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Facial Impressions and Facial Memory: Evidence for Potential Factors Mediating the Effects of Distinctiveness and Attractiveness

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Using photographs of male faces, the present study investigated the influence of the impressions they created together with their attractiveness and distinctiveness on the memorability of the faces. The faces were rated by the first group of participants using the semantic differential method. Factor analysis with the varimax rotation extracted three factors of 'activeness', 'potency', and 'evaluation'. The second group of participants rated the attractiveness and distinctiveness of those same faces. Next, the third group of participants was presented with photographs of same faces and they then performed a yes-no recognition test. It was found that faces with a low rating of activeness and faces with a low rating of evaluation produced a high rate of recognition. It was the activeness factor that showed the largest effect on the memorability of faces. The evaluation factor was found to have the greater effect than potency factor on the memorability of the faces, while the contribution ratio of evaluation was smallest in factor analysis of all the rated impressions. Attractiveness was found to be correlated with evaluation and activeness; it was also found that attractiveness affected recognition. Distinctiveness did not affect recognition because it was correlated only with potency which had no significant effect on recognition. Accordingly, it is highly likely that impression factors moderate facial memory, and hence mediate the effects of attractiveness and distinctiveness.

Key words: face, recognition, impression, attractiveness, distinctiveness

Introduction

When we memorize a face, there may be several factors which influence face recognition. Many researchers have thought that facial attractiveness and distinctiveness affect face recognition.

There are various theories about the relationship between facial attractiveness and recognition. Some researchers have maintained that highly attractive faces are easily recognized (Cross, Cross & Daly, 1971), while in contrast, other researchers have reported that as facial attractiveness increases, recognizability decreases (Light, Hollander & Kayra-Stuart, 1981). Moreover, Shepherd and Ellis (1973) have claimed that both faces with a high rating of attractiveness as well as those with a low rating of attractiveness are easy to remember even after a long duration of 35 days. However, Light et al. (1981) used only male faces, while Shepherd and Ellis (1973) used only female faces. Therefore it could be regarded that there are different

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factors at work in the recognition of male and female faces.

The term 'distinctive' when used to describe faces simply implies characteristic faces and this distinctiveness has often been portrayed to the participants by asking them to assess how easily they think a particular face would stand out in a crowd (Sarno & Alley, 1997; Valentine & Bruce, 1986). It can also be assumed that distinctive faces are located on the periphery of the encoded face space (Valentine, 1991; Johnstone, Milne & Williams, 1997), and so it is possible that such faces possess many cues for helping us remember them. It has been reported that faces which are rated as highly distinctive are recognized more correctly than faces rated as typical (Bartlett, Hurry, & Thorley, 1984; Light, Kayra-Stuart, & Hollander, 1979).

It is thought that both faces with a high rating of attractiveness as well as those with a low rating of attractiveness are more memorable due to their facial distinctiveness. That is, attractiveness and distinctiveness may interactively affect memorability. However the relationship between attractiveness and distinctiveness is also controversial. In the experiment of Bruce, Burton, and Dench (1994), no significant correlation was found between attractiveness and distinctiveness. Sarno and Alley (1997) indicated that attractiveness scarcely influenced recognition performance, whereas distinctiveness strongly affected the memory of faces. Yarmey (1979) showed that women with a high rating of attractiveness and men with a low rating of attractiveness were identified easily, and that women with a low rating of distinctiveness and men with a high rating of distinctiveness were also remembered easily. These studies suggest that there may be sex differences with regard to which factor facilitates facial memory, attractiveness or distinctiveness. One possibility is that physical saliency seems to be important for recognizing male faces, while the evaluative perspective is important for female faces. However, there is no firm view as to the manner in which attractiveness and distinctiveness really work on facial memorability.

Moreover, the above-mentioned research entails several problems. First, the definition of attractiveness and distinctiveness differed among the researchers. Second, measurement of these concepts also varied among the experiments. In addition, it was reported that there was no significant correlation between attractiveness and distinctiveness (Bruce, Burton, & Dench, 1994). Accordingly, there would seem to be a great variety of opinions about the relationship between attractiveness and distinctiveness, and their interactive effects on recognition.

In our research, we investigated how the multiple impressions induced from the face influence face recognition and interact with attractiveness and distinctiveness. There have been many studies where facial impressions were measured by the semantic differential (SD) method developed by Osgood, Suci and Tannenbaum (1957). They maintained that affective meanings of various concepts could be explained by three main factors, these being activity, potency and evaluation. Some researchers have confirmed that facial impressions could also be explained by three factors like them (Hakoda, Haraguchi, Yoshizaki, Oda, & Akamatsu, 2000). However, there has been little research concerning the influence of facial impressions on recognition memory. In real-life situations, there may be several kinds of 'attractive' people, some being active and attractive, whereas others are elegant and attractive. Similarly, distinctiveness might entail various aspects of impression. Therefore, by investigating the effects of multiple facial

impressions and their relationship to attractiveness or distinctiveness, we have attempted to clarify those potential factors which interactively affect the facial recognition performance.

Experiment 1: Impression rating

Impression ratings of Japanese male faces were performed by the SD method and the target faces for the memory task were selected in Experiment 1. At first, all the faces were rated using multiple adjective scales, and then the main factors were extracted from the multiple data by factor analysis. Based on the magnitude of factor scores, the target faces were chosen and divided into three groups which had low, middle, and high properties for each factor dimension. Although only male faces were used in the present study, we asked both male and female participants to judge the impressions in order to deal with the possible sex difference of ratings.

Method

Participants

The total participants comprised 60 undergraduate and graduate students (36 males and 24 females), but 30 of them rated only half of all the stimuli, while the other 30 rated the other half.

Stimuli

The stimuli consisted of 48 monochromatic photographs of adult Japanese males. The faces did not show any expressions, they wore no accessories (pierced earrings etc.) and they did not have showy hairstyles. Eight men wore glasses. All the photographs were frontal faces, and scanned into a personal computer and their size and the contrast of the photographs were equated as much as possible.

Procedure

At first, we performed a preliminary study in order to choose the appropriate adjectives to use in the impression-rating task. Based on a previous study (Inoue & Kobayashi, 1985), 30 adjective-pairs were chosen as 7-point scales, which were considered to be suitable for the impression judgment of faces. A pilot factor analysis was performed for the faces in terms of the principal factor method using the varimax rotation. Based on the communality and factor loadings obtained, 18 adjective pairs were chosen and used in the impression ratings.

The all face photographs were printed out onto A6 size paper and put into transparent cases. Two types of presentation order were prepared in order to reduce the effect of the order in which the stimuli were presented. The face photographs were presented to the participants in such a manner that similar facial features of faces were not presented in succession. As to the rating papers, three kinds of patterns containing a different order of the adjectives and their polarities were prepared and assigned to an equal number of participants.

Results and Discussion

Factor analyses were performed on the rating data. At first, the data were analyzed separately for the male and the female participants. With both the male and female data, three factors were extracted in terms of the principal factor method using the varimax rotation. These

were named ‘activeness’, ‘potency’, and ‘evaluation’. Since very similar factor structures were revealed, so subsequent analysis was performed with the combined data of both sexes. Table 1 shows the results of factor analysis. The contribution ratios for the three factors were 26.65% for activeness, 15.31% for potency, and 11.78% for evaluation.

Table 1. Extracted factors from the data of impression ratings.

Factor	Activeness		Potency		Evaluation	
	Adjective	Factor loading	Adjective	Factor loading	Adjective	Factor loading
Representative adjective and factor loading	cheerful-dismal	.81	masculine-feminine	.72	elegant-unrefined	.68
	extraverted-introverted	.80	powerful-weak	.66	calm-nervous	.65
	showy-plain	.72	violent-mild	.58	excellent-incapable	.60
	free-not free	.71	soft-hard	.58		
Eigen value	4.80		2.76		2.12	
Contribution of each factor	26.65		15.31		11.78	
Cumulative contribution	26.62		41.96		53.74	

The activeness factor contains some attention-gathering meanings, such as ‘showy-plain’ and ‘cheerful-dismal’. The potency factor portrays a kind of energy such as ‘powerful-weak’ and ‘masculine-feminine’. These two factors seem to be mainly judged based on the external appearance of faces. In contrast, the evaluation factor contains some adjectives, such as ‘elegant-unrefined’, ‘calm-nervous’, and ‘excellent-incapable’. These adjectives would seem to represent the inner characteristics of the person rather than the appearance of their faces. It can be thought that viewers use both external information and internal information to describe the impression given by a face.

Next, we chose 24 faces to be used as target stimuli in the recognition tests, based on their properties with regard to the three factors. Then, the target stimuli were categorized into three groups, each comprising eight faces for each factor following the magnitude of factor scores of activeness, potency, and evaluation. For activeness, the mean factor scores of low, middle, and high groups were -0.695, 0.109, and 0.771, respectively ($F(2, 118) = 187.807, p < .001$). For potency, they were -0.924, 0.002, and 0.775, respectively ($F(2, 118) = 225.960, p < .001$). For evaluation, they were -0.500, 0.121, and 0.683, respectively ($F(2, 118) = 133.229, p < .001$). As described later, the recognition performances were compared between these three groups. The other 24 faces, which were located around the center of the factor space, were chosen as distractor stimuli.

Experiment 2: Attractiveness and distinctiveness rating

Using the target faces selected in Experiment 1, distinctiveness and attractiveness ratings were conducted with a different group of participants. The relationships between these two ratings and three factor scores were investigated by calculating correlations and by multiple regression analysis. The faces were then divided into three groups (low, middle and high) according to the rating scores of attractiveness and distinctiveness.

Method

Participants

The participants comprised 40 undergraduate and graduate students (20 men and 20 women) who had not taken part in the impression rating of the faces in Experiment 1.

Stimuli

The 24 photographs of faces that had been previously selected as target stimuli in Experiment 1 were used. The stimuli were again printed out in A6 size.

Procedure

The participants rated attractiveness for 12 of the 24 faces and distinctiveness for the other 12 faces which were randomly chosen for each participant. The participants were asked to categorize each face based on 5 levels (from 1: least attractive / distinctive to 5: most attractive / distinctive). We instructed the participants to rate the faces on the basis of 'how attractive you find each face' for the attractiveness rating, and 'how easily do you think you could spot each face in a crowd' (Valentine & Bruce, 1986; Sarno & Alley, 1997) for the distinctiveness rating. The ratings were conducted after looking at all of the 12 faces and comparing each of the faces. Half the participants rated attractiveness first and then distinctiveness. The other half rated distinctiveness first, later attractiveness.

Results and Discussion

We examined the relationships among the ratings for attractiveness, distinctiveness and the three impression factors in the three analyses listed below.

Analysis 1: The relationship between attractiveness and impression factors

We calculated the correlation coefficients between attractiveness ratings and the three impression factor scores, and found that there were significant correlations between the attractiveness and the activeness ($r = 0.658, p < .001$), and between attractiveness and evaluation ($r = 0.567, p < .005$). On the other hand, attractiveness and potency showed no significant correlation ($r = -0.213, p = .317$).

We also conducted multiple regression analysis of the attractiveness rating with the impression factor scores as predictors. The regression was significant ($R^2 = 0.728, p < .001$) and all of the three factors (activeness, potency, and evaluation) showed significant standardized partial regression coefficients, 0.533 ($p < .001$), -0.306 ($p < .05$), and 0.550 ($p < .001$),

respectively. These analyses indicated that the faces with higher activeness and evaluation had increasing attractiveness.

Analysis 2: The relationship between distinctiveness and impression factors

Next, we calculated the correlation coefficients between the distinctiveness ratings and the three impression factor scores, and found that only the correlation between distinctiveness and potency was significant ($r = 0.514$, $p < .05$).

Multiple regression analysis of the distinctiveness ratings with the impression factor scores as predictors was performed again, and it was revealed that the regression coefficient was significant ($R^2 = 0.406$, $p < .05$) and only the potency factor showed significant standardized partial regression coefficients (3.421, $p < .005$). From these results, it can be said those faces which had a high potency rating also had a high distinctiveness rating.

Analysis 3: The relationship between attractiveness and distinctiveness

Finally, we calculated the correlation coefficients between attractiveness and distinctiveness ratings. It was found that there was no significant correlation ($r = 0.045$, $p = .835$), this result being consistent with the findings of a previous study (Bruce, Burton, & Dench, 1994).

Then, for the recognition test, the 24 faces chosen as target stimuli were categorized into three groups of eight faces based on their attractiveness and distinctiveness ratings. The mean scores of attractiveness were 1.506 for the low, 2.737 for the middle, and 3.91 for the high group ($F(2,48) = 169.05$, $p < .001$), while the mean scores of distinctiveness were 1.895 for the low, 3.127 for the middle, and 4.135 for the high group ($F(2,48) = 129.263$, $p < .001$). As described later, the recognition performances were compared between these three groups.

Experiment 3: Recognition test

We performed a recognition test in order to examine which one of the five variables (comprising three impression factors plus attractiveness and distinctiveness) most affected facial recognition. We also investigated the sex difference of participants in the recognition performance, since it has been pointed out that there may be a viewer's sex difference with regard to recognizing faces (Hakoda, Haraguchi, Yoshizaki, Oda, & Akamatsu, 2000; McKelvie, 1981).

Method

Participants

The participants comprised 40 undergraduate and graduate students (20 men and 20 women), who had not taken part in the impression rating and distinctiveness or attractiveness rating of the faces.

Stimuli

From among the male Japanese faces previously selected, 24 photographs were used for targets, while another 24 were used for distractors. The stimuli were presented on a 15-inch computer display using slide-display software. The stimuli size was 10.0 cm × 10.0 cm. The screen resolution was 1,253 pixels/cm². The viewing distance was about 40 cm. Two types of slide order (Type A, Type B) were prepared in order to reduce any possible effect of the presentation order.

Procedure

In the study phase, the participants were presented with the 24 target faces for 2 sec each on the computer display in succession, and instructed to memorize them. After each stimulus was shown, an interval of 1 second was provided by a black slide before the next stimulus was shown. After presenting all the targets, a simple addition task was performed for 5 minutes as an inserted task. The participants had to perform the calculation task between the study phase and the recognition test in order to prevent rehearsals of the studied items. During the recognition phase, 48 faces (24 target faces mixed with 24 distractor faces) were presented one by one, and the participants were asked to answer whether the face had already been seen (old) or not (new) during the study phase. The participants were tested for the 24 targets in the recognition task and the percentage of correct responses was computed as the recognition performance.

Results

At first, in order to examine whether there was any significant difference according to the main effect of a stimulus presentation order or not, we carried out an ANOVA test, which contained the presentation order (Type A, Type B) as a factor. Consequently, it was found that there was a tendency but not a significant difference in recognition ratios ($F(1, 19) = 3.489, p < .10$). Therefore, the data obtained from Type A and Type B order were combined in the subsequent analysis.

Analysis 1: Recognition performance and impression factors

Figure 1 shows the recognition performances for each group of faces that were categorized depending upon the magnitude of each impression factor. Two-way ANOVA test (participants' sex: male, female × face group: high, middle, low) were performed on each factor.

With regard to the factor of activeness, it was found that there was a significant main effect of the face groups ($F(2, 38) = 4.261, p < .05$). Faces with a low rating of activeness produced a significantly higher recognition performance than the faces with a middle rating of activeness ($MSe = 0.019, p < .05$). Main effect of participants' sex and interaction of participants' sex and face group were not significant ($F(1, 19) = 0.126, p = .726; F(2, 38) = 0.289, p = .751$).

Concerning the factor of potency, no significant effect of participants' sex, face group and no significant interaction of them were found on the recognition performance ($F(1, 19) = 0.126, p = .726; F(2, 38) = 2.424, p = 0.102; F(2, 38) = 0.1, p = .905$).

With regard to the factor of evaluation, there was a significant main effect of the face group ($F(2, 38) = 3.804, p < .05$). Faces with a rating of low evaluation produced a significantly higher

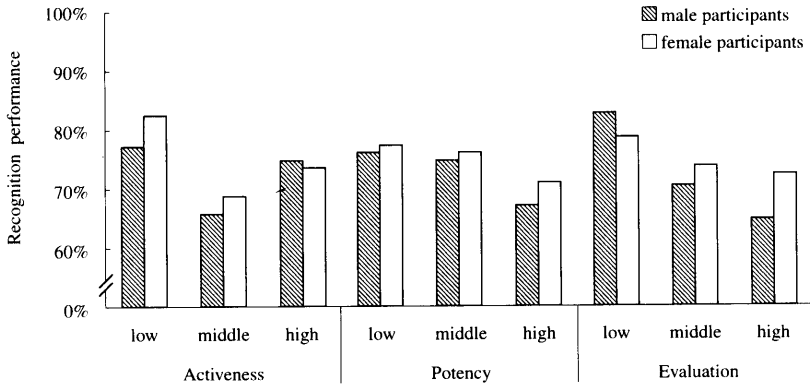


Figure 1. Recognition performance in relation to activeness, potency, and evaluation.

recognition performance than the faces with a high rating of evaluation ($MSe = 0.019$, $p < .05$). There were no significant main effect of participants' sex and interaction of participants' sex and face group ($F(1, 19) = 0.126$, $p = .726$; $F(2, 38) = 0.873$, $p = .426$).

Analysis 2: Recognition performance in relation to attractiveness

In order to examine differences in the recognition performance produced by the perceived attractiveness, the three categories of faces prepared in previous analysis (Experiment 2) were used. As is shown in Figure 2, there was a significant main effect of attractiveness ($F(2, 38) = 3.36$, $p < .05$). Faces with a low rating of attractiveness tended to provide the higher recognition performance than faces with a high rating of attractiveness ($MSe = 0.0148$, $p < .05$). Main effect of participants' sex and interaction of participants' sex and face group were not significant ($F(1, 19) = 0.126$, $p = .726$; $F(2, 38) = 0.144$, $p = .866$).

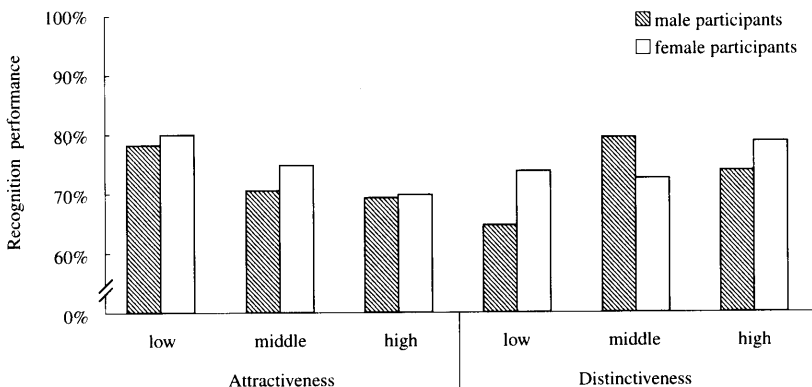


Figure 2. Recognition performance in relation to attractiveness and distinctiveness.

Analysis 3: Recognition performance in relation to distinctiveness

We analyzed the recognition performance according to the three groups of distinctiveness (Experiment 2). The results are shown in Figure 2. There were no significant main effect of participants' sex and face group ($F(1, 19) = 0.126, p = .726$; $F(2, 38) = 1.462, p = 0.245$) and no significant interaction of them ($F(2, 38) = 1.592, p = .217$).

So far, we have investigated the effects of activeness, potency, evaluation, attractiveness and distinctiveness on the face recognizability. On the whole, participants' sex did not show significant effect on recognition. This result is not in accordance with the results of previous research (Yarmey, 1979). Of all the five variables tested, it was the activeness factor that had the biggest effect on the recognition performance, and next, the evaluation factor. Potency was the second large factor of impression rating, but it did not have a significant effect on recognition.

General Discussion

We found that there were three factors underlying facial impressions and we named them 'activeness', 'potency', and 'evaluation', based on the previous study of the semantic differential method (Osgood et al., 1957). Factors similar to ours have also been reported in several other studies (Hakoda et al., 2000; Lundqvist, Esteves, & Ohman, 1999).

These impression factors did not affect recognition in the same order as their factor loadings. Activeness and evaluation affected the recognition performance, while potency had no significant effect on it. Evaluation factor, which is the third factor with a relatively lower contribution ratio, had the larger influence on the recognition performance, compared with potency, that had higher contribution ratio in the impression rating. Thus, the factor which has a large influence on the impression rating did not necessarily correspond to the factor which affected the recognition memory. Therefore, it would seem that different determinants are involved in the impression rating of faces and in their recognition.

Low evaluation refers to impressions described by adjectives such as tacky, incompetent and restless. Such faces might include a sign of possible violence or some negative behavior. Consequently, it is highly likely that participants tend to pay a great deal of attention to such faces.

In the present study, attractiveness negatively affected face recognition. Faces with a low rating of attractiveness were remembered more easily than faces with a high rating of attractiveness. These results are in line with the findings of a previous study of Light et al. (1981). They used only male faces, as did the current study. Since other studies using female faces or faces of both sexes (Cross et al., 1971; Shepherd et al., 1973) showed different results from ours, it would seem that the sex of the faces is an important factor for recognition of attractive faces.

No significant correlation was found between attractiveness and distinctiveness, similar to the findings of Bruce et al. (1994). Accordingly, it could be said that attractive faces are not always conspicuous. Some researchers have reported that typical or average faces tend to be rated as being more attractive (Light et al., 1981). They maintained that attractive faces were difficult to

recognize because of their typicality. In our research too, faces with a high rating of attractiveness were not recognized easily, whereas faces with a low rating of attractiveness were more recognizable.

Our data show that attractiveness is correlated with the factors of activeness and evaluation. Both highly active faces and highly evaluative faces were rated as being more attractive. In the present research, activeness corresponds to the impression of vividness and cheerfulness as induced from facial appearance. Evaluation refers to the impression of elegance or competence. These features are close to social desirability and are therefore likely to be rated as highly attractive. In contrast, the potency factor was not correlated with attractiveness. Potency implies masculinity and powerfulness which are not likely to be connected with a high rating of attractiveness, since there is the possibility that masculinity may increase some negative impressions, such as perceived dominance and dishonesty (Perrett, Lee, Penton-Voak, Rowland, Yoshikawa, Burt, Henzi, Castles & Akamatsu, 1998).

On the other hand, distinctiveness did not have any significant effect on recognition, although previous studies (Bartlett et al., 1984; Light et al., 1979) have reported a stronger effect of distinctiveness than suggested by the current results. It is thought that previous research used a broader range of faces than that used in our current research, since we chose faces based on variations of multiple impressions, not by simply focusing on distinctiveness. Distinctiveness showed a correlation only with potency, which had no significant effect on memorability. This may be the second reason why distinctiveness failed to affect face recognition.

To conclude, the present study indicates that attractiveness which was correlated with activity and evaluation, affected recognition performance, while distinctiveness which was correlated only with potency, did not affect recognition. Therefore it would seem that attractiveness and distinctiveness do not simply affect recognition themselves, but work interactively with other impression factors to affect recognition.

As described above, some researchers have reported that facial attractiveness affects recognition, while others have reported negative results. Most of the previous studies have been concerned only with attractiveness and distinctiveness. However, we have concluded that it is difficult to discuss their influence on the memory of faces accurately without considering other potential impression factors. Our study has indicated that the factors of activeness and evaluation have a much greater influence on memorability than any of the other variables. It is highly likely that such impression factors moderate facial memory and hence mediate the effects of attractiveness and distinctiveness.

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