

The Effect of Moral Behavior on Facial Attractiveness

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Purpose: Evaluating face attractiveness is a core aspect of face perception, which plays an important role in impression formation. A more reliable source of information in impression formation is moral behavior, which forms the primary basis for the comprehensive evaluation of others. Previous studies have found that one can easily form an association when faces and moral behaviors are presented together, which in turn affects facial attractiveness evaluation. However, little is known of the extent to which these learned associations affect facial attractiveness and whether the influence of moral behavior on facial attractiveness was related to facial appearance.

Methods: We used the associative learning paradigm and manipulated face presentation duration (Experiment 1 and Experiment 2) and response deadline (Experiment 2) to investigate these issues. Under these conditions, the association information was difficult to be retrieved. Participants learned associations between faces and scenes of moral behavior, and then evaluated facial attractiveness.

Results: We found that both moral behavior and facial appearance influence facial attractiveness under conditions where associated information was difficult to retrieve, and their effects increased with the increase of face presentation time. With increasing response deadlines, the effect of moral behavior on facial attractiveness increased. The influence of moral behavior on facial attractiveness was associated with facial appearance.

Conclusion: These results suggest that moral behavior continuously affects facial attractiveness. Our findings expand previous research by showing a robust influence of moral behavior on facial attractiveness evaluation, and highlight the important role of moral character in impression formation.

Keywords: facial appearance, moral behavior, learning, facial attractiveness

Introduction

Aesthetic experience is very important to human beings, and facial aesthetics, as an important aspect of social interaction, is no exception.^{1,2} Facial aesthetics, also called facial attractiveness, refers to the positive and pleasant emotional experience induced by the face. Facial attractiveness increases the willingness of others to approach a person.³ In research on face perception, facial aesthetics is an important component of social aesthetics and impression formation.^{4,5} Social psychologists theorize that people infer the personality traits based on facial attractiveness,⁶⁻⁸ and this inference is consistent across time.⁹⁻¹¹ Moreover, the evaluation of facial attractiveness is fast and automated.^{7,8}

Numerous studies have shown that face attractiveness affects people's inferences about an individual's personality traits.⁹⁻¹² Individuals with attractive faces are more likely to be judged to have positive personality traits and as more likely to perform good behaviors, known as the beauty-is-good stereotype.¹³⁻¹⁵ This stereotype has cross-cultural and cross-ethnic consistency,^{4,7,13,16} and has been shown to affect the perceiver's subsequent behaviors.^{4,15} A previous study found that people tend to think that individuals with attractive faces possess more positive personality traits and better moral qualities, such as sincerity, kindness, and trustworthiness.¹³ Other studies indicated that people's moral judgments of individuals were affected by facial attractiveness.^{17,18}

Taking the converse perspective, some researchers have proposed that personality and moral traits can also affect facial attractiveness ratings. Individuals who perform positive behaviors look more attractive, known as the good-is-beauty

stereotype.^{19–21} For instance, Gross and Crofton found that faces were rated more attractive when they were paired with positive moral behaviors.¹⁹ Other studies showed that participants evaluated faces paired with positive behaviors as more attractive than faces paired with negative behaviors.^{20,22} Zhang found that participants evaluated faces as more attractive when the face and the positive social label were presented together.²¹

Moral goodness and moral beauty are two forms of moral judgement. Moral goodness usually refers to the quality of moral behavior, without deep accompanying emotional experience.²³ Moral beauty refers to the abstraction of beauty associated with positive moral behavior independent of specific instantiation.²⁴ Moral beauty not only enables people to distinguish between good and bad moral behaviors but also enables people to generate aesthetic experiences and emotional elevation.^{25–28} It should be noted that although there are differences in theoretical definition between moral goodness and moral beauty, in practice they share common methods of manipulation in experimental work.²⁹

Although many studies have explored the influence of moral behavior on facial attractiveness, they all used similarly attractive faces and did not examine the influence of the attractiveness of the face itself or how moral behavior interacts with physical appearance. To our knowledge, no studies have tested the combined influence of moral behavior and facial appearance on facial attractiveness. Thus, it is still unclear whether the influence of moral behavior on facial attractiveness will be affected by facial appearance.

Additionally, prior work has established that when faces and sentences describing personality traits are presented together, people can easily form the types of associations in the laboratory which are the cornerstone of social perception in real life situations and which influence subsequent face evaluation.^{30–34} For example, Rudoy and Paller had individuals make face assessments by integrating information from two sources: one perceptual-based information (face trustworthiness in their study), and the other memory-based information, defined as the pre-learned association between the face and a positive or negative adjective.³⁰ Their research also found that reducing the response time of participants increased the influence of the facial appearance on the evaluation of the face. In another study, participants were first asked to associate faces with sentences indicating positive or negative previous behavior, and then rate the faces presented in isolation.³⁵ They found that faces associated with positive behaviors were rated as more trustworthy than faces associated with negative behaviors. Verosky used a similar method to examine whether affective person learning affected the evaluation of faces in conditions where association was difficult to retrieve.³⁶ They found that facial evaluation was still influenced by person learning. However, these previous studies did not manipulate the preexisting level of facial attractiveness. A study showed that it may be necessary to pay attention to both the role of external sensory input and internal information in aesthetic appreciation.³⁷ Therefore, it is important to consider both facial appearance and past behavior for facial aesthetics.

Given the essential and primary role that moral traits play in the formation of impressions,^{38–40} the present study aims to investigate the extent to which moral behavior and facial appearance influenced facial attractiveness and whether the influence of moral behavior on facial attractiveness depended on facial appearance. To this end, we conducted two experiments to answer these questions. We manipulated face presentation duration and response deadline, which allows us to examine whether moral behavior consistently influenced facial attractiveness evaluation when associative information was difficult to be retrieved.

Materials and Methods

Material Ratings

Method

Participants

We recruited 24 college students (11 women, $M_{age} = 20.29$, $SD = 1.83$) to rate face pictures and another 23 college students (13 women, $M_{age} = 21.52$, $SD = 1.78$) to rate moral behavior scene pictures. All participants were from South China Normal University and did not participate in the formal experiments. They were right-handed and had normal or corrected-to-normal vision. Participants were paid for their participation. All participants gave written informed consent in accordance with the Declaration of Helsinki. This research was implemented following approval by the Institutional Review Board of South China Normal University.

Materials and Procedure

For the rating of face pictures, we developed two sets of pictures, one of attractive and one of unattractive Chinese men, using the following procedure. First, fifty men's photos of Chinese faces were selected from the Chinese Facial Affective Picture System (CFAPS; Lu et al, 2015). These photos were unfamiliar to the participants. All faces had neutral expressions and frontal gazes. The size of the facial images was 260×280 pixels and each was presented on a black background. Participants were asked to rate the familiarity and attractiveness of each face on a 7-point Likert scale ranging from 1 (very unfamiliar/unattractive) to 7 (very familiar/attractive).

Pictures depicting scenes of moral behavior were drawn by art students with themes of moral beauty, neutral, and ugliness. The pictures were presented in black and white, and the size was 260×280 pixels. Participants were asked to rate the degree of moral beauty, artistry, compositional complexity, and emotional valence of each scene on a 7-point scale. These pictures were adjusted to the same size using Adobe Photoshop. E-Prime 2.0 software was used to present stimuli and collect responses in the material ratings and subsequent experiments.

Results

Statistical analysis was performed using SPSS 22.0 software. Based on the results of face picture ratings, we selected a set of 12 attractive faces ($M = 5.27$, $SD = 0.17$) and a set of 12 unattractive faces ($M = 2.03$, $SD = 0.13$, $t(22) = 53.04$, $p < 0.001$). Familiarity differences between attractive and unattractive faces were not significant ($M_{\text{attractive}} = 3.17$, $SD = 0.33$; $M_{\text{unattractive}} = 2.98$, $SD = 0.43$; $t(22) = 1.21$, $p > 0.05$).

Based on the results of the moral scene picture ratings, 24 scenes, 8 each depicting moral beauty, neutral, and moral ugliness were selected (Figure 1). Characters in each type of scene include both men and women. The ratings of the of moral behavior scenes are shown in Table 1.

Experiment I

Experiment 1 explored the effects of moral behavior learning and facial appearance on facial attractiveness under limited face presentation time. We controlled face presentation duration using the durations established in a previous study: 35ms and 187ms. We predicted that moral behavior and facial appearance would influence facial attractiveness after short face presentation time. The effects of moral behavior and facial appearance on facial attractiveness to increase with the duration of face presentation.

Method

Participants

We recruited a total of 40 Chinese university students from the South China Normal University (25 women, $M_{\text{age}} = 22.50$, $SD = 2.10$) to participate in experimental task. All participants were right-handed and had normal or corrected-to-normal vision. Participants were paid for their participation. All participants gave written informed consent in accordance with the Declaration of Helsinki.

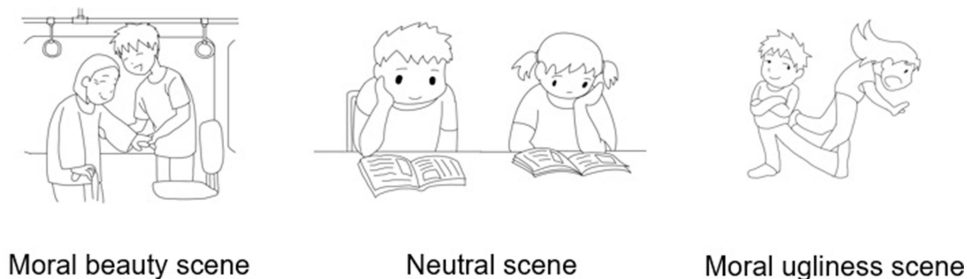


Figure 1 Examples of moral materials used in Experiment I.

Table 1 Descriptive Statistics of Different Attributes of Moral Scenes

Moral Behavior	Attributions			
	Moral Beauty	Artistry	Complexity	Emotional Valence
Moral beauty	6.03±0.83	4.76±0.60	3.93±0.56	5.50±0.80
Neutral	4.09±0.21	4.38±0.60	3.90±0.34	4.24±0.32
Moral ugliness	2.05±0.75	4.56±1.27	3.82±0.55	2.43±0.85
F	211.74***	1.07	<1	112.73***

Note: *** $p < 0.001$.

Design

The experiment used a 2 (facial appearance: attractive, unattractive) \times 3 (moral behavior: beauty, neutral, ugliness) \times 2 (presentation duration: 35ms, 187ms) mixed design, with the first two factors as within-subject and the last as a between-subject factor. The dependent variable was the rating score of facial attractiveness.

Materials

Based on the results of the material ratings, 24 face pictures and 24 moral behavior scene pictures were selected as experimental stimuli.

Procedures

Learning

An associative learning paradigm was used to learn the relationship between the faces and the moral behaviors. Each face was randomly matched to a different moral behavior scene of the same type and appeared twice. Each trial began with a 500ms fixation cross, and then a face was shown for 5000ms, followed immediately by a moral behavior scene (5000ms). Participants were instructed to form impressions of the face in conjunction with the moral behavior depicted.

Facial Attractiveness Evaluation Task

Participants then were shown each face individually in a masked paradigm in which the face was shown for a short duration (35ms / 187ms) and then immediately followed by a masking stimulus. The mask consisted of a scrambled version of the face. The participant was then asked to use a 7-point scale to evaluate the facial attractiveness of the stimulus. Each face was rated twice and the series of stimuli was randomized. The experimental flow chart is shown in Figure 2.

After completing the facial attractiveness assessment with limited presentation durations, participants performed the facial attractiveness evaluation under the condition of unlimited presentation duration. Each trial started with a fixation cross (500ms), followed by a face image, which remained on the screen until a response was made.

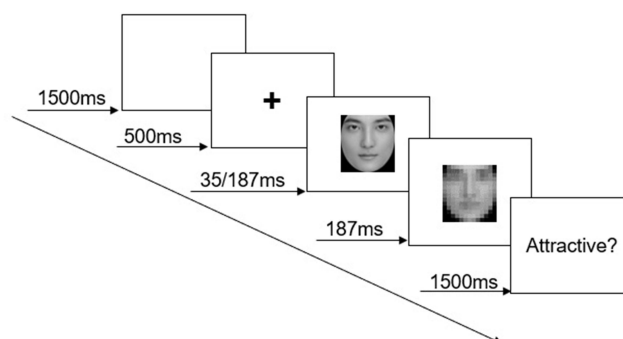


Figure 2 Facial attractiveness evaluation task for Experiment 1. Each trial began with a blank screen (1500ms), followed by a fixation cross (500ms), the face image (35/187ms), a mask image (187ms, scrambled version of the face image), and then a response screen for 1500ms.

Results

Manipulation Check

We first analyzed the experimental data of participants evaluation of facial attractiveness under the unlimited response time condition. The dependent variable was the rating score of facial attractiveness. By performing a 2 (facial appearance: attractive, unattractive) \times 3 (moral behavior: beauty, neutral, ugliness) repeated measures ANOVA, we found that the interaction between facial appearance and moral behavior was significant, $F(2,78) = 11.23, p < 0.001, \eta^2 = 0.22$, see Table 2. Post-hoc analysis showed that under the attractive faces condition, faces presented with moral beauty behaviors ($M = 5.20, SD = 0.84$) were more attractive than faces presented with neutral behaviors ($M = 4.56, SD = 0.79, t(39) = 3.73, p = 0.001, d = 1.19$) and moral ugliness behaviors ($M = 4.46, SD = 0.98, t(39) = 4.25, p < 0.001, d = 1.36$). There was no significant difference in the facial attractiveness evaluation that faces presented with moral ugliness and neutral behaviors conditions ($t(39) = 0.50, p = 0.62, d = 0.16$); Under the unattractive faces condition, faces presented with moral beauty behaviors ($M = 3.38, SD = 1.05$) are more attractive than faces presented with moral ugliness behaviors ($M = 2.37, SD = 0.99, t(39) = 5.49, p < 0.001, d = 1.76$), the difference between the faces presented with moral beauty and neutral behaviors was not significant ($t(39) = 0.10, p = 0.92, d = 0.03$). In the post-hoc analysis, we found that for results with significant differences, they were all large effects ($d > 0.8$), while for results without significant differences, they were all small effects ($d < 0.2$). The main effects of moral behavior and facial appearance were significant, $F(2, 78) = 21.18, p < 0.001, \eta^2 = 0.35$; $F(1,39) = 117.95, p < 0.001, \eta^2 = 0.75$.

Facial Attractiveness Evaluation Task

The results of a 2 (facial appearance: attractive, unattractive) \times 3 (moral behavior: beauty, neutral, ugliness) \times 2 (presentation duration: 35ms, 187ms) repeated measures ANOVA revealed that the three-factor interaction among facial appearance, moral behavior, and presentation duration was not significant, $F(2, 76) = 3.0, p = 0.06, \eta^2 = 0.07$, see Table 3. The interaction between facial appearance and presented duration was also not significant ($F(1, 38) = 2.09, p = 0.16, \eta^2 = 0.05$).

Critically, the interaction between facial appearance and moral behavior was significant, $F(2, 76) = 9.64, p < 0.001, \eta^2 = 0.20$. Post-hoc comparisons showed that under the attractive faces, participants evaluated faces that were presented with moral beauty behaviors ($M = 5.34, SD = 0.61$) more attractive than faces presented neutral behaviors ($M = 4.93, SD = 0.58, t(39) = 4.08, p < 0.001, d = 1.31$) and faces presented with moral ugliness behaviors ($M = 4.76, SD = 0.83, t(39) = 3.92, p < 0.001, d = 1.26$). There was no significant difference between faces presented with moral ugliness and neutral behaviors conditions ($t(39) = 1.32, p = 0.20, d = 0.42$). Under the unattractive faces, participants evaluated faces presented with moral beauty behaviors ($M = 3.31, SD = 0.84$) more attractive than faces presented with moral ugliness behaviors ($M = 2.44, SD = 0.89, t(39) = 5.58, p < 0.001, d = 1.79$), and faces presented with moral ugliness behaviors more unattractive than faces presented with neutral behaviors ($M = 3.41, SD = 0.83, t(39) = 5.78, p < 0.001, d = 1.85$), the difference between faces presented with moral beauty behaviors and faces that presented with neutral behaviors was not significant ($t(39) = 0.74, p = 0.46, d = 0.24$) (Figure 3a). In the post-hoc analysis, we found that for results with significant differences were large effects ($d > 0.8$), while for results without significant differences were small effects ($0.2 < d < 0.5$).

Next, we compared whether the impact of facial appearance and moral behavior on facial attractiveness would change over time. The results indicated that the interaction between moral behavior and presented duration was significant, $F(2, 76) = 3.96, p = 0.02, \eta^2 = 0.10$. Specifically, after 35ms, moral behavior has a significant effect on facial attractiveness ($F(2, 57) = 4.35, p = 0.02, \eta^2 = 0.20$, it was a large effect). Participants evaluated faces presented with moral beauty behaviors ($M = 4.30, SD = 0.53$) more attractive than faces presented with moral ugliness behaviors ($M = 3.86, SD =$

Table 2 ANOVA for the Manipulation Check in Experiment I (N = 40)

Factors	F	p	η^2	Effect Size
Facial appearance	117.95	< 0.001	0.75	Large
Moral behavior	21.18	< 0.001	0.35	Large
Facial appearance \times Moral behavior	11.23	< 0.001	0.22	Large

Table 3 ANOVA for the Facial Attractiveness Evaluation Task in Experiment 1 (N = 40)

Factors	F	p	η^2	Effect Size
Facial appearance	221.78	< 0.001	0.85	Large
Moral behavior	27.83	< 0.001	0.42	Large
Presentation duration	2.55	0.12	0.06	Medium
Facial appearance × Moral behavior	9.64	< 0.001	0.20	Large
Facial appearance × Presentation duration	2.09	0.16	0.05	Small
Moral behavior × Presentation duration	3.96	0.02	0.10	Medium
Facial appearance × Moral behavior × Presentation duration	3.00	0.06	0.07	Medium

0.49, $t(19) = 3.39$, $p = 0.003$, $d = 1.56$). Faces presented with moral ugliness behaviors were rated as more unattractive than faces presented with neutral behaviors ($M = 4.23$, $SD = 0.41$, $t(19) = 3.19$, $p = 0.005$, $d = 1.46$). There was no significant difference between faces presented with moral beauty behaviors and faces presented with neutral behaviors ($t(19) = 0.57$, $p = 0.58$, $d = 0.26$, it was a small effect); After 187ms, moral behavior still had a significant impact on the facial attractiveness ($F(2, 37) = 20.74$, $p < 0.001$, $\eta^2 = 0.53$, it was a large effect). Participants evaluated faces presented with moral beauty behaviors ($M = 4.35$, $SD = 0.60$) more attractive than faces presented with moral ugliness behaviors ($M = 3.35$, $SD = 0.51$, $t(19) = 5.35$, $p < 0.001$, $d = 2.45$), faces presented with moral ugliness behaviors more unattractive than faces presented with neutral behaviors ($M = 4.11$, $SD = 0.63$, $t(19) = 4.83$, $p < 0.001$, $d = 2.22$). There was no significant difference between faces presented with moral beauty behaviors and faces presented with neutral behaviors ($t(19) = 1.79$, $p = 0.09$, $d = 0.82$, it was a large effect) (Figure 3b). In the post-hoc analysis, we found that for results with significant differences were large effects ($d > 0.8$). Additionally, the main effects of facial appearance and moral behavior were significant ($F(1, 38) = 221.78$, $p < 0.001$, $\eta^2 = 0.85$; $F(2, 76) = 27.83$, $p < 0.001$, $\eta^2 = 0.42$). The main effect of presentation duration was not significant, $F(1, 38) = 2.55$, $p = 0.12$, $\eta^2 = 0.06$.

Discussion

In the Experiment 1, we found that after only 35ms of face presentation, moral behavior and facial appearance influenced facial attractiveness. With the increase of face presentation time, the influence of moral behavior and facial appearance on facial attractiveness increased, suggesting that additional visual information was useful for facial attractiveness evaluation. These results were in line with the hypothesis. Although we used visual masks in Experiment 1 to prevent further processing of facial appearance, this may not prevent the extraction of information about already existing moral behavior. To explore the extent to which moral behavior information that has been learned affects facial attractiveness, we conducted Experiment 2. In this Experiment, we manipulated both face presentation time and response deadline.



Figure 3 (a) The interaction effect between facial appearance and moral behavior on facial attractiveness. (b) The interaction effect between moral behavior and presentation duration on facial attractiveness. Error bars represent standard error.

Notes: ** $p < 0.01$, *** $p < 0.001$.

Experiment 2

We adopted a method from previous studies to manipulate the response deadline,^{30,36} specifically, participants were required to evaluate facial attractiveness either within 1500ms or after 3000ms of when the face presented. We expected that moral behavior would still influence facial attractiveness even if response times were limited.

Method

Participants

We recruited a total of 60 Chinese university students from the South China Normal University (33 women, $M_{age} = 21.53$, $SD = 2.03$) to participate in experimental task. All of them were right-handed and had normal or corrected-to-normal vision. Participants were paid for their participation.

Design

The experiment used a 2 (facial appearance: attractive, unattractive) \times 3 (moral behavior: beauty, neutral, ugliness) \times 2 (response deadline: respond within 1500ms, after 3000ms) \times 2 (presentation duration: 35ms, 187ms) mixed design, with the first three factors as within-subject and the last as a between-subject factor. The dependent variable was the rating score of facial attractiveness.

Materials

Materials were the same as Experiment 1.

Procedures

Learning

The experimental procedure in the learning phase was the same as in Experiment 1.

Facial Attractiveness Evaluation Task

The facial attractiveness evaluation task was similar to Experiment 1, except that in addition to manipulating the face presentation duration, we also manipulated the response deadline (Figure 4). In the experiment, each face was randomly repeated twice in the same response deadline condition. The faces were divided into eight blocks of six faces each. The order of the blocks was randomized for each participant. At the beginning of each block, participants were informed

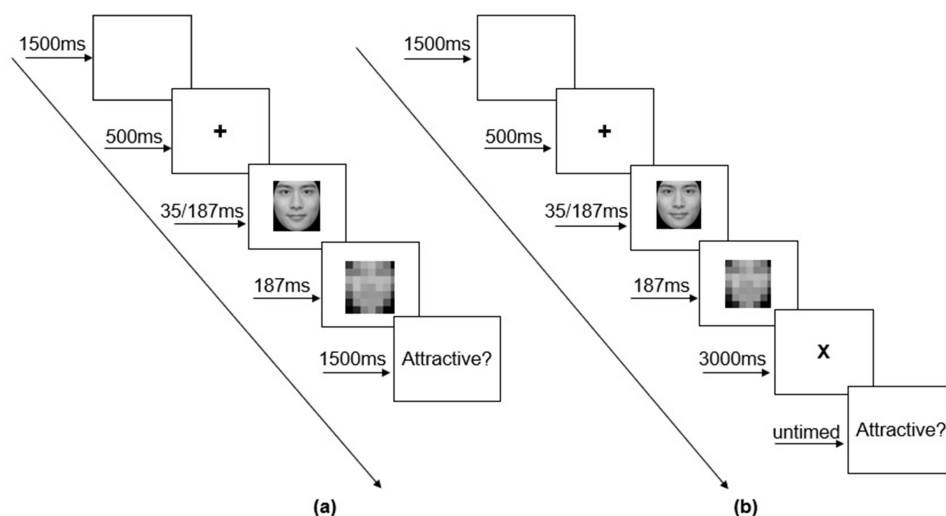


Figure 4 Facial attractiveness evaluation task for Experiment 2. Each trial began with a blank screen (1500ms), followed by a fixation cross (500ms), the face image (35/187ms), a mask image (187ms, scrambled version of the face image). In the low response deadline condition (a, left) the response screen appeared immediately and remained for 1500ms during which the participant was required to make their response. In the high response deadline condition (b, right) the response screen did not appear until after a 3000ms delay (during which a red X appeared on the screen) and the participant had to wait until the screen appeared to make their response.

whether the block was a long response deadline or short response deadline block. The order of faces in each block were randomized, and the order of each block was counterbalanced across participants. During data analysis, the two ratings for each face were averaged together. Since Experiment 1 has confirmed that learning affects facial attractiveness, participants were not required to perform facial attractiveness evaluation under unlimited presentation duration.

Results

The results of a 2 (facial appearance: attractive, unattractive) \times 3 (moral behavior: beauty, neutral, ugliness) \times 2 (response deadline: respond within 1500ms, after 3000ms) \times 2 (presentation duration: 35ms, 187ms) repeated measures ANOVA showed that the four-factor interaction among facial appearance, moral behavior, presentation duration, and response deadline was not significant, $F(2, 116) = 0.35$, $p = 0.71$, $\eta^2 = 0.01$, see Table 4. None of the remaining effects reached significance (facial appearance \times moral behavior \times response deadline: $F(2, 116) = 2.88$, $p = 0.06$, $\eta^2 = 0.05$; facial appearance \times response deadline \times presentation duration: $F(1, 58) = 0.46$, $p = 0.50$, $\eta^2 = 0.01$; moral behavior \times response deadline \times presentation duration: $F(2, 116) = 0.04$, $p = 0.97$, $\eta^2 < 0.01$; facial appearance \times moral behavior \times response deadline: $F(2, 116) = 1.01$, $p = 0.37$, $\eta^2 = 0.02$; facial appearance \times response deadline: $F(1, 58) = 0.41$, $p = 0.53$, $\eta^2 = 0.01$; facial appearance \times presented duration: $F(1, 58) = 2.65$, $p = 0.11$, $\eta^2 = 0.04$; presented duration \times response deadline: $F(1, 58) = 0.15$, $p = 0.71$, $\eta^2 < 0.01$).

Importantly, there was significant interaction between facial appearance and moral behavior ($F(2, 116) = 12.99$, $p < 0.001$, $\eta^2 = 0.20$). Post-hoc analysis indicated that under the attractive faces, participants evaluated faces paired with moral beauty behaviors ($M = 5.10$, $SD = 0.65$) more attractive than faces paired with neutral behaviors ($M = 4.80$, $SD = 0.67$, $t(59) = 4.22$, $p < 0.001$, $d = 1.10$) or faces paired with moral ugliness behaviors ($M = 4.80$, $SD = 0.72$, $t(59) = 3.59$, $p = 0.001$, $d = 0.93$). There was no significant difference between faces paired with moral ugliness behaviors and the faces paired with neutral behaviors ($t(59) = 0.04$, $p = 0.97$, $d = 0.01$). Under the unattractiveness faces, faces paired with moral beauty behaviors ($M = 3.17$, $SD = 0.78$) more attractive than faces paired with moral ugliness behaviors ($M = 2.70$, $SD = 0.77$, $t(59) = 5.72$, $p < 0.001$, $d = 1.49$) or neutral behaviors ($M = 3.10$, $SD = 0.76$), faces paired with moral ugliness behaviors more unattractive than faces paired with neutral behaviors ($M = 3.18$, $SD = 0.76$, $t(59) = 5.61$, $p < 0.001$, $d = 1.46$). There was no significant difference between faces paired with moral beauty behaviors and faces paired with neutral behaviors ($t(59) = 0.16$, $p = 0.88$, $d = 0.04$) (Figure 5a). In the post-hoc analysis, we found that for results with significant differences were large effects ($d > 0.8$), while for results without significant differences were small effects ($d < 0.2$).

Next, we examined whether the face appearance and moral behavior would affect the facial attractiveness, and whether this effect would increase with the increase of face presentation duration. The results showed that there was

Table 4 ANOVA for the Facial Attractiveness Evaluation Task in Experiment 2 (N = 60)

Factors	<i>F</i>	<i>p</i>	η^2	Effect Size
Facial appearance	221.73	< 0.001	0.79	Large
Moral behavior	21.15	< 0.001	0.27	Large
Response deadline	10.38	0.002	0.15	Large
Presentation duration	2.65	0.11	0.04	Small
Facial appearance \times Moral behavior	12.99	< 0.001	0.18	Large
Facial appearance \times Response deadline	0.41	0.53	0.01	Small
Facial appearance \times Presentation duration	2.65	0.11	0.04	Small
Moral behavior \times Response deadline	4.15	0.02	0.07	Medium
Moral behavior \times Presentation duration	4.15	0.02	0.07	Medium
Response deadline \times Presentation duration	0.15	0.71	< 0.01	Small
Facial appearance \times Moral behavior \times Response deadline	1.01	0.37	0.02	Small
Facial appearance \times Moral behavior \times Presentation duration	2.88	0.06	0.05	Small
Facial appearance \times Response deadline \times Presentation duration	0.46	0.50	0.01	Small
Moral behavior \times Response deadline \times Presentation duration	0.04	0.97	< 0.01	Small
Facial appearance \times Moral behavior \times Response deadline \times Presentation duration	0.35	0.71	0.01	Small



Figure 5 (a) The interaction between facial appearance and moral behavior on facial attractiveness. (b) The interaction between moral behavior and presentation duration on facial attractiveness. Error bars represent standard error.

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

significant interaction between moral behavior and presentation duration ($F(2, 116) = 4.15, p = 0.02, \eta^2 = 0.07$). After 35ms, moral behavior has a significant effect on the facial attractiveness ($F(2, 57) = 3.65, p = 0.03, \eta^2 = 0.10$, it was a medium effect). Faces paired with moral beauty behaviors ($M = 4.12, SD = 0.37$) more attractive than faces paired with moral ugliness behaviors ($M = 3.89, SD = 0.46, t(29) = 4.13, p < 0.001, d = 1.53$). Faces paired with moral ugliness behaviors more unattractive than faces paired with neutral behaviors ($M = 4.11, SD = 0.57, t(29) = 2.45, p = 0.02, d = 0.91$). There was no significant difference between faces paired with moral beauty behaviors and faces paired neutral behaviors ($t(29) = 0.07, p = 0.95, d = 0.03$); After 187ms, moral behaviors still had a significant impact on the facial attractiveness, and this impact was more significant strong ($F(2, 57) = 19.19, p < 0.001, \eta^2 = 0.40$, it was a large effect). Faces paired with moral beauty behaviors ($M = 4.15, SD = 0.49$) were more attractive than faces paired with neutral behaviors ($M = 3.87, SD = 0.42, t(29) = 3.94, p < 0.001, d = 1.46$) or faces paired with moral ugliness behaviors ($M = 3.61, SD = 0.49, t(29) = 4.71, p < 0.001, d = 1.75$), faces paired with moral ugliness behaviors were more unattractive than faces that paired with neutral behaviors ($t(29) = 2.87, p < 0.01, d = 1.07$) (Figure 5b). In the post-hoc analysis, we found that for results with significant differences were large effects ($d > 0.8$), while for results without significant differences were small effects ($d < 0.2$).

For the response deadline, we were interested in whether the effect of facial appearance, and especially the effect of moral behaviors, would be observed under the response deadline condition. We found that the interaction between moral behavior and response deadline was significant ($F(2, 116) = 4.15, p = 0.02, \eta^2 = 0.10$). Post-hoc analysis showed that under the response deadline condition, moral behavior affected facial attractiveness ($F(2, 57) = 6.77, p = 0.002, \eta^2 = 0.20$, it was a large effect). Faces paired with moral beauty behaviors ($M = 4.00, SD = 0.49$) were more attractive than faces paired with moral ugliness behaviors ($M = 3.75, SD = 0.55, t(59) = 3.58, p = 0.001, d = 0.93$, it was a large effect). Faces paired with moral ugliness behaviors were more unattractive than faces paired with neutral behaviors ($M = 3.92, SD = 0.56, t(59) = 2.37, p = 0.02, d = 0.62$, it was a medium effect). There was no significant difference between faces paired with moral beauty behaviors and faces paired with neutral behaviors ($t(59) = 1.48, p = 0.14, d = 0.39$, it was a medium effect); Under the no response deadline condition, moral behaviors also affected facial attractiveness ($F(2, 57) = 15.19, p < 0.001, \eta^2 = 0.35$, it was a large effect). Faces paired with moral beauty behaviors ($M = 4.27, SD = 0.53$) were more attractive than faces paired with moral ugliness behaviors ($M = 3.75, SD = 0.58, t(59) = 5.43, p < 0.001, d = 1.41$) and faces paired with neutral behaviors ($M = 4.03, SD = 0.56, t(59) = 3.49, p = 0.001, d = 0.91$). Faces paired with moral ugliness behaviors were more unattractive than faces paired with neutral behaviors ($t(59) = 3.14, p = 0.003, d = 0.82$). They were all large effects ($d > 0.8$). These results revealed that moral information has a greater effect on facial attractiveness in the no response deadline condition.

Additionally, there were significant main effects of facial appearance, moral behavior, and response deadline ($F(1, 58) = 221.73, p < 0.001, \eta^2 = 0.79$; $F(2, 116) = 21.15, p < 0.001, \eta^2 = 0.27$; $F(1, 58) = 10.38, p = 0.002, \eta^2 = 0.15$). There was no significant main effect of presentation duration ($F(1, 58) = 2.65, p = 0.11, \eta^2 = 0.04$).

Discussion

In Experiment 2, we found that the effect of moral behavior on facial attractiveness increased with increasing response deadline. In contrast, the effect of facial appearance on facial attractiveness did not increase with increasing response deadline. These results were in line with a previous study,³⁶ and it supports the hypothesis that a longer deadline would lead to greater memory retrieval and processing of moral information that would then increase the effect of moral behavior on facial attractiveness.

General discussion

This study adopted the association learning paradigm combined with the masking paradigm to investigate the influence of moral behavior and facial appearance on facial attractiveness ratings under conditions that association information was difficult to retrieval. These conditions included rapid face presentation and a response deadline. The results showed significant main effects of facial appearance and moral behavior in all experiments, which indicated that both factors affected ratings of facial attractiveness.

Moreover, we found that facial appearance significantly affected facial attractiveness even after the short face presentation time. These results indicated that facial appearance plays a key role in facial attractiveness assessment, which is consistent with previous studies.^{11,41,42} We also found that moral behavior still affected the facial attractiveness after manipulating the presentation duration of faces, suggesting that moral behavior continues to influence facial attractiveness even when faces were difficult to identify. In addition, we found that the effects of both moral behavior and face appearance on facial attractiveness increased as face presentation time increased. These results indicated that additional visual information is useful for facial attractiveness ratings, which was consistent with previous studies.^{30,36} After manipulating both face presentation time and response deadline, we found that as response time increased, the influence of moral behavior on facial attractiveness increased, but the influence of facial appearance on facial attractiveness did not. These results suggested that the additional processing time may have facilitated the retrieval of behavioral association.

More importantly, we found a significant interaction between facial appearance and moral behavior under limited presentation time. These results provided support for our hypothesis that the influence of moral behavior on facial attractiveness was regulated by facial appearance. Overall, the results of two experiments confirm to some extent the stereotype that good is beautiful. Besides, our results further indicated that the role of moral behavior in impressions formation may go beyond the attractiveness of the face itself, as found in previous studies.^{38,39,43}

The results of this study further supported the stereotype that good is beautiful, and are of great significance for a better understanding of this stereotype. Meanwhile, the results revealed that moral behavior continued to affect facial attractiveness. The current study extends prior findings by further confirming the crucial role of moral behavior in facial attractiveness evaluation. Furthermore, our results support the notion that the knowledge acquired through learning has a strong influence on aesthetic experience in the form of top-down processing.⁴²

It is important to mention that this study also has several limitations. First, we only used men's faces as experimental materials, and therefore whether the same results exist for women's faces remains to be further studied. Although previous studies on impression formation also used only men's faces as experimental stimuli,^{36,38} future studies could consider using women's faces as experimental materials. Second, static moral behavior scenes were used in this study, but moral behavior in real life mostly occurs in dynamic situations. Therefore, future research could also consider combining dynamic face and moral behavior scenes to further enhance the ecological validity of the experiment.

Conclusion

In conclusion, the results of this study showed that the behavioral information obtained through learning has a strong impact on facial attractiveness. The evaluation of facial attractiveness is not only affected by the physical characteristics of the face itself, but also by moral behavior. Under conditions where association was difficult to retrieve, moral behavior continued to influence facial attractiveness. Taken together, these results suggest that learned moral behaviors may easily

influence facial attractiveness. Moral behaviors affect facial attractiveness in a top-down processing manner, and physical features of faces affect facial attractiveness in a bottom-up processing manner. This study helps to further clarify the relationship between moral behaviors and facial attractiveness, and provides a new perspective to understand the influence of moral behavior on facial attractiveness.

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Disclosure

The authors declare that they have no competing interests in this work.

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