Arch Sex Behav
DOI 10.1007/s10508-010-9676-2

ORIGINAL PAPER

The Effects of Impulsivity, Sexual Arousability, and Abstract Intellectual Ability on Men's and Women's Go/No-Go Task Performance

Kathryn R. Macapagal · Erick Janssen · Daniel J. Fridberg · Peter R. Finn · Julia R. Heiman

Received: 2 October 2009 / Revised: 29 July 2010 / Accepted: 29 July 2010

Abstract While a number of studies have assessed the role of personality traits, situational variables, and drug use on sexual risk behaviors, fewer studies have employed experimental methods to examine cognitive processes that may underlie risky sexual decision making. This study used a go/no-go paradigm to examine how individual difference variables and sexual arousal influence discrimination learning and sexual and nonsexual decision making. A total of 28 men (M age = 20 years) and 25 women (M age = 19 years) completed self-report measures of impulsivity, abstract intellectual ability, and sexual excitation and inhibition and participated in a laboratory experiment. The experiment consisted of two go/no-go tasks with sexual stimuli and two tasks with neutral stimuli, preceded by either sexually arousing or sexually neutral stimulus presentations. Task performance was measured by totals of false alarms and misses. Individuals high in impulsivity and low in abstract intellectual ability committed more false alarms in conditions involving sexually arousing stimuli. Furthermore, higher sexual excitation scores were linked to more misses. These findings indicate that cognitive processes associated with decision making that occurs in the "heat of the moment" are influenced by a combination of situational and sexual and nonsexual individual difference variables.

Keywords Go/no-go task · Impulsivity · Sexual arousability · Intellectual ability · Dual processes

K. R. Macapagal · E. Janssen · J. R. Heiman
The Kinsey Institute for Research in Sex, Gender, and Reproduction, Indiana University, Bloomington, IN, USA

K. R. Macapagal (✉) · E. Janssen · D. J. Fridberg · P. R. Finn · J. R. Heiman
Department of Psychological & Brain Sciences, Indiana University, 1101 East Tenth St., Bloomington, IN 47405, USA
e-mail: karmacap@indiana.edu

Introduction

Sexual decisions made in the "heat of the moment" can have dire consequences. Risky sexual behaviors can result in unplanned pregnancies and lead to sexually transmitted infections (STIs) and human immunodeficiency virus (HIV), rates of which remain high in the United States (Centers for Disease Control and Prevention, 2009; Joint United Nations Programme on HIV/AIDS & World Health Organization, 2007). While research has identified a number of dispositional (e.g., impulsivity, sensation seeking) and situational (e.g., mood, sexual arousal) factors associated with increased likelihood of risky sexual practices, less is known about relationships between such factors and cognitive processes. The current study examined the effects of dispositional and situational factors on cognitive processes relevant to sexual decision making through the use of experimental methods. To evaluate these relationships, we used a widely-used measure of discrimination learning and decision making, the go/no-go task, which has yet to be employed in sexual decision making research.

Dual Systems Theories of Decision Making

The rational model of decision making—in which individuals consider the risks and benefits of several options in order to make the best decision; a time consuming and effortful process—is believed to be insufficient to explain decision making under all conditions (Kahneman, 2003). To explain departures from rational decision making, dual systems theories have proposed that choice behavior is governed by two information processing systems. While the details of each theory vary, they generally agree that one system, generically labeled "System 1" (Stanovich & West, 2000), involves rapid, preconscious cognitive processing and is responsible for automatic, or "intuitive" decisions. System 1 drives judgments and decisions made

Published online: 23 September 2010

effortlessly or out of habit, and which prove difficult to modify (Kahneman, 2003). System 1 deals largely with affectively or motivationally salient stimulus information, which is encoded in memory during initial exposures and guides decision making during similar or related situations in the future (Hofmann, Friese, & Strack, 2009). For example, during a sexual encounter, positive experiences and sexual arousal can lead an individual to associate sex with desirable and positive feelings and outcomes. Subsequent sexual encounters may activate these associations and, in an automatic, preconscious way, bias the individual toward a specific way of responding (e.g., engaging in unprotected sex without considering future consequences).

In contrast to System 1, "System 2" relies upon controlled, conscious, and effortful processing and mediates rational, deliberative decisions (Stanovich & West, 2000). System 2 operations lend themselves to serial processing and rely upon past consequences, as well as present and future implications of actions, to guide decision making. Unlike System 1, System 2 operations are rule-governed, emotionally neutral, and monitor cognition and overt behavior, including those generated by System 1. Through its focus on rational decision making, a large proportion of earlier research on risky sexual behavior is consistent with the System 2 view (e.g., Pinkerton & Abramson, 1992). In the context of the previous example, the decision to engage in risky sexual activity would be the result of a purely rational comparison of relative risks and rewards of each possible action. Although System 2 processes could possibly override or inhibit System 1, they are mentally taxing and serial in nature, often leading to a predominance of more intuitive, automatic, System 1 choice behaviors (Strack & Deutsch, 2004).

Impulsivity, Sexual Inhibition, and Sexual Excitation

Dual systems theories hold that the degree to which each system guides decision making is influenced by dispositional or situational variables (Hofmann et al., 2009). This may be particularly relevant to decisions made in sexual situations, as factors such as mood, sexual arousal, and certain personality characteristics have been found to affect sexual decision making (e.g., Abbey, Saenz, & Buck, 2005; Bancroft et al., 2003; MacDonald & Hynie, 2008; MacDonald & Martineau, 2002). For example, impulsivity, or the tendency to act with little forethought or regard for consequences, has been linked to a proclivity for various risk behaviors (Llewellyn, 2008; Verdejo-Garcia, Lawrence, & Clark, 2008). However, its association with *sexual* risk behaviors has been less widely studied. Justus, Finn, and Steinmetz (2000) found that numbers of one-night stands and casual sex partners were positively correlated with impulsivity, but not after accounting for other traits indicative of behavioral disinhibition including sensation seeking. In another study (McCoul & Haslam, 2001), impulsivity was associated with unprotected sex, but not with numbers of sexual partners in high-risk heterosexual men.

In addition to impulsivity, other mechanisms specific to sexual behavior and response should be considered as possible contributors to risky sexual behavior. One candidate concerns the role of individual differences in sexual inhibition and excitation (Bancroft, 1999; Bancroft & Janssen, 2000). Sexual excitation refers to the ease with which an individual becomes sexually aroused, and sexual inhibition refers to the degree to which potential social, physical, or emotional threats or risks may suppress sexual arousal and associated approach tendencies. Several studies involving both men and women have found that sexual excitation is associated with high numbers of sexual partners and sexual inhibition with inconsistent condom use (for a review, see Bancroft, Graham, Janssen, & Sanders, 2009).

Intellectual Ability

Low intellectual ability has been associated with risky decision making (e.g., Batty, Deary, & Macintyre, 2006; Brand, Heinze, Labudda, & Markowitsch, 2008; de Wit, Flory, Acheson, McCloskey, & Manuck, 2007), including sexual decision making (e.g., Shearer, Mulvihill, Klerman, Hovinga, & Redden, 2002). Lower abstract intellectual abilities, which include planning, reasoning, working memory, and attention, are linked to risky decision making as well (Giancola & Tarter, 1999). Individuals with low abstract intellectual aptitude may not draw as much on past experiences or consider implications of their choices when making decisions, and may have more difficulty inhibiting impulses relative to individuals with higher abstract intellectual ability. One study showed that under the influence of alcohol, adults with lower intellectual abilities were more likely to report intentions to engage in sex without a condom in a hypothetical sexual scenario compared to those with higher intellectual abilities (Abbey, Saenz, Buck, Parkhill, & Hayman, 2006). However, little else is known about the role of intellectual aptitude in the sexual decision making process. Since System 2 operations rely heavily on intellectual abilities (Stanovich & West, 2000), lower intellectual aptitude may hinder rational sexual decision making and bias an individual toward System 1 processes.

Sexual Arousal

In addition to more stable, or trait variables, the state of sexual arousal is associated with compromised decision making in groups with a propensity for sexual risk taking, such as HIV-positive men who have sex with men (Shuper & Fisher, 2008) and heterosexual college-aged men and women (Abbey et al., 2005; Ariely & Loewenstein, 2006; Ditto, Pizarro, Epstein, Jacobson, & MacDonald, 2006; MacDonald, MacDonald, Zanna, & Fong, 2000). In sexual situations, sexual arousal influences attention to appetitive or aversive cues (Barlow, 1986;

Wiegel, Scepkowski, & Barlow, 2007). Combined with high impulsivity, low sexual inhibition, or low intellectual ability, sexual arousal may increase the salience of desirable, immediate prospects (e.g., sexual pleasure) and decrease the salience of undesirable future consequences (e.g., unintentional pregnancy, STI transmission), rendering some people more likely to take sexual risks. Moreover, sexual arousal may impact negatively an individual's ability to discriminate between high- and low-risk sexual partners or situations (Shuper & Fisher, 2008).

Assessment of Sexual Decision Making Processes

Previous laboratory research on sexual decision making has relied mainly upon behavioral analogue tasks to examine how situational and dispositional factors influence individuals' sexual risk taking. For instance, participants may be asked to imagine themselves in a hypothetical, eroticized sexual situation with a new partner where no condom is available (e.g., Abbey et al., 2005, 2006; George et al., 2009; MacDonald et al., 2000; Norris et al., 2009). Participants may be queried regarding their intentions to engage in sexual risk behavior at various points during the task, which allows researchers to determine how situational variables and sexual and nonsexual traits moderate different stages of the decision making process. However, these behavioral analogue tasks likely access more controlled, deliberative System 2 processes than automatic System 1 ones.

To investigate System 1 operations relevant to sexual behavior, researchers have used implicit cognitive-behavioral methods, including priming (e.g., Janssen, Everaerd, Spiering, & Janssen, 2000), dot-detection (e.g., Prause, Janssen, & Hetrick, 2008), Stroop (e.g., Smith & Waterman, 2004), and lexical decision tasks (e.g., Gillath, Mikulincer, Birnbaum, & Shaver, 2007). These tasks have been used to measure how sexual information influences automatic cognitive processes, behaviors, and psychophysiological responses in clinical and non-clinical populations. For example, priming tasks have demonstrated that subliminal exposures to sexual stimuli facilitate decision times to sexual stimuli but not nonsexual stimuli (Gillath et al., 2007; Janssen et al., 2000; Spiering, Everaerd, & Janssen, 2003). Some studies have found that priming with sexual stimuli can influence genital responses, as can subliminally presented stimuli in conditioning paradigms (Hoffmann, Janssen, & Turner, 2004; Janssen et al., 2000).

While the implicit tasks discussed above capture System 1 aspects of decision making, their reliance on the instruction to subjects to respond as fast as possible means that they do not, by design, differentiate between processes relevant to the initiation or suppression of behavioral impulses or action tendencies. In contrast, the go/no-go task, a method that has not yet been used in sexuality research, is particularly well-suited to studying such operations. Go/no-go tasks have been used to examine disadvantageous decision making patterns in disinhibited and risk-taking individuals (e.g., Finn, Mazas, Justus, & Steinmetz, 2002; Newman, Widom, & Nathan, 1985) and involve processes relevant to both learning to respond to stimuli associated with reward ("Go" stimuli) and learning to withhold responses to stimuli associated with negative consequences ("No-go" stimuli). Some versions of the task include a contingency reversal, in which Go stimuli become No-go stimuli and vice versa. Failing to update one's representations of the Go and No-go stimuli after the reversal is associated with an inability to adapt behavior to unexpected circumstances (Finn, Justus, Mazas, & Steinmetz, 1999). This task involves processes analogous to sexual situations. For example, failing to use condoms on a regular basis can lead to STI infection. Some individuals may learn from this consequence and alter their future behavior to use condoms consistently; however, others may not adapt to this consequence and continue to have unprotected sex. Depending on the person, these decisions may be influenced to different degrees by sexual arousal, sexual inhibition and excitation, impulsivity, and intellectual aptitude.

Ultimately, a closer examination of System 1 decision processes could clarify why some act carefully, and others impulsively, in the "heat of the moment" of a sexual situation. Thus, the present study used a go/no-go task to examine how situational (i.e., sexual arousal) and sexual and nonsexual variables (i.e., impulsivity, sexual inhibition and excitation, and intellectual aptitude) influence automatic cognitive processes relevant to sexual decision making.

Hypotheses

First, we predicted that high impulsivity would be associated with worse overall performance on the go/no-go task (e.g., Finn et al., 1999). Second, we predicted that low sexual inhibition or high sexual excitation would be linked to worse performance on the task, specifically when individuals were presented with sexually arousing stimuli. We made no predictions regarding sex differences on the task based on the dual control model since, to date, no experimental research has compared sexual inhibition and excitation patterns in men and women. Third, we expected that lower intellectual abilities would be associated with worse performance on the task, particularly in conditions with sexually arousing stimuli. Sexually arousing situations are shown to bias individuals' cognitive processes by shifting focus from inhibiting cues to appealing, desirable cues (Gold, 1993). Individuals low in intellectual ability, high in sexual excitation, or low in sexual inhibition may be more susceptible to such interference than impulsive individuals.

Fourth, we expected that men would perform worse on the go/no-go task when presented with sexual stimuli than would women, since, compared to women, men demonstrate stronger approach tendencies to sexual stimuli (Baumeister, Catanese, & Vohs, 2001) and are shown to be more sexually excitable and

less sexually inhibited (Carpenter, Janssen, Graham, Vorst, & Wicherts, 2008). Finally, we expected that participants would perform better after the contingency reversal, which would demonstrate learning over the course of the task. However, we expected that high levels of impulsivity and sexual excitation, and low sexual inhibition and intellectual abilities, would be linked to worse performance on the task following the reversal.

Method

Participants

Participants were 53 self-identified heterosexual undergraduate students (28 men and 25 women) recruited from the psychology subject pool at a large Midwestern university. The mean age of participants was 19.5 years ($SD = 1.7$, range = 18–27), and the majority (86%) were white. In terms of self-reported relationship status, 64% were single/never married, and the remaining 46% were in an exclusive, monogamous relationship. All participants indicated having previous exposure to sexually explicit media. Participants were reimbursed for their participation with up to 3 h of research credit for an introductory psychology course. Study approval was obtained from the university's Human Subjects Committee.

Measures

Demographics and Sexual History Questionnaire (DSHQ)

This questionnaire was adapted from Bancroft et al. (2003, 2004) and covers demographic information, sexual orientation, relationship status, and frequency of different types of sexual activity.

Impulsivity

The Impulsivity subscale of the Eysenck Personality Questionnaire (Eysenck, Pearson, Easting, & Alsopp, 1985) measures the propensity for engaging in impulsive behavior and consists of 19 items with a forced-choice response format, scored as 0 or 1. Items include, "Do you need to use a lot of self-control to keep out of trouble?" and "Do you generally do and say things without stopping to think?" Normative mean scores on the Impulsivity scale for individuals in the 20–29 age range are approximately 7.9 ± 4.1 for men and 9.0 ± 4.1 for women. The Impulsivity scale demonstrates good internal consistency reliability, with a Cronbach alpha of .83 for men and .84 for women.

Sexual Inhibition/Sexual Excitation Scales (SIS/SES)

The SIS/SES is a 45-item questionnaire that measures individual differences in the propensity for sexual inhibition and sexual excitation in men and women (Janssen, Vorst, Finn, & Bancroft, 2002a, b). The SIS/SES consists of three subscales: sexual excitation (SES), sexual inhibition due to threat of performance failure (SIS1; e.g., ability to maintain an erection or vaginal lubrication), and sexual inhibition due to threat of negative consequences (SIS2; e.g., fear of pregnancy or STIs). Items are rated on a 4-point Likert scale, ranging from 1 = strongly agree to 4 = strongly disagree. For the purpose of this study, and to limit the number of variables for analysis, we specifically focused on the SES and SIS2 subscales, which in previous research have been associated with the tendency to engage in risky sexual behavior (e.g., Bancroft et al., 2003, 2004). SES subscale scores range from 20 to 80, with a Cronbach alpha = .90. SIS1 subscale scores range from 14 to 56 with a Cronbach alpha = .75. SIS2 subscale scores range from 11 to 44, with a Cronbach alpha = .78 (Janssen et al., 2002a, b). Low SIS2 scores indicate a propensity for continued sexual response and arousal when faced with potentially negative consequences of sex, and high SES scores indicate a tendency to be easily sexually aroused by a variety of potentially sexual situations and stimuli. Normative means and SD for men on the SIS2 subscale are 27.7 ± 4.8 and 57.2 ± 7.9 on the SES subscale (Janssen et al., 2002a). Women's normative means and SD on the SIS2 subscale are 31.7 ± 4.3 and 51.3 ± 8.5 on the SES subscale (Carpenter et al., 2008).

Abstraction Subtest of the Shipley Institute of Living Scale (SILS)

The SILS is a brief, self-administered test of general intellectual functioning in adolescents and adults (Zachary, 1986). It consists of two subtests that measure vocabulary and abstract reasoning, and full-scale Wechsler Adult Intelligence Scale-Revised: 2006; Law et al., 2009) and relies more on prefrontal function than the vocabulary subtest, which is an indicator of crystallized intelligence (Vitaliano et al., 2005).

Subjective Sexual Arousal

Finally, to determine the influence of sexual arousal on go/no-go task performance, participants were asked to rate their subjective sexual arousal on a 5-point Likert scale (1 = not at all sexually aroused to 5 = extremely sexually aroused) immediately following each of the four film clips presented during the experiment.

Procedure

Stimuli

At the beginning of each of the four conditions, participants were presented with a 3 min film clip to induce either sexual arousal or a neutral mood state. Of the four film clips, two were sexual in nature and had been rated as highly sexually arousing in a previous study (Janssen, Carpenter, & Graham, 2003). The two neutral film clips were taken from documentaries about cats and sea turtles. After each of the four film clips, participants engaged in a go/no-go task comprised of ten sexual or ten neutral stimuli. The stimuli consisted of 40 color photos taken from the Hot/Cool Picture Set (Finn, Rickert, & Lucas, 2004, unpublished raw data). Half of the photos depicted nude, heterosexual couples engaged in sexual activity (e.g., oral sex, vaginal intercourse). The remaining 20 photos depicted neutral scenes of individuals engaged in everyday activities (e.g., work, leisure). The photos were scaled to the same dimension of 1024 × 768 pixels and were shown on a black background. All film clips and photos were presented using DirectRT v.2004 (Empirisoft Corporation, New York) on an LCD computer screen.

Upon the participant's arrival, the experimenter explained the study procedures and provided the participant with a detailed informed consent statement to review. The experimenter addressed the participant's questions or concerns regarding the study prior to obtaining written consent. The SILS was then administered in paper-and-pencil format. Following the SILS, the participant was seated alone in front of a computer screen in a closed testing room. The DSHQ and other self-report measures were administered online using SurveyMonkey data collection software (SurveyMonkey.com, Portland, Oregon). The participant was also fitted with headphones to hear audio from the film clips and to minimize distraction from ambient noise. The participant then engaged in a brief practice session that demonstrated a mock version of the go/no-go task.

Instructions presented on the computer screen informed the participant that four short film clips would be shown, and after each one the participant would engage in a short photo learning task. The go/no-go task, adapted from Finn et al. (1999), involved the serial presentation of ten different stimuli, each shown on a computer screen for a maximum of 1500 ms. Unlike Finn et al., the present experiment employed sexual and neutral photos instead of numeric stimuli. Five of the photos were randomly assigned to be "Go" stimuli and five were assigned to be "No-go" stimuli. Participants were instructed to learn by trial and error when to Go (press the spacebar) and when not to Go (withhold a response). To distinguish between Go and No-go stimuli, participants could choose to press the spacebar during the presentation of each photo. After pressing the spacebar, corrective feedback was provided within a 750 ms inter-trial interval. A black screen displayed the word "CORRECT, +1000 points" in green text if the participant responded to a Go stimulus, or "WRONG, −1000 points" in red text if the participant responded to a No-go stimulus. If participants withheld responses to Go stimuli or to No-go stimuli, no feedback was given and the experiment automatically proceeded to the next trial. Ultimately, participants who performed well on the task learned to respond consistently to Go stimuli and to stop responding to No-go stimuli. Task performance was measured by totals of false alarms (i.e., pressing the spacebar in response to a No-go stimulus) and misses (i.e., not pressing the spacebar in response to a Go stimulus). Unlike previous studies, we did not provide monetary rewards for good performance on the task to avoid confounding the motivational salience of financial incentives with that of the sexually arousing stimuli.

The experiment was organized into four conditions presented to each participant in randomized order. Each condition consisted of a sexual or neutral film clip, a rating of subjective sexual arousal in response to the film clip, and a sexual or neutral go/no-go task. Each go/no-go task included 10 blocks of 10 trials depicting either all sexual or all neutral stimuli. Thus, the four conditions were as follows: a neutral film clip followed by a neutral go/no-go task (NF/NT), a neutral film clip followed by a sexual go/no-go task (NF/ST), a sexual film clip followed by a neutral go/no-go task (SF/NT), and a sexual film clip followed by a sexual go/no-go task (SF/ST; see Table 1). All stimuli within each condition were presented in randomized order. As in Finn et al. (1999), task contingencies were reversed halfway through each condition, such that previously correct stimuli (i.e., Go stimuli) were followed by feedback indicating a wrong response, and previously wrong stimuli (i.e., No-go stimuli) were followed by feedback indicating a correct response. Participants were not informed when this contingency reversal would occur.

Data Analysis

Using a median split, high and low scoring groups were created for Abstraction, Impulsivity, and SIS/SES scores. Subjects with scores equal to the median were randomly assigned to low and high scoring groups so that both groups would remain roughly equivalent in size. Mixed analyses of variance (ANOVAs) were performed to test influences of the within-subjects variables of film clips and task stimuli and the between-subjects variables of

Table 1 Abbreviations for experiment conditions

	Neutral go/no-go task	Sexual go/no-go task
Neutral mood film clip	NF/NT	NF/ST
Sexual arousal film clip	SF/NT	SF/ST

Note: Each condition consisted of 10 blocks of 10 trials of a go/no-go task, preceded by a film clip. Conditions were counterbalanced to avoid order effects

participant sex and individual differences (i.e., SIS2, SES, Impulsivity, and Abstraction scores) on each of the dependent variables of total false alarms and misses on the go/no-go task. Separate false alarm and miss totals were calculated for before and after the contingency reversal in each condition. Significant interaction effects were followed up with post-hoc pairwise comparisons using Bonferroni corrections. SPSS v.16.0 for Windows (SPSS Inc.) was used for all analyses.

Results

Sample Characteristics and Manipulation Check

Comparing both means and medians, men and women did not significantly differ in age, SES, SIS2, Impulsivity, or Abstraction (see Table 2). Bivariate correlations revealed no significant associations among our self-report measures, indicating that each of our measures assessed a different construct. The median responses were 53 for SES, 31 for SIS2, and 8 for Impulsivity. Therefore, for each questionnaire, 26 participants were assigned to the low scoring group, and 27 participants to the high scoring group. The median response to the Abstraction scale was 15. One participant did not complete the scale; thus, 26 participants were assigned to each of the two (low and high) groups.

To test whether the sexual film clips effectively induced sexual arousal, we performed a one-sample t test on participants' subjective ratings of sexual arousal after the sexual films. This analysis revealed that participants found the films significantly sexually arousing, $t(52) = 25.40$, $p < .001$. A t test yielded no significant sex difference in subjective sexual arousal ratings after the sexual films, $t(51) = 1.47$. All participants rated the nonsexual films as "not at all sexually arousing." Finally, bivariate correlations tested associations between ratings of sexual arousal, impulsivity, sexual excitation and inhibition, and intellectual ability. The analysis showed a significant positive correlation between SES scores and sexual arousal ratings, $r(51) = .33$, $p < .05$, indicating that individuals higher in sexual excitation found the films more sexually arousing. No other significant correlations were found.

Table 2 Sample characteristics

Variable	Men ($N = 28$)		Women ($N = 25$)	
	M	*SD*	*M*	*SD*
Age	19.8	1.6	19.3	1.9
SIS2	29.5	5.0	31.9	4.8
SES	52.7	6.9	52.3	7.7
Impulsivity	9.4	4.3	7.9	3.9
Abstraction	15.4	2.8	15.1	2.6

Note: No significant sex differences. Absolute ranges: SIS2, 0–44; SES, 0–80; Impulsivity, 0–19; Abstraction, 0–20

False Alarms

A 2 (Sex: Male vs. Female) × 2 (Impulsivity: Low vs. High) × 2 (Contingency Reversal: Pre vs. Post) × 2 (Film: Sexual vs. Neutral) × 2 (Task: Sexual vs. Neutral) mixed factor ANOVA examined the effects of participant sex, impulsivity, and sexually arousing stimuli on participants' false alarms before and after the task contingency reversal. Significant results of this analysis (see Table 3) included main effects of Contingency Reversal, Sex, and Task, qualified by a Sex × Task interaction and an Impulsivity × Film × Task interaction. Participants committed more false alarms before the contingency reversal ($M = 9.4$, $SE = 0.4$) than after the reversal ($M = 6.6$, $SE = 0.5$), indicating that they learned to stop responding to No-go stimuli as the task progressed. Follow-up tests on the Sex × Task interaction revealed that during the sexual task, women committed more false alarms ($M = 10.3$, $SE = 0.6$) than did men ($M = 8.0$, $SE = 0.6$; $p < .01$), contrary to our prediction. No sex differences were found for the neutral task. Finally, individuals with higher impulsivity scores committed more false alarms in the SF/ST condition than in the NF/ST condition (Fig. 1). No differences in false alarms related to impulsivity were found in the remaining conditions.

The next ANOVA replaced the Impulsivity factor with Abstraction. Like in the previous analysis, the main effects of Contingency Reversal, Sex, and Task, and the Sex × Task interaction, were significant and will not be repeated here. This analysis also yielded a significant Abstraction × Film × Contingency Reversal interaction, $F(1, 48) = 8.72$, $p < .01$, partial $\eta^2 = .15$. Follow-up analyses comparing pre- and post-contingency reversal errors showed that, after a sexual film, individuals with higher abstraction scores had significantly fewer false alarms after the contingency reversal ($M = 5.2$, $SE = 0.7$) than before the contingency reversal ($M = 8.9$, $SE = 0.6$; $p = .01$),

Table 3 Mixed analysis of variance with impulsivity for false alarms

Source	*df*	*F*	η^2	*p*
Between subjects				
Sex	1	4.27	.08	<.05
Error	49	(51.0)		
Within subjects				
Task	1	44.87	.48	<.001
Task × Sex	1	5.81	.11	<.05
Error	49	(12.6)		
Contingency reversal	1	31.86	.39	<.001
Error	49	(25.3)		
Film × Task × Impulsivity	1	4.51	.08	<.05
Error	49	(21.0)		

Note: Values in parentheses are mean square errors. Only significant effects are shown. Full ANOVA tables are available from the corresponding author upon request

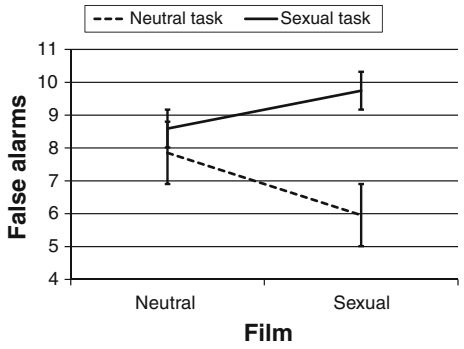

Fig. 1 Mean false alarms on the go/no-go tasks for participants high in impulsivity. Participants high in impulsivity had significantly more false alarms on sexual tasks following the presentation of a sexual film, compared to their false alarms on neutral tasks following a sexual film ($p < .001$)

whereas individuals with lower abstraction scores did not show this difference. A direct comparison of the low and high abstraction groups showed that individuals high in abstraction tended to commit fewer errors after the contingency reversal when sexual films were presented ($M = 5.2$, $SE = 0.7$) than did individuals low in abstraction ($M = 7.0$, $SE = 0.7$; $p < .06$). Together, these findings indicate that, compared to individuals lower in intellectual ability, individuals higher in intellectual ability may have been more successful at withholding responses to No-go trials after the contingency reversal.

Finally, as in the previous two analyses, the MANOVAs replacing the Abstraction factor with SES and SIS2 produced significant main effects of Contingency Reversal, Task, and Sex, and a significant interaction of Sex × Task. However, there were no significant effects involving either SIS2 or SES.

Misses

Similar analyses were performed to test the effects of our within- and between-subjects variables on the dependent variable of misses. The 2 (Sex) × 2 (Impulsivity) × 2 (Contingency Reversal) × 2 (Film) × 2 (Task) mixed factor ANOVA revealed a main effect of Sex, $F(1, 49) = 5.13$, $p < .05$, partial $\eta^2 = .10$. Furthermore, a main effect of Contingency Reversal, $F(1, 49) = 6.69$, $p < .05$, partial $\eta^2 = .12$, was qualified by a Contingency Reversal × Film interaction, $F(1, 49) = 6.97$, $p < .05$, partial $\eta^2 = .13$. Regarding the main effect of Sex, men had more misses ($M = 5.3$, $SE = 0.6$) than women ($M = 3.5$, $SE = 0.6$). Follow-up analyses on the Contingency Reversal × Film interaction revealed that, after neutral films, participants had more misses prior to the contingency reversal ($M = 5.7$, $SE = 0.6$) than after the reversal ($M = 3.6$, $SE = 0.5$; $p = .001$). However, following a sexual arousal induction, there was no significant difference in misses before ($M = 4.5$, $SE = 0.5$) and after the contingency reversal ($M = 4.0$, $SE = 0.5$), indicating that participants learned to adjust their response strategy after the presentation of neutral films, but not after sexual films. We found no effects of impulsivity on participants' misses, consistent with our predictions.

A similar ANOVA replaced the Impulsivity factor with Abstraction and showed significant effects of Contingency Reversal and Film × Contingency Reversal, but did not show a significant main effect of Sex in contrast to the previous analysis on miss data. The analysis also yielded a Sex × Abstraction × Task interaction, $F(1, 48) = 4.91$, $p < .05$, partial $\eta^2 = .09$. Follow-up tests showed that men with lower abstraction scores had significantly more misses on the sexual go/no-go tasks ($M = 6.5$, $SE = 1.0$) than men with high abstraction scores ($M = 3.6$, $SE = 0.9$) and women with low abstraction scores ($M = 3.5$, $SE = 1.0$; $ps < .05$). No significant effects were found for the neutral task. This finding (Fig. 2) supported our hypothesis that low intellectual aptitude, at least in men, would be associated with more errors linked to sexually arousing stimuli.

The next analysis replaced the Abstraction factor with SIS2 and yielded significant main effects of Sex, Contingency Reversal, and a Film × Contingency Reversal interaction. We also found a significant SIS2 × Film × Task interaction, $F(1, 49) = 4.12$, $p < .05$, partial $\eta^2 = .08$. A follow-up analysis on the three-way interaction indicated that individuals low in sexual inhibition tended to have more misses in the SF/ST condition ($M = 5.6$, $SE = 0.9$) than in the SF/NT condition ($M = 3.2$, $SE = 0.9$), although this result was significant at the trend level only ($p = .06$). The analysis failed to show other interactions with SIS2.

The final ANOVA replaced the SIS2 factor with SES and yielded significant main effects of Sex, Contingency Reversal, a Film × Contingency Reversal interaction, and a SES × Film interaction. These effects were qualified by significant SES × Film × Contingency Reversal and Sex × SES × Film × Task × Contingency Reversal interactions (see Table 4). The SES ×

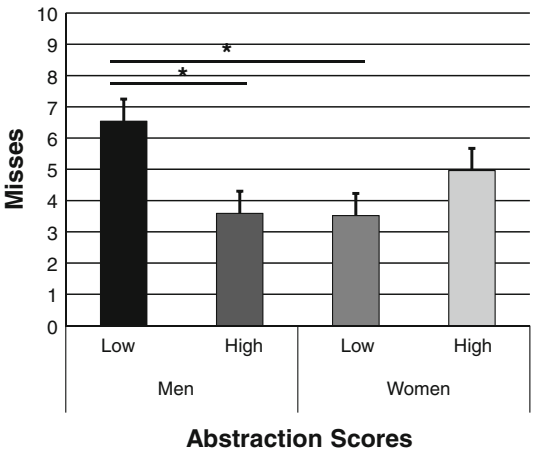

Fig. 2 Mean misses on the sexual go/no-go tasks by abstraction scores and participant sex. Men low in abstraction had significantly more misses on sexual go/no-go tasks compared to men high in abstraction and women low in abstraction ($ps < .05$)

Table 4 Mixed analysis of variance with sexual excitation scores for misses

Source	*df*	*F*	η^2	*p*
Between subjects				
Sex	1	4.30	.08	<.05
Error	49	(71.5)		
Within subjects				
Film × SES	1	4.60	.09	<.05
Error	49	(21.8)		
Contingency reversal (CR)	1	7.23	.13	.01
Error	49	(26.0)		
Film × CR	1	7.42	.13	<.01
Film × CR × SES	1	4.87	.09	<.05
Error	49	(7.9)		
Film × Task × CR × Sex × SES	1	5.75	.11	<.05
Error	49	(5.8)		

Note: Values in parentheses are mean square errors. Only significant effects are shown

Film interaction indicated that individuals low in sexual excitation had fewer misses after the presentation of a sexual film ($M = 3.5$, $SE = 0.6$) than after a neutral film ($M = 4.9$, $SE = 0.7$). The remaining significant results in this analysis appear to be driven by the robust main effect of Contingency Reversal. The SES × Film × Contingency Reversal interaction revealed that participants high in sexual excitation had more misses prior to the contingency reversal when a sexual film was presented ($M = 5.7$, $SE = 0.7$) than did participants low in sexual excitation ($M = 3.3$, $SE = 0.7$; Fig. 3). Participants low in sexual excitation had fewer misses prior to the contingency reversal after sexual films than after neutral films ($M = 6.0$, $SE = 0.9$; $p < .01$).

Finally, follow-up tests on the Sex × SES × Film × Task × Contingency Reversal interaction revealed that prior to the contingency reversal, men high in sexual excitation had more misses in the SF/NT condition ($M = 7.6$, $SE = 1.3$) than did men low in sexual excitation ($M = 3.6$, $SE = 1.3$) and women high in sexual excitation ($M = 3.9$, $SE = 1.3$; $ps < .05$). Second, men low in sexual excitation had fewer misses in the SF/ST condition ($M = 3.7$, $SE = 1.4$) compared to the NF/ST condition ($M = 7.1$, $SE = 1.5$; $p < .05$). Lastly, women low in sexual excitation had fewer misses in the SF/NT condition ($M = 2.2$, $SE = 1.4$) compared to the NF/NT condition ($M = 6.4$, $SE = 1.6$; $p < .05$). Together, these findings supported our hypothesis that high sexual excitation would be associated with more misses, and low sexual excitation with fewer, in response to sexually arousing stimuli.

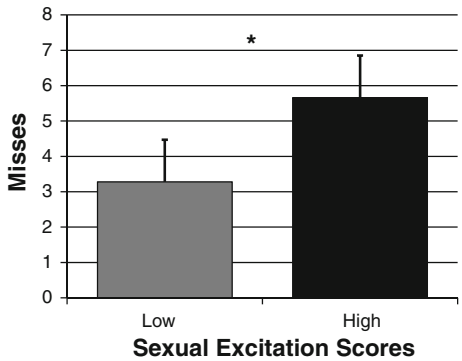

Fig. 3 Mean misses on the go/no-go tasks prior to contingency reversal and after a sexual film. Compared to participants low in sexual excitation, participants high in sexual excitation had significantly more misses on the go/no-go tasks before the contingency reversal in conditions presenting sexual films ($p < .05$)

Discussion

To our knowledge, this is the first study to use the go/no-go paradigm to examine relationships between personality and other individual difference variables and System 1 processes relevant to sexual decision making. We predicted that low sexual inhibition and high sexual excitation, but not high trait impulsivity, would be associated with decreased performance (i.e., more false alarms and misses) in conditions involving sexual images or sexual film clips. Moreover, we predicted that lower intellectual abilities would be associated with poorer performance in conditions with sexually arousing stimuli. We also expected that men would have more errors compared to women, and that performance post-contingency reversal would show fewer errors except for those high in impulsivity and sexual excitation, and low in sexual inhibition and intellectual ability.

Impulsivity

Contrary to our predictions, impulsivity was associated with more false alarms in the SF/ST condition. Thus, while impulsivity has been linked to poor overall performance on other laboratory tasks of decision making (e.g., Sweitzer, Allen, & Kaut, 2008), the present study found that impulsivity was associated with poor performance specifically in response to sexually arousing stimuli. Some conceptualizations of impulsivity involve a tendency to respond to motivationally- or emotionally-salient stimuli (Evenden, 1999), which may explain this finding.

Sexual Arousability

Sexual inhibition was not associated specifically with errors during conditions in which sexual stimuli were presented. The SIS2 scale measures "sexual inhibition due to threat of performance consequences" (Janssen et al., 2002a, b), such as unwanted pregnancy or contracting an STI. However, our study did not present participants with potential negative consequences, which

may partly explain why sexual inhibition was unrelated to error totals. Thus, the inclusion of high-risk sexual scenarios (e.g., Abbey et al., 2005) or actual monetary loss (e.g., Finn et al., 1999) in our study might have elicited different effects involving sexual inhibition. Alternatively, while SIS2 scores have been found to be predictive of self-reported sexual risk behaviors in relatively large survey studies (for a review, see Bancroft et al., 2009) they have mainly been predictive in smaller laboratory studies when subjects were selected on SIS/SES scores (Janssen et al., 2002b), which was not the case in the present study. Thus, the current study may have involved a more limited range of SIS/SES scores, in particular an underrepresentation of low SIS2 scores. For example, in the study by Janssen et al. (2002b), which involved men only, the average of the low SIS2 group was 19 and the average of the high SIS2 group was 29. The average SIS2 score of the male sample in the current study was 29.5 (with a median of 31), which indicates that the current sample scored, overall, relatively high on SIS2.

Sexual excitation scores, while on average lower for both men and women than has been found in other studies (e.g., Carpenter et al., 2008; Janssen et al., 2002a, b), showed somewhat more variability, and were linked to a number of findings showing more misses on go/no-go tasks that followed sexual films. Sexual excitation was associated with more misses, particularly after the midway contingency reversal in conditions with sexual films. Individuals high in sexual excitability are thought to exhibit an attentional bias toward sexually arousing cues (Janssen et al., 2002a). Since sexual excitation scores were positively associated with sexual arousal, this may have led participants to fail to attend to signals indicating they should reverse their response strategy. In an actual sexual situation, individuals high in sexual excitability may be so sensitive to the pleasurable aspects of sexual encounters that they miss, or purposely ignore, cues indicating potentially negative outcomes.

Intellectual Ability

As expected, lower intellectual abilities were generally associated with more false alarms after the contingency reversal in conditions involving the presentation of a sexual film. This finding builds upon those of Finn et al. (1999), who also showed a relationship between low cognitive ability and higher error rates post-contingency reversal on a go/no-go task. Following a contingency reversal, participants must not only remember which stimuli were previously correct and wrong in order to reverse their response pattern, but they must also do so quickly and accurately to avoid penalty. This demanding cognitive process requires mental flexibility, attention, and working memory. Consequently, the ability to avoid responding to previously rewarded stimuli may be particularly difficult for individuals of lower intellectual ability who are also sexually aroused. This has implications for real-world sexual situations. For instance, not all individuals who engage in risky, yet pleasurable sexual activity (e.g., unprotected sex) that is paired with a negative consequence (e.g., contracting an STI) will choose to wear condoms. It may be that individuals with lower intellectual abilities are at higher risk for continuing to have unprotected sex despite the possibility of spreading or contracting additional STIs. Furthermore, lower intellectual abilities in men were associated with more misses when sexual images were presented, compared to both women with similar abilities and men with higher abilities. Low intellectual ability has been associated with attentional problems in men (e.g., Frazier, Demaree, & Youngstrom, 2004), and it may be that the content of the sexual images drew attention away from the task at hand, leading to greater miss rates.

Sex Differences

The go/no-go task also elicited interesting sex differences associated with our sexual stimuli. Unexpectedly, we found that women had more false alarms in tasks depicting sexual images, whereas men had more misses. This may be due to differences in sexual interest in the images. Pressing the spacebar to respond to a photo immediately removed it from the screen, thereby reducing its presentation time. Men may have desired to look longer at the images, thereby missing the opportunity to respond to Go trials, whereas women may have wanted to proceed more quickly through the sexual images, leading them to be less careful in responding to No-go trials. Although we did not explicitly evaluate participants' sexual interest in the photos, it may be beneficial to do so in future studies.

Conclusions

Together, these findings suggest that the processes underlying decision making and learning relevant to sexual behavior are complex. In some individuals, poor task performance was related to a mechanism specific to sexual behavior (i.e., sexual excitation), whereas in others, it was associated with more general individual difference variables. It is likely that errors in real-world sexual situations, such as failures to use condoms or neglecting to ask a new partner's STI or HIV status, are associated with different processes depending on the person and the context. For example, deciding against using condoms may be linked to impulsivity in one person who engages in risk behaviors in multiple domains, whereas in another, it may be due to increased sensitivity to sexually arousing stimuli or low intellectual ability.

Compared to previous research on sexual decision making, the methodology of the current study was unique in several ways. To our knowledge, this is the first study to use the go/no-go task paradigm to explore the mechanisms of discrimination learning and choice behavior when individuals are presented with sexually arousing stimuli. While previous analogue studies

that measured individuals' responses to a hypothetical sexual scenario likely tap into more deliberative, effortful decision processes, go/no-go tasks are better suited to measure automatic, rapid choice behavior which more closely approximates System 1 decision making in the "heat of the moment." Furthermore, such implicit tasks do not rely on subjective self-reports, which render them less susceptible to socially desirable responding. Additionally, this study used brief film clips to induce sexual arousal or a neutral mood state prior to each task, whereas previous studies on go/no-go learning and risky decision making have not attempted this type of manipulation. Finally, unlike the study design of Newman et al. (1985) and Finn et al. (1999), our go/no-go task did not use monetary incentives to reinforce learning. Providing participants with money totals may have been a potential confound, as we would be unable to disentangle whether participants' performance was linked to their monetary reward or their response to the content of the sexual photos themselves.

Limitations of the current study should be considered in future research on sexual decision making. The relatively small sample size may have masked subtle individual differences in sexual inhibition and excitation, impulsivity, or intelligence because after questionnaire scores were divided by median split, approximately 26 participants were assigned to each high and low group. Furthermore, our sample consisted primarily of college-aged men and women, who may have had minimal sexual experience and may not be representative of the sexual inhibition and excitation propensities of older adults. Thus, future studies may consider a targeted recruitment strategy in order to capture a wider age range and more variability in our variables of interest. Lastly, one may argue that using a go/no-go task to measure mechanisms of sexual decision making is less ecologically valid than an analogue study design. It would be interesting to include an implicit learning and decision task as well as an analogue task in one study to explore the different decision processes elicited by the two methods.

This study contributes to the growing literature demonstrating that a confluence of cognitive, motivational, and personality factors contribute to variability in rapid decision making relevant to sexual behavior. Our findings provide evidence that, for impulsive individuals, or those low in intellectual ability, sexually arousing stimuli interfere with the ability to quickly and appropriately respond to cues signaling reward and punishment. Moreover, sexually excitable individuals may have difficulty shifting attention from sexually arousing cues to signals indicative of risk in the heat of the moment. Finally, our findings imply that sexual inhibition may not necessarily lead to disadvantageous patterns of decision making when potential negative consequences of sexual behavior are not evident.

Acknowledgments This research was supported by predoctoral fellowships to the first author from the National Institute of Mental Health (T32-MH17146) and the National Institutes of Health (TL1-RR025759), as well as a graduate research grant from the Friends of the Kinsey Institute. Development of the Hot/Cool Picture Set was supported by a grant from the National Institute on Drug Abuse to Peter R. Finn (1R01-DA017924).

References

Abbey, A., Saenz, C., & Buck, P. O. (2005). The cumulative effects of acute alcohol consumption, individual differences, and situational perceptions on sexual decision making. *Journal of Studies on Alcohol, 66*, 82–90.

Abbey, A., Saenz, C., Buck, P. O., Parkhill, M. R., & Hayman, L. W. (2006). The effects of acute alcohol consumption, cognitive reserve, partner risk, and gender on sexual decision making. *Journal of Studies on Alcohol, 67*, 113–121.

Ariely, D., & Loewenstein, G. (2006). The heat of the moment: The effect of sexual arousal on sexual decision making. *Journal of Behavioral Decision Making, 19*, 87–98.

Bancroft, J. (1999). Central inhibition of sexual response in the male: A theoretical perspective. *Neuroscience and Biobehavioral Reviews, 23*, 763–784.

Bancroft, J., Graham, C. A., Janssen, E., & Sanders, S. A. (2009). The dual control model: Current status and future directions. *Journal of Sex Research, 46*, 121–142.

Bancroft, J., & Janssen, E. (2000). The dual control model of male sexual response: A theoretical approach to centrally mediated erectile dysfunction. *Neuroscience and Biobehavioral Reviews, 24*, 571–579.

Bancroft, J., Janssen, E., Carnes, L., Goodrich, D., Strong, D., & Long, J. S. (2004). Sexual risk taking in young heterosexual men: The relevance of sexual excitation, mood and sensation seeking. *Journal of Sex Research, 41*, 181–192.

Bancroft, J., Janssen, E., Strong, D., Carnes, L., Vukadinovic, Z., & Long, J. S. (2003). Sexual risk taking in gay men: The relevance of sexual excitation, mood and sensation seeking. *Archives of Sexual Behavior, 32*, 555–572.

Barlow, D. H. (1986). Causes of sexual dysfunction: The role of anxiety and cognitive interference. *Journal of Consulting and Clinical Psychology, 54*, 140–148.

Batty, G. D., Deary, I. J., & Macintyre, S. (2006). Childhood IQ and life course socioeconomic position in relation to alcohol induced hangovers in adulthood: The Aberdeen Children of the 1950s Study. *Journal of Epidemiology and Community Health, 60*, 872–874.

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 and Social Psychology Review, 5*, 242–273.

Brand, M., Heinze, K., Labudda, K., & Markowitsch, H. J. (2008). The role of strategies in deciding advantageously in ambiguous and risky situations. *Cognitive Processes, 9*, 159–173.

Carpenter, D., Janssen, E., Graham, C., Vorst, H., & Wicherts, J. (2008). Women's scores on the Sexual Inhibition/Sexual Excitation Scales (SIS/SES): Gender similarities and differences. *Journal of Sex Research, 45*, 36–48.

Centers for Disease Control and Prevention. (2009). *Trends in reportable sexually transmitted diseases in the United States, 2007: National surveillance data for chlamydia, gonorrhea, and syphilis.* Available at http://www.cdc.gov/std/stats07/trends.pdf.

de Wit, H., Flory, J. D., Acheson, A., McCloskey, M., & Manuck, S. (2007). IQ and nonplanning impulsivity are independently associated with delay discounting in middle-aged adults. *Personality and Individual Differences, 42*, 111–121.

Ditto, P. H., Pizarro, D. A., Epstein, B. E., Jacobson, J. A., & MacDonald, T. K. (2006). Visceral influences on risk-taking behavior. *Journal of Behavioral Decision Making, 19*, 99–113.

Evenden, J. L. (1999). Varieties of impulsivity. *Psychopharmacology, 146*, 348–361.

Eysenck, S. B. G., Pearson, P. R., Easting, G., & Allsopp, J. F. (1985). Age norms of impulsivity, venturesomeness, and empathy in adults. *Personality and Individual Differences, 6*, 613–619.

Fadardi, J. S., & Cox, W. M. (2006). Alcohol attentional bias: Drinking salience or cognitive impairment? *Psychopharmacology, 185*, 169–178.

Finn, P. R., Justus, A., Mazas, C., & Steinmetz, J. E. (1999). Working memory, executive processes and the effects of alcohol on go/no-go learning: Testing a model of behavioral regulation and impulsivity. *Psychopharmacology, 146*, 465–472.

Finn, P. R., Mazas, C. A., Justus, A., & Steinmetz, J. E. (2002). Early-onset antisocial alcoholism with a history of conduct disorder: Go/no-go learning deficits, personality, and working memory capacity. *Alcoholism, Clinical and Experimental Research, 26*, 186–206.

Finn, P. R., Rickert, M. E., & Lucas, J. (2004). [Hot/Cool Picture Set]. Unpublished raw data.

Frazier, T. W., Demaree, H. A., & Youngstrom, E. A. (2004). Meta-analysis of intellectual and neuropsychological test performance in attention-deficit/hyperactivity disorder. *Neuropsychology, 18*, 543–555.

George, W. H., Davis, K. C., Norris, J., Heiman, J. R., Stoner, S. A., Schacht, R. L., … Kajumulo, K. F. (2009). Indirect effects of acute alcohol intoxication on sexual risk-taking: The roles of subjective and physiological sexual arousal. *Archives of Sexual Behavior, 38*, 498–513.

Giancola, P. R., & Tarter, R. E. (1999). Executive cognitive functioning and risk for substance abuse. *Psychological Science, 10*, 203–205.

Gillath, O., Mikulincer, M., Birnbaum, G., & Shaver, P. R. (2007). Does subliminal exposure to sexual stimuli have the same effects on men and women? *Journal of Sex Research, 44*, 111–121.

Gold, R. S. (1993). On the need to mind the gap: On-line versus off-line cognitions underlying sexual risk-taking. In D. J. Terry, C. Gallois, & M. McCamish (Eds.), *The theory of reasoned action: Its application to AIDS-preventive behaviour* (pp. 227–252). Oxford: Pergamon Press.

Hoffmann, H., Janssen, E., & Turner, S. (2004). Classical conditioning of sexual arousal in women and men: Effects of varying awareness and biological relevance of the CS. *Archives of Sexual Behavior, 33*, 43–53.

Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science, 4*, 162–176.

Janssen, E., Carpenter, D., & Graham, C. (2003). Selecting films for sex research: Gender differences in erotic film preference. *Archives of Sexual Behavior, 32*, 243–251.

Janssen, E., Everaerd, W., Spiering, M., & Janssen, J. (2000). Automatic processes and the appraisal of sexual stimuli: Towards an information processing model of sexual arousal. *Journal of Sex Research, 37*, 8–23.

Janssen, E., Vorst, H., Finn, P., & Bancroft, J. (2002a). The Sexual Inhibition (SIS) and Sexual Excitation (SES) Scales: I. Measuring sexual inhibition and excitation proneness in men. *Journal of Sex Research, 39*, 114–126.

Janssen, E., Vorst, H., Finn, P., & Bancroft, J. (2002b). The Sexual Inhibition (SIS) and Sexual Excitation (SES) Scales: II. Predicting psychophysiological response patterns. *Journal of Sex Research, 39*, 127–132.

Joint United Nations Programme on HIV/AIDS & World Health Organization. (2007). *2007 AIDS epidemic update.* Available at http://data.unaids.org/pub/EPISlides/2007/2007_epiupdate_en.pdf.

Justus, A. N., Finn, P. R., & Steinmetz, J. E. (2000). The influence of traits of disinhibition on the association between alcohol use and risky sexual behavior. *Alcoholism, Clinical and Experimental Research, 24*, 1028–1035.

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist, 58*, 697–720.

Law, C. W. Y., Soczynska, J. K., Woldeyohannes, H. O., Miranda, A., Brooks, J. O., & McIntyre, R. S. (2009). Relation between cigarette smoking and cognitive function in euthymic individuals with bipolar disorder. *Pharmacology, Biochemistry and Behavior, 92*, 12–16.

Llewellyn, D. J. (2008). The psychology of risk taking: Toward the integration of psychometric and neuropsychological paradigms. *American Journal of Psychology, 121*, 363–376.

MacDonald, T. K., & Hynie, M. (2008). Ambivalence and unprotected sex: Failure to predict sexual activity and decreased condom use. *Journal of Applied Social Psychology, 38*, 1092–1107.

MacDonald, T. K., MacDonald, G., Zanna, M. P., & Fong, G. T. (2000). Alcohol, sexual arousal, and intentions to use condoms in young men: Applying alcohol myopia theory to risky sexual behavior. *Health Psychology, 19*, 290–298.

MacDonald, T. K., & Martineau, A. M. (2002). Self-esteem, mood, and intentions to use condoms: When does low self-esteem lead to risky health behaviors? *Journal of Experimental Social Psychology, 38*, 299–306.

McCoul, M. D., & Haslam, N. (2001). Predicting high risk sexual behavior in heterosexual and homosexual men: The roles of impulsivity and sensation seeking. *Personality and Individual Differences, 31*, 1303–1310.

Newman, J. P., Widom, C. S., & Nathan, S. (1985). Passive avoidance in syndromes of disinhibition: Psychopathy and extraversion. *Journal of Personality and Social Psychology, 48*, 1316–1327.

Norris, J., Stoner, S. A., Hessler, D. M., Zawacki, T. M., George, W. H., Morrison, D. M., & Davis, K. C. (2009). Cognitive mediation of alcohol's effects on women's in-the-moment sexual decision making. *Health Psychology, 28*, 20–28.

Pinkerton, S. D., & Abramson, P. R. (1992). Is risky sex rational? *Journal of Sex Research, 29*, 561–568.

Prause, N., Janssen, E., & Hetrick, W. (2008). Attention and emotional responses to sexual stimuli and their relationship to sexual desire. *Archives of Sexual Behavior, 37*, 934–959.

Shearer, D. L., Mulvihill, B. A., Klerman, L. V., Hovinga, M. E., & Redden, D. T. (2002). Association of early childbearing and low cognitive ability. *Perspectives on Sexual and Reproductive Health, 34*, 236–243.

Shuper, P. A., & Fisher, W. A. (2008). The role of sexual arousal and sexual partner characteristics in HIV+MSM's intentions to engage in unprotected sexual intercourse. *Health Psychology, 27*, 445–454.

Smith, P., & Waterman, M. (2004). Processing bias for sexual material: The emotional Stroop and sexual offenders. *Sexual Abuse: A Journal of Research and Treatment, 16*, 163–171.

Spiering, M., Everaerd, W., & Janssen, E. (2003). Priming the sexual system: Implicit versus explicit activation. *Journal of Sex Research, 40*, 134–145.

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences, 23*, 645–726.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*, 220–247.

Sweitzer, M. M., Allen, P. A., & Kaut, K. P. (2008). Relation of individual differences in impulsivity to nonclinical emotional decision making. *Journal of the International Neuropsychological Society, 14*, 878–882.

Verdejo-Garcia, A., Lawrence, A. J., & Clark, L. (2008). Impulsivity as a vulnerability marker for substance-use disorders: Review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience and Biobehavioral Reviews, 32*, 777–810.

Vitaliano, P. P., Echeverria, D., Yi, J., Phillips, P. E. M., Young, H., & Siegler, I. C. (2005). Psychophysiological mediators of caregiver stress and differential cognitive decline. *Psychology and Aging, 20*, 402–411.

Wiegel, M., Scepkowski, L., & Barlow, D. (2007). Cognitive-affective processes in sexual arousal and sexual dysfunction. In E. Janssen (Ed.), *The psychophysiology of sex* (pp. 143–165). Bloomington: Indiana University Press.

Zachary, R. A. (1986). *Shipley institute of living scale: Revised manual*. Los Angeles: Western Psychological Services.