Whether Regular Visual Art Training Can Enhance People's Face Recognition & Memory Ability

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Abstract: When humans want to befriend someone, they must remember what their faces look like and try to link faces and names together. Sometimes, they may mismatch some of their friends due to the high similarity of faces. Indeed, they may not observe faces carefully so that information from faces is not deeply stored in their mind. People trained in visual art may have a stronger ability to recognize the features and structures of subjects than those who never undergo any art training. They may distinguish similar faces from the aspects common people are unaware of and accurately link faces to names in their brains. In order to explore whether regular visual art training can enhance people's face recognition & memory ability, experts and non-experts were invited to finish a self-reported questionnaire about their subjective face recognition ability, and an objective face recognition test called Cambridge Face Memory Test (CFMT). Through these two exams, the results found were not powerful enough to confirm the hypothesis, which meant the relation between visual art training and face recognition ability was still ambiguous.

Keywords: visual art training, face recognition ability, experts in art, non-experts in art

1. Introduction

The first impression of humans always relies on their facial information within a few milliseconds. Sometimes, people will be disturbed by the faces of friends who share so many similar features, and they are highly likely to mismatch their names when seeing their pictures simultaneously. For instance, lots of people may fail to distinguish Jingjiang Xu and Chris Hemsworth when they are wearing the same Thor's suit. Face recognition can be related to visual working memory (VWM) obtained from visual art training. Many studies have stated that face recognition, which could be affected by external factors, was not simply stimulated in VWM as people imagined. As a visually complex item, when representing faces in VWM storage organization, a memory capacity limit will occur because it needs a larger amount of memory resources [1]. Face recognition represented in VWM could be affected by static features that carry social information, for instance, identity and race [2]. Through an identity change detection task to indicate how familiar and unfamiliar actors' faces would affect a VWM improvement (capacity and sensitivity), Jackson & Raymond concluded that long-term memory in VVM representations was involved by familiar faces [3]. This also proved Gambarota and Sessa's judgment about the relationship between familiarity with specific individual faces and their storage in VWM [4]. Race is also a component influencing the quality of face processing as well as VWM representations. Steler and Degner indicated that other-race faces are processed as inefficiently as inverted faces at both configure and feature levels of processing [5]. However, all these studies about VWM and race and familiarity are limited because no artists are participating. Owen et al. demonstrated that artists were stronger in observing internal facial features and capturing the key components [6]. Zhou et al. indicated that art students showed smaller holistic processing than ordinary participants when disrupted by composite faces [7]. Devue and Barsics further revealed the relationship between the practise of portraiture and face processing abilities [8]. They found that portrait artists, who benefited from being trained in perceptual and visual short-term memory skills, could better recognize newly learned faces than controls. There have not been extensive studies exploring whether art training can enhance VWM and enable individuals to outperform in face recognition compared with non-artists.

2. Goal and Hypothesis

To fill the gap, this study explores whether experts' enhanced visual memory capacity will enable them to outperform non-experts in face recognition even though faces are other-race and unfamiliar. Regular visual art training can enhance individuals' visual memory capacity, enabling them to outperform their peers in face recognition. Students majoring in painting, designing, photography, and so on are considered more likely to observe unfamiliar and familiar faces from different races. They can have summarized and classified features and structures of faces stored and repeated in their minds. However, other students need more opportunities to observe faces as carefully as art students. Some of them may fail to remember the faces of their foreign classmates even though they have met several times at the same lectures, not to speak of recognizing someone they have never met before.

3. Methods

3.1. Participants

Twenty-two recruited participants have already studied in different English-speaking countries. In order to classify experts and controls better, participants trained in the visual art domain for more than one year were standardized as experts, while the rest were controls. Experts (N = 11) contacted through emails and social networks were from art majors and must have had a specified volume of training on drawing faces. Controls (N = 11) recruited to match experts in terms of study abroad background reported that they seldom drew any subjects on a regular basis. All of the participants had normal or corrected-to-normal vision.

3.2. Procedure

A Google document link of a questionnaire and a Cambridge Face Memory Test (CFMT) link were sent to participants at the same time, and they had to finish these two tests in their leisure time. They need to complete a revised questionnaire to self-assess their ability to recognize faces. The questionnaire called the Stirling Face Recognition Scale consists of ten positive (e.g., I find it very easy to visualize individual faces in my mind with great detail) and ten negative questions (e.g., I often fail to recognize someone who knows me) to quantify one's self-report face recognition ability from the low to high end was replicated [9]. It was designed as a Likert scale participants needed to select a number from strongly disagree ($score = 1$) to strongly agree ($score = 7$) in each question, and the full score of the questionnaire was 140. There was no time limit to complete this questionnaire, and participants were asked to answer questions as honestly as possible. After completing the questionnaire, they were told to participate in CFMT to examine whether their performance could match their scores in the questionnaire [10]. It only took participants 10-15 minutes to finish. CFMT has become a standard tool in face recognition studies, which was used to find out if people have super face recognition abilities. There are three phases in CFMT (See Figure 1). In the first phase (same-image condition), participants should choose a target face, which they have learned from three viewpoints from two matched-format distractors. The procedure contains six target faces, which are displayed sequentially. Before starting the second phase, there will be 20s to review all of six faces together. Then, in the second phase ("easy" condition), the target faces are presented in a novel view or lightened from different angles. There is still another 20s' review of faces before the last phase. Finally, visual noise is added to every target face in the last noise phase. What the study can get from CFMT is every participant's accuracy in the experiment. They are required to send screenshots of their scores through email or other social networks.

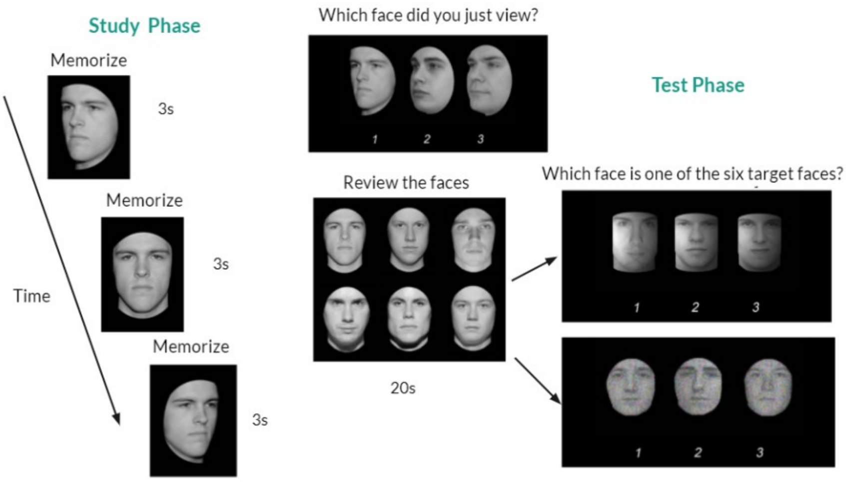

Figure 1: The process of CFMT

4. Results

4.1. Questionnaire Data Analysis

Table 1 shows experts and non-experts self-report their face recognition ability according to the questionnaire. The questionnaire mainly focused on how experts and non-experts would self-report on both kinds of questions and secondarily paid attention to the differences in self-assessment between genders. It is found that experts ($Mean\ score = 4.49$, range from 2.90 to 6.60) had a lower mean score of positive questions (PQ) than non-experts ($Mean\ score = 5.11$, range from 4.50 to 6.20) (Figure 2), and the spread was much larger than that of the non-experts. However, their mean score $= 2.53$, ranging from 1.10 to 5.30, of negative questions (NQ) was higher than the non-experts' (Mean score = 1.98, ranging from 1.10 to 2.90) (Figure 3). Also, the spread IQR was larger, and two upper outliers were found in experts.

Table 1: Descriptive Data of self-report face recognition ability

	Positive Questions		Negative Questions	
	Experts	Non-experts	Experts	Non-experts
Mean	4.49	5.11	2.53	1.98
Min	2.90	4.50	1.10	1.10
Max	6.60	6.20	5.30	2.90
Max	1.36	0.55	1.47	0.56

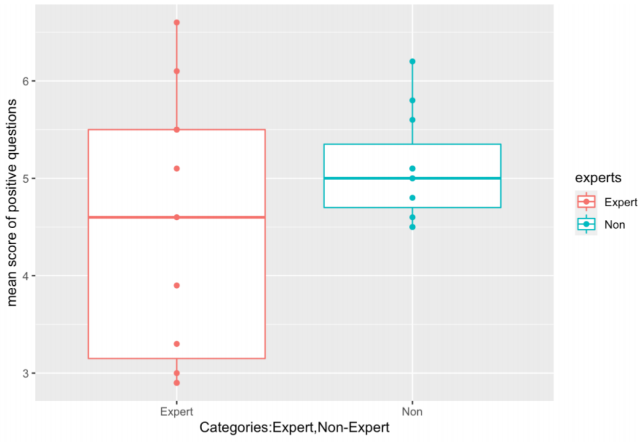

Figure 2: Experts and Non-experts’ mean score of PQ

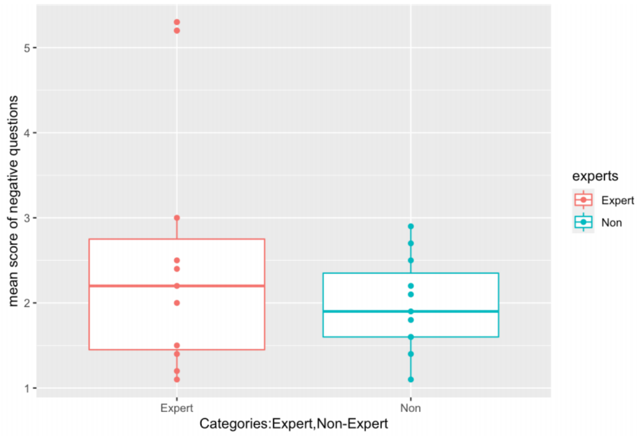

Figure 3: Experts and Non-experts’ mean score of NQ

The data distribution of two kinds of questions between genders is roughly observed. Figure 4 indicated that male and female experts had a similar mean, while females had a larger IQR on PQ. Additionally, both mean and IQR were similar between male and female non-experts on PQ, but there was one outlier from males. Figure 5 presented that male experts tended to perform worse on the mean score of NQ, and both mean scores of NQ were similar between male and female non-experts, while males presented a larger IQR.

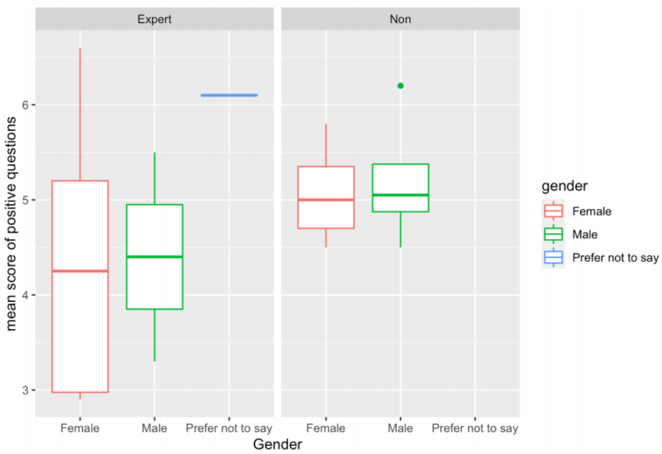

Figure 4: Effect of gender on the mean score of positive questions

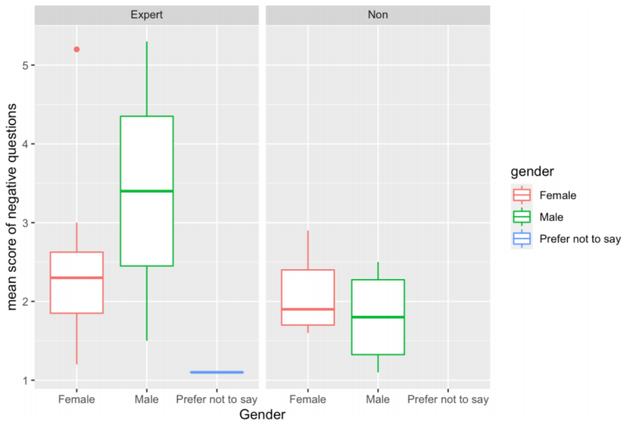

Figure 5: Effect of gender on the mean score of negative questions

QQ plot was used to check whether both kinds of questions' scores met the distribution of normality. Most points lay on the QQ line, meaning the distribution of negative and positive question scores might assume normality. Then, a two-sample t-test was performed to examine the difference in mean scores. It revealed that the average score of positive questions was not significantly higher among experts ($M = 4.49$, $SD = 1.36$) than among non-experts ($M = 5.11$, $SD = 0.55$), $t = -1.397$, $p > 0.1$. The situation was quite similar when it showed the average score of negative questions was among experts ($M = 2.53$, $SD = 1.47$) than among non-experts ($M = 1.98$, $SD = 0.56$), $t = 1.151$, $p > 0.1$. Thus, it took a lot of work to find distinct differences between experts and non-experts when they were required to self-assess their face recognition abilities.

4.2. CFMT

Table 2 shows how experts and non-experts perform in CFMT. The CFMT score showed that experts generally achieved higher scores $M = 0.807$, ranging from 0.560 to 0.960, than non-experts $= 0.748$, ranging from 0.36 to 0.89, to some extent reflecting the effectiveness of their frequent art training on face recognition.

Table 2: Descriptive data of experts and non-experts in CFMT

	Mean	Min	Max	SD
Experts	0.807	0.560	0.960	0.112
Experts	0.748	0.360	0.890	0.146

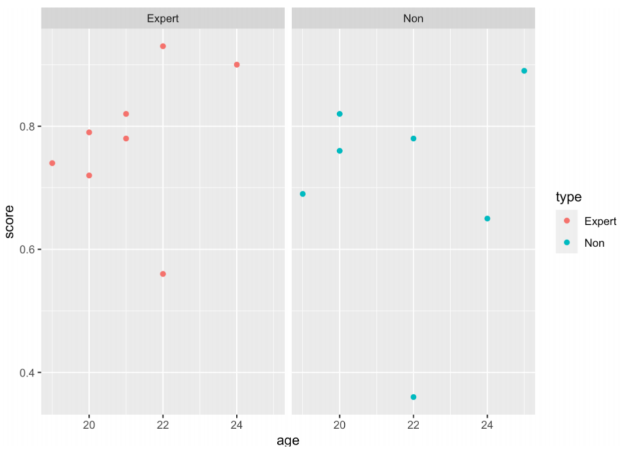

Figure 6: Effect of types on CFMT score

In order to explore the difference in CFMT scores between experts and non-experts, a two-sample t-test was still used, which showed experts ($M = 0.807,\ SD = 0.112$) did not significantly perform better than non-experts ($M = 0.737, SD = 0.146$), $t = 1.259,\ p > 0.2$. Hence, it could be accepted that there was no difference in true mean scores between experts and non-experts. Participants were further divided into two groups to use the chi-square test of independence to examine the relationship between participants' types and score types. The group *"Above"* were the test takers whose scores were over 0.77, and the other group "Below" were the rest of the test takers (Figure 6). According to the $X2$ test of independence, this difference was not statistically significant $X2\ (1, N = 22)$= .7857, $p = .3754$. It could thus infer that subjects' types and score types were independent, which seemed there was no relationship between participants' types and score types.

5. Conclusion

The study tried to explore whether regular visual art training could improve face recognition ability. Based on self-assess questionnaire, it is conducted two-sample T-tests to analyze mean differences between experts' and non-experts' scores to positive & negative survey questions. Then, a two-sample T-test and Chi-square test were applied to analyze the mean differences between experts' and non-experts' scores on CFMT. It was found that there needed to be obvious evidence to show the gap of confidence to face recognition ability between experts and non-experts through the true mean of self-evaluation. Perhaps they consider the situation they recognize their race faces; instead, they find it hard to evaluate whether their memory will work when remembering other-race faces. However, subjects' types and score types were not intensively correlated with each other. It needed to demonstrate more proof to present the correlation between regular visual art training and face recognition ability. Although experts have more opportunities to observe structures of faces, their facial recognition abilities do not improve their drawing training, especially when all participants were required to remember other-race faces.

Additionally, a factor must be addressed: some super face recognizers among common people, even though they may not have any talent for drawing. Visual art training as the factor that influenced people's face recognition abilities is still ambiguous, while it may affect how humans recognize faces in a specific way. Those experts may be good at recovering faces they have met, however, if they are provided limited time to remember faces, it will greatly narrow the gap between experts and non-experts.

5.1. Limitation

5.1.1. Sample

The small size of participants might restrict the expectation of the research hypothesis. Only 22 students are too hard to present the popularity of the research conclusion. Then, choosing a voluntary sample instead of a random sample may lead to bias in the final result. Someone who received the link forgot to finish the questionnaire, increasingly reducing the sample size. Furthermore, experts are mainly female, a kind of gender imbalance in the research. Hensen et al. revealed that women's face recognition ability was more likely to decrease when exposure time was lower [11]. However, women participating in this study showed women experts won higher CFMT scores, which was partially different from the study done by Hensen. Furthermore, the study fails to explore how the gender difference among experts will further affect face recognition ability because of the reluctance of male attendance.

5.1.2. Cross-race effect

Although the participants invited are international students from China, CFMT, which only includes Caucasian faces, is still difficult for Chinese people. One reason can be that none of them have lived in a foreign country for quite a long period, and there are few local students in their social circle. Another reason seems to be the face inversion effect led by seeing faces from other races, which may reduce all participants' face recognition ability. The number of Chinese faces should increase to investigate the face recognition ability of faces from the same race.

5.1.3. Survey Subjectivity

Negative questions might cause misunderstanding for participants, and their wrong judgment also decreases the accuracy of the self-report questionnaire. It had better change all these negative questions to positive ones so that their misunderstanding will seldom happen. Another reason should contribute to self-report bias. Perhaps all of them hold the belief that every answer needs to be better than average, and their final scores may cut down the reliability.

5.2. Future Directions

5.2.1. CFMT-Chinese

Although all the participants invited have overseas study experience, other-race faces still can lead to face inversion effect, which may reduce the exact accuracy of face recognition. It had better adopt CFMT-Chinese to decrease the interference for VWM. The procedure of CFMT-Chinese totally follows the CFMT format, and only Chinese faces are used. Further study may find out what contributed to visual art training and whether CFMT-Chinese scores for experts can be much higher than non-experts.

5.2.2. Long-term Memory Test

CFMT mainly examines visual short-term memory skills, while how experts and non-experts will perform in the long-term VWM test deserves further discussion. Steler and Degner emphasized that early processing differences between own-group and other-group faces led to effects in both working memory and long-term memory [5]. Further study may design a new task, including ten trials. In each trial, participants will be required to play a *Face Memory Game* online. To start the game, they need to press *the start* button. When testers say stop, they must press *the play* button and be given 15s to memorize the face they see on the screen. After 15s, a maths calculation (e.g., 100-3-6-9-12=?) will be shown on the screen, replacing the face. When they give the correct question, they can only see a white screen and a column including hair, eyes, cheek, nose, chin and mouth options. They need to choose the right number for each face part to recover the original one. Testers will record the number of successful facial recoveries and examine whether experts have better long-term VWM of faces due to their visual art training.

References

[1] Ma, W. J., Husain, M., Bays, P. M. (2014). Changing concepts of working memory. Nat. Neurosci., 17: 347-356.

[2] Oosterhof, N. N., Todorov, A. (2009). Shared perceptual basis of emotional expressions and trustworthiness impressions from faces. Emotion., 9: 128–133.

[3] Jackson, M. C., Raymond, J. E. (2008). Familiarity enhances visual working memory for faces. J. Exp. Psychol. Hum. Percept. Perform., 34: 556–568.

[4] Gambarota, F., Sessa, P. (2019). Visual Working Memory for Faces and Facial Expressions as a Useful "Tool" for Understanding Social and Affective Cognition. https://doi.org/10.3389/fpsyg.2019.02392

[5] *Stelter, M., Degner, J. (2018). Investigating the other-race effect in working memory. Br. J. Psychol.,109: 777–798.*

[6] *Kozbelt, A., Seidel, A., EIBassiouny, A., Mark, Y., Owen, D. R. (2010). Visual Selection Contributes to Artists' Advantages in Realistic Drawing. Psychology of Aesthetics, Creativity, and the Arts., 4: 93-102.*

[7] *Zhou, G., Cheng, Z., Zhang, X. (2012). Smaller holistic processing of faces associated with face drawing experience. Psychon Bull Rev., 19: 157-162.*

[8] *Devue. C., Barsics, C. (2016). Outlining face processing skills of portrait artists: Perceptual experience with face predicts performance. Vision Research.,127: 92-103.*

[9] *Bobak, A.K.,Mileva,V.R.,Hancock, P.J. (2019). Facing the facts: Naive participants only have moderate insight into their face recognition and perception abilities. Quarterly Journal of Experimental Psychology.,72:872-881.*

[10] *Duchaine, B., & Nakayama, K. (2006). The Cambridge Face Memory Test: Results for neurologically intact individuals and an investigation of its validity using inverted face stimuli and prosopagnosic participants. Neuropsychologia., 44: 576-585.*

[11] *Hensen, T., Zaichkowsky, J., Jong, A. (2021). Are women always better able to recognize faces? The unveiling role of exposure time. PLoS ONE., 16: 1-16.*