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# Hemi-field memory for attractiveness

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**ABSTRACT**

In order to determine whether or not facial attractiveness plays a role in hemispheric facial memory, 35 right-handed participants first assigned attractiveness ratings to faces and then performed a recognition test on those faces in the left visual half-field (LVF) and right visual half-field (RVF). We found significant interactions between the experimental factors and visual half- field. There were significant differences in the extreme ends of the rating scale, that is, the very unattractive versus the very attractive faces: Female participants remembered very attractive faces of both women and men, with memory being superior in the RVF than in the LVF. In contrast, the male participants remembered very unattractive faces of both women and men; RVF memory was better than the LVF for women faces while for men faces memory was superior in the LVF. The interactions with visual half-field suggest that hemispheric biases in remembering faces are influenced by degree of attractiveness.

## INTRODUCTION

Functional brain asymmetry is an organizational principle of the human mind known as hemispheric specialization. Broadly put, while the left hemisphere specializes in language production and comprehension, and analytic and detailed cognitive processes, the right hemisphere specializes in visuo-spatial knowledge, facial memory and identification, and gestalt cognitive strategies. Left-right asymmetries are present throughout the human body as well, and their origin is attributed to evolutionary brain adaptation associated with communication and tool use. In humans we have manual dominance, ocular dominance, foot asymmetries, testicular and breast asymmetries (Corballis, 1991; Kimura, 1992) and face expressiveness (Benson & Laskin, 2001; Zaidel, et al., 1995). Hemispheric specialization is associated in more or less predictable ways in relation to bodily asymmetries. For example, manual dominance is strongly correlated with cerebral dominance for language, while for ocular dominance the correlations with cerebral dominance are weak (Kimura, 1992). In this paper we will explore functional brain asymmetry in recognition memory for attractive versus non-attractive faces through the use of the hemi-field technique.

The hemispheric role in attractiveness and facial recognition is poorly understood. There has also been paucity of research on the relationship between facial attractiveness and memory in the general psychological literature. However, there was a peak in interest by experimental psychologists in facial attractiveness and memory in the 1970's and 1980's that resulted in two major claims. The first claim originated with Galton's 1907 hypothesis (Galton, 1907); it states that very attractive people are characterized by a more typical appearance, and thus are harder to remember than less attractive people (Cutler & Penrod, 1989; Langlois & Roggman, 1990; Light, et al., 1981; Mueller, et al., 1984; Sarno & Alley, 1997). This claim supports the distinctiveness effect on facial recognition performance. Conversely, Shepherd & Ellis (Shepherd & Ellis, 1973) claimed that it is the attractiveness factor that has an effect on facial recognition

performance, that is, both very attractive and very unattractive people are characterized by distinctive features, and are easier to remember than people with average attractiveness. Thus, they proposed that the relationship between attractiveness and facial recognition performance is a U-shaped curvilinear function with faces of average attractiveness being least distinctive and most difficult to remember.

Other factors such as the salience of different facial features, context similarity, the amount of change in facial appearance, and the likeability of facial features have been proposed to explain memory for faces in general (Bruce, 1988; Laughery, et al., 1971; Mueller, et al., 1984; Sommer, et al., 1995; Yarmey, 1979). However, with regards to the relationship between memory and facial attractiveness, research has clearly revolved around the issue of distinctiveness versus attractiveness, with distinctiveness being favored. For example, various studies revealed a significant positive correlation between attractiveness and distinctiveness but no significant correlation between attractiveness and facial recognition performance (Brigham, 1990; Cutler & Penrod, 1989; Sarno & Alley, 1997). Yet, it should be noted that no significant correlation between attractiveness and facial recognition performance was recorded due to the fact that their range of attractiveness excluded the very attractive and very unattractive faces. Further, in Light et al.'s 1981 study, only Caucasian male participants were included and the facial stimuli differed in angle of orientation and facial features (e.g., eyeglasses, facial hair). Lack of uniformity across studies explains the conflicting results regarding distinctiveness and attractiveness and their effects on recognition performance.

Previously, findings of facial asymmetry in attractiveness (Zaidel, et al., 1995), expressiveness (Zaidel, et al., 1995), identity (Chen, et al., 1997), and health appearance (Reis & Zaidel, 2001) were interpreted against a background of the co-evolution in humans of hemispheric specialization and facial adaptation for purposes of face-to-face communication. In the attractiveness asymmetry study (Zaidel, et al., 1995) we found a sex-related difference with only women's faces showing the asymmetry (right-right was

judged more attractive than left-left). In the present study, we wished to explore the hemispheric status in recognition memory for attractive versus non-attractive faces of women's as well as men's faces by female and male participants. We used front view stimuli and compared participants' attractiveness ratings of these faces to their hemi-field memory for the very same faces. Given the results reported in the general psychological literature described above, we were interested in the extreme ends of the attractiveness scale. In addition, we were interested in the way that the sex of the participants interacts with some of the variables in our study. Indeed, the results revealed several statistical interactions with participant sex.

## METHODS

### Participants

Our study had 35 right-handed participants (18 females, 17 males); they were undergraduate students enrolled in introductory psychology classes at the University of California, Los Angeles. They had lived in an English-speaking country for the 7 years prior to the beginning of this study and they participated in exchange for partial course credit.

### Materials

A total of 56 front view black and white photographs, half of women and half of men, were used. Their attractiveness level was previously determined on a 5-point Liker scale and the 56 faces were chosen out of a larger rated set. The 28 target faces (to-be-remembered) and the 28 decoy faces (used later in the recognition test phase) were matched as closely as possible on the basis of the attractiveness rating.

### Procedures

Participants viewed faces on a Macintosh IIsi computer. In the first phase of this experiment, they were asked to rate the attractiveness of 28 target faces (14 women’s faces, 14 men’s faces) on a 5-point Liker scale, with1 being very unattractive and 5 being very attractive. Each face stayed on the computer screen while it was rated for 5 seconds and participants indicated their judgment with a button press on the keyboard. Within

each participant sex, half the participants used the right index finger and half used their left index finger.

Immediately after the attractiveness rating phase, the hemi-field recognition memory test began. The 28 faces from the first phase plus another 28 faces serving as the decoys (never seen by the participants) were now intermixed in a single series. They were flashed on the computer screen one at a time, either to the left or right of a central fixation point randomly while participants decided whether or not they remembered each face. The exposure duration was 150 msec per stimulus. Participants' answer consisted of pressing a "yes" or a "no" button on the computer keyboard. Within each visual half-field, the faces were counterbalanced with respect to face sex and attractiveness level.

## RESULTS

For each participant, the number of correct "yes" responses were determined for each visual half-field according to Face Sex and rating level on the scale (i.e., 1, 2, 3, 4, 5). The accuracy data were entered into a repeated measures ANOVA with a between subjects factor of Subject Sex (females, males) and within subjects factors of Face Sex (women, men), Visual Field (LVF, RVF), and Attractiveness Rating (1, 2, 3, 4, 5). Figure 1 summarizes the mean percent correct responses (error bars indicate standard error of the mean).

We obtained a main effect for Visual Field ($F=5.25$, $df=1, 33$, $p=0.028$), reflecting more accurate responses in the RVF than in the LVF, as well as a main effect for Attractiveness Rating ($F=3.96$, $df=132$, $p=0.004$), reflecting a greater proportion of the "1" (very unattractive) and "5" (very attractive) compared to "2", "3", and "4" on the scale.

The triple interaction of Subject Sex X Face Sex X Attractiveness Rating was significant ($F=3.32$, $df= 4, 132$, $p=0.012$), as was the triple interaction of Subject Sex X Visual Field X Attractiveness Rating ($F=3.75$, $df=4, 132$, $p=0.006$). The triple interaction

of Face Sex X Visual Field X Attractiveness Rating was also significant (F=8.12, df=4, 132, p=0.000006).

In view of the significant interactions, analyses for simple effects were further applied to the data. Since 2 of the interactions involved Subject Sex, it seemed logical to carry out 2 ANOVAs, one for the female data and one for the male data. In each ANOVA the within subject factors were for Face Sex (women, men), Visual Field (LVF, RVF), and Attractiveness Rating (1, 2, 3, 4, 5). The results for the female participants ANOVA revealed a significant main effect Visual Field (F=4.62, df=1,17, p=0.04) reflecting a higher accuracy in the RVF than in the LVF. The triple interaction of Face Sex X Visual Field X Attractiveness Rating was significant (F=3.48, df=4, 68, p=0.01). The ANOVA for the male participants revealed a main effect for Face Sex (F=4.3, df=1,16, p=0.05) as well as a significant triple interaction of Face Sex X Visual Field X Attractiveness Rating (F=5.44, df=4, 64, p=0.0007).

Given the significant triple interactions in the data of the female and male participants separately, analyses for simple effects were conducted. For the female participants, the analyses showed a significant difference between the visual fields in rating "5" (very attractive) for the women faces (t=-2.76, df=17, p=0.01) reflecting more accuracy in remembering these faces in the RVF than in the LVF. In addition, we found that very attractive men faces ("5") were remembered significantly better in the RVF than in the LVF (t=-2.05, df=17, p=0.05). This is seen clearly in Figure 1. For the male participants, the simple effects analysis revealed a significant visual field difference for the most unattractive faces ("1"), with women faces better recognized in the RVF than in the LVF (t=-3.69, df=16, p=0.001) and men faces better recognized in the LVF than in the RVF (t=5.25, df=16, p=0.00007).

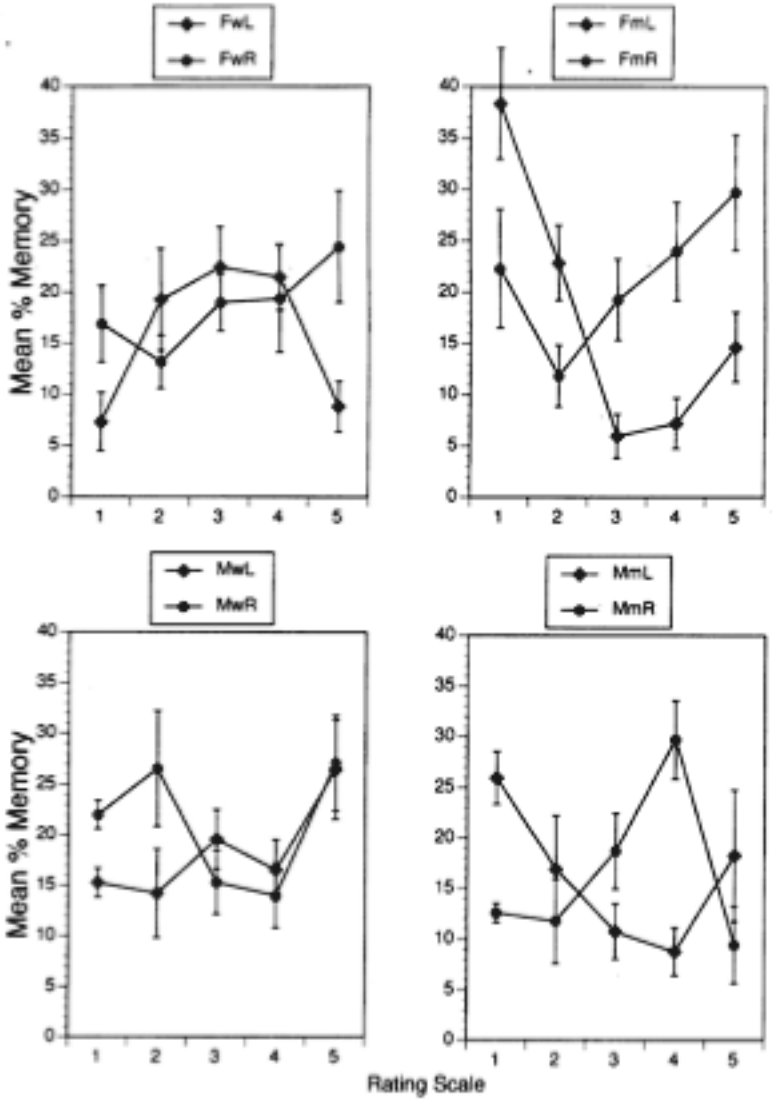


**FIGURE 1.** Mean percentage accuracy (error bars indicate standard error of the mean) in remembering faces left (LVF) or right (RVF) as function of the attractiveness ratings the faces received. FwL = participants remembering women faces in the LVF. FwR = Female participants remembering in the RVF. MwL = Male participants remembering women faces in the LVF. MwR = Male remembering women faces in the RVF. FmL = Female participants remembering men faces in R = Female participants remembering men faces in the RVF. MmL = Male participants men faces in the LVF. MmR = male participants remembering men faces in the RVF.

## DISCUSSION

We explored the relationship between facial attractiveness and hemi-field recognition memory and found significant statistical interactions with the factor of Visual Field. In addition, we found that female participants remembered the most attractive faces of women and men and that memory was superior in the RVF than in the LVF. There was no significant visual half-field asymmetry for the least attractive faces. In contrast, the male participants remembered the least attractive better than the most attractive, with women's faces being remembered better in the RVF than in the LVF and men's faces better in the LVF than in the RVF. These results reflect strong hemispheric asymmetry and interactive effects.

One would expect to see consistent LVF superiority in a facial memory task, given the well-known specialization of the right hemisphere for facial memory (Beardsworth & Zaidel, 1994), but this did not happen here. The significant statistical interaction with visual half-field suggests that the responses represent hemispheric effects. Absence of a significant interaction would imply parallel or shared hemispheric processing. It would appear that the degree of attractiveness in the face enters into the computational memory processes in each hemisphere, although we do not know which aspect of the attractiveness is utilized.

While we were interested mainly in the extreme ends of the attractiveness scale, it did not escape our attention that the "almost very attractive" faces of men (rating 4) were substantially better remembered by both female and male participants, and this was so particularly in the RVF (see Figure 1). The same was not true for the women faces. This outcome becomes especially noteworthy in the context of the male participants where there is no significant hemi-field difference for "very attractive" men (rating 5); there is, however, a significant visual half-field difference in the female participants' performance for "very attractive" men. Clearly something in the "almost very attractive" men elicited memorable reactions. Possibly, taking more time to decide between 4 and 5 on the scale,

the difficulty in deciding, the complexity, and perhaps depth of processing entailed in this decision may have affected subsequent memory.

Although, to the best of our knowledge this is the first study to apply the question of facial attractiveness to hemispheric memory, some of our results are consistent with findings in the general psychological literature. One study (Fleishman, et al., 1976) reported a high score in memory accuracy for the most and least attractive women faces, and concluded that attractiveness, or unattractiveness for that matter, significantly affects facial recognition. Unfortunately, only women faces were used in that study. Like Fleishman et al.'s study, we found a significant attractiveness effect at both ends of the attractiveness scale. Similarly, Light et al. (Light, et al., 1981) reported a negative relationship between attractiveness and facial recognition, that is, as facial attractiveness increased, facial recognition performance decreased. However, the participants in that study were Caucasian males only. In this regard our findings are consistent with their negative relationship between attractiveness and facial recognition since our male participants remembered the least attractive women and men faces as well. But the inclusion of hemispheric differentiation, sex face, and sex subject in our study demonstrates that this relationship is far from being linear as suggested by Light et al. (Light, et al., 1981).

Similarly, Shepherd & Ellis' 1973 study (Shepherd & Ellis, 1973), using women target faces only, reported that the memory of women's faces is influenced by their attractiveness, that is, both the very unattractive and attractive faces are more memorable than neutral faces. Their results became significant only after an interval of 35 days. Or, no significant attractiveness effect was found in recognition scores immediately or 6 days after target stimulus presentation. Indeed, in agreement with their study we did not find a main effect for Face Sex in our overall ANOVA. Since our study had added factors, we were in a position to tease out some variables in the relationship between memory and facial attractiveness. Thus, our significant triple interaction of Subject Sex

X Visual Field X Attractiveness Rating shows that immediately after target stimulus presentation females are superior at remembering very attractive faces of women as well as of men in the RVF whereas males are better at remembering very unattractive women and men faces in the RVF and LVF, respectively. Given the foregoing, our findings highlight the complexity of the phenomenon under investigation.

Published studies reported not only no significant sex differences in memory for faces (Shepherd & Ellis, 1973; Yarmey, 1979) or conflicting results (Laughery, et al., 1971) but also that facial recognition memory is influenced by both participant sex and face sex. For example, some studies reported that female participants were better at facial recognition than were males (e.g., (Going & Read, 1974; Witryol & Kaess, 1957; Yarmey, 1974). Moreover, two studies found females reliably better in recognizing other women whereas males recognized men and women faces equally (Cross, et al., 1971; McKelvie, 1987). Going and Read (1974) also reported that women faces were easier to recognize than men faces and, at both levels of distinctiveness, female observers recognized women faces best whereas males recognized both sexes equally. Recently, a study confirmed that female participants recognized women faces better than men faces and better than male participants (no attractiveness data were collected), whereas for men faces there was no participant sex difference (Lewina & Herlitz, 2002).

It is tempting to speculate on the underlying reasons for the interactions with visual half-field, participants' sex, and attractiveness ratings in evolutionary adaptive terms. The published findings in the general psychological literature are not helpful here. In that vein, we may need to wonder whether or not what made faces memorable to the female versus the male participants could be related to brain mechanisms involved in mate selection strategies. We note that the significant hemi-field differences with the female participants occurred for attractive faces whereas with the male participants, hemi-field differences occurred for unattractive faces. At this time we cannot explain this interaction of attractiveness and participants' sex, but future experiments may provide additional clues.

Future studies in which the issue of facial attractiveness and memory is further explored in the left and right hemispheres may shed additional light on the present findings, particularly on the performance we observed in the RVF. The question of remembering attractive faces has fascinated scientists and laypersons alike. Our findings here have shown that hemispheric specialization plays a role in memory for attractive and unattractive faces.

## REFERENCES

Beardsworth, E., & Zaidel, D. W. (1994). Memory for faces in epileptic children before and after unilateral temporal lobectomy. Journal of Clinical and Experimental Neuropsychology, 16, 738-748.

Benson, K. J., & Laskin, D. M. (2001). Upper lip asymmetry in adults during smiling. Journal of Oral Maxillofacial Surgery, 59, 396-398.

Brigham, J. C. (1990). Target person distinctiveness and attractiveness as moderator variables in the confidence-accuracy relationship in eyewitness identification. Basic and Applied Social Psychology, 11, 101-115.

Bruce, V. (1988). Recognizing faces. Hillsdale, NJ: Erlbaum.

Chen, A. C., German, C., & Zaidel, D. W. (1997). Brain asymmetry and facial attractiveness: Beauty is not simply in the eye of the beholder. Neuropsychologia, 35, 471-476.

Corballis, M. C. (1991). The Lopsided Ape. New York: Oxford University Press.

Cross, J. F., Cross, J., &Daly, J. (1971). Sex, race, age, and beauty as factors in recognition of faces. Perception and Psychophysics, 10, 393-396.

Cutler, B. L., & Penrod, S. D. (1989). Moderators of the confidence-accuracy correlation in face recognition: The role of information processing and base rates. Applied Cognitive Psychology, 3, 95-107.

Fleishman, J. J., Buckley, M. L., Klosinsky, M. J., Smith, N., &Tuck, B. (1976). Judged attractiveness in recognition memory of women's faces. Perceptual and Motor Skills, 43, 709-710.

Galton, F. (1907). Inquiries into human faculty and its development (2nd ed.). London: Dent, J. D.

Going, M., & Read, J. D. (1974). Effects of uniqueness, sex of subject, and sex of photograph on facial recognition. Perceptual and Motor Skills, 39, 109-110.

Kimura, D. (1992). Sex differences in the brain. Scientific American, 267, 118-125.

Langlois, J. H., & Roggman, L. A. (1990). Attractive faces are only average. Psychological Science, 1, 115-121.

Laughery, K. R., Alexander, J. F., &Lane, A. B. (1971). Recognition of human faces: Effects of target exposure time, target position, pose position, and type of photograph. Journal of Applied Psychology, 55, 477-483.

Lewina, C., & Herlitz, A. (2002). Sex differences in face recognition: Women's faces make the difference. Brain and Cognition, 50, 121–128.

Light, L. L., Hollander, S., &Kayra-Stuart, F. (1981). Why attractive people are harder to remember. Personality and Social Psychology Bulletin, 7, 269-276.

McKelvie, S. J. (1987). Sex differences, lateral reversal, and pose as factors in recognition memory for photographs of faces. Journal of General Psychology, 114, 13-37.

Mueller, J. H., Heesacker, M., &Ross, M. J. (1984). Likability of targets and distractors in facial recognition. American Journal of Psychology, 97, 235-247.

Reis, V. A., & Zaidel, D. W. (2001). Functional asymmetry in the human face: Perception of health in the left and right sides of the face. Laterality, 6, 225-231.

Sarno, J. A., & Alley, T. R. (1997). Attractiveness and the memorability of faces: Only a matter of distinctiveness? American Journal of Psychology, 110, 81-92.

Shepherd, J. W., & Ellis, H. D. (1973). The effect of attractiveness on recognition memory for faces. American Journal of Psychology, 86, 627-633.

Sommer, W., Leuthold, H. H., Matt, J., & Schweinberger, S. R. (1995). Meta-memory, distinctiveness, and event-related potentials in recognition memory for faces. Memory and Cognition, 23, 1-11.

Witryol, S. L., & Kaess, W. A. (1957). Sex differences in social memory tasks. Journal of Abnormal and Social Psychology, 54, 343-346.

Yarmey, A. D. (1974). Proactive interference in short-term retention of human faces. Canadian Journal of Psychology, 28, 333-338.

Yarmey, A. D. (1979). Through the looking glass: Sex differences in memory for self-facial poses. Journal of Research in Personality, 13, 450-459.

Zaidel, D. W., Chen, A. C., &German, C. (1995). She is not a beauty even when she smiles: Possible evolutionary basis for a relationship between facial attractiveness and hemispheric specialization. Neuropsychologia, 33, 649-655.

## FIGURE LEGEND

FIGURE 1: Mean percent accuracy in remembering faces flashed in the left (LVF) or right (RVF) as function of the attractiveness rating the faces received.