Concentrating on Beauty: Sexual Selection and Sociospatial Memory

D. Vaughn Becker
Arizona State University, Polytechnic

Douglas T. Kenrick
Arizona State University

Stephen Guerin
Redfish Group, Santa Fe

Jon K. Maner
Florida State University

In three experiments, location memory for faces was examined using a computer version of the matching game Concentration. Findings suggested that physical attractiveness led to more efficient matching for female faces but not for male faces. Study 3 revealed this interaction despite allowing participants to initially see, attend to, and match the attractive male faces in the first few turns. Analysis of matching errors suggested that, compared to other targets, attractive women were less confusable with one another. Results are discussed in terms of the different functions that attractiveness serves for men and women.

Keywords: *evolutionary psychology; episodic memory; face recognition; physical attractiveness; interpersonal perception*

Think back to a party you attended where there were a number of people varying in sex, size, and level of attractiveness. If you were asked, halfway through the party, to close your eyes and recall where particular party-goers were standing when you observed them, would your ability to perform this task depend on whose location you were trying to remember? Would the specific individuals you were able to best locate reflect random variations in your memory or perhaps reflect on functionally constrained biases in the way humans process social information?

Functionalist evolutionary theories often posit the existence of adaptively tuned cognitive mechanisms (e.g., Kenrick, 1993; Klein, Cosmides, Tooby, & Chance, 2002). Thus far, however, little empirical research has examined basic questions about the particular stages of information processing at which these hypothesized mechanisms operate. Studies have instead tended to focus more directly on relatively complex and "considered" aspects of cognition—explicit preferences, judgments, and interpretations—leaving unexplored the more basic mechanisms presumed to underlie them. In the current research, we examine the extent to which particular social targets might give rise to enhanced encoding and retrieval in an ongoing episodic memory task. Specifically, we present data suggesting that the sex and physical attractiveness of a person can affect how well that person's location is remembered, using the classic matching game commonly known as Concentration. Tasks such as the one we use here, which challenge a participant to respond as rapidly as possible to a difficult task, are less susceptible to social desirability biases than questionnaires or other measures that elicit more considered responses (Kenrick, 1993).

Cognizing Beauty: Biases in the Processing of Attractive Others

Research suggests that people tend to prefer physically attractive others in many social relationships, particularly in those linked to mating. Physical attractive-

Authors' Note: This research was supported by National Institutes of Health Grant 5R01MH64734, awarded to Douglas Kenrick, Steven Neuberg, and Mark Schaller. Correspondence concerning this article should be addressed to D. Vaughn Becker, Arizona State University, Polytechnic Campus, Department of Applied Psychology, Mesa, AZ 85212; e-mail: vaughn.becker@asu.edu.

PSPB, Vol. 31 No. 12, December 2005 1-10
DOI: 10.1177/0146167205279583

ness is important in the formation of (e.g., Feingold, 1990, 1992), maintenance of (e.g., Simpson, Gangestad, & Lerma, 1990), and satisfaction with romantic relationships (Shackelford, 2001). Much of the research on attractiveness has focused on explicit preferences such as actual or hypothetical choice of dates, sexual partners, or marriage partners (Buss, 1989; Kenrick & Keefe, 1992). We have been involved in a program of research that examines more basic cognitive processes, exploring ways in which observers differentially attend to, encode, and remember other people (e.g., Maner et al., 2003, 2005). This research suggests that physically attractive others are treated favorably not only in terms of "downstream" preferences and judgments but they also tend to receive biased processing at more basic stages of cognition. However, the research also provided some preliminary evidence that any processing advantage for attractive targets might depend on whether the target is a man or a woman.

In one study, Maner et al. (2003) used an eye-tracking procedure to assess differential attention to targets varying in sex and attractiveness. The findings revealed that when exposed to arrays of female targets, both men and women looked significantly more at good-looking than average-looking women. When exposed to arrays of men, women looked preferentially at handsome men but men showed no such bias. In another study, participants were shown individual photographs of men and women and then watched a distractor film for several minutes. Later, they were given a recognition memory test that included faces viewed earlier as well as similar faces not previously viewed. After this delay, beautiful women were remembered by both sexes but handsome men were not accurately remembered by either women or men. Although these differential attentional and memory biases were demonstrated using different samples of participants and stimuli, the findings suggested the possibility that (a) attractive others receive differential processing at the level of initial visual attention but (b) only attractive women are subsequently recognized—an intriguing disjunction of basic cognitive processes.

The present studies were designed to further explore the preferential processing of attractive individuals. We focus on a different type of cognitive processing in which memory and attentional processes are more temporally contiguous and in which participants are required to recall not only a target's identity but also his or her location.

The Concentration Game: Assessing Episodic Memory

Assessments of face recognition typically assess the extent to which a person knows that he or she has previously viewed a particular face (e.g., Light, Hollander, & Karya-Stuart, 1981; Shepard & Ellis, 1973). Recognition memory thus reflects a person's ability to retrieve a particular face stored in long-term memory. In contrast, to not only recall a face but to also remember where one saw it requires linking the face with its location. We designed the present experiments to assess (a) whether the binding process may occur more strongly when observing attractive individuals, (b) whether this depends on the sex of the person being observed, and (c) whether either a or b depends on the sex of the perceiver. To achieve these goals, we developed a computerized matching task designed to assess location memory for faces.

The task used in the current studies is an adaptation of the classic matching game Concentration. The framework for this task is as follows: pairs of identical playing cards are placed face down in a random arrangement and one's task is to turn over two cards at a time to try for a match. If the cards are correctly matched, they remain face up; if not, they are turned back over and the player must try to remember the location of those two cards to facilitate a future match. The task continues in this way until all of the cards have been matched. The object of the task is to match all cards in as few turns as possible.

But are all locations retrieved with equal fluency? One might expect that the locations of certain items—such as face cards or aces—are more easily matched than others. This might be due to these cards having more distinctive and discriminable physical features or due to the greater value that we tend to place on them in other contexts (such as in a game of poker). The present experiments explore whether such differences exist for different kinds of faces and contrast memory for attractive others with memory for average-looking others.[1]

Overview of the Current Research and Hypotheses

Selective memory for the location of physically attractive others might be predicted by any of a number of theories of attraction, including classic social learning or social exchange formulations. For example, according to social learning models, physical attractiveness is a source of reward in others, associated with positive feelings (e.g., Byrne & Clore, 1970; Lott & Lott, 1974). A defining feature of a rewarding stimulus is that people work to gain access to that stimulus, and there is evidence, for example, that children will work harder to view an attractive person than an unattractive person (Dion, 1977). Similarly, according to social exchange theories, physical attractiveness is a particularly desirable "asset" in deciding on a mate's market value (e.g., Walster, Walster, & Berscheid, 1978). Social learning and social exchange approaches are both "domain-general" theories, and in their classical formulations, neither approach considered questions about "why" physical attractiveness was valued or focused on the possibility

that the reward value of attractiveness might be intrinsically different for men and women. Thus, these perspectives might lead to a straightforward prediction that attractiveness is a memorable feature in either male or female targets.

From an evolutionary perspective, the desirability of any trait depends on its adaptive function, and there is reason to believe that physical attractiveness may serve slightly different functions for men and women. Given that physical attractiveness has been associated with good genes and physical health (e.g., Gangestad & Simpson, 2000), one might expect that both sexes would attend similarly to physical attractiveness in opposite-sex targets (and perhaps in same-sex targets as well, to the extent that they perceived to serve as one's sexual competitors).

However, a more detailed analysis of the function of physical attractiveness suggests fundamental sex differences in the significance of physical attractiveness in both opposite-sex targets and in same-sex competitors (Kenrick, Montello, Gutierres, & Trost, 1993). Evolution-based studies have generated some evidence that men place relatively greater priority on physical attractiveness in choosing mates, whereas women prioritize status-linked features over attractiveness (Buss, 1989; Kenrick, Neuberg, Zierk, & Krones, 1994; Sadalla, Kenrick, & Vershure, 1987; Wiederman, 1993). For example, although both men and women consider attractiveness a desirable feature in a partner (if they could have everything they want), Li, Bailey, Kenrick, and Linsenmeier (2002) found that only men prioritized good looks when there were realistic limitations put on their choices (women instead strongly prioritized social status over good looks, if forced to choose).

Another series of studies found that exposure to attractive men did not affect women's appraisals of their mates, or men's self-appraisals, whereas exposure to attractive women undermined women's self-appraisals and men's appraisals of their current mates (Gutierres, Kenrick, & Partch, 1999; Kenrick et al., 1994). Furthermore, although both sexes are drawn to attractive people for extra-pair relationships, men are more inclined to have affairs than are women (e.g., Buss & Schmitt, 1993; Clark & Hatfield, 1989; Kenrick, Sadalla, Groth, & Trost, 1990). These findings converge to suggest that good-looking intrasexual competitors may pose more of a threat to women than to men (Dijkstra & Buunk, 1998; Kenrick et al., 1994). Based on these findings, one might then expect selective memory for attractive women to be exhibited by both male and female observers.

In the present experiments, we test this hypothesis that facial attractiveness influences the memory for locations as a function of target sex. The design of our final experiment (Study 3) allowed two additional hypotheses to be tested: (a) that any deficit in location memory for attractive men would occur despite relatively pronounced initial attention to attractive male faces and (b) that people would be relatively less likely to confuse one attractive woman for another and relatively more likely to confuse one attractive man for another.

EXPERIMENT 1

Method

Participants. Participants (Ps) were undergraduates (16 men, 33 women) in an introductory social psychology class who took part in exchange for extra credit. All Ps had normal or corrected-to-normal vision.

Stimuli. Thirty-two black-and-white facial photos were used (half men, half women). All faces were digitally scanned from high school yearbooks and magazines. Half of these faces had been previously rated by a sample of psychology students as being average in attractiveness, whereas the other half had been rated as being very attractive. Faces were selected such that facial expression, hair color, head position and relative size, brightness, and contrast were equivalent across the different conditions of face sex and attractiveness.

Design. Four tasks were performed in randomized order. Each included eight pairs of faces of the same sex, yielding two 4 × 4 male arrays and two 4 × 4 female arrays. Four of the faces in each had been prerated as attractive and four had been prerated as being of average attractiveness. None of the faces appeared in more than one task.

The location of squares was randomized, with one constraint: the task was designed such that Ps would turn over each face once before having the opportunity to make a single match. All Ps were presented with this first round of faces in identical order. Ps were not aware of this task constraint, which ensured that no one could match a pair of faces by luck alone before all of the faces were viewed.

Procedure. Ps were instructed to go to a particular Web site on which the task program was located. Ps first viewed an introductory Web page that contained instructions. Ps then responded to a number of demographic questions, after which they began performing the tasks.

Ps first performed a practice task that involved matching emotionally expressive faces. Then the four experimental tasks were performed in randomized order. The concentration game consisted of a 4 × 4 array of squares presented in computer array. Ps used a mouse to click on one square, which revealed a face. Ps then chose another square, and if the faces matched, the squares remained face up. If the faces did not match, they both returned to the face down position after 2 s. The object of the task

TABLE 1: Experiment 1: Mean Number of Trials to Correctly Match a Face as a Function of Target Sex, Target Attractiveness, and Participant Sex

	Female Ps		*Male Ps*		*Total*
	M	SD	M	SD	M
Female face					
Attractive	2.78	0.94	2.55	1.39	2.71
Average	3.01	1.18	2.85	1.46	2.96
Male face					
Attractive	3.29	1.04	2.98	1	3.19
Average	3.2	1.1	2.83	1.14	3.08

NOTE: Lower numbers indicate better performance (fewer trials to correctly match a face). Ps = participants.

was to match all the pairs in as few trials as possible. After the last task had been performed, Ps were provided an online debriefing.

Results

The program recorded the total number of times each P clicked on the square for either of the two faces in a given pair before they were matched. Thus, a lower number of turns indicated that a pair of faces was more efficiently matched. Means for each factorial combination of sex and attractiveness were calculated for each participant (see Table 1). We then conducted a 2 within- (face sex) × 2 within- (face attractiveness: attractive, average-looking) × 2 between- (P sex) subjects mixed-design analysis of variance (ANOVA).

Results indicated that the interaction of face sex and face attractiveness was significant, $F(1, 47) = 7.71$, $p = .008$, partial $\eta^2 = .141$. To explore this interaction, we compared performance for attractive versus average-looking targets, separately for male and female targets. Performance was significantly better for attractive female faces than for average female faces, $F(1, 48) = 6.39$, $p = .015$, partial $\eta^2 = .118$. The performance for attractive male faces, in contrast, was not significantly different than performance for average male faces, $F(1, 47) = 1.20$, $p > .2$. There were no significant effects associated with participant sex.

Discussion

These results indicate that, consistent with previous evidence for biases in recognition memory, observers exhibited enhanced episodic memory for attractive women. These results are consistent with the importance people tend to place on female attractiveness. Men place a premium on attractive mates. Women tend to exercise great vigilance to attractive female competitors. And, indeed, both male and female observers showed enhanced memory for attractive women. In contrast, no memory advantage was found for attractive male faces; they were remembered no better than average-looking male faces. This is consistent with research suggesting that women are primarily attracted to dominant, rather than physically attractive, men. It is also consistent with previous research showing that recognition memory tends not to be great for attractive male faces.

EXPERIMENT 2

One limitation of Experiment 1 is that stimulus faces appeared in small arrays consisting only of same-sexed targets, which might introduce interpretational ambiguities when making comparisons between opposite-sexed targets. Experiment 2 examined P's abilities to match faces within larger arrays that contained both male and female faces.

Method

Participants. All Ps were undergraduates in an introductory social psychology class who took part in exchange for extra credit. There were 19 men and 23 women, all with normal or corrected-to-normal vision.

Stimuli. The same face pairs from Experiment 1 were again used in Experiment 2.

Design. Ps played a game containing 16 pairs of faces in an 8 × 4 array, with equal numbers of attractive and average male and female faces.

Procedure. Ps performed the tasks on the Internet in an instructional classroom with 20 computers during open access hours with an experimenter or lab monitor present. Ps were presented with a brief description of the tasks and written instructions on how to access them. After performing the tasks, they were automatically directed to a Web page that contained the debriefing.

Results

As in Experiment 1, the number of turns required to complete a match served as the primary dependent variable. There were no main effects of interactions associated with sex of participant; therefore, we collapsed across participant sex. There was a main effect of attractiveness, $F(1, 41) = 7.37$, $p = .010$, partial $\eta^2 = .152$, and a marginally significant main effect of face gender, $F(1, 41) = 3.80$, $p = .058$, partial $\eta^2 = .085$. The interaction of face sex and face attractiveness was marginally significant, $F(1, 41) = 2.99$, $p = .099$, partial $\eta^2 = .065$, such that attractiveness facilitated episodic memory for female faces, $F(1, 41) = 8.19$, $p = .007$, partial $\eta^2 = .167$, whereas it bore no relationship to episodic memory for male faces, $F < 1$ (see Table 2).

Discussion

Results of Experiment 2 corroborated the initial findings of Experiment 1 using a mixed-sex array. We again

TABLE 2:Experiment 2: Mean Number of Presentations Required to Match Pairs of Faces as a Function of Sex of Target, Attractiveness of Target, and Sex of Participant

	Female Ps		*Male Ps*		*Total*
	M	SD	M	SD	M
Female face					
Attractive	3.55	1.25	4.01	1.44	3.76
Average	4.37	0.97	4.3	1.33	4.34
Male face					
Attractive	4.41	1.39	4.17	1.31	4.3
Average	4.29	1.29	4.33	1.27	4.31

NOTE: Lower numbers indicate better performance (fewer trials to correctly match a face). Ps = participants.

observed that attractive women were matched in fewer turns than average men, whereas no such bias was present for male targets. These findings again suggest that observers have a tendency to more strongly process the circumstances in which attractive women are observed, thereby facilitating subsequent episodic memory for those women.

EXPERIMENT 3

In Experiment 3, we again tested the hypothesis that people would exhibit enhanced episodic memory for attractive women. In addition, we investigated the possibility that, compared with other targets, attractive women might be confused with one another to a lesser extent, reflecting the individuated processing they receive (cf. Taylor, Fiske, Etcoff, & Ruderman, 1978). To explore this possibility, we recorded the number of times that Ps incorrectly matched targets with other members of the same category (e.g., attempting to match an attractive man with a different attractive man).

Furthermore, we explicitly investigated the possible disjunction between initial processing and subsequent episodic memory that the results of Maner et al. (2003) suggested. That is, we assessed the possibility that although Ps might initially attend to and process attractive male targets, this processing advantage would not translate into enhanced episodic memory for those attractive faces. To detect this disjunction between initial processing and subsequent episodic memory, we incorporated a new element to the task in Experiment 3: All of the faces were presented in their randomly assigned locations to the participant for 6 s at the outset of the game. Thus, the first few matches provided an index of where the participant's attention had been initially drawn.

Experiment 3 also included two other methodological changes. First, we developed a larger task that consisted of 48 faces of both sexes. Second, we used a new stimulus set of color photographs to verify that the effects observed in Experiments 1 and 2 were not unique to a particular stimulus set.

Method

Participants. All Ps were undergraduates in an introductory psychology class who took part in exchange for course credit. There were 20 men and 26 women, all with normal or corrected-to-normal vision.

Stimuli. There were 24 color photographs, 6 each of attractive and average female and male faces. These photographs were selected from a larger set such that hair color, head position, and/or lighting differences were equally variable across the stimulus groups.

Procedure. Ps performed this task in a perception laboratory in sound-attenuated booths or separate cubicles. They performed a task in which 24 pairs of faces were randomly assigned to unique locations in a 4 × 12 array. Before beginning the task, Ps were instructed to carefully view the faces for a short time before beginning the matching portion of the task. After pressing the start button, all faces were shown to the participant for 6 s, after which they could immediately begin matching. Once they matched all of the faces, Ps were debriefed and dismissed.

Results and Discussion

As in the previous two experiments, we conducted 2 (target sex) × 2 (face attractiveness) × 2 (P's sex) mixed-design ANOVAs on matches. In addition, we performed a parallel analysis treating the proportion of within-category errors (e.g., attempting to match an attractive man with a different attractive man) as the dependent variable. Finally, we examined the first pair of faces that each participant matched, an index of where their attention was initially drawn.

Correct matching performance. The main effect of target sex was significant, $F(1, 44) = 5.13$, $p = .027$, as was the main effect of target attractiveness, $F(1, 44) = 7.43$, $p = .009$. As in Experiments 1 and 2, the interaction between target sex and target attractiveness was significant, $F(1, 44) = 14.16$, $p < .001$, partial $\eta^2 = .243$ (see Table 3). No effects were associated with participant sex, all Fs < 1.

To explore the Target Sex × Attractiveness interaction, we compared matching efficiency for attractive versus average faces, separately for male and female targets. For female targets, attractive faces were matched more efficiently than average faces, $F(1, 45) = 22.66$, $p < .001$, partial $\eta^2 = .335$. The attractiveness of the male faces, in contrast, did not affect matching performance, $F(1, 45) = 1.96$, $p = .168$.

Within-category mismatches. In addition to measuring the number of times it took Ps to correctly match each pair, the task also recorded information about incorrect

TABLE 3: Experiment 3: Mean Number of Trials to Correctly Match a Face, and the Mismatches to Faces of the Same Category, as a Function of Target Sex, Target Attractiveness, and Participant Sex

	Female Ps		*Male Ps*		*Total*
	M	SD	M	SD	M
Mean trials to match					
Female face					
Attractive	5.5	1.22	5.77	1.65	5.63
Average	6.54	1.7	6.78	1.65	6.66
Male face					
Attractive	6.71	1.57	6.75	2.07	6.73
Average	6.47	1.49	6.36	2.27	6.42
Within-category errors					
Female face					
Attractive	0.18	0.15	0.22	0.16	0.20*
Average	0.36	0.24	0.39	0.2	0.38*
Male face					
Attractive	0.33	0.21	0.37	0.21	0.35*
Average	0.31	0.25	0.32	0.24	0.32

NOTE: Ps = participants.
*Indicates that the value is statistically significantly different ($p < .05$) from 0.25 (or chance performance).

trials. After Ps made each initial card selection, if they then selected a face that did not match, the identity of the second face was recorded. This allowed us to examine the extent to which mistakes were made within a particular target category. For example, if Ps confused attractive male faces with one another, this should result in a greater number of attractive male mismatches for any given attractive male face. The dependent variable for this analysis was the proportion of within-category errors for each type of target.

Two significant effects emerged from this analysis: There was a main effect of attractiveness, $F(1, 44) = 7.11$, $p = .011$, and a significant interaction between face sex and face attractiveness, $F(1, 44) = 12.04$, $p = .001$, partial $\eta^2 = .300$. This interaction mirrored the one found for match accuracy. Ps made a lower proportion of within-category mismatches for attractive women as compared to average-looking women, $F(1, 45) = 19.80$, $p < .001$, partial $\eta^2 = .305$. For male faces, there was no difference between the proportion of within-category errors for attractive versus average-looking male targets, $F < 1$. There was a significantly greater number of these within-category mismatches for attractive male faces than would be expected by chance alone, indicating that they are somewhat confusable with one another.

Analysis of the first faces matched. The design of this experiment allowed us to examine which faces were matched first, an indication of which faces drew attention in the first 6 s (see Table 4). If all faces were equally likely to be matched first, the expected proportion for each type of face (attractive and average, male and female) would be 0.25. This, however, was not the case. Both male and female Ps were more likely to match an attractive female first (for women, $p = .015$, and for men, $p = .013$, with a binomial test), suggesting that attractive female faces drew initial attention. Attractive male faces also tended to be matched first more often than average male faces, although this pattern depended somewhat on the sex of the participant (for women, $p = .009$, and for men, $p = .170$, with a binomial test).

TABLE 4: The Proportion of First Matches in Experiment 3, as a Function of Face Sex, Face Attractiveness, and Participant Sex

	Overall	*Female Ps*	*Male Ps*
Female target			
Attractive	0.48	0.46	0.5
Average	0.11	0.12	0.1
Male target			
Attractive	0.28	0.31	0.25
Average	0.13	0.12	0.15

NOTE: Ps = participants.

Combined with the overall matching performance, this finding indicates that memory for attractive male faces is no better than for average-looking men. Although an attractive male face may draw the initial attention of an observer early in the game, this advantage does not compensate for the poor memory for the rest of the attractive male faces, which garner the worst matching performance by the end of the game.

META-ANALYSIS OF STUDIES 1 THROUGH 3

We performed a meta-analysis to assess the reliability of the key sex difference observed in these studies. Table 5 shows the effect sizes and significance tests for this attractiveness advantage as a function of the sex of the face (and also the sex of the participant) as well as a meta-analysis of these statistics. Across these studies, the memory advantage for attractiveness was highly significant for female faces and reflected a medium-sized effect. For male faces, on the other hand, there was a marginally significant reversal of this effect (with a small effect size).

GENERAL DISCUSSION

Results of three studies revealed a strong tendency for both men and women to preferentially recall the location of beautiful female targets. This tendency was not found for handsome male targets and, in fact, there is some evidence that they were more poorly remembered relative to average-looking men. This pattern of findings fits with the view that physical attractiveness serves a different function in men and women and meshes with a larger literature, indicating that physical attractiveness takes greater priority in decisions regarding female tar-

TABLE 5:Attractiveness Memory Advantage

	Female Ps		*Male Ps*		*Overall*	
	d	t *Test*	d	t *Test*	d	t *Test*
Study 1						
Female faces	0.22	–1.69	0.21	–2.33	0.2	–2.53
Male faces	–0.08	0.66	–0.14	1.1	–0.1	1.09
Study 2						
Female faces	0.74	–3.56	0.21	–0.84	0.46	–2.86
Male faces	–0.09	0.41	0.12	–0.58	0.01	–0.03
Study 3						
Female faces	0.71	–3.92	0.61	–2.77	0.66	–4.76
Male faces	–0.16	0.84	–0.18	1.13	–0.17	1.4
Meta-Analysis	d	z *Test*	d	z *Test*	d	z *Test*
Female faces	0.52	4.48*	0.36	3.12*	0.44	5.42*
Male faces	–0.11	1.09	–0.06	0.88	–0.09	1.45

NOTE: *Indicates a *z* test with $p < .001$. Ps = participants.

gets than male targets (e.g., Kenrick et al., 1994; Li et al., 2002).

In the third study reported here, in which Ps were briefly shown the full array of faces before playing the Concentration game, beautiful women again had an advantage on initial trials as well as on later trials. Initial trials also indicated a tendency for Ps (particularly women) to match handsome men more efficiently than they matched average-looking men or women. Any hint of a processing advantage for attractive men, however, disappeared across the later trials, and by the end of the game, these faces appeared to be the least successfully matched.

One might expect that greater attention would always lead to greater memory. Yet, whatever makes attractive male faces initially eye-catching (at least to women) apparently does not translate into later recall of those faces. The higher than chance number of within-category mismatches indicates that people were retrieving locations that contained attractive men, but not the correct attractive men. This pattern of findings may indicate that although particular attractive male faces may catch the eye and hold attention, without sustained attention to their identities, they are not distinct from each other in memory. In other words, a face can be distinct at two different stages of processing, distinctive in that it draws attention and distinctive in so far as it can be remembered and not confused with another face. Beautiful women appear to be distinctive in both stages, whereas attractive men may be so only initially.[2] There is in fact much inconsistency in the literature on memory for distinctiveness and attractiveness that can be reconciled by such a view (cf. Light et al., 1981; O'Toole et al., 1998; Shepard & Ellis, 1973).[3]

So why are attractive men, compared to attractive women, so very "nonsticky" in memory?

Differential Parental Investment and Sexual Selection

When considered in light of a broader network of findings, the relative differences in the memorability of attractive men and women may reflect a set of powerful principles underlying a diverse set of human and nonhuman behaviors. One of these principles involves the intrinsic connection between differential parental investment and mate choice (Trivers, 1972). The theory of differential parental investment in its simplest form is this: When the men and women of any given species differ in their usual levels of parental investment, the sex investing more will be choosier about selecting mates; the sex investing less will compete among themselves to be chosen by the more selective sex.

In most vertebrate species, women have higher minimal obligatory investment (e.g., female birds produce large eggs; female mammals hatch their eggs inside their own bodies and then nurse the young after they are born). Hence, women generally tend to be choosier, whereas men are more intrasexually competitive. This general mammalian pattern is consistent with a number of findings on human mating. For instance, human men are quite willing to accept low-cost mating opportunities when they are offered, but females are generally unlikely to offer a mating opportunity to, or accept a mating offer from, a man who has not demonstrated either especially good evidence of his superiority over other men or, more commonly, of his willingness to invest in her and her offspring (e.g., Buss & Schmitt, 1993; Gangestad & Simpson, 2000). The sexes also differ dramatically in their interest in, and willingness to engage in, casual short-term sexual relationships (Kenrick et al., 1990). For example, in two studies conducted a decade apart, about three-quarters of college men accepted an offer to sleep with a female stranger who approached them on campus, whereas not a single female accepted a similar offer from a male student (Clark & Hatfield, 1989).

Therefore, although both sexes face a mixture of costs and rewards when pursuing any desirable target (e.g., potential loss of current partner, arousing jealousy in target's partner), the cost to benefit ratio of pursuing a physically attractive stranger is simply more unfavorable for a woman. A male stands a net increase in reproductive potential with every fertile woman with whom he can successfully mate, regardless of her commitment to him; a woman, in contrast, can only have one offspring at a time. Hence, before a woman is willing to consider a partner, he will generally be required to demonstrate a number of characteristics that she can only assess over an extended period of time.

Humans do not have only one mating strategy, however (Buss & Schmitt, 1993; Gangestad & Simpson, 2000; Kenrick et al., 1990). Although acting like typical mammals with regard to low-investment sexual opportunities, human men also commonly invest time and effort in offspring care, leading men to be selective about partner characteristics. Given wide variation in female fertility over the lifespan as well as individual differences in female fertility at any given age, men are presumed to maximize their reproductive potential by seeking out characteristics that signal a woman's potential fertility. Because physical attractiveness is linked to perceptions of a woman's youth, health, and fertility, it draws the attention of both men and women (for whom it indicates the presence of a potential competitor for mates; Maner et al., 2003). Although some of the key features used by women in mate choice are also linked to a man's physical condition, others involve social dominance and a man's ability and willingness to invest resources in offspring, which are somewhat less available upon initial viewing. Accounting for the disjunction of attention and memory may therefore require considering not only the perceiver but also the signals of attractiveness.

Attractive Signals and Their Perception

Although physical attractiveness may provide an initial and easily recognizable cue to a man's desirability (an indication of good genes, which might therefore draw attention), it does not tend to be the key dimension on which they are evaluated as mates (Buss, 1989; Feingold, 1990, 1992; Kenrick et al., 1990), which might explain why these faces are not remembered. On the other hand, because attractiveness is a key dimension on which female faces are evaluated, attractiveness might make a female face both more eye-catching and more memorable because attractive women can be both a reproductive opportunity (for men) and a threat (to other women) in both immediate and long-term contexts. If we assume that this sex difference in desirable mate qualities is relatively ancient—a position consistent with cross-cultural (Buss, 1989) and transgenerational (Kenrick & Keefe, 1992) data—then attention and memory systems could have evolved to reflect these different priorities. It should be noted that other cues, which tend to be more central to a man's desirability (e.g., social dominance; Buss, 1989), may play a greater role in determining a man's memorability.

Of course, processes involved in learning likely contribute to these patterns of attention and memory, as well. Humans undoubtedly learn that certain physical features are relatively more important to a woman's mate value, and social dominance to a man's mate value, which would be consistent with people's coming to remember the location of attractive women (because they reciprocally define their place in the local hierarchy of mates) while not similarly remembering the location of physically attractive men (unless they also provide access to resources). Furthermore, men may have learned that their greatest relationship threat comes from high-status and familiar men, and not from physically attractive strangers, and so the dimension of attractiveness may not capture whom they would be likely to remember. However, to speculate that we efficiently learn to remember faces with high social value still presupposes that humans actively search for what these social cues are, and thus seems to require a design feature conditioned on more ultimate grounds. We have made the case elsewhere that processes of learning and evolution likely interact in this fashion (Kenrick, Becker, Butner, Li, & Maner, 2003).

It is also worth considering how signals of attractiveness may have been sexually selected to coevolve with perceiver-based mechanisms. Research suggests that one aspect of facial attractiveness is closely linked to a lack of defects—a function of facial symmetry—that signals a robust immune system (Gangestad, Thornhill, & Yeo, 1994). It is thus an indicator of a potential mate's genetic fitness. By definition, then, an attractive face is closer to the prototypical face, which should make it more difficult to differentiate from other faces. Consistent with this, it is well known that a composite face (made up of a blend of many faces) is rated as more attractive than the individual faces that it is created from (Langlois & Roggman, 1990). Symmetry could be attention grabbing (see Enquist & Arak, 1998, for a review of how symmetry might be selected for) but it would not be a feature that would lead in a straightforward manner to greater memorability because there are fewer distinctive features to distinguish the face from others in memory.

There are other signals that may act as cues for memory, however. Research suggests that the signs of female beauty that are endorsed cross-culturally—such as full lips and a small nose and chin—are estrogen markers and are direct indicators of a woman's fertility and her ability to carry and nurse a child (Johnston, 2000; Johnston, Hagal, Franklin, Fink, & Grammer, 2001; Perrett et al., 1998). These features distinguish physically attractive women from average-looking women. Indeed, there seems to be something more to female attractiveness than mere prototypicality: A composite of attractive female faces is consistently rated as more attractive than a composite of average faces (Perrett, May, & Yoshikawa, 1994). Are there similar features that might make a male face stick in memory? Signs of testosterone are evident in the male jawline and brow. Although there is evidence that ovulating women find these testosterone markers more attractive, this same research found that nonovulating women actually pre-

ferred men with more feminine features (Penton-Voak, Jacobson, & Trivers, in press). Furthermore, whereas most studies have found that facial features of masculinity are related to perceived dominance,[4] many find a negative relationship between dominance and facial attractiveness (Berry & McArthur, 1985; Perrett et al., 1998). Thus, for attractive female faces, there are unambiguous signals of their fertility that may make them both more attractive and more discriminable from other women, whereas the relationship between male hormone markers and attractiveness is much less clear.

In sum, both perceiver-based mechanisms and sexually selected signals may work together to explain why the locations of attractive women are remembered but those of attractive men are not. This suggests that male faces are revealing the default pattern—attractiveness (as symmetry and prototypicality)—is attention-grabbing but paradoxically it may contain fewer distinctive features on which memory can operate. This disjunction does not occur for attractive female faces, perhaps because although they are prototypical, they may have additional features that signal reproductive fitness and thus are distinctive in memory as well as attention.

Additional Questions

A question remains as to the generality of the superior memory for attractive female faces. If there is a perceiver-based affordance of female attractiveness that is keyed to mate goals, then we should not expect to see these effects in populations that do not have those goals, such as prepubescent individuals and perhaps older adults. On the other hand, if it is driven by naturally selected, signal-based features, then everyone should remember these distinctive features regardless of mating-related motives.

Another important follow-up would examine memory for attractive men by female Ps who are ovulating. If the memory difference is driven by the greater confusability of this signal (and not by a perceiver-based mechanism), then ovulating women should show no greater memory for attractive men than anyone else. If, however, male facial features of attractiveness or social dominance are preferentially processed when a woman is ovulating, we could see better location recall for men with these features at this time in a woman's cycle.

There is another interesting trend that suggests potentially interesting follow-up research. When we compared the results across the different studies reported here, we noticed a tendency for attractive women to have a relatively greater advantage in subsequent studies. One difference is that the number of faces increased across the studies and the task became consequently more difficult. These findings may be consistent with other evidence that intrinsically salient stimuli continue to capture attention somewhat independent of the number of distractors (e.g., Ohman, Lundqvist, & Esteves, 2001). This possibility that such an effect might exist for attractive female faces could be directly examined in future research by systematically manipulating display size and/or the presence of other distractors.

Conclusion

The present experiments demonstrated that memory for the spatial location of a face is generally facilitated if it is an attractive woman but not an attractive man. Viewed in light of other findings on differential attention to male and female faces, and on sex differences in human mate preferences and behaviors, these findings add to a richer understanding of the ways in which simple cognitive processes may reflect broad underlying evolutionary principles.

NOTES

1. The use of average-looking (as opposed to unattractive) faces as a control is important because unattractive others also might generate strong memories. Such faces are likely to have distinctive features (the features that make them unattractive), which are likely to be easily remembered. Indeed, one early study of face recognition found that both attractive and unattractive female faces were remembered better than average-looking faces after 15 days (Shepard & Ellis, 1973).

2. We had 37 participants (Ps) rate how distinctive the 24 faces from Study 3 were (specifically, how memorable or likely to stick out of a crowd) on a scale of 1 to 9 (9 being *the most distinctive*). Although the mean rating of distinctiveness for the six attractive female faces was significantly higher ($M = 6.26$, $SD = 0.43$) than those for the average-looking female faces ($M = 3.864$, $SD = 0.67$), $t(10) = 7.33$, $p < .001$, the mean rating of distinctiveness for the attractive male faces ($M = 5.37$, $SD = 1.18$) was only marginally above those for average-looking male faces ($M = 4.43$, $SD = 0.45$), $t(10) = 1.82$, $p = .10$. Although we do not see evidence that attractive male faces are rated as less distinctive than average faces, this may be because Ps are combining distinctiveness in terms of how eye-catching the face is (i.e., likely to pop out of a crowd) with distinctiveness in terms of how memorable the face is, estimates that are in conflict for the attractive male faces (it should be noted that Ps are not very good at making meta-memory judgments; O'Toole et al., 1998, found that the correlation between such judgments and actual memory performance was only .19 for Caucasian faces). Consistent with this, we calculated the standard deviations of the distinctiveness ratings for each of the faces and verified that these were larger for male faces relative to female faces using a Mann-Whitney U test, $z = -2.339$, $p = .009$ (no significant differences were observed for attractiveness, either across or within target sex).

3. This might suggest that the construct of distinctiveness is in some sense superfluous and may be subsumed by constructs more directly related to a face's ability to grab attention versus remain discriminable in memory.

4. Note, however, that Anderson, John, Keltner, and Kring (2001) reported that attractiveness predicts status for men, which might suggest that the attractive men would be more memorable if a purely perceiver-based bias drove encoding and memory.

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Received October 26, 2004
Revision accepted April 4, 2005