
Effects of Visual Exposure to the Opposite Sex: Cognitive Aspects of Mate Attraction in Human Males

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This research is an investigation into the cognitive aspects of mate attraction in human males. Two experiments demonstrate that visual exposure to women (in person or within photographs) can prime large changes in the attitudes, mood states, and personality trait descriptions of male participants. These changes, furthermore, are such that participants show greater conformity to female mate preferences as described in the extant literature: In particular, men exposed to potential mates reported higher valuations of material wealth, greater momentary feelings of ambition, higher valuations of other indicators of social status, and personality trait descriptions indicative of high surgency/extraversion. All such effects occurred without participants' awareness that their responses had been affected by the experimental manipulations. These findings suggest a model of mate attraction mechanisms in which input cues from potential mates can prime those psychological representations that facilitate the behavioral expression of courtship tactics.

Keywords: mate attraction; priming; cognition

Recent research has documented consistent patterns in human mate preferences and attraction tactics (for a review, see Buss, 1994). Little is known, however, about the cognitive mechanisms that implement these preferences and tactics. This article presents an investigation into the cognitive aspects of mate attraction in human males. The objectives of this investigation are twofold: First, to test novel hypotheses about the ability of ecological cues to prime the activation of psychological constructs related to mate attraction, and second, to suggest possibilities for incorporating the empirical and conceptual tools of social cognition research into the study of human mating.

Mating and Mechanism

Much recent work on human mating has been approached from the theoretical perspective of evolutionary psychology. This perspective posits the human mind to be composed of domain-specific psychological mechanisms that are designed to address specific information-processing problems such as mate choice, social exchange, or parenting (e.g., Tooby & Cosmides, 1992). These psychological mechanisms are described as processes that (a) accept narrowly defined informational inputs that indicate the type of processing problem encountered, (b) transform that input information according to certain decision rules, and (c) use the products of those transformations to regulate physiological, psychological, or behavioral outputs (Buss, 1999; Tooby & Cosmides, 1992). The research program entailed by this perspective essentially involves mapping the causal rela-

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tionships between ecological input cues, internal psychological changes, and manifest behavioral outputs.

Extant research on human mate attraction, though, has focused almost exclusively at the level of behavioral output. In typical studies, participants are asked to self-report their attraction tactics to test hypotheses about topics such as sex differences or differential behaviors associated with short-term versus long-term mating (e.g., Buss, 1988; Schmitt & Buss, 1996). Notice that such surveys address neither the input cues that activate behavioral tactics nor the psychological changes that mediate the relationship between input and output.¹ As such, significant portions of the research program for delineating specific mechanisms have yet to be implemented for this domain. Investigation of the cognitive aspects of human mating is a logical next step in this area of research (cf. Roney, 1999).

Social Cognition

The social cognition literature contains many findings that may have implications for the psychological processes involved in human courtship. There is evidence, for instance, that participants will alter the presentation of their own attitudes to more closely correspond to the preferences of attractive members of the opposite sex (Morier & Seroy, 1994; Zanna & Pack, 1975). Participants in these studies were explicitly told the preferences of opposite sex interactants, though, and were led to believe that those interactants would read the participants' own self-descriptions. Nonetheless, this research suggests that one facet of the psychology of courtship may be the alteration of self-conceptions in such a way as to better conform to the preferences of potential mates.

Other research suggests the possibility that specific input cues may be capable of automatically priming the psychological changes associated with mate attraction. Category accessibility experiments test the ability of various input cues to nonconsciously enhance the accessibility of constructs stored in memory as assessed through certain (usually linguistic) behavioral measures (for a review, see Higgins, 1996). Various manipulations have demonstrated that the unobtrusive presentation of input cues can nonconsciously prime attitudes (Bargh, Chaiken, Govender, & Pratto, 1992; Fazio, Sanbonmatsu, Powell, & Kardes, 1986), information-processing goals (Chartrand & Bargh, 1996), personality trait descriptions (Higgins, Rholes, & Jones, 1977; Srull & Wyer, 1979), and even physical behaviors (Bargh, Chen, & Burrows, 1996). Application of such findings to human courtship suggests the possibility that ecological input cues may be capable of nonconsciously priming those changes in self-conceptions that foster greater compliance with the mate preferences of the opposite sex.

In sum, extant research in social cognition offers possibilities for the general nature of the psychological processes involved in mate attraction. Additional research is needed, however, to more precisely characterize cognitive aspects of courtship. The self-presentation studies reviewed above, for instance, directly told participants the preferences of those persons whom they were about to meet. This leaves unknown the way self-conceptions might change without such preference information, first of all, as well as whether such effects would be found absent the expectation of actually interacting with an attractive person. Likewise, the category accessibility literature has been largely limited to the use of input cues that are synonyms for the constructs they are priming (cf. Chartrand & Bargh, 1996, p. 476). As such, extant research provides no guidance as to the nature of ecologically realistic cues that might prime courtship-related changes in self-conceptions. The present work thus seeks to build a richer model of courtship cognition by specifying the relationship between specific input cues and specific psychological changes related to mate attraction.

The Present Research

This research provides a preliminary test of a basic cognitive model of mate attraction in human males. The model posits that (a) sensory stimuli from women can act as input cues that (b) prime a psychological orientation directed toward mate attraction that (c) facilitates the behavioral expression of courtship tactics. Social cognition research supports the plausibility of both steps in the model via its demonstration that objects in the environment can automatically prime psychological constructs (a-b) the activation of which increases the probability of behaving in ways consistent with the content of those constructs (b-c) (see also Bargh & Chartrand, 1999). The present work seeks to make a novel contribution to the human mating literature by providing the first test of the proposed relationship between input cues and psychological responses (a-b).

Candidate input cues for courtship behaviors make functional sense only if they reliably indicate the presence of potential mates or mating opportunities. A logical hypothesis, then, is that visual perception of women can prime the psychological representations that underlie mate attraction behaviors in men. The influence of analogous cues is well documented in many nonhuman species in which males enact courtship displays in response to the sight of females (see Andersson, 1994; Jameson, 1988). Likewise, across many vertebrate species, nontactile exposure to conspecific females is associated with large, short-onset increases in male testosterone levels (e.g., Harding, 1981; Macrides, Bartke, & Dalterio, 1975; Mendoza & Mason, 1989). The logic of the visual exposure hypothesis is thus bolstered by the

fact that the physical mere presence of conspecific females is often a powerful input cue for males of vertebrate species.

The hypothesized content of the psychological orientation toward mate attraction is drawn from previous theory and research on human mating. Based on Trivers's (1972) theory of parental investment, a number of researchers have predicted that ancestral females' parental investment of their own physiological resources (via gestation and lactation) versus males' more indirect investments of material resources (such as food, shelter, protection) should have led to the evolution of sex differences in mate preferences (e.g., Kenrick, Groth, Trost, & Sadalla, 1993). In particular, numerous studies have predicted and found that women express greater mate preferences for cues related to resource possession such as wealth, ambition, and social status, whereas men express greater preferences for cues related to fertility and health such as youth and physical attractiveness (e.g., Buss, 1989; Buss & Barnes, 1986; Kenrick & Keefe, 1992; Kenrick, Sadalla, Groth, & Trost, 1990; for a review, see Feingold, 1992). These findings suggest the hypothesis that male courtship cognition might include changes in self-conceptions such that men place greater importance on cues related to the possession of material resources.

The greater female versus male mate preference for qualities associated with resource possession is consistent with parental investment theory but does not necessarily demonstrate that such qualities are especially important for female mate choice. In fact, self-report studies in which participants rate preference traits one at a time have found that women express the strongest preference for traits such as "kind and understanding" (e.g., Buss & Barnes, 1986). In some studies, furthermore, women even report stronger preferences for physical attractiveness than for earning capacity (Buss & Schmitt, 1993).

Such self-report findings are called into question by experimental studies that have pitted preference traits against one another. Townsend and colleagues, for instance, have conducted a series of experiments in which women have shown clear preferences for men high in status and ambition but low in physical attractiveness over men low in status and ambition but high in physical attractiveness (Townsend, 1998; Townsend & Levy, 1990; but see also Speed & Gangestad, 1997). Townsend and Wasserman (1998) presented additional evidence supporting a threshold model in which men must meet minimum standards for income potential and status before being considered as potential dating partners (cf. Kenrick et al., 1990). Other research that has required participants to trade off levels of various traits also has found that women consider resource

acquisition a necessity in a long-term mate (Li, Bailey, Kenrick, & Linsenmeier, in press). Such findings are corroborated by sociological data showing that wealthier men are more likely to marry (Trivers, 1985) and tend to marry women higher in physical attractiveness (e.g., Elder, 1969; Udry & Eckland, 1984). Finally, experiments have shown that women evaluate their romantic relationships less favorably after exposure to men high in dominance but not after exposure to men high in physical attractiveness (Kenrick, Neuberg, Zierk, & Krones, 1994); likewise, men rate themselves as less desirable mates after exposure to dominant men but not after exposure to men who are physically attractive (Gutierrez, Kenrick, & Partch, 1999). Taken together, the above studies argue strongly for the position that cues to resource possession play an important role in male mate attraction.

The present research thus tested the general hypothesis that visual exposure to potential mates can prime a psychological orientation in men that accords elevated importance to cues associated with the control of material resources. Specifically, men exposed to young women were hypothesized to report more favorable attitudes toward material wealth, greater momentary feelings of ambition, and higher importance ratings of other indicators of social status. In addition to tests of these hypotheses, the present data also allowed an exploratory examination of whether men would value their own kindness and physical attractiveness more highly after exposure to potential mates. The overall focus on wealth and social status in this research was not meant to imply that other traits are not important for male courtship; rather, this choice allowed for a clear initial test of the cognitive courtship model by using a focused set of content items for which there was a clear theoretical and empirical rationale.

STUDY 1

The first experiment tested whether the physical mere presence of members of the opposite sex could prime psychological changes associated with mate attraction. In particular, male participants in mixed-sex groups were predicted to report more positive attitudes toward material wealth than those in same-sex groups. Subsidiary analyses were undertaken to provide a broader context for tests of the main hypothesis. An item measuring the importance of dating success was analyzed to assess whether the general goal of mate attraction had been primed in the mixed-sex condition. Two items that indirectly indexed attitudes toward kindness and three items related to physical attractiveness also were examined to test whether the mixed-sex context might affect importance ratings of other characteristics

that are rated desirable in self-report studies of mate preferences.

The inclusion of female participants in Study 1 also allowed for a preliminary test of similar priming effects in young women. The theoretical rationale for such effects, however, is more uncertain. Trivers's (1972) theory of parental investment, for instance, predicts that the sex that invests more in offspring will be more discriminating and cautious in its mate choice, and, as such, young women may require more than just visual information about potential mates before initiating efforts at mate attraction (see Townsend & Wasserman, 1998, for evidence consistent with this idea). Nonetheless, the available data allowed for a test of the possibility that female participants in a mixed-sex condition would report elevated importance ratings of traits associated with male mate preferences (e.g., physical attractiveness).

Method

Participants. The 10th and 12th grades of a Midwestern high school were sent parental consent requests for participation in a larger study (see Csikszentmihalyi & Schneider, 2000). The 278 students who received permission were randomly assigned (within restrictions imposed by the sizes of available rooms) to one of five testing rooms: two same-sex rooms, one male and one female; one room in which both male and female participants were seated in cubicles in an attempt to approximate an alone condition; and two mixed-sex rooms. Participation on the day of testing was voluntary and 159 students complied. The alone condition was dropped from consideration given that the cubicles were arranged such that students were able to partially see one another.² This left 142 participants distributed as follows: 17 males and 25 females in the respective same-sex rooms, 11 males and 16 females in the first mixed-sex room, and 27 males and 46 females in the other mixed-sex room. The two mixed-sex rooms were combined for data analyses because responses across rooms did not differ within sex for any of the items examined in the results. Rates of compliance with the original room assignments were as follows: 42.5% and 55.9% in the male same-sex and mixed-sex conditions, respectively; 62.5% and 62% in the female same-sex and mixed-sex conditions, respectively.

Materials. Participants completed three large booklets of surveys as part of the larger study. Three specific questionnaires were targeted for analysis in this experiment. The first asked students to answer the question, "For the job you expect to have in the future, how important are the following to you?" Sixteen items were assessed on a 5-point scale (1 = *not at all important*, 5 = *very important*), including the target item, "having lots of money," as well

as two items related to kindness: "helping people" and "working to improve society." The second questionnaire read: "When you are working on a difficult task such as schoolwork, how important are the following to you?" Thirteen items were assessed using the same 5-point scale and included the target item, "getting information that will help you make money later." The third questionnaire was a modified version of an instrument used in the larger study in which items related to mate attraction were added. It queried: "How important are the following to you in your life?" Twenty items were assessed on a 9-point scale (1 = *not important*, 9 = *very important*), including such items as, "having an active dating life" and "being considered physically attractive." Participants in the larger mixed-sex testing room did not complete the third questionnaire because the investigators in the larger study limited the use of the modified version to only a subset of the participants.

Also included among the instruments of the larger study were requests for self-reports of high school grades and parents' level of education. Previous research has shown that importance ratings of money are inversely related to socioeconomic status and quality of high school grades (Green, 1993). As a check on the effectiveness of random assignment, therefore, students' grades and parents' education were examined for associations with the testing conditions.

Procedure. Participants simply filled out the survey booklets without any reference being made to either the gender composition of the testing room or the identity of the target surveys. Responses were written privately and participants were discouraged from talking to one another.

Results

Checks on random assignment. Students were unaware of the conditions to which they had been assigned before their arrival, and their names were checked against room assignments to ensure there was no self-selection into particular testing conditions. Nonetheless, the high rates of attrition across testing rooms suggests, the importance of checking the effectiveness of random assignment. If deviations from random assignment were causing scores on the target items to differ across conditions, then one would expect variables correlated with the target items to also differ across testing contexts. As mentioned earlier, students' grades and socioeconomic status are both known to correlate inversely with valuations of wealth. Students' self-reported grades were virtually identical across testing conditions (same-sex vs. mixed-sex) for both males, $F(1, 130) = .06, p = .80$, and females, $F(1, 130) = .05, p = .83$. Parents' education was examined as a rough index of socioeconomic status. In 50.5% of the sample, the highest educated parent had a

bachelor's degree or less, and in 49.5% of the sample, the highest educated parent held some sort of graduate degree. The association between these two outcomes and experimental condition was not significant for either males, $\chi^2(1, N = 48) = 1.18, p = .28$, or females, $\chi^2(1, N = 61) = 1.27, p = .26$. These results provide no evidence that students were distributed across conditions in anything but a random manner.

Main hypothesis. The main hypothesis predicted an interaction between gender and testing context such that males but not females would rate the importance of material wealth more highly when in mixed-sex groups than when in same-sex groups. The two target items related to wealth were combined ($r = .50$) to create a composite variable (statistical conclusions were unchanged when the items were analyzed separately). Figure 1 depicts the results for this composite measure (for males: same-sex $M = 3.47, SD = .98$ and mixed-sex $M = 4.21, SD = .61$; for females: same-sex $M = 3.50, SD = .80$ and mixed-sex $M = 3.46, SD = .91$). The predicted interaction effect was in fact statistically significant, $F(1, 131) = 6.01, p < .01, \eta^2 = .04$. Males in the mixed-sex group reported significantly higher importance ratings than did males in the same-sex group, $F(1, 131) = 9.11, p < .01, \eta^2 = .07$, whereas there were no differences across testing conditions among female participants, $F(1, 131) = .03, p = .86, \eta^2 = .00$.

The effect of social context did not generalize across non-target items. The two questionnaires in which the items pertaining to wealth were embedded contained an additional 27 items that assessed the importance of such things as "enjoying what you are doing" and "teaching others." Interactions between gender and testing context were not significant for any of these items. Within gender, responses differed significantly across testing conditions for only 1 of these 27 items;³ one or two significant differences could be expected by chance. The specificity of the context effect rules out alternative explanations that might appeal to effects of the manipulation on general response patterns (e.g., a tendency to produce more socially acceptable answers).

Subsidiary analyses. Post hoc analyses were undertaken to provide initial tests of the breadth of the proposed priming effect. Two items from the first questionnaire—"helping people" and "working to improve society"—were combined ($r = .60$) to form a rough index of attitudes toward kindness. The interaction between gender and testing context approached statistical significance for this composite measure, $F(1, 130) = 2.86, p < .10, \eta^2 = .02$. Mean scores for males students, however, were nonsignificantly higher in the same-sex condition ($M = 3.88, SD = 1.01$) than in the mixed-sex condition ($M = 3.5, SD = 1.18$), $F(1, 130) = 1.80, p = .18, \eta^2 = .01$. The

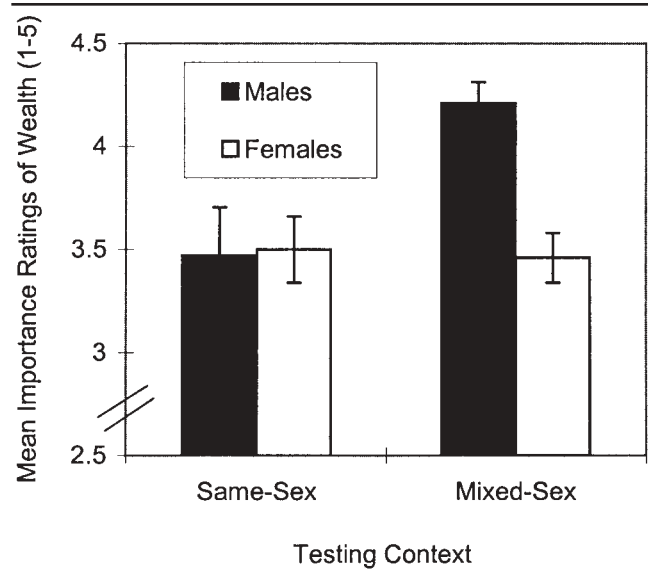


Figure 1 Mean importance ratings of material wealth ($\pm SE$) computed as the average of the two target items and depicted by sex and testing context.

NOTE: Sample sizes were $n = 17$ males and $n = 25$ females in the same-sex condition; $n = 36$ males and $n = 57$ females in the mixed-sex condition.

opposite nonsignificant trend was evident among female participants: same-sex $M = 3.76, SD = .79$; mixed-sex $M = 4.0, SD = .87, F(1, 130) = 1.06, p = .31, \eta^2 = .01$. These data provide no evidence for an effect of testing context on male attitudes toward kindness that is similar to the effect of context on attitudes toward material wealth.

The third questionnaire contained six items related to mating (see Table 1). The item that assessed "importance of having an active dating life" was examined as an indirect measure of whether the goal of mate attraction had been primed in the mixed-sex condition. Importance ratings were higher in the mixed-sex condition for both sexes, although the within-sex contrast across testing conditions was significant for males, $F(1, 55) = 4.0, p = .05, \eta^2 = .07$, but not for females, $F(1, 55) = 1.55, p = .22, \eta^2 = .03$. The interaction between gender and testing condition was not significant, $F(1, 55) = .45, p = .51, \eta^2 = .01$. These results suggest that the mixed-sex context may have primed the goal of mate attraction in male students but they do not provide sufficient evidence to conclude that any such effect was stronger in males than in females.

Table 1 also includes items that assessed attitudes toward physical attractiveness, wealth, and social status. There were no statistically significant effects of the manipulation for any of these items, but there were trends toward higher importance ratings of all three qualities in the mixed-sex condition among the male students. These null findings should be interpreted with

TABLE 1: Mean Importance Ratings by Gender and Testing Condition

	<i>Males</i>				<i>Females</i>			
	<i>Same-Sex^a</i>		<i>Mixed-Sex^b</i>		<i>Same-Sex^c</i>		<i>Mixed-Sex^d</i>	
	M	SD	M	SD	M	SD	M	SD
Having an active dating life	5.53	1.94	7.0	1.56	4.44	2.16	5.25	1.53
Being considered good looking, physically attractive	4.94	2.16	5.91	2.77	5.44	1.75	5.19	2.04
Being thin	4.00	2.09	4.82	2.36	5.44	2.06	5.20	1.90
Dressing well, having stylish clothes	4.94	2.33	6.10	2.60	5.13	1.75	5.25	2.21
Having lots of money	5.71	2.17	6.82	2.09	5.47	2.23	5.31	1.99
Having prestige, social status	5.19	1.87	6.09	1.64	4.40	2.13	4.20	1.52

NOTE: Questionnaire read: "How important are the following to you in your life?" The scale ran from 1 (*not important*) to 9 (*very important*).

a. $n = 17$.

b. $n = 11$.

c. $n = 16$.

d. $n = 16$.

caution, though, given the smaller sample sizes for items drawn from the third questionnaire.

Discussion

Results from the first experiment provide initial support for the cognitive model of male mate attraction. As predicted, male students in a mixed-sex testing environment reported higher valuations of material wealth than did male students in a same-sex environment. Young men in the mixed-sex condition also reported higher importance ratings of having an active dating life. These findings suggest that the presence of young women may have primed in young men both the implicit goal of mate attraction and the activation of attitudes consistent with that goal. The breadth of the priming effect is less certain. There was a trend toward higher importance ratings of physical appearance among males in the mixed-sex condition but no such trend for items that indexed attitudes toward kindness. In all, the restriction of context effects to items related to wealth, dating, and physical attractiveness provides at least face validity for the contention that the experimental manipulation specifically affected psychological representations related to mating and mate attraction.

The social context manipulation had no discernible effects on female students' responses. As mentioned earlier, expectations for such effects were weaker: Females of most vertebrate species court males less vigorously than vice versa and usually require more than minimal visual information before doing so (e.g., Andersson, 1994; Trivers, 1972). In addition, the tendency for women to report greater attraction to men older than themselves (e.g., Kenrick & Keefe, 1992) suggests the possibility that the female participants in this study were relatively uninterested in the high school boys with whom testing took place. Because Study 2 employed only male participants, the investigation of cognitive aspects

of female mating psychology remains a topic for future research.

STUDY 2

The second experiment was an attempt to replicate and extend the results of the first study while actively manipulating the likelihood that persons to whom participants were exposed would be considered potential mates. In the first experiment, it was simply assumed that male students in the mixed-sex condition would perceive some of the female students as potential mates. In the second experiment, male participants were exposed to magazine advertisements containing photos of either young women who were rated highly attractive or older women who were rated less attractive. The general objective of this manipulation was to test whether the high-attractiveness photos would be differentially more likely to act as input cues capable of priming psychological responses related to mate attraction.

Study 2 was designed to test three a priori hypotheses. Hypothesis 1 predicted that men exposed to the younger women would report higher importance ratings of their own financial success than would men exposed to the older women. Subsidiary to Hypothesis 1, other items related to social status and resource accrual capacity (e.g., "having a prestigious job") were also predicted to be more highly valued after exposure to the younger models. Hypothesis 2 predicted that men who had just viewed the advertisements containing the younger models would report feeling more ambitious than would men who had just viewed the other advertisements. Women from many different cultures rate ambition as one of the most highly desired characteristics in a potential mate (Buss, 1989); the projection of ambitiousness may therefore be an effective male courtship response. Finally, Hypothesis 3 predicted that men exposed to the younger models would produce self-descriptions that

female raters estimated to be associated with greater odds of attracting women in social situations. If visual exposure to potential mates can in fact prime a psychological orientation that reflects female mate preferences, then the traits momentarily most accessible for the production of self-descriptions may be those that are attractive to the opposite sex.

Method

Participants. Participants were male University of Chicago students recruited by flyers and paid \$6 for their participation. Twenty-six students completed the experiment, but data from 3 participants were excluded because the respondents reported a gay sexual orientation, and a fourth participant's data were dropped due to suspicion of the study's true purpose. Of the remaining 22 participants, 7 were graduate students and 15 were undergraduates. Participants' ages ranged from 18 to 36 years with $M = 22.5$ and $SD = 4.0$.

Materials. Two sets of four magazine advertisements comprised the stimulus materials. In one set of advertisements, three of the ads each contained a photograph of a different female model in her 20s. In the other set, one ad contained a photograph of a model who appeared to be in her 50s and a second ad contained photos of five different women all of whom appeared at least 50 years old. The four ads containing the younger models promoted the following products: skin cream, plastic wrap, beer, and a cruise line. The ads containing the older models promoted a high-end clothing store, a cruise line, expensive windows, and skin cream.

Five men who were not participants in the rest of this study estimated the cost of the products depicted in the respective ads and rated the physical attractiveness of the human models on a 9-point scale. The younger models were perceived as far more physically attractive ($M = 8.4$, $SD = .60$) than were the older models ($M = 3.3$, $SD = 1.41$), paired $t(4) = 7.86$, $p < .01$. These ratings strongly suggest that only the younger models would likely be perceived as potential mates by the young men in this study. The products promoted in the set of ads containing the older models were perceived as slightly more expensive ($M = \$529.95$, $SD = \$113.22$) than those depicted in the set containing the younger models ($M = \$392.90$, $SD = \$123.40$), paired $t(4) = -2.58$, $p < .07$. This trend suggests that higher valuations of wealth reported after viewing the younger models would likely not be attributable to having seen ads for costlier products.

Three instruments were employed to collect the main dependent measures. The first was an attitude scale that queried, "With respect to the job/career you would like to have, how important are the following to you?" Fourteen items were assessed on a 7-point scale (1 = *not at all important*, 7 = *very important*), including the primary tar-

get items, "having a large income" and "being financially successful" (see Table 2). The second instrument was a mood scale with the following instructions: "Please circle the number on the scale that best describes how you feel at this moment." Among the eight items was the target item anchored at *unambitious-ambitious* (see Table 3). The third instrument requested a free-response listing of five personality traits that participants felt were particularly self-descriptive.

Procedure. Materials were administered to participants one at a time in an isolated testing room. Participants were randomly assigned to either a younger models condition or an older models condition. They first read a cover story that requested their participation in both an advertising study and a study of self-conceptions. Participants in the younger models condition then rated the effectiveness of the set of ads containing the younger models, and participants in the older models condition rated the set of ads containing the older models. The attitude scale, mood scale, and free response listing of personality traits followed in that order. A background survey and debriefing questionnaire were presented last. Participants were then fully debriefed, paid, and thanked for their participation.

Results and Discussion

Hypothesis 1. The first hypothesis predicted that men in the younger models condition would report higher valuations of material wealth than would men in the older models condition. The results listed in Table 2 demonstrate the confirmation of this hypothesis: Both of the target items related to wealth were rated much more highly by men in the younger models condition. Ratings of a composite measure of the two items combined ($r = .79$) also differed significantly between the two groups, $t(20) = 3.93$, $p < .001$, $d = 1.76$. It is difficult to overstate the influence of visual exposure on these attitudes: The effect of the manipulation was so dramatic that there was very little overlap between the response distributions of the respective conditions.⁴

Hypothesis 1a. This hypothesis predicted that other indicators of social status also would be evaluated more favorably by men in the younger models condition. The six items at the top of Table 2 were chosen to form a scale assessing the display of social status ($\alpha = .78$). This scale was in fact rated more favorably by men in the younger models condition ($M = 5.09$, $SD = 1.0$) than by those in the older models condition ($M = 3.95$, $SD = 0.95$), $t(20) = 2.73$, $p < .02$, $d = 1.22$. When the wealth items were taken out of the scale, however, differences between conditions only approached significance (younger $M = 4.91$, $SD = 1.09$; older $M = 4.16$, $SD = 1.14$), $t(20) = 1.58$, $p = .13$, $d = .71$. Consistent with the general hypothesis that cues

TABLE 2: Mean Importance Ratings by Testing Condition

Items	Younger Models ^a		Older Models ^b		t	d ^c
	M	SD	M	SD		
A priori display scale						
Having a large income	5.09	1.30	3.27	1.35	3.22**	1.44
Being famous	4.09	1.76	2.73	1.42	2.00	0.89
Being in a position of authority	4.36	2.01	4.27	1.56	0.12	0.03
Having a prestigious job	4.55	2.07	3.82	1.99	0.84	0.38
Being financially successful	5.82	1.08	3.82	1.25	4.02**	1.80
Being able to display your talents	6.64	0.51	5.82	1.17	2.13*	0.95
Miscellaneous items						
Helping people	5.00	1.67	5.36	1.12	-0.60	0.27
Working to improve society	5.00	1.95	5.55	1.37	-0.76	0.34
Teaching others	4.91	1.92	5.82	1.25	-1.32	0.59
Maintaining high ethical and moral standards	5.27	2.05	6.18	0.87	-1.35	0.60
Working closely with other people	5.27	1.74	4.46	1.86	1.07	0.48
Working with your hands	3.55	1.81	3.18	1.17	0.56	0.25
Having few responsibilities	2.91	1.70	2.00	1.27	1.42	0.64
Working outdoors	2.46	1.37	2.46	1.51	0.00	0.00

NOTE: Questionnaire read: "With respect to the job/career you would like to have, how important are the following to you?" The scale ran from 1 (*not important*) to 7 (*very important*).

a. $n = 11$.

b. $n = 11$.

c. Effect sizes measured as Cohen's d . Cohen (1977) defines effect sizes of .20 as "small," .50 as "medium," and .80 as "large."

* $p < .05$. ** $p < .01$.

from potential mates can prime psychological representations associated with courtship displays, the individual item "being able to display your talents" was rated significantly higher in the younger models condition. In general, effect sizes for the items within the display scale provide qualified support for the idea that the changes in attitudes toward wealth were part of a broader priming of the importance of social status.

There were no significant differences between conditions for any of the miscellaneous items within the attitude questionnaire (see Table 2). As with Study 1, then, the attitudinal effects of visual exposure did not appear to generalize across domains unrelated to mating. Also similar to Study 1, results for two items related to kindness—"helping people" and "working to improve society"—revealed no significant effect of the experimental manipulation.

Hypothesis 2. The second hypothesis predicted that men in the younger models condition would report feeling more ambitious than would men in the older models condition. Results depicted in Table 3 demonstrate the confirmation of this hypothesis. Once again, the effect size was quite large ($d = 1.08$). This result is probably not attributable to a general mood induction effect given that average scores on the happy-sad item were virtually identical across the testing conditions. Although not predicted, men in the younger models condition also reported feeling significantly more aggressive (see Table 3).

Hypothesis 3. The third hypothesis predicted that men in the younger models condition would be disproportionately likely to list self-descriptive personality traits that female raters estimated to be associated with greater odds of attracting women. The traits listed by the participants were typed onto separate index cards and presented to five female graduate students who were blind to the study's hypotheses. The women were asked to imagine a social situation and then rate the likelihood that men who conformed to the respective personality descriptions would be successful in securing a date with a woman at the social event. Ratings were made on a 7-point scale (1 = *less likely than other men*, 4 = *equally likely*, 7 = *more likely than other men*). Averaged across the five raters ($\alpha = .88$), there was a trend toward higher ratings of men in the younger models condition (younger $M = 4.40$, $SD = 1.44$; older $M = 3.31$, $SD = 1.20$), $t(19) = 1.90$, $p = .07$, $d = .87$.⁵ This provides initial evidence that the men exposed to potential mates altered their self-descriptions in response to that exposure.

Examination of the specific traits participants listed revealed more evidence for the effect of the manipulation. Consistent with Hypothesis 2, 60% of the men in the younger models condition described themselves as "ambitious" compared to only 9% (one person) in the older models condition, $Z = 2.48$, $p < .01$. Participants' traits also were matched to the Big Five personality factors by looking up their item loadings in a personality study that utilized 1,431 trait adjectives (Goldberg,

TABLE 3: Mean Mood Ratings by Testing Condition

Scale Anchors ^c	Younger Models ^a		Older Models ^b		t	d ^d
	M	SD	M	SD		
Not at all aggressive–Aggressive	2.64	1.21	1.73	0.65	2.20*	0.98
Passive–Active	3.46	1.29	3.00	0.89	0.96	0.43
Submissive–Dominant	3.36	0.67	2.91	0.54	1.75	0.78
Competitive–Not at all competitive	3.18	1.40	3.18	0.98	0.00	0.00
Stingy–Generous	3.36	0.92	3.00	1.00	0.89	0.40
Sociable–Unsociable	2.27	1.49	3.09	0.70	-1.65	0.74
Unambitious–Ambitious	4.09	0.70	3.46	0.52	2.42*	1.08
Happy–Sad	2.55	1.37	2.46	0.93	0.18	0.08

NOTE: Questionnaire read: "Please circle the number on the scale which best describes how you feel at this moment."

a. $n = 11$.

b. $n = 11$.

c. The term on the left corresponded to 1 on the numerical scale; the term on the right corresponded to 5 on the numerical scale.

d. Effect sizes measured as Cohen's d . Cohen (1977) defines effect sizes of .20 as "small," .50 as "medium," and .80 as "large."

* $p < .05$.

1990). Men in the younger models condition listed more traits that load on the positive pole of the extraversion factor (37%) than did men in the older models condition (17%), $Z = 2.22$, $p < .02$. Furthermore, the net positive reference to the extraversion factor (i.e., the number of traits that load negatively subtracted from the number that load positively) accounted for 85% of the variance in the female ratings of the likelihood of dating success, $r(21) = .92$, $p < 10^{-7}$. There were no significant results related to the other four personality factors. In sum, visual exposure to young women increased the likelihood that participants would describe themselves as extraverted, and degree of extraversion in turn predicted female ratings of the probability of dating success.

The effect of the manipulation on self-reports of extraversion was not predicted a priori but is consistent with some previous research related to mate attraction. Berry and Miller (2001), for instance, found that male extraversion and female physical attractiveness were the only significant predictors of quality of interaction (including liking) for previously unacquainted opposite sex dyads. Furthermore, more than half of the extraversion traits listed by men in the younger models condition load highly on extraversion subfactors related to the control of resources, such as dominance and capacity for status. Although differences between conditions on feelings of dominance did not reach conventional significance levels (see Table 3), the effect size ($d = .78$) suggests that the greater reports of dominant personality traits in the younger models condition may have been accompanied by stronger feelings of dominance as well.

Debriefing. None of the final 22 participants expressed any suspicion about the true purpose of the experiment. Likewise, no participant reported having consciously thought about mate attraction, and all of the

participants denied any awareness that their responses had been affected by which set of ads they had examined.

GENERAL DISCUSSION

The two experiments presented here demonstrate powerful but previously unknown psychological effects of exposure to ecologically realistic stimuli. In particular, visual exposure to young women caused dramatic changes in the attitudes, mood states, and personality trait descriptions of young men. Across two very different participant populations, young men who were exposed to young women reported far more favorable attitudes toward material wealth than did men exposed to either other men or older women. Visual exposure to young women also was associated with greater feelings of ambition and aggressiveness, as well as self-descriptions indicative of high surgency/extraversion. These effects all occurred without any evidence that participants were aware of the influence of the experimental manipulations. As such, it appears that visual stimuli from human females are capable of priming large psychological changes in human males.

The psychological effects of visual exposure were unified by their thematic relationships to aspects of female mate preferences. Previous research has found that wealth, ambition, and social status play important roles in female mate choice and male courtship tactics. The effects of visual exposure were largely restricted to items related to precisely these constructs. These results suggest that men may store a representation of female mate preferences in memory that when primed causes the activation of a psychological orientation directed toward mate attraction. This research thus provides the first evidence for a cognitive model of mate attraction in which visual stimuli from potential mates act as input cues capa-

ble of priming psychological changes likely to underlie behavioral courtship tactics. Although this model will no doubt undergo considerable refinement, it is significant as a first attempt to go beyond self-reports of courtship tactics to an examination of the psychological processes involved in mate attraction.

It is important to point out that this research does not bear directly on debates regarding origin theories for specific patterns of mate preferences. Some researchers have argued that patterns of mate preferences develop as evolved predispositions (e.g., Buss & Schmitt, 1993), whereas others contend that they simply reflect prevailing sex-differentiated social roles (e.g., Eagly & Wood, 1999). The present research tested content predictions derived from evolutionary approaches, but the cognitive model of male mate attraction does not actually entail a position on the origin of the psychological representations primed by exposure to potential mates.

The research reported here can be seen as an example and extension of research on motivated cognition (Kunda, 2000). This literature has shown that participants' self-conceptions can change in ways consistent with their current goals. Kunda and Sanitioso (1989), for example, demonstrated that participants were more likely to describe themselves as extraverted after having read that extraversion was associated with success in their field. A similar effect may occur in the present experiments in which specific self-conceptions were altered in ways consistent with the goal of mate attraction. The present experiments extend this literature, though, via the demonstration that mere visual perception of environmental stimuli can cue motivated self-conceptions in the absence of any additional information. As such, these findings link research on motivated cognition with work on automaticity and category accessibility (e.g., Bargh & Chartrand, 1999). The cognitive model of mate attraction offered here is thus consistent with an integration of findings across diverse branches of the social cognition literature.

Limitations and Alternative Explanations

One limitation of the present work is that it leaves ambiguous the breadth of the proposed priming effect. This research focused on content items related to resource possession because both parental investment theory and experimental work on human mating provided clear reasons to expect effects for such content. Nonetheless, other constructs also might be affected by the same input cues. Results from Study 1, for instance, revealed a nonsignificant trend toward higher importance ratings of physical appearance. In neither experiment, however, was there any effect of the manipulations on items related to kindness. Other traits such as intelli-

gence or creativity also might show priming effects. In general, it is difficult to make precise predictions regarding the breadth of the proposed priming effect due to mixed findings from the extant mating literature. Studies in which traits were pitted against one another (e.g., Li et al., in press; Townsend & Levy, 1990) have generally found that cues to resource control have priority status for female mate preferences and male attraction tactics, whereas studies in which preference traits were rated one at a time (e.g., Buss & Barnes, 1986) have reported that these traits are less important than others. The issue is further complicated by the effects of context and individual differences on attraction strategies (Gangestad & Simpson, 2000). The present findings are most consistent with parental investment theory and the more experimental studies of mate preferences, but future work should more precisely define both the content and contextual qualifications of the mate attraction priming effect.

Another limitation concerns the absence of positive findings related to female mate attraction. Null results for female students in Study 1 may have been a consequence of sex differences in responsiveness to mere visual exposure to potential mates. Future work might test whether other types of input cues from potential mates can prime psychological changes related to mate attraction in women.

Alternative explanations might be offered for the results presented here. Some aspect of the content in the magazine ads of Study 2, for instance, might have primed constructs related to the target variables. A number of factors, however, corroborate the idea that the priming effects were related to mate attraction. First, the higher importance ratings of material wealth in the exposure conditions of both studies argue against any alternative explanations that are applicable to only one of the experimental manipulations (such as a response to the content of the magazine ads). Second, the restriction of effects to items related to male courtship tactics argues against more domain-general priming effects that could be expected to affect a broader array of items. On a related note, significant effects were found for items that were directly related to mating and courtship display, such as "having an active dating life" in Study 1 and "being able to display your talents" in Study 2. Third, effectiveness ratings of the ads used in Study 2 did not mediate the effects of the manipulation on the target variables (see Note 4) and, as such, there is no positive evidence that the content of the ads introduced confounds. Fourth, the female graduate students' ratings of the personality traits listed in Study 2 provide at least prima facie external validation for the idea that exposure to young women primed more attractive self-conceptions. In sum, the available evidence suggests the priming of a

psychological orientation related to courtship as the most parsimonious explanation for the results of the two experiments. Nonetheless, alternative explanations are possible and could be investigated in future research.

Directions for Future Research

The present evidence does not allow determination of whether the mechanism postulated in this study represents a specialized courtship adaptation or is the by-product of associationist mechanisms that have caused specific visual cues to become linked to particular psychological responses. Future research will be necessary to investigate the possibility of specialized adaptation. One direction for such research could be the identification of the brain pathways that mediate the relationship between sensory input and cognitive output. Research on nonhuman vertebrates has implicated components of the limbic-hypothalamic circuit as the transducing pathway that mediates the perception of stimuli from potential mates and the activation of various sexual responses (e.g., Baum, 1992). These same brain structures, furthermore, are known to regulate levels of sex steroids such as testosterone. Research could therefore investigate whether reactive increases in testosterone levels are correlated with psychological reactions to sensory cues from women. Positive results would strongly suggest phylogenetic continuity between the specialized neurobiological structures that implement courtship responses in human and non-human species. Other research could investigate topics such as individual differences or developmental trends in responses to cues from potential mates. In short, the present work is envisioned as the first step in a research program directed toward the elucidation of the cognitive, neurobiological, developmental, and phylogenetic aspects of mate attraction in human males.

Conclusion

The present research is noteworthy as one of the first investigations of the cognitive aspects of human mating. The two experiments taken together provide evidence for a heretofore unknown psychological courtship response in human males. In particular, young men who were exposed to young women seemed to adopt the psychological profile of high-status men, at least in Western cultures: They reported high valuations of their own financial and social success, momentary feelings of ambition, and personality traits indicative of high surgency/extraversion. These effects imply that images of women have a heretofore unrecognized potency to broadly affect the thought processes of men. Whatever its explanation, this potency may have important implications for the nature of human social cognition.

NOTES

1. Simpson, Gangestad, Christensen, and Leck (1999) examined how participants contrasted themselves with competitors after exposure to an attractive confederate who posed as a potential dating partner. This study did employ ecologically realistic inputs (auditory and visual exposure to the confederates) but did not measure psychological changes that may have mediated the relationship between inputs and behavioral tactics.

2. Males in the cubicle condition reported scores on the target items that were on average intermediate between scores within the same-sex and mixed-sex conditions. Statistical conclusions for the target items were unchanged when data from participants in the cubicle condition were included in the same-sex condition.

3. For the item that assessed the importance of "Living up to your parents' expectations," males in the mixed-sex condition ($M = 3.86$, $SD = .92$) reported higher ratings than did males in the same-sex condition ($M = 2.88$, $SD = 1.05$), $F(1, 135) = 11.24$, $p < .01$, $\eta^2 = .08$.

4. As part of the cover story for the experiment, participants rated each ad on 5-point scales for overall effectiveness, visual appeal, and quality of the product being advertised. When these ratings were combined to form a composite index ($\alpha = .83$), ads in the younger models condition ($M = 3.54$, $SD = .62$) were rated more highly than those in the older models condition ($M = 2.94$, $SD = .46$), $t(20) = 2.62$, $p < .05$, $d = 1.17$. More important, though, when these composite ratings were partialled out, the point-biserial correlations between experimental condition and the target variables were still significant for both the items related to wealth, $r(19) = .64$, $p < .01$, and the item that assessed ambition, $r(19) = .47$, $p < .05$. Likewise, inclusion of effectiveness ratings in regression analyses had no effect on the amount of variance in the target variables explained by experimental condition.

5. Degrees of freedom are only 19 because one participant in the younger models condition did not complete this section.

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