

The Heat of the Moment: The Effect of Sexual Arousal on Sexual Decision Making

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ABSTRACT

Despite the social importance of decisions taken in the “heat of the moment,” very little research has examined the effect of sexual arousal on judgment and decision making. Here we examine the effect of sexual arousal, induced by self-stimulation, on judgments and hypothetical decisions made by male college students. Students were assigned to be in either a state of sexual arousal or a neutral state and were asked to: (1) indicate how appealing they find a wide range of sexual stimuli and activities, (2) report their willingness to engage in morally questionable behavior in order to obtain sexual gratification, and (3) describe their willingness to engage in unsafe sex when sexually aroused. The results show that sexual arousal had a strong impact on all three areas of judgment and decision making, demonstrating the importance of situational forces on preferences, as well as subjects’ inability to predict these influences on their own behavior. Copyright © 2005 John Wiley & Sons, Ltd.

KEY WORDS sexual arousal; situational influences; prediction of preferences

INTRODUCTION

The sex drive is a vitally important motivational force in human behavior, from the perspective of both the individual and the society. Sexual motivation plays a direct role in considerable economic activity, including pornography and prostitution, and a less direct role in diverse industries and activities such as night-time entertainment, advertising, and fashion. Sexual motivation and behavior also underlies numerous social ills, including sexually transmitted disease, unwanted pregnancies, and sex-related crimes.

Despite the importance of the topic, most of the information we have about the effect of sexual arousal on judgment, choice, and behavior more generally, comes from personal or vicarious experience. Unlike the extensive research on, for example fear (e.g., LeDoux, 1996; Lerner & Keltner, 2001; Panksepp, 1998), there has been very little research tracing out the diverse effects of sexual arousal on judgment and decision making. In this paper, we examine the effect of sexual arousal in young male adults on three aspects of judgment

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and choice: (1) their preferences for a wide range of sexual stimuli and activities, (2) their willingness to engage in morally questionable behaviors in order to obtain sexual gratification, and (3) their willingness to engage in unsafe sex when sexually aroused.

There are good reasons, beyond introspection and casual empiricism, to suspect that sexual arousal will affect these dimensions of judgment and choice. The sexual circuitry of men and women evolved not only to orchestrate sexual behavior but also to motivate it in suitable situations (Buss, 2003; Rolls, 1999). By exogenously arousing male subjects we are, in effect, parasitizing men's evolved psychological mechanisms, providing internal and external cues that would ordinarily be associated with increased odds of gaining access to what Buss and Schmitt (1993) refer to as "short-term opportunistic copulation."

Most appetitive systems in the brain, including hunger and thirst, are designed to increase motivation during times of opportunity (Rolls, 1999), and there is no reason to expect sex to be an exception to the rule. When the brain receives cues that are commonly associated with opportunities for copulation, which would include experiencing a state of high sexual arousal, we should expect to observe an increase in motivation to have sex.¹ This increase in motivation should, in turn, have diverse consequences for judgments and decisions. Consistent with such a prediction, prior research has shown that sexual motivation can distort judgments of the risk of contracting sexually transmitted disease (Blanton & Gerrard, 1997; Ditto, Pizarro, Epstein, Jacobson, & MacDonald, 2005), and that it leads to steeper time discounting in males (Wilson & Daly, 2004).

The next question is whether individuals can correctly estimate the effects of high sexual arousal states on their preferences and behavior. Based on prior research on "hot-cold empathy gaps" (Loewenstein, 1996; Loewenstein, O'Donoghue, & Rabin, 2003; Van Boven & Loewenstein, 2003), we anticipated that people who were not aroused would underestimate the influence of emotional arousal on their preferences and decisions. Previous research has demonstrated hot-cold empathy gaps across several emotional states. For example, people who do not own an object underestimate how attached they would be to it and how much money they would require to part with the object if they owned it (Loewenstein & Adler, 1995; Van Boven, Dunning, & Loewenstein, 2000). People who are about to exercise predict they would be less bothered by thirst if they were lost without food or water than do people who have just exercised and are thirsty and warm (Van Boven & Loewenstein, 2003). People who are sated because they have just eaten are less likely to choose a high-calorie snack to consume at a well-defined time in the future than hungry people who have not eaten (Read & van Leeuwen, 1998), and people who are hungry because they have not eaten expect to be more interested in eating a plate of spaghetti for breakfast than people who are sated (Gilbert, Gill, & Wilson, 2002). Heroin addicts who are not currently craving because they just received a "maintenance" dose of opioid agonist, value getting an extra dose a week later about half as highly as those asked to value the extra dose an hour earlier, before they have received their maintenance dose (Giordano et al., 2002). And, in the prior research most obviously relevant to the research reported here, men who are not sexually aroused predicted they would be less likely to engage in sexually aggressive behavior than men who are sexually aroused as a result of viewing photographs of nude women (Loewenstein, Nagin, & Paternoster, 1997).

A finding that sexual arousal affects predictions of the individual's own judgments and behavior would not only support the idea that arousal influences decision making, but also suggest that people have little insight into these effects. If people were aware of how their judgments and (hypothetical) decisions were being influenced by their own state of arousal then they could compensate for such influences in their judgments and decisions. When not aroused, if they appreciated how being aroused would influence their responses and expected to be aroused in the situation asked about in the question, they could adjust their answers accordingly. The same logic would apply to those who were aroused if they fully appreciated how the arousal was influencing their responses.

¹We might also expect to observe a commensurate decrease in other dimensions of motivation (see, Brendl, Markman, & Messner, 2003).

The experiment presented below was designed to jointly test if a state of sexual arousal influences these three aspects of judgment and choice (preferences for a wide range of sexual stimuli; willingness to engage in morally questionable behavior; and their willingness to engage in unprotected sex), and whether our participants can accurately predict these influences.

THE STUDY

Method

Research participants were given a laptop computer and were asked to answer a series of questions using a small handheld keypad. The keypad and the program that administered the questions were designed to be operated easily using only the non-dominant hand. In the control (non-aroused) treatment, subjects answered the questions while in their natural, presumably not highly aroused, state. In the arousal treatment, subjects were first asked to self-stimulate themselves (masturbate), and were presented with the same questions only after they had achieved a high but sub-orgasmic level of arousal.

The screen of the computer, as it appeared in the arousal treatment, was divided into three panels, each with a different function (see Figure 1). Three keys on the top left corner of the keypad switched between these three panels, with the activated panel indicated on the screen by a bright red border.

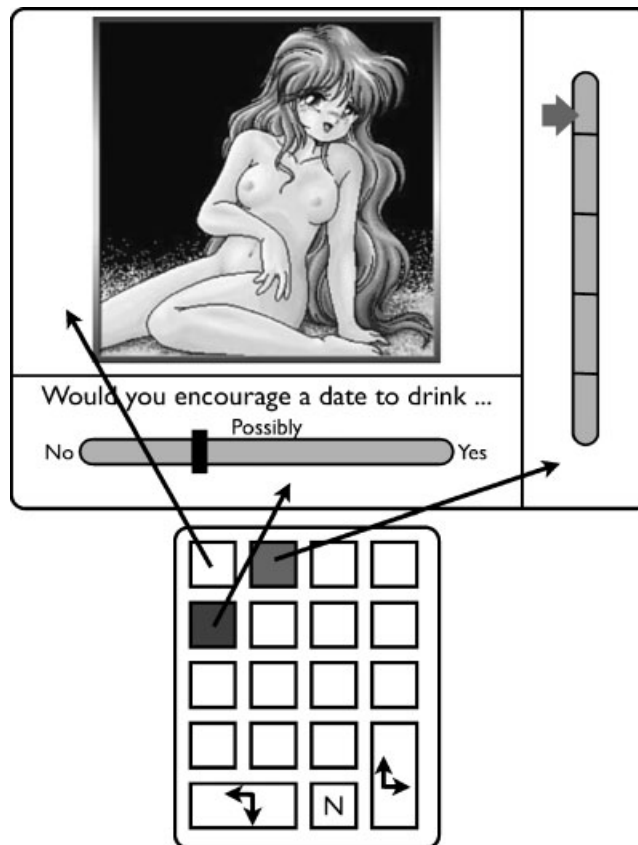


Figure 1. An illustration of the screen with a non-representative cartoon image. The right panel and the top left panel were only available in the arousal condition. The keypad below illustrates the controls of the interface

right and on the top left part of the screen were displayed only in the arousal treatment. The panel on the right, when activated, displayed an “arousal thermometer” with regions colored from blue to red representing increasing levels of arousal. Two keys on the keypad allowed the user to move the probe on the arousal meter to indicate their momentary level of arousal. The panel on the top left occupied the largest part of the screen, displaying diverse erotic photographs. When this panel was activated, the same two keys used to move the probe on the arousal thermometer allowed the subject to scroll forward and backward through the photographs. The panel at the bottom of the screen presented the series of questions that the subjects answered. This panel was visible in both treatments, but, in the arousal treatment, the questions could be answered only when the self-declared level of arousal was 75% or higher on the arousal thermometer. (This criteria was set to create high level of arousal but at the same time not too high in order to avoid ejaculation.) The same two keys used to move the probe on the arousal thermometer, and to scroll forward and backward through the photographs, allowed the subject to move a probe to indicate their answers to the questions presented in this panel. A different key was used to submit the answer and progress to the next question.

The questions took the form of statements, which participants could react to on a visual-analog scale that stretched between “no” on the left to “possibly” in the middle to “yes” on the right. Because the movement of the probe on the visual-analog scale was carried out by repeatedly pressing keys, we used a discrete scale with twenty-six steps along the visual-analog scale. Responses were converted to a 0–100 scale, where 0 is the most extreme negative response and 100 is the most extreme positive response.

The questions were presented in three modules, each designed to address one of the issues mentioned earlier: the attractiveness of different sexual activities to the respondent, the lengths the respondent would go to in order to obtain sexual gratification, and their attitude toward sexual risks in the heat of passion.

The set of questions that asked subjects to evaluate the attractiveness of different sexual stimuli and activities included questions about the attractiveness of women’s shoes, a 12-year-old girl, an animal, a 40-, 50-, and 60-year-old-woman, a man, an extremely fat person, a hated person, a threesome including a man, a woman who was sweating, cigarette smoke, getting tied up by their sexual partner, tying up their sexual partner, a woman urinating, getting spanked by a woman, spanking a woman, anal sex, contacts with animals, having sex with the lights on, and reactions to “just” kissing.

The set of questions that asked subjects to assess the lengths they would go to procure sex included questions about whether they would encourage a date to drink, slip her a drug, take her to a fancy restaurant or tell her they loved her (when they in fact did not), in all cases with the goal of having sex, and also whether they would try to have sex even after the person they were dating said “no.”

The items dealing with sexual risk-taking elicited the respondent’s self-reported likelihood of using birth control and the likelihood of negative consequences if one failed to do so. Still other items, not discussed in this paper, asked subjects to make a series of hypothetical intertemporal and risky choices for monetary outcomes.²

Subjects

Research participants were 35 University of California, Berkeley male undergraduates recruited with ads placed around campus, who received \$10 per session in exchange for participating. Before the experimental session subjects were informed about the experiment, including the fact that it would involve masturbation,³ signed a consent form, and were randomly assigned to one of the three order-conditions.

²The general finding from these items was that aroused subjects tended to be more risk-seeking and more short-sighted. We are currently following up this part of the study by presenting aroused and non-aroused subjects with choices involving real consequences.

³This, and the within-subject nature of the experiment, avoided the problem of differential dropout between conditions.

Table 1. The three experimental order-conditions

Condition	Treatment 1	Treatment 2	Treatment 3	Analysis
N ($n = 11$)	Non-aroused 1			—
AN ($n = 12$)	Aroused 2	Non-aroused 3		2 versus 3
NAN ($n = 12$)	Non-aroused 4	Aroused 5	Non-aroused 6	5 versus (4 + 6)/2

Design

The experimental design was a mixed within- and between-subjects design (as described in Table 1). In the *N* condition, subjects answered the questions in the non-aroused treatment, returned the laptop to the experimenter on the following day, and were paid \$10. In the *AN* condition, subjects first participated in the arousal treatment; then, when they returned the laptop the following day, they were informed about the second session and were asked to participate in the non-aroused treatment. After completing the non-aroused treatment, the subjects returned the laptop to the experimenter and were paid \$20. In the *NAN* condition, the subjects first answered the questions in the non-aroused treatment; then, when they returned the laptop, they were asked to participate in the aroused treatment. When they returned the laptop again, they were asked to participate in another non-aroused session. After completing this second non-aroused treatment subjects returned the laptop to the experimenter and were paid \$30. In all cases there was at least a one-day delay between participation in the different sessions.

Results

First, we examined the impact of the arousal treatment on the reported levels of online arousal. Figure 2 presents the mean reported level of arousal in the arousal treatment as a function of the session's duration. Note that the range of the scale in Figure 2 is from 75 to 100, since participants were not permitted to answer questions until their self-reported arousal level, as indicated on the arousal thermometer, reached the required level of 75%. As can be seen in Figure 2, reported momentary arousal kept increasing during the experiment. It is important to note that all the subjects completed the sessions, and no one reported that

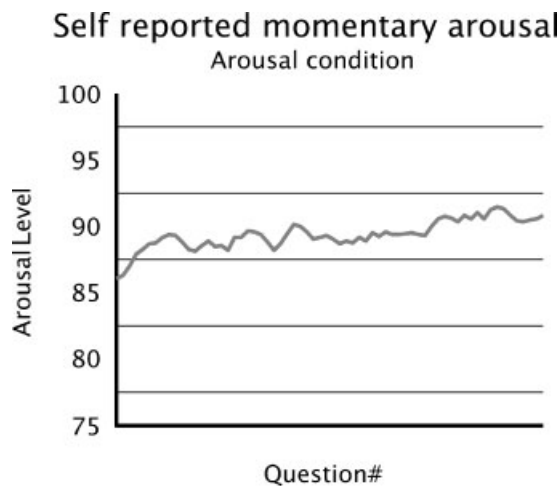


Figure 2. Momentary self-reported arousal in the arousal condition. Note that the abscissa is in terms of questions, and that in this condition, subjects could not answer any questions until their arousal was at least 75

they accidentally ejaculated during the session (subjects were instructed to press the tab key if they ejaculated, which would have ended the session).

The experimental design included some comparisons between, and some within, the subjects (see Table 1). The minimum delay of one day between the experimental sessions was designed to minimize contamination effects of repeated exposure to the questions. To test whether repeated exposure to the questions in fact had any impact on the responses, three tests were conducted.

In the first-order test all four non-aroused treatments were compared in a two-factor mixed ANOVA, with all the different responses by the same subject (all the questions) as a within-subject factor, and the four types of non-aroused treatments as a between-subject factor. We used this model to examine the effect of the different non-aroused treatments controlling for the different questions and for individual subjects effects. This analysis revealed that none of the non-aroused treatments were statistically different from the others [$F(3, 43) = 0.17, p = 0.92$], that the questions were statistically different from each other [$F(32, 1376) = 60.88, p < 0.001$], and that the interaction between them was not significant [$F(96, 1376) = 0.65, p = 1$].

A second-order test focused on the comparison of the first and second non-aroused treatments in the NAN condition. If being aroused made subjects permanently aware of the effect of arousal on their attitudes and behaviors, we would expect a difference between the two non-aroused treatments—running in the same direction as the difference between the aroused and the first non-aroused treatment. This test was a two factorial within ANOVA with the first and second non-aroused treatments as one repeated factor, and all the different responses by the same subject (all the questions) as a second within-subject factor. The analysis revealed that the two non-aroused treatments were statistically indistinguishable from each other [$F(1, 11) = 0.1, p = 0.76$], that the questions were statistically different from each other [$F(32, 352) = 19.53, p < 0.001$], and that the interaction between them was not significant [$F(32, 352) = 0.91, p = 0.61$]. The third- and final-order test compared responses for the arousal treatment when it was first (AN) to when it followed the non-aroused treatment (NAN). These two arousal treatments were compared in a two-factor mixed ANOVA, with all the different responses by the same subject (all the questions) as a within-subject factor, and the two order-conditions as a between-subject factor. This analysis revealed that the two arousal treatments were statistically indistinguishable from each other [$F(1, 22) = 0.50, p = 0.49$], that the questions were statistically different from each other [$F(32, 704) = 24.78, p < 0.001$], and that the interaction between them was not significant [$F(32, 704) = 0.69, p = 0.90$]. Overall these results suggest that while there were systematic differences between the different questions (which is somewhat obvious given the different nature of the questions), there were no systematic order effects for either the non-aroused or the aroused treatments. Moreover, there were no interactions between the order and the type of question—indicating that it is not the case that the order of the treatments systematically influenced the responses for some questions but not others.

Based on this lack of order effects, and for simplicity of presentation, we present the main results as a within-subjects ANOVA, focusing on the comparison between the aroused and non-aroused treatments. For this analysis the *N* condition was eliminated from the analysis (since it has no within subjects comparison), and the responses of each subject in the two non-aroused treatments in the NAN condition were averaged, resulting in a within-subject comparison across the arousal and non-aroused conditions for each of the questions (see last column of Table 1).

The task included 20 different items that elicited subjects' preferences for sexual stimuli and activities. To examine the effect of the state of arousal on these items, we analyzed them with a 20 (questions) \times 2 (state of arousal) fully within ANOVA. The overall model revealed a significant main effect for the arousal state [$F(1, 23) = 53.81, p < 0.001$], an overall significant main effect for the questions factor [$F(19, 437) = 43.31, p < 0.001$], and an overall significant interaction between arousal state and the questions factor [$F(19, 437) = 1.98, p = 0.009$]. These results suggest that that the arousal state had a significant effect on the responses to the different questions, that the questions were not all the same, and that the arousal state had a differential effect on the different questions. Therefore, we followed these analyses with a set of 20 independent paired *t*-tests for each of the questions. As can be seen in Table 2, subjects found a variety of

Table 2. Mean response, standard deviations, and differences for the different questions on the attractiveness of different activities

Question	Non-aroused	Aroused	Difference	<i>p</i> [<i>t</i> (23)]
Are women's shoes erotic?	42 (5.9)	65 (4.06)	23	<0.001
Can you imagine being attracted to a 12-year-old girl?	23 (4.11)	46 (6.08)	23	<0.001
Can you imagine having sex with a 40-year-old woman?	58 (3.32)	77 (2.07)	19	<0.001
Can you imagine having sex with a 50-year-old woman?	28 (4.80)	55 (4.69)	27	<0.001
Can you imagine having sex with a 60-year-old woman?	7 (2.55)	23 (4.61)	16	<0.001
Can you imagine having sex with a man?	8 (2.47)	14 (3.78)	6	=0.14 (ns)
Could it be fun to have sex with someone who was extremely fat?	13 (4.30)	24 (5.29)	11	<0.05
Could you enjoy having sex with someone you hated?	53 (6.04)	77 (3.59)	24	<0.001
If you were attracted to a woman and she proposed a threesome with a man, would you do it?	19 (4.97)	34 (7.10)	25	<0.005
Is a woman sexy when she's sweating?	56 (3.1)	72 (5.62)	16	<0.01
Is the smell of cigarette smoke arousing?	13 (3.88)	22 (6.00)	9	<0.03
Would it be fun to get tied up by your sexual partner?	63 (5.09)	81 (4.49)	18	<0.005
Would it be fun to tie up your sexual partner?	47 (3.22)	75 (3.89)	28	<0.001
Would it be fun to watch an attractive woman urinating?	25 (5.57)	32 (5.53)	7	<0.03
Would you find it exciting to spank your sexual partner?	61 (5.35)	72 (4.70)	11	<0.1
Would you find it exciting to get spanked by an attractive woman?	50 (3.40)	68 (5.29)	18	<0.003
Would you find it exciting to have anal sex?	46 (4.91)	77 (3.58)	31	<0.001
Can you imagine getting sexually excited by contact with an animal?	6 (2.55)	16 (4.19)	10	<0.02
Do you prefer to have sex with the light on?	52 (5.84)	50 (5.15)	-2	=0.46 (ns)
Is just kissing frustrating?	41 (4.43)	69 (4.37)	28	<0.001

Note: Each question was presented on a visual-analog scale that stretched between "no" on the left (0) to "possibly" in the middle (50) to "yes" on the right (100).

potential sexual activities to be more attractive under high arousal than they did under low arousal. From the 20 questions of this type only one activity (Do you prefer to have sex with the light on?) was viewed as less appealing by those in the arousal condition than by those in the non-aroused condition, though not significantly so ($p = 0.46$). One activity (Can you imagine having sex with a man?) was viewed as more appealing, but not significantly so ($p = 0.14$) by those who were aroused, and one question was only marginally significant (Would you find it exciting to spank your sexual partner? $p = 0.1$). The remaining 16 questions were all significantly different in the predicted direction. A one-sample sign test over all 20 items revealed a highly significant effect ($p < 0.001$), indicating that, overall, arousal fundamentally increases predicted enjoyment and liking for the diverse activities that we queried subjects about.

Five other questions asked subjects about their willingness to engage in morally questionable behavior to procure sex. To examine the effect of the state of arousal on these items, we analyzed them with a 5 (questions) \times 2 (state of arousal) fully within ANOVA. The overall model revealed a significant main effect for arousal state [$F(1, 23) = 26.40$, $p < 0.001$], an overall significant main effect for the questions factor [$F(4, 92) = 55.70$, $p < 0.001$], and an overall non-significant interaction between arousal state and the questions factor [$F(4, 92) = 0.41$, $p = 0.8$]. These results suggest that the arousal state had significant effect on the responses to the different questions, that the questions were not all the same, but that the arousal state had a similar effect on the different questions. To examine these effects in more detail, we followed these analyses with a set of five independent paired *t*-tests for each of the questions. As can be seen in Table 3, arousal had a strong influence on participants' self-reported likelihood of engaging in a set of morally questionable

Table 3. Mean response, standard deviations, and differences for the different questions on the likelihood to engage in immoral “date-rape” like behaviors (a strict order of severity is not implied)

Question	Non-aroused	Aroused	Difference	p [t (23)]
Would you take a date to a fancy restaurant to increase your chance of having sex with her?	55 (5.86)	70 (3.83)	15	0.01
Would you tell a woman that you loved her to increase the chance that she would have sex with you?	30 (5.40)	51 (4.54)	21	0.001
Would you encourage your date to drink to increase the chance that she would have sex with you?	46 (5.80)	63 (2.87)	17	<0.005
Would you keep trying to have sex after your date says “no.”	20 (4.32)	45 (3.44)	25	<0.001
Would you slip a woman a drug to increase the chance that she would have sex with you?	5 (2.51)	26 (3.65)	21	<0.001

Note: Each question was presented on a visual-analog scale that stretched between “no” on the left (0) to “possibly” in the middle (50) to “yes” on the right (100).

behaviors to increase the likelihood of obtaining sex. In this set of questions, all five individual questions were statistically significant in the expected direction.

Finally, the survey included eight questions that elicited subjects’ willingness to engage in risky sexual practices. To examine the effect of arousal on these items, we analyzed them with an 8 (questions) \times 2 (state of arousal) fully within ANOVA. The overall model revealed a non-significant main effect for the arousal state [$F(1, 23) = 0.05$, $p = 0.82$], an overall significant main effect for the questions factor [$F(7, 161) = 47.6$, $p < 0.001$], and an overall significant interaction between arousal state and the questions factor [$F(7, 161) = 5.90$, $p = 0.009$]. These results suggest that the arousal state did not have a significant main effect on the responses to the different questions, that the questions were not all the same, and that the arousal state had a differential effect on the different questions. We followed these analyses with a set of eight independent paired t -tests for each of the questions. As can be seen in Table 4, the results for these questions are not as clear-cut as the other two sets of questions. There were no differences between the aroused and non-aroused treatments for the four questions dealing with the perceived efficacy of coitus-interruptus, acknowledgment that a friend can transmit STDs, trusting someone they have just met, and assigning responsibility

Table 4. Mean response, standard deviations, and differences for the different questions on willingness to engage in, and outcomes of, sexually unsafe behaviours

Question	Non-aroused	Aroused	Difference	p [t (23)]
If you pull out before you ejaculate, a woman can still get pregnant (N)	92 (2.95)	92 (4.55)	0	= 0.97 (ns)
A woman who is a good friend can give you a sexually transmitted disease (N)	86 (4.44)	89 (4.89)	-3	= 0.21 (ns)
Would you trust a woman you’ve just met who says she is using birth control? (A)	29 (5.14)	25 (5.51)	-4	= 0.47 (ns)
Birth control is the woman’s responsibility (A)	34 (5.41)	44 (5.69)	10	= 0.051
A condom decreases sexual pleasure (A)	66 (3.88)	78 (3.73)	12	<0.002
A condom interferes with sexual spontaneity (A)	58 (5.21)	73 (4.45)	15	<0.01
Would you always use a condom if you didn’t know the sexual history of a new sexual partner? (N)	88 (2.66)	69 (6.33)	19	<0.003
Would you use a condom even if you were afraid that a woman might change her mind while you went to get it? (N)	86 (3.04)	60 (4.32)	26	<0.001

Note: Each question was presented on a visual-analog scale that stretched between “no” on the left (0) to “possibly” in the middle (50) to “yes” on the right (100).

The expected higher response is marked with A for aroused or N for non-aroused.

for birth control to women (which was marginally significant). Answers to all four questions dealing with condoms were, however, strongly influenced by sexual arousal. For all four condom-related questions, subjects in the aroused treatment indicated a lower likelihood of using a condom compared with subjects in the non-aroused treatment. This difference between the two types of questions might suggest that arousal does not change the general knowledge of individuals about the risks of unprotected sex, but when it comes to concrete steps involving condoms, sexual arousal changes one's perceptions of the tradeoffs between benefits and disadvantages in a fashion that decreases the tendency to use them.

GENERAL DISCUSSION

This study examined the effect of high levels of sexual arousal on the subjective attractiveness of different activities, on self-reported willingness to take various morally dubious measures to procure sex, and on willingness to engage in risky sexual activities. Our results on attractiveness of activities suggest that sexual arousal acts as an amplifier of sorts. Activities that are not perceived as arousing when young males are not sexually aroused become sexually charged and attractive when they are, and those activities that are attractive even when not aroused, become more attractive under the influence of arousal. By showing that, when aroused, the same individual will find a much wider range of activities sexually appealing than when not aroused, these findings weigh in against the view of sexual preferences as being purely an individual difference variable—i.e., as dispositionally rather than situationally determined. Certainly, there are robust individual differences in sexual preferences and in the likelihood of engaging in various behaviors, but there also seem to be striking intra-individual differences caused, in our study, by externally caused variations in arousal level.

Our results further suggest that the change in attractiveness influences the intensity of motivation to have sex relative to other goals. Specifically, the increase in motivation to have sex produced by sexual arousal seems to decrease the relative importance of other considerations such as behaving ethically toward a potential sexual partner or protecting oneself against unwanted pregnancy or sexually transmitted disease. Like other drive-states (Loewenstein, 1996), and also somewhat analogous to the effects of alcohol (Ditto et al., 2005; Steele & Josephs, 1990), sexual arousal seems to narrow the focus of motivation, creating a kind of tunnel-vision where goals other than sexual fulfillment become eclipsed by the motivation to have sex (c.f., Blanton & Gerrard, 1997).

As noted in the introduction, a secondary implication of our findings is that people seem to have only limited insight into the impact of sexual arousal on their own judgments and behavior. Such an under-appreciation could be important for both individual and societal decision making.

At the individual level, there is a considerable research showing that one's meta-understanding of one's own preferences can in many situations be almost as important as the preferences themselves. For example, as O'Donoghue and Rabin (2003) show, the impact of hyperbolic time discounting on actual intertemporal choice behavior depends critically on whether one is naïve or sophisticated about the fact that one will face self-control problems in the future. Ariely and Wertenbroch (2002) likewise found, in a study of students taking a class, that those who were aware of their own tendency to procrastinate, and hence voluntarily set deadlines for themselves, got higher course grades than those who did not. Self-insight when it comes to sexual arousal and sexual behavior is similarly likely to be important for decision making. For example, the most effective means of self-control is probably not willpower (which has been shown to be of limited efficacy), but rather avoiding situations in which one will become aroused and lose control. Any failure to appreciate the impact of sexual arousal on one's own behavior is likely to lead to inadequate measures to avoid such situations. Similarly, if people under-appreciate their own likelihood of having sex, they are likely to fail to take precautions to limit the potential damage from such encounters. A teenager who embraces "just say no," for example, may feel it unnecessary to bring a condom on a date, thus greatly increasing

the likelihood of pregnancy or transmission of STDs if he/she ends up getting caught up in the heat of the moment.

The same logic applies interpersonally. If people judge others' likely behavior based on observing them when they are not sexually aroused, and fail to appreciate the impact of sexual arousal, then they are likely to be caught by surprise by the other's behavior when aroused. Such a pattern could easily contribute to date-rape. Indeed, it can create the perverse situation in which people who are the least attracted to their dates are most likely to experience date-rape because being unaroused themselves they completely fail to understand or predict the other (aroused) person's behavior.

At a social level the failure to appreciate the influence of sexual arousal when one is unaroused can have diverse consequences. For example, judges and jurors, who are generally unaroused when making decisions of guilt and punishment, may be excessively condemnatory and punitive toward sexual offenders because they make their decisions in a sexually unaroused state and fail to appreciate how intense sexual arousal would alter even their own decision making in potentially compromising circumstances. The result is that decisions will be stigmatized as immoral misbehavior even by people who would themselves make the same choice when in an aroused state. It should be clear that such effects of arousal cannot justify any sexual exploitation, but they can make such behaviors somewhat more understandable. From the perspective of the legal system it is possible that sexual arousal should be given more credit as a partially mitigating factor than it would normally receive. Moreover, understanding these effects can help guide individuals (sex offenders for example) such that they will be less likely to sexually exploit or re-exploit. Finally, as alluded to in the discussion of individual decision making, the failure to appreciate sexual arousal by those who are not themselves immediately aroused can also help to explain the enactment of misguided and ineffective policies such as "just say no", leaving young adults unprepared to limit the potential damage from their own behavior in the heat of the moment.

Limitations

As an initial investigation into the effect of sexual arousal on judgment and decision making, our study inevitably suffers from serious limitations. For example, it is important to note that we did not observe actual behavior. It is therefore possible that the effect of sexual arousal was not to change the desirability of different actions and activities, but to make respondents more willing to *admit* to their feelings. If this were the case, however, we should expect to see a stronger effect for items that people are embarrassed about (e.g., finding a 12-year-old girl attractive, or being excited by animals), but the effects were fairly similar across these types of items and those that were unlikely to draw much shame (e.g., being attracted to a 40-year-old).

A second limitation incumbent in not observing actual behavior is that we have no way to ascertain whether respondents' predictions of their own behaviors are more accurate when subjects respond under treatments of arousal or non-arousal. Based on previous research on hot-cold empathy gaps (Bouffard, 2002; Loewenstein, Nagin, & Paternoster, 1997), which shows that people often mispredict how they would behave in an affective state different from the one they are in, we suspect that behavioral predictions made under states of arousal more accurately predict behavior in the heat of the moment than do predictions made when respondents are not aroused. However, without observing actual behavior in the situations we ask about, we have no ability to ascertain whether this is in fact the case.

A third limitation concerns the lack of control that we had over the experimental setting. We had subjects conduct the experiment in the privacy of their own residence so as to provide privacy and reduce inhibitions, but this limited our ability to ensure that they carefully and conscientiously carried out the instructions. Indeed, our initial expectations were that at least some of the subjects in the arousal condition would indicate by pressing the tab key that they had accidentally ejaculated, but none did. Finally, our experimental setup did not allow us to measure subjects' arousal using physiological methods, so we instead relied on self-reports of arousal, which have been shown to be fallible (Janssen, 2002). However, since we manipulated

sexual arousal experimentally, the validity of our results do not hinge upon the accuracy of our measures of arousal.

Yet a fourth limitation is that the study focused only on men, so it is possible that the observed effects do not generalize to women. Baumeister, Catanese, and Vohs (2001) concluded from multiple sources of evidence that the male sex drive is more intense and uncompromising than the female, and it is at least, in principle, possible that the lesser intensity of the female sex drive entails that women would not be (or not as much) affected by sexual arousal in their decisions. The present work shows that sexual arousal changes the way males would make sexual decisions, but without further data it is not safe to assume that women would show the same pattern.

Clearly, there are many ways in which the experimental design could be improved, though we suspect that design changes intended to eliminate existing shortcomings would inevitably introduce new ones. For example, better monitoring of subjects' sexual arousal by conducting the study in the laboratory and taking physiological measures of arousal could induce greater inhibition on the part of subjects and decrease truthful responding. Given the politically and socially charged nature of sex, research on the topic is inherently difficult, so compromises are unavoidable.

In sum, the current study shows that sexual arousal influences people in profound ways. This should come as no surprise to most people who have personal experience with sexual arousal, but the magnitude of the effects is nevertheless striking. At a practical level, our results suggest that efforts to promote safe, ethical sex should concentrate on preparing people to deal with the "heat of the moment" or to avoid it when it is likely to lead to self-destructive behavior. Efforts at self-control that involve raw *willpower* (Baumeister & Vohs, 2003) are likely to be ineffective in the face of the dramatic cognitive and motivational changes caused by arousal.

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REFERENCES

- Ariely, D., & Wertenbroch, K. (2002). Procrastination, deadlines, and performance: self-control by precommitment. *Psychological Science, 13*, 219–224.
- Baumeister, R. F., Catanese, K. R., & Vohs, K. D. (2001). Is there a gender difference in strength of sex drive? Theoretical views, conceptual distinctions, and a review of relevant evidence. *Personality & Social Psychology Review, 5*, 242–273.
- Baumeister, R. F., & Vohs, K. D. (2003). Willpower, choice and self-control. In G. Loewenstein, D. Read, & R. Baumeister (Eds.), *Time and decision: Economic and psychological perspectives on intertemporal choice* (pp. 201–216). New York: Russell Sage Foundation Press.
- Blanton, H., & Gerrard, M. (1997). Effect of sexual motivation on men's risk perception for sexually transmitted disease: there must be 50 ways to justify a lover. *Health Psychology, 16*, 374–379.
- Bouffard, J. A. (2002). The influence of emotion on rational decision making in sexual aggression. *Journal of Criminal Justice, 30*, 121–134.
- Brendl, C. M., Markman, A. B., & Messner, C. (2003). The devaluation effect: activating a need devalues unrelated choice options. *Journal of Consumer Research, 29*, 463–473.
- Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: an evolutionary perspective on human mating. *Psychological Review, 100*, 204–232.
- Buss, D. M. (2003). *The evolution of desire: Strategies of human mating* (revised ed.). New York: Basic Books.
- Ditto, P. H., Pizarro, D. A., Epstein, E. B., Jacobson, J. A., & MacDonald, T. K. (2005). *Motivational myopia: Visceral influences on risk taking behavior* (submitted for publication).

- Gilbert, D. T., Gill, M. J., & Wilson, T. D. (2002). The future is now: temporal correction in affective forecasting. *Organizational Behavior and Human Decision Processes*, *88*, 430–444.
- Giordano, L. A., Bickel, W. K., Loewenstein, G., Jacobs, E. A., Marsch, L., & Badger, G. J. (2002). Mild opioid deprivation increases the degree that opioid-dependent outpatients discount delayed heroin and money. *Psychopharmacology*, *163*, 174–182.
- Janssen, E. (2002). Psychophysiological measurement of sexual arousal. In M. W. Wiederman, & B. E. Whitley, (Eds.), *Handbook for conducting research on human sexuality* (pp. 139–171). Mahwah, NJ: Erlbaum.
- Ledoux, J. (1996). *The emotional brain*. New York: Simon & Schuster.
- Lerner, J., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology*, *81*, 146–159.
- Loewenstein, G. (1996). Out of control: visceral influences on behavior. *Organizational Behavior and Human Decision Processes*, *65*, 272–292.
- Loewenstein, G., & Adler, D. (1995). A bias in the prediction of tastes. *The Economic Journal*, *105*, 929–937.
- Loewenstein, G., Nagin, D., & Paternoster, R. (1997). The effect of sexual arousal on predictions of sexual forcefulness. *Journal of Crime and Delinquency*, *32*, 443–473.
- Loewenstein, G., O'Donoghue, T., & Rabin, M. (2003). Projection bias in predicting future utility. *Quarterly Journal of Economics*, *118*, 1209–1248.
- O'Donoghue, T., & Rabin, M. (2003). Self-awareness and self-control. In G. Loewenstein, D. Read, & R. Baumeister (Eds.), *Time and decision: Economic and psychological perspectives on intertemporal choice* (pp. 201–216). New York: Russell Sage Foundation Press.
- Panksepp, J. (1998). *Affective neuroscience*. New York: Oxford University Press.
- Read, D., & van Leeuwen, B. (1998). Time and desire: the effects of anticipated and experienced hunger and delay to consumption on the choice between healthy and unhealthy snack food. *Organizational Behavior and Human Decision Processes*, *76*, 189–205.
- Rolls, E. T. (1999). *The brain and emotion* (pp. 218–243). Oxford: Oxford University Press.
- Steele, C. M., & Josephs, R. A. (1990). Alcohol myopia: its prized and dangerous effects. *American Psychologist*, *45*, 921–933.
- Van Boven, L., Dunning, D., & Loewenstein, G. (2000). Egocentric empathy gaps between owners and buyers: misperceptions of the endowment effect. *Journal of Personality and Social Psychology*, *79*, 66–76.
- Van Boven, L., & Loewenstein, G. (2003). Social projection of transient drive states. *Personality and Social Psychology Bulletin*, *29*, 1159–1168.
- Wilson, M., & Daly, M. (2004). Do pretty women inspire men to discount the future? *Biology Letters*, *271*, S177–S179.

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