2</sup>, Yi Lu<sup>1(✉)</sup>, and Shan Fu<sup>1</sup>

<sup>1</sup> Department of Automation, School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai 200240, China

luyil@sjtu.edu.cn

<sup>2</sup> Counseling and Support Services, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai 200240, China

**Abstract.** Choice blindness is a common psychological phenomenon in many selection tasks. It always presents as a person's failure to notice a mismatch between one's preference and task decision. An important affecting factor of choice blindness is emotion. We studied the impacts of positive emotion and different similarity on the choice blindness based on visual cognitive tests. We designed a 2 (high and low similarity pictures)  $\times$  2 (positive emotion and neutral emotion) mixed design. 20 pairs of scenery pictures with different similarities were used as materials and 80 adults were recruited as participants. The results verified the existence of choice blindness in both positive emotion group and neutral emotion group. It was found that significant difference existed in the perception of false feedback between the positive emotion group and neutral emotion group. The female participants in the positive emotion group was more easily perceived the false feedback of low similarity scenery pictures than those female participants in the neutral emotion. In other words, positive emotion had an effect on the choice blindness of the female when they faced the low similarity scenery pictures.

**Keywords:** Choice blindness · Positive emotion · Picture similarity · Gender difference · Interaction effect

## 1 Introduction

When people make choices in life, they always think they know the reasons for their choices and can easily detect the mismatch between their choices and the results. But this is a wrong thinking about our reliability of decision-making. More and more studies have found that people may not know what their real choice is. Choice blindness is robust, repeatable and dramatic psychological phenomenon. Choice blindness is ubiquitous in choice preference and has important influence on individual decision. In theory, the study about the impact of emotion on choice blindness can provide a deeper understanding of choice blindness, deepen the study on the factors, and provide a theoretical basis for the blindness study of later researchers. In practice,

choice blindness is closely related to decision-making, which is common in consumer psychology, attitude formation, moral judgment and other fields. This study can help individuals make better decisions. Therefore, the study of choice blindness has great theoretical significance and application value.

The concept of choice blindness was first proposed and verified the existence of the phenomenon in laboratory experiments and field experiments in 2005. It means "Participants cannot find that their real choices are manipulated" [1]. In other words, it always presents as a person's failure to notice a mismatch between one's preference and task decision. The primal experiment became a classical experimental paradigm. In this experiment, participants were told that they were taking part in an experiment on the attractiveness of female faces. Then participants were presented with pairs of female face pictures and were required to make a choice between the two pictures based on attractiveness. After making a choice, the picture they chose was presented again and they were asked to explain why it was more attractive. But in fact, the participants were given false feedback in partial selection feedback. That is, the participants were presented with another photo they did not choose at first. The final results showed that up to 70% of the participants did not detect that the photos presented to them were not the original photos in the false feedback. In recent years, more and more researchers have paid attention to the mental mechanism and impact factor of choice blindness. They found that the similarity of select objects, the type of selective channel, the content and form of false feedback, personal feature of participants, the situation and so on were the impact factors. In the classic experiment, the researchers used high similarity and low similarity female face photos as the experimental materials. They found that there was no significant difference between high similarity and low similarity ones. The similarity of female face photo was not the impact factor of visual blind selection under this experimental condition [1]. But the similarity impacted on the tactile blind selection in others experiment. The more similar the select objects are, the more blind selection appeared [2, 3]. Some trails changed the materials based on the classic paradigm to explore the choice blindness. A choice blindness task used drawing pictures which were abstract painting, life painting, landscape painting and portrait painting as materials. The most participants did not notice the mismatch between their choices and the results [4]. Some researcher studied the effects of emotion on change blindness based on experiments. They found that positive emotions promoted individual awareness of change, while negative emotions hindered individual awareness of change [5]. But there is no relevant experiment about choice blindness.

The research on choice blindness is mainly concentrated in Western Europe and North America, but few in east Asia. Zhang [6] explored the psychological mechanism of choice blindness from the perspective of memory representation and recruited Chinese as participants. Although the choice blindness was persistent, the lasting time wasn't long. The memory representation theory is the cognition perspective to explain the choice blindness. Both the representation failure and the extraction failure may be the occurrence mechanism of the choice blindness, but the representation failure is likely to the basis. By studying cognitive style and sensory channel on choice blindness [7], and finding that sensory channel was an important factor of choice blindness. The participants (from china) were more likely to suffer from choice blindness under the auditory condition than the visual condition. There was also a comprehensive overview

of the current studies about choice blindness was conducted and it discussed the stability of choice blindness [8].

## 2 Method

### 2.1 Participants

80 healthy adults (half male and half female, age range 18–22 years) were recruited to participate in this study, and were randomly divided into two groups (each group of 40 participants, half male and half female). All participants had normal or corrected to normal vision. And they had never participated in the choice blindness experiment to ensure that they did not know the purpose of the experiment. They also had basic computer operation ability.

### 2.2 Material

The Chinese version of positive and negative emotion scale was made by Watson et al. and Tellege and proven cross-cultural homogeneity by Weidong Zhang. The scale presented good internal consistency (0.87), reliability and validity. The scale has 20 items and score by 5-point Likert scale. There are 10 items with the dimension of positive emotion and the left 10 items negative. 10 items with the dimension of positive emotion were used in this experiment as needed, we call it as the Chinese version of positive emotion scale.

Two pieces of video were used as the emotion induce materials. The home humor video which lasted 3 min and 58 s was used to induce positive emotion and the documentary about Palace Museum which lasted 3 min and 39 s was used to induce neutral emotion. A five minute soothing music was used to relax music.

20 pairs of scenery pictures with different similarities (10 pairs of high similarity pictures and 10 pairs of low similarity pictures) were used as select materials. All the scenery pictures were rated on a scale of 1 to 10 for similarity by 30 other participants in the pre-experiment. 1 meant this pair of scenery pictures was completely different, and 10 meant this pair of scenery pictures was completely identical. The average similarity of these high similarity pictures was  $6.82 \pm 0.48$  ( $M \pm SD$ ), and the average similarity of these low similarity pictures was  $2.78 \pm 0.61$  ( $M \pm SD$ ). Four of the twenty pairs were chosen as target pairs. Four of these pairs were false feedback pictures (2 pairs of high similarity pictures and 2 pairs of low similarity pictures), that is, the pictures presented to the participants was the non-preference pictures that the participants did not choose at the beginning.

### 2.3 Experiment Design

We designed a 2 (high and low similarity pictures)  $\times$  2 (positive emotion and neutral emotion) mixed design based on the classical selection of blind paradigm.

The independent variables were time interval (positive emotion and neutral emotion) and picture similarity (high similarity and low similarity). In independent

variables, emotion was the variable between subjects and picture similarity was the variable within subjects. The dependent variables were the reaction after participants receiving the false feedback scenery pictures. 20 pairs of scenery pictures were presented. 16 pairs were veridical feedback pictures, and 4 pairs were false feedback. The order of veridical and false feedback pairs and pictures' similarity was presented by ABBA design.

## 2.4 Experiment Procedure

All participants completed the trail on the computer. First step, before the formal experiment begins, the participants were informed that "This is an experiment on scenic attraction. Please take a deep breath and relax. This experiment will not have adverse effect on you. Next, we will start the experiment, please follow the instructions to do every step."

Second step, the participants listened to the soothing music and finished the 10 items with the dimension of positive emotion of positive and negative emotion scale.

Third step, the participants watched video. One group watched the home humor video and the other group watched the documentary about Palace Museum. They finished again the 10 items with the dimension of positive emotion of positive and negative emotion scale.

Fourth step, we used the E-prime software programming to complete the experiment. A pair of scenery pictures were displayed on the left and right side of the computer screen. Participants were asked to choose the more attractive scenery picture between presented pairs. And the choice process was free. After chosen, the selected pictures or the unselected pictures, that is the false feedback will appear again in the center of the computer screen (Fig. 1). And participants were asked to write down the reasons of the chosen the preferred picture on the experimental record chart. The process was also no limited time.

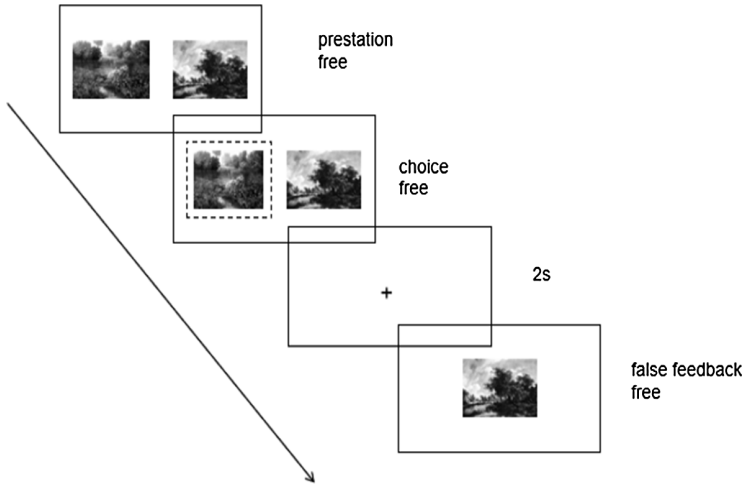
## 2.5 Data Recording and Processing

We used E-prime and SPSS 20.0 software to process the results. The participants' unawareness of the false feedback pictures was scored as 0, their detections of once was scored as 1, and twice was scored as 2. We also recorded the reasons for the participants to choose the preferred pictures and the reaction time. The reasons were divided into three types: wholeness, detail, and intuition.

# 3 Results

## 3.1 Emotion Induced

To examine the effect of emotion induced, we used the t-test to compare the difference in score of the Chinese version of positive emotion scale. There was no significant difference in the score of positive emotion scale between the pretest score and posttest score of neutral emotion. There was significant difference in the score of positive



**Fig. 1.** The process of false feedback in the experiment procedure.

emotion scale between the pretest score and posttest score of positive emotion ( $F = -7.12$ ,  $P < 0.0001$ , Table 1). The positive emotions of the participants are successfully evoked in positive emotion group.

**Table 1.** The t-test for score of the Chinese version of positive emotion scale in both groups (positive emotion and neutral emotion).

Group	Pretest score ( $M \pm SD$ )	Posttest score ( $M \pm SD$ )	F	P
Positive emotion	$2.73 \pm 0.73$	$3.35 \pm 0.50$	-7.12	0.000***
Neutral emotion	$2.77 \pm 0.58$	$2.87 \pm 0.66$	-1.06	0.30

\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

### 3.2 Choice Blindness

For verifying the existence of choice blindness, we analyzed the detection rate of choice blindness by participants' reports and used SPSS20.0 software to taking statistical analysis. There were the 320 false feedback in total. The detection rate of false feedback was 44.69%. Specifically, it was 56.88% in the positive emotion group, and it was 38.75% in the neutral emotion group. In other words, nearly half of the participants in both groups were not aware of the false feedback. The results showed the choice blindness occurred for Chinese adults really.

### 3.3 Impacts of Positive Emotion and Picture Similarity on the Choice Blindness

To examine the effect of positive emotion and picture similarity on the choice blindness, we used the chi-square test to compare the difference in number of detections for false feedback pictures. There was significant difference in the detections of false feedback pictures between the two groups ( $\chi^2 = 9.70, p = 0.008^{**} < 0.01$ ; Table 2). There was no significant difference between the two groups in high similarity pictures, but there was significant difference between the two groups in low similarity pictures ( $\chi^2 = 5.87, p = 0.049^* < 0.05$ ; Table 2). The detection rate of false feedback in low similarity pictures was 72% in the positive emotion group, and it was only 49% in the neutral emotion group. Faced with the low similarity pictures, the choice blindness more easily occurred for in the participants of positive emotion group.

**Table 2.** The chi-square test for number of detecting false feedback pictures with different similarity in both groups.

Group	Picture similarity	0	1	2
Positive emotion	High similarity	13	20	7
	Low similarity	3	16	21
Neutral emotion	High similarity	20	18	2
	Low similarity	11	18	11

Used the chi-square test, there was significant difference between the female and male in both groups ( $\chi^2 = 12.98, P = 0.04^* < 0.05$ ; Table 3). For further analysis, there was no significant difference between the male in the positive emotion group and the neutral emotion group ( $\chi^2 = 9.89, P = 0.14$ ; Table 3). But there was significant difference between the female in the positive emotion group and the neutral emotion group ( $\chi^2 = 7.19, P = 0.02^* < 0.05$ ; Table 3).

**Table 3.** The chi-square test for number of detecting false feedback pictures with different gender in both groups

Group	Gender	0	1	2
Positive emotion	Female	5	20	15
	Male	11	16	13
Neutral emotion	Female	14	19	7
	Male	17	17	6

There was significant difference between the female in the positive emotion group and the neutral emotion group when they faced the low similarity pictures ( $\chi^2 = 7.19, P = 0.02^* < 0.05$ ; Table 4). There existed an interaction effect of emotion, gender and similarity on choice blindness (Fig. 2). Faced the low similarity pictures, the average of female in the positive emotion group was 70%, but the average of female in the neutral emotion group only was 45%.

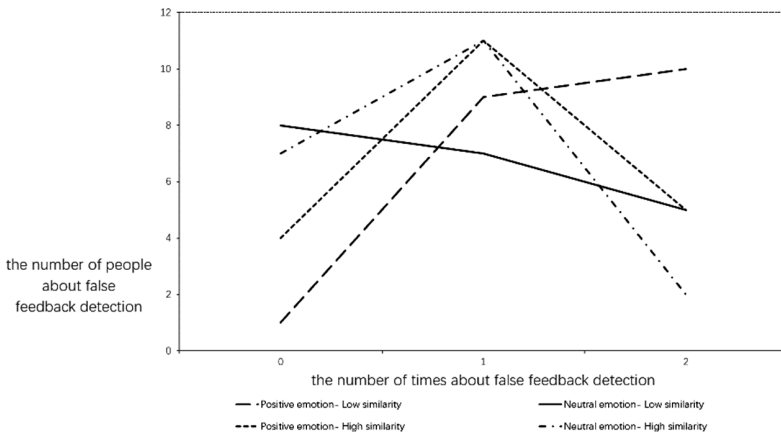
**Table 4.** The chi-square test for female number of detecting false feedback pictures with different similarity in both groups

Group	Picture similarity	0	1	2
Positive emotion	High similarity	4	11	5
	Low similarity	1	9	10
Neutral emotion	High similarity	7	11	2
	Low similarity	8	7	5

We recorded the participants' reasons for choosing preferences and divided three part (i.e. wholeness, detail and intuition). There was significant difference of reasons between female in positive emotion group and neutral emotion ( $\chi^2 = 8.93$ ,  $P = 0.01^* < 0.05$ ; Table 5). The female participants in neutral emotion were focus on scenery pictures' wholeness. However, the female participants in positive emotion were focus on scenery pictures' detail.

**Table 5.** The chi-square test for Reasons of false feedback received by female in both groups

Group	Wholeness	Detail	Intuition
Positive emotion	11	19	10
Neutral emotion	24	9	7

**Fig. 2.** The interaction effect of emotion, gender and similarity on choice blindness.

## 4 Discussion

In this study, there was significant difference in the score of positive emotion scale between the pretest score and posttest score of positive emotion. The positive emotion of the participants was successfully evoked in positive emotion group. The participants

of positive emotion group were in a positive emotional state. The participants of neutral emotion group maintained emotional stability.

Nearly half of the participants in both groups were not aware of the false feedback. The results showed the choice blindness occurred for Chinese adults really. Computing the result of choice blindness, it is consistent with the previous study in China [9, 10].

In this study, we found that positive emotions also promoted the participants awareness of false feedback. Some researchers studied the effects of emotion on change blindness based on experiments. They found that positive emotions promoted individual awareness of change, while negative emotions hindered individual awareness of change [5]. Change blindness and choice blindness had the similar phenomenon. Whether there are common mechanism of the change blindness and choice blindness has to be studied further. In the studies of emotion, some researchers found positive emotion improved the retrieval speed of individual's attention and enhanced attention [11]. According to motivational dimensional model of affect, some researchers studied the influence of positive emotions on individual cognitive control in different states of approaching motivation intensity by controlling the arousal level of positive emotions. They found that low approach-motivated positive affect enhances cognitive flexibility, whereas high approach-motivated positive affect enhances cognitive stability. This research extends previous work on cognitive breadth to cognitive control which partly reflects the temporality of cognitive processes. Taken together, this line of research suggests that the effects of positive affect on cognitive processes are modulated by its approach motivational intensity [12].

In the classical choice blindness experiment, the researchers used the faces pictures with different similarity as materials and found that the difference in similarity had no significant difference in the detections rate of choice blindness. That is, similarity was not the influencing factor of choice blindness [1]. But in our study, there existed an interaction effect of emotion, gender and similarity on choice blindness. When participants received the feedback of pictures (including veridical and false feedback), their reasons for the preference pictures were focused on the wholeness. No matter how many times the experiment was carried out, it can be clearly seen that the overall description was the main reason. This was consistent with previous studies. Some researchers pointed out in the cross-cultural study of attention that the overall processing mode of Oriental people involved a larger area of attention [13]. In exploring the psychological mechanism of choice blindness, it was found that the overall feature description was more than the specific feature description when the participants gave causal descriptions to the pictures with veridical or false feedback [1]. As for the reasons for false feedback pictures, we found that although both males and females paid more attention to the picture's wholeness, and females focused on the details of the picture was 13.4%. While males paid attention to the details of the picture was 24.5%. This suggested that men pay more attention to detail than women, which may explain why males who were tested in one-week time interval group spent significantly more time than females. Therefore, male participants in one-week time interval group were more likely to detect false feedback.

Future work should increase the number of participants to enhance the sample representativeness. The selection of experimental materials also needs to be more careful and considerable.



## 5 Conclusions

We studied the impact factors of positive motion and picture similarity in choice blindness based on visual cognitive tests. The results verified the existence of choice blindness in both positive emotion group and neutral emotion group. It was found that significant difference existed in the perception of false feedback between the positive emotion group and neutral emotion group. The female participants in the positive emotion group was more easily perceived the false feedback of low similarity scenery pictures than those female participants in the neutral emotion. The positive emotion had an effect on the choice blindness of the female when they faced the low similarity scenery pictures.

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