

Mating and Memory: Can Mating Cues Enhance Cognitive Performance?

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Abstract

The literature on sexual selection and the social brain hypothesis suggest that human cognition and communication evolved, in part, for the purpose of displaying desirable cognitive abilities to potential mates. An evolutionary approach to social cognition implies that proximate mating motives may lead people to display desirable mental traits. In signaling such traits, one can increase the likelihood of attracting a potential mate. Two experiments demonstrated that exposure to mating cues—highly attractive opposite-sex faces—led people to display enhancements in declarative memory—a process underlying a variety of abilities such as resource acquisition, intelligence, and creativity. Experiment 1 showed that men (but not women) displayed enhanced memory for details of a story that was presented during exposure to highly attractive opposite-sex faces. Experiment 2 demonstrated that heightened displays of declarative memory reflect an enhancement in retrieval rather than in encoding. Findings contribute to the literatures on human mating and cognitive performance and provide novel insight into links between social processes and basic cognition.

Keywords

evolutionary psychology, mating, social cognition, adaptive memory, costly signaling

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The fact that highly attractive members of the opposite sex can make people lose all their mental faculties is nearly a comedic cliché. Imagine a young, male college student walking to class, when a beautiful woman approaches him to ask for directions. Many people could likely relate if this young man, when faced with the attractive woman, was to suddenly forget the way to the cafeteria. Indeed, Karremans, Verwijmeren, Pronk, and Reitsma (2009) demonstrated that interacting with attractive members of the opposite sex can distract and impair cognitive performance. Their work fits the image of a bumbling young man trying to explain directions to a beautiful stranger.

Yet, demonstrating desirable mental traits, such as a robust memory, would be helpful for attracting a mate. Consequently, an evolutionary approach might predict that mating cues would motivate individuals to signal their desirability as a mate by displaying strong mental traits. The current work tests the hypothesis that exposure to attractive members of the opposite sex will lead people to display enhancements in memory.

Theories of sexual selection suggest that people seek qualities in mates that signal reproductively beneficial traits. For instance, people place a premium on physical traits such as

symmetry (Thornhill & Gangestad, 1994) and facial masculinity in men (Fink & Penton-Voak, 2002) because those traits can signal high genetic quality. In addition to physical traits, people seek desirable mental traits such as intelligence, creativity, and sense of humor (Buss, 1989; Li, Bailey, Kenrick, & Linsenmeier, 2002; Marlowe, 2004; Miller, 2000; Prokosch, Coss, Scheib, & Blozis, 2009). That women place a higher value on traits such as being “educated, cultured, and intelligent” during times of high conception risk lends further credence to the notion that preference for these traits is, at least to some extent, driven by mating-related goals (Beaulieu & Havens, 2015). Relative to physical traits, desirable mental

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traits are not as easily observed, and thus perceivers rely on behavioral displays to identify their presence. Consequently, when people are interested in acquiring a mate, they are often motivated to display desirable mental traits. For example, Griskevicius, Cialdini, and Kenrick (2006) found that the activation of mating goals increased displays of creativity.

These social displays are often taxing, mentally or physically, to the party attempting to attract a mate. The theory of costly signaling states that (1) a reliable signal must be expensive and burdensome for the sender to indicate the honesty of the signal to the receiver and (2) that there must be a rational connection between the signal and the message for the receiver to easily decipher (Connelly, Certo, Ireland, & Reutzel, 2011; Zahavi & Zahavi, 1997). Indeed, it has been suggested that the human desire to assess levels of key mental fitness indicators such as intelligence, creativity, language, and humor in potential mates has led to the development of signals to be used in mating contexts that display these advanced abilities (McKeown, 2013).

Unlike creativity and a good sense of humor, memory does not often spring immediately to mind when considering traits to look for in a mate. However, consider the popularity of trivia game shows and local trivia quizzes. Those games depend on contestants' ability to display memory of a wide variety of facts and successful displays of memory confer prizes and social status. Traits such as general intelligence and ability to obtain valuable resources are known to be important (particularly when selecting a long-term mate) and are directly related to memory. Indeed, there is empirical support for the notion that individual differences in intelligence and resource acquisition are dependent on memory. For example, a meta-analysis of the cognitive abilities that influence general intelligence scores revealed that memory is a significant predictor (Grubb & McDaniel, 2000). Furthermore, success at obtaining resources in the wild and achieving educational goals relevant to career success depends on memory (Fagan, Holland, & Wheeler, 2007; Reser, 2009; Sherry & Schacter, 1987). Thus, not only does memory directly aid in one's survival but displays of one's memory would also be useful for signaling an array of reproductively beneficial abilities to potential mates.

Declarative memory, dealing primarily with facts and events of the physical world, involves the ability to declare or discuss information with other people (Tulving & Markowitsch, 1998). By comparison, other types of memory (e.g., implicit memory) involve an individual's private experience. The social nature of declarative memory makes it valuable for testing the proposed model of memory displays as a signaling mechanism. Furthermore, since declarative memory involves statements of fact that can be independently verified by third parties, it can function as an honest, or at least, costly signal (Zahavi & Zahavi, 1997). In the current investigation, we predicted that exposure to mating cues would lead participants to display increases in declarative memory.

In addition to this hypothesis, we considered the possibility that there might be relatively greater effects among men than women. First, mental qualities are especially important to

Table 1. Study 1: Mean (and Standard Deviation) Memory Performance by Priming Condition and Sex.

Priming Condition	Males (<i>n</i> = 28)	Females (<i>n</i> = 30)
Attractive faces (<i>n</i> = 32)	2.81 (1.38)	2.44 (1.82)
Average-looking faces (<i>n</i> = 26)	1.50 (1.51)	2.79 (0.97)

Note. Higher numbers indicate better memory performance.

people who are seeking long-term partners (Buss, 1989; Miller, 2000) and women are relatively more inclined than men to seek long-term relationships (Buss & Schmitt, 1993). Second, relative to men, women tend to place greater priority on desirable mental (as opposed to physical) traits when seeking partners (e.g., Li et al., 2002). Thus, signaling desirable mental traits might be especially useful for men seeking female partners, although we do not rule out the possibility that women may also show enhancements in the display of mental traits as a way of attracting men.

To test our hypotheses, we conducted two experiments in which participants were exposed to mating primes and listened to information they were later asked to recall. We predicted that mating primes would lead to displays of enhanced memory, perhaps especially among men.

Study 1

Method

Fifty-eight psychology students (30 women) participated for course credit (age ranged from 18 to 28 years). Participants were randomly assigned to view 10 opposite-sex faces that were pre-rated (7-point scale) as either highly attractive ($M = 6.16$) or average in attractiveness ($M = 2.55$). Previous studies demonstrate that highly attractive faces can prime mating motives (Baker & Maner, 2008; Wilson & Daly, 2004). While viewing the faces, participants listened via headphones to a male voice reciting a spoken account of two people who spend a day completing errands and engaging in social interactions. Participants were instructed to pay attention to both the story and the faces and were told that they might be asked to remember either later on. This instruction was provided in order to prevent participants from closing their eyes in order to focus solely on the details of the story, which would have prevented exposure to the facial stimuli. Ten faces were presented for 7 s each, spanning the 70 s duration of the audio presentation of the story. Finally, participants answered six questions designed to test their memory for the details of the story (e.g., "Where did the characters go before they went to the hardware store?"). Correct answers were summed with higher scores indicating better memory performance.

Results and Discussion

Descriptive statistics are provided in Table 1 and an interaction plot is provided in Figure 1. A 2 (attractive vs. average faces) \times 2 (participant sex) analysis of variance revealed a significant

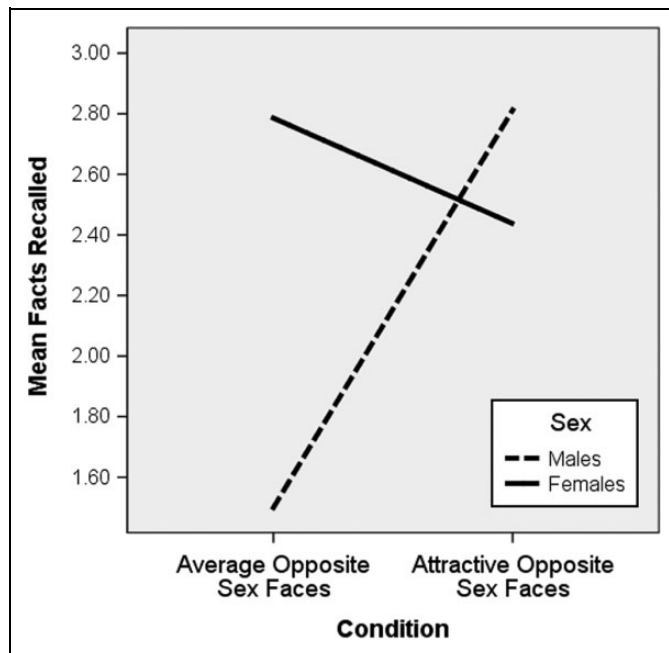


Figure 1. Study 1: Interaction between participant sex and prime condition.

Sex \times Condition interaction, $F(1, 54) = 4.60, p = .04, \eta^2 = .08$. In order to probe this interaction, the responses of men and women in the two facial attractiveness conditions were analyzed separately using post hoc t -tests. A Levene's test for Equality of Variances suggested that equal variances should not be assumed for female participants in the two conditions ($F = 8.70, p < .01$); therefore, the more conservative version of this test is reported. This was not the case for male participants. Although memory performance of female participants did not vary by condition, $t(23.5) = -.66, p = .51, d = .24$, there was an effect of the facial stimuli among men, such that men who viewed attractive female faces while listening to the story remembered more details than men who viewed average faces, $t(26) = 2.40, p = .02, d = .91$.

Findings from Study 1 are consistent with the hypothesis that mating cues enhanced memory performance, and this effect was observed in men but not women. However, the relatively low mean for men in the control condition of Study 1 creates some interpretational ambiguity such that it is unclear whether the observed main effect was driven by the enhancement of memory among men who viewed the attractive faces or an impairment of memory among men who viewed the average-looking faces. Moreover, the results leave open the possibility that effects were driven merely by increases in arousal, as opposed to mating motives. Thus, Study 2 provided a replication experiment and directly assessed the potential role of arousal.

Finally, because the story was presented at the same time as the stimuli, the design of Study 1 leaves open the possibility that mating cues increased encoding, in addition to or instead of retrieval. Indeed, it is reasonable to assert that encoding enhancement might convey similar benefits to retrieval

enhancement, given that successful retrieval is, to some extent, dependent upon successful encoding. However, we argue that although encoding and retrieval are not completely independent, neither are they homologous, as one can fail to retrieve information that was successfully encoded. Another important distinction between encoding and retrieval that is relevant to the current signaling hypothesis is the different functional value of these processes. Retrieval is a process through which people can directly communicate to others their knowledge and intelligence, thus serving as an honest signal of mental traits that would be desired by a potential mate. Encoding, on the other hand, is an early stage mechanism that can signal mental prowess only via more downstream processes (i.e., those that communicate the information that was encoded). In other words, encoding success is private and can only function as a signal via retrieval. Thus, compared with retrieval, one might expect that encoding would not be as readily affected by exposure to mating cues. Furthermore, consider that if information is successfully encoded, then this stored information may or may not contribute to mating-related signaling at an unknown later time, whereas retrieval immediately following exposure to mating primes would be much more likely to function as a display of desirable traits. We therefore argue that retrieval, due to its greater degree of functional value and relevance to self-presentation, is likely to have been subject to greater selection pressure than encoding. Study 2 addresses the uncertainty of whether mating cues affect encoding, retrieval, or both processes by varying the time at which exposure to mating cues occurred.

Study 2

Method

Two hundred and twenty-eight psychology students (123 women) participated for course credit (age ranged from 18 to 39 years). Participants viewed the same opposite-sex faces and listened to the same story as in Study 1. However, the order of presentation was altered to isolate retrieval as the stage of processing affected by mating cues. Participants were exposed to stimuli in one of three orders. In the "encoding enhancement" condition, participants viewed attractive faces immediately followed by an audio presentation of the story, then viewed average-looking faces, and finally completed a test of their memory for the details of the story. Thus, in the encoding enhancement condition, the mating cues (attractive faces) were perceived immediately prior to encoding, which was intended to activate mating motives during the encoding stage. In the "retrieval enhancement" condition, participants viewed average-looking faces, listened to the story, then viewed attractive faces, and finally completed a test of their memory for the story. Thus, in the retrieval enhancement condition, the mating cues were perceived immediately prior to retrieval so that mating motives would be active during retrieval. Participants in a "no enhancement" condition viewed average-looking faces prior to both the story and the memory test. Although

Table 2. Study 2: Mean (and Standard Deviation) Memory Performance by Priming Condition and Sex.

Priming Condition	Males (<i>n</i> = 97)	Females (<i>n</i> = 112)
Retrieval enhancement (<i>n</i> = 73)	4.26 (1.48)	3.79 (1.42)
Encoding enhancement (<i>n</i> = 58)	3.25 (1.23)	3.62 (1.54)
No enhancement (<i>n</i> = 78)	3.68 (1.53)	3.35 (1.55)

Note. Higher numbers indicate better memory performance. That average performance was worse across participants and conditions in Study 1 compared to Study 2 is likely due to the fact that the mating-related stimuli and the story were presented simultaneously in Study 1, thus dividing participants' attention.

average-looking, opposite sex individuals might be viewed as potential mates, exposure to average faces does not prime mating motives as strongly as exposure to images of highly attractive faces (Baker & Maner, 2008). The audio presentation of the story in Study 1 occurred simultaneously with the presentation of the facial stimuli, thus dividing participants' attention between visual and auditory stimuli. Since the facial stimuli in Study 2 were presented prior to and following the story, participants were asked to view seven emotionally neutral images chosen from the International Affective Picture System (Lang, Bradley, & Cuthbert, 1997) while they listened to the story. In order to keep the task as similar as possible between Study 1 and Study 2, participants were instructed to pay attention to both the pictures and the story. Memory performance was again measured by summing accurate responses to six questions about the story. Participants also completed the Brief Mood Introspection Scale (BMIS, Mayer & Gaschke, 1988), a widely used 16-item scale that provides measures of arousal (e.g., "lively") and positive mood valence (e.g., "content") that have been shown to have factor validity and Cronbach's α reliabilities ranging from .76 to .83. The BMIS was presented immediately following the presentation of the attractive faces in the encoding enhancement and retrieval enhancement conditions and following the second presentation of average-looking faces in the no enhancement condition.

Results and Discussion

Descriptive statistics are provided in Table 2. Nineteen participants indicated during debriefing that they had participated in Study 1; their data were excluded from analysis. An omnibus 3 (encoding enhancement vs. retrieval enhancement vs. control) \times 2 (participant sex) analysis of covariance with the BMIS subscales of arousal and pleasant mood included as covariates revealed a main effect of condition, $F(2, 201) = 6.68, p < .05, \eta^2 = .03$, but no interaction between condition and participant sex, $F(2, 201) = 1.59, p = .21, \eta^2 = .016$, and no effects of arousal, $F(1, 201) = .01, p = .93, \eta^2 < .001$, or mood, $F(1, 201) = 2.79, p = .26, \eta^2 = .006$. A planned comparison confirmed that participants who viewed attractive faces prior to retrieval remembered significantly more details than participants in the other two conditions, $F(1, 203) = 5.83, p < .05, \eta^2 = .03$. Consistent with Study 1, this effect was larger in men

($\eta^2 = .062$) than in women ($\eta^2 = .007$), although the interaction with participant sex was not significant.

These results indicate that exposure to mating cues enhanced retrieval rather than encoding, and this effect occurred independent of any effects of arousal or mood. Furthermore, although the interaction with participant sex was not significant, there was some indication that the effect was relatively stronger in men than in women (consistent with the findings of Study 1).

General Discussion

Because memory is essential for resource acquisition and other survival skills, a central aspect of human intellectual performance, and is associated with a variety of other desirable mental traits, a display of robust memory can serve as an honest signal of one's possession of an array of reproductively beneficial traits. The current studies found that memory displays were enhanced by exposure to mating cues and these effects were not due to mood or arousal. These findings are consistent with the hypothesis that mating primes would motivate people to display desirable mental abilities. Study 2 demonstrated that this enhancement was specific to retrieval, rather than encoding, fitting with the idea that enhancements in declarative memory serve a social signaling function.

We observed some evidence that effects of mating cues on memory displays were relatively stronger in men than women, although the strength of this evidence was inconsistent across studies. A sex difference would fit with previous work demonstrating that, compared with men, women tend to place relatively greater weight on the mental traits of prospective partners (Buss & Schmitt, 1993); thus, men may reap particular benefits from signaling desirable mental attributes like good memory.

One possible explanation for inconsistent evidence for sex difference might lie in the way the primes were presented. Griskevicius et al. (2006) found that men's creativity was enhanced when primed with either a short-term or a long-term mating goal, whereas women's creativity was enhanced only when primed with a long-term goal. The attractive faces we used are likely to have primed a short-term mating goal, as physical attractiveness is a trait sought primarily in short-term partners (Li & Kenrick, 2006). Nevertheless, attractive long-term partners are also preferred over unattractive ones, and, thus, the primes in the current experiments may also have primed long-term mating goals. Because the primes did not clearly differentiate between cues relevant to short-term versus long-term mating, this may have weakened our ability to detect sex differences.

Nevertheless, findings from both studies provide novel evidence that exposure to mating cues can lead to displays of enhanced memory. If we had found that images of attractive opposite-sex targets had hindered successful memory displays, some might have dismissed this finding as intuitively obvious. After all, several studies show that attractive members of the opposite sex powerfully capture attention and thus should be

highly distracting (Maner et al., 2003; Maner, Gailliot, Rouby, & Miller, 2007).

The distracting nature of potential mates is consistent with Karremans et al. (2009) who reported that the presence of an attractive opposite sex experimenter caused men to perform more slowly on a test of cognitive performance. The dependent variable used by Karremans and colleagues reflected a measure of response time. It is possible that their findings partially reflected greater effort by participants. A desire to display mental acuity, for example, could have slowed performance; such speed-accuracy trade-offs are well documented in the literature (Dutilh, Wagenmakers, Visser, & van der Maas, 2011). Thus, one possibility is that mating cues may have motivated participants to display desirable mental traits by prioritizing accuracy over speed.

Another important contrast is that, unlike the Karremans et al. (2009) studies, the current studies did not require a face-to-face interaction. Such an interaction would require a greater degree of impression management, which can deplete cognitive resources (Vohs, Baumeister, & Ciarocco, 2005). Indeed, Karremans and colleagues found cognitive performance was negatively correlated with participants' self-reported levels of self-presentation during an interaction with a member of the opposite sex. A strength of the current work is that by exposing participants to mating cues via images rather than an interaction, we were presumably able to avoid tapping into impression management and more directly test the effect of mating cues on cognitive displays.

Nonetheless, impression management is likely an important component in a real-world mating context. The increased cognitive burden of impression management (like that present in Karremans and colleagues' experimental paradigm) would make cognitive displays, such as memory displays, all that much more difficult to fake in an interaction. This fits with the idea that displays of mental traits are honest signals that can demonstrate to potential mates that one possesses reproductively beneficial traits. Given this, the findings of Karremans et al. (2009) study may complement the current work by supporting the premise that successful displays of mental traits are an honest, costly signal of reproductively beneficial traits. Thus, the current studies extend the literature on human mating by providing a more nuanced understanding of how exposure to mating cues impacts displays of cognitive performance. This research also supplements the literature on cognitive performance by identifying a key social variable with the capacity to upregulate people's memory displays.

Additional avenues for future studies are suggested by limitations of our research. For example, because the current work relied upon samples of undergraduate students, who may be especially active in their pursuit of mating interests, it may have provided particularly optimal conditions for testing our hypothesis. Future research would benefit from examining mating-related cognition in more demographically varied samples.

In addition, the current studies operationalized declarative memory as retrieval of details from a spoken story and one that

included only male actors. Future studies would benefit from assessing whether these findings generalize to other stimuli and other measures of declarative memory. Moreover, in light of work suggesting disjunctions between different cognitive processes (e.g., strongly remembering someone despite a lack of attention; Becker et al., 2010), future investigations would benefit from understanding whether similar disjunctions characterize the effects of mating cues on cognitive performance. One possibility is that while mating cues enhance declarative memory, they might initially narrow people's attention, as the presence of a potential mate might distract attention from peripheral aspects of the situation (Maner et al., 2007).

An additional factor that could be included in research that seeks to extend the findings of the current work is the role of hormonal fluctuations in memory displays (and memory performance more broadly). Although the current work did not evaluate where female participants were in their menstrual cycles, it has been established that these fluctuations can influence memory performance (e.g., attention and memory have been shown to be worse at ovulation compared to the luteal phase; Hartley, Lyons, & Dunne, 1987; Solís-Ortiz & Corsi-Cabrera, 2008). Future studies may track ovulation in an attempt to determine whether hormonal fluctuations have any effect on declarative memory.

Finally, it is unclear whether the current research primed short- or long-term mating mind-sets. Although there is considerable overlap between the traits desired in these two contexts, there are also important differences (Buss, 1989; Li et al., 2002). This should have implications for the specific characteristics people signal in these contexts. Future research should examine potential differences between the effects of long- and short-term mating cues on the display of desirable traits.

Although intuition might suggest that exposure to highly attractive people would be distracting and would impair cognitive performance, a functionalist perspective suggests that mating goals might lead people to display desirable mental traits. Because memory is a foundational cognitive process that is linked to important survival skills (such as resource acquisition) as well as desired mental attributes including intelligence, displaying a robust memory would signal a variety of reproductively beneficial characteristics. It is also possible that the memory enhancement following exposure to mating primes that was demonstrated in the current study functions in the service of more downstream processes such as use of humor and generation of creative displays, which play a more direct role in mate attraction. This work provides new insight into fundamental links between social processes and human cognitive performance.

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