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Spontaneous Cognition and HIV Risk Behavior

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Theories of cognitive processes and risk behavior have not usually addressed spontaneous forms of cognition that may co-occur with, or possibly influence, behavior. This study evaluated whether measures of spontaneous cognition independently predict HIV risk behavior tendencies. Whereas a trait-centered theory suggests that spontaneous cognitions are a by-product of personality, a cognitive view hypothesizes that spontaneous cognitions should predict behavior independently of personality. The results revealed that spontaneous cognition was an independent predictor of behavior tendencies in cross-sectional analyses. Its predictive effect was stronger than drug use, a frequently emphasized correlate of HIV risk behavior in the literature, and comparable with sensation seeking in magnitude. The results suggested that a relatively spontaneous form of cognition may affect HIV risk behavior.

Keywords: HIV, associative memory, accessibility, sensation seeking

Cognition relevant to risky or addictive behaviors can be conceptualized and measured in many ways. In research on HIV risk behavior, however, most cognitive research has been limited predominantly to one general approach relying on direct questioning about cognitions related to the behavior. For example, participants are frequently asked directly to report their beliefs, attitudes, or knowledge relevant to risky sex, either through questionnaires or interviews. An alternative approach, found successful in work on addictive behavior (for reviews, see Wiers & Stacy, 2006), focuses on indirect assessments of cognition. This approach assumes that much of cognition relevant to risky behavior is activated with minimal deliberation or effort and thus should be assessed by measures that do not encourage extensive processing or questionnaire judgments. This framework attempts to tap into what Kahneman (2003) has characterized as *System 1*, a system that does not depend on rationality yet links cognition to behavior.

One way to characterize System 1 is that it involves spontaneous forms of cognition. These forms of cognition do not address or encourage considerations of pros or cons, judgments of effects, self-perceptions, or other processes characteristic of executive control functions (Royall et al., 2002). The focus is simply on activation of content in memory, assessed indirectly.

We propose that spontaneous cognition is a useful heuristic or umbrella under which a variety of cognitive processes relevant to risky behavior can be subsumed. It is reasonable to include under this general domain specific processes such as implicitly (or automatically) activated memory and cognition (De Houwer, 2006; Nelson, McKinney, Gee, & Janczura, 1998), involuntary explicit memory (Schacter & Badgaiyan, 2001), and chronically accessible cognition (Bargh, Bond, Lombardi, & Tota, 1986). Each of these cognitions can be activated with little effort, minimal prompting, and without requesting judgments. Our main goal in this study was to determine if a set of measures designed to assess this class of cognitive process can explain variation in HIV risk behavior, even though the measures do not encourage any type of self-perception or judgment process. A further goal was to see if these measures explain this variation even when controlling for other, more frequently emphasized variables in the analysis, such as drug use, sensation seeking, and other variables.

Translation of Specific Processes From Basic Research and Measurement Possibilities

Recent reviews that address spontaneous cognition relevant to health-related behavior have revealed a range of concepts and potential assessments (Wiers & Stacy, 2006). For the present purposes, we focused on spontaneous cognitive processes that are likely based on two complementary processes: frequency and association. Frequency or repetition effects on spontaneous cognition imply that cognitions relevant to risky behaviors arise because of many previous activations of those cognitions. This view is consistent with basic research on memory, in which frequency of activation has had important effects on later cognition (e.g., Dixon

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& Twilley, 1999), as well as research on social cognition (e.g., Bargh, Lombardi, & Higgins, 1988), which has suggested that chronically activated constructs are potent influences on behavior. Associative or relational effects imply that something in particular (e.g., setting, object, word, person, feeling) has become related enough through experience to subsequently act as a cue or trigger that spontaneously activates the cognition in memory (e.g., Nelson et al., 1998).

Despite the heuristic distinction between frequency and relational effects, in basic memory research the two sources of activation have often been highly correlated and likely constitute two aspects of an interwoven process (Nelson & McEvoy, 2000). Translating this basic research to risk behaviors, it is likely that risk-related cognitions that occur very frequently acquire a greater number of connections to possible triggers, and thus, frequency and relational effects may operate hand in hand. This suggests that cognitions arising from both types of processes should be addressed and assessed, if possible, in research on spontaneous forms of cognition. In the cognitive measures used in the present study, one set of measures focused on chronic sources of activation, assessing the likelihood of generation of risk-related cognitions with very minimal cues that do not encourage associative or relational processing. The second set of cognitive measures used triggers or cues designed to spontaneously prompt risk-related cognitions among individuals who have acquired associations between the cues and cognitions in memory.

Risk-consistent spontaneous cognitions revealed in these assessments should represent both chronically accessible cognitions and cognitions that are readily prompted by related cues. In both cases, these cognitions are expected to be important for risk behavior because they color one's train of thought, delimit the range of behavioral options available for subsequent processing, and essentially steer behavior in the direction of risky actions. Theories of social cognition (Higgins, King, & Mavin, 1982; Olson & Fazio, 2004; Todorov & Bargh, 2002), decision (Kahneman, 2003), and addictive behavior (Wiers & Stacy, 2006) are consistent with the view that spontaneously generated forms of cognition can bias choices toward specific streams of behavior. Thus, we expected the two sets of indirect measures just introduced, though very different in surface content, to form a common factor capable of explaining variation in HIV risk behavior tendencies. Investigating this hypothesis is an important step in evaluating the potential of this framework for understanding HIV risk behavior.

Personality and Spontaneous Cognition

Several models of personality maintain that systematic biases in information processing can influence spontaneous thoughts and lead to biased interpretation of ambiguous events (Beck & Weishaar, 1989; Dohr, Rush, & Bernstein, 1989). Spontaneous cognition in personality theory can be traced at least as far back as Freud and Jung, whose association methods elicited spontaneous thoughts that were symptomatic of behavior (Jung, 1910; Kandel, 1999).

In one of the contemporary approaches to personality that avoids psychodynamic interpretations, individuals vary in a trait-like neurobiologically based need for stimulation, making them more likely to engage in risky behaviors and more susceptible to the reinforcing effects of pleasurable stimuli (Cloninger, 1994; Cloninger, Svrakic, & Przybeck, 1993; Zuckerman, 1994). Zuckerman (1994) has implicated the sensation-seeking trait as a correlate of these neurobiological processes. A number of studies have shown that sensation seeking is among the strongest correlates of HIV risk behavior (e.g., Donohew et al., 2000; Hoyle, Fejfar, & Miller, 2000; McCoul & Haslam, 2001). It is reasonable to assume that sensation seeking may have some manifestations that spontaneously seep into cognitive processing—this trait may thus correlate with variation in spontaneous cognitions related to risky behaviors. However, if the sensation seeking trait is the primary cause of the risky behavior, then spontaneous cognition concerning the behavior could be seen as an epiphenomenon or symptom that does not predict behavior once the effects of the trait are controlled for. This implies a direct predictive effect of sensation seeking, but not spontaneous cognition, on risk behavior. An alternative hypothesis based on the cognitive approaches suggests that spontaneous cognition would still be predictive, even when the predictive effects of sensation seeking are controlled for. Spontaneous cognition in these latter approaches is based on frequency and associative effects that are important in their own right, either with causal preeminence over traits or at least functional autonomy.

Converging and Diverging Predictions

Cognitive and personality approaches both suggest that measures of spontaneous cognition related to HIV risk behavior may be correlated with relevant behavior, before controlling for potential confounders of this relationship. However, the personality approach focusing on sensation seeking suggests that the effect of spontaneous cognition will disappear once this trait is controlled for. The memory approach, and allied positions from social cognition and decision theory, suggests a direct predictive effect of spontaneous cognition related to the target behavior, even when the predictive effects of traditional personality traits are controlled for. The cognitive positions do not address sensation seeking, but it is not inconsistent for one to expect that both spontaneous cognition and sensation seeking could independently predict HIV behavior tendencies. Given previous results about these constructs, we evaluated this latter hypothesis as a starting place to compare alternatives. Potential confounders of these predictors are evaluated in a priori sets of other variables.

Other Variables

In any observational study of naturally occurring behavior, it is important to assess a range of potential correlates or confounders of the primary predictions. Thus, the study assessed a behavioral domain that is often implicated in risky sexual behaviors: drug use (e.g., Boyer, Tschann, & Shafer, 1999; Corbin & Fromme, 2002; Leigh & Stall, 1993). In addition, the available sample was heterogeneous in ethnic origin; thus, the most likely impact of ethnic origin was studied in an exploratory manner with measures of acculturation (for a review, see Berry, 1998) toward the dominant groups in the sample, as well as effect codes representing ethnicity. Another exploratory analysis involved possible differences in prediction models across gender. Drug use, ethnic, and gender effects were not a focus of this study but were evaluated because of possible confounding effects of these variables.

All alternatives were evaluated in cross-sectional models, but the models report predictive effects in the statistical sense that partialed paths (beta weights) are reported, adjusting for alternatives. Although causality is not inferred, the predictive weights reveal the viability of the hypotheses in cross-sectional data. We assume that additional research will be needed to provide inferences of causality for any promising predictive effects uncovered in these analyses.

Method

Participants

In the study of HIV risk behavior, it is important to ensure adequate variability in the target behaviors. It is also useful to study populations at known risk for HIV infection. The sample consisted of 502 ethnically diverse adults in drug diversion and drug treatment programs in the Los Angeles, California area. Participants were drug offenders referred to these education and treatment programs in lieu of prosecution for a variety of drug-related offenses. These individuals varied in the extent to which they have been involved in the use of and/or sale of illegal substances as well as risky behaviors associated with use. The drug diversion and treatment programs from which these participants were recruited provide educational sessions about substance abuse and HIV risk behavior.

Participants ranged in age from 18 to 65 years, with a mean age of 34 years (SD = 9.85): 27% were women and 73% were men; 15% were African American, 5% were Asian American, 22% were Latino, 49% were White, and 9% were other minorities. Of the participants, 44% had been convicted for possession of an illegal drug, 32% were convicted of driving under the influence of alcohol, 8% were convicted for driving under the influence of another drug, 6% were convicted for sales of an illegal drug, and approximately 10% were convicted for miscellaneous other offenses (e.g., fake prescription, cultivating, manufacturing). The majority of the sample reportedly used alcohol (92%) and marijuana (70%) in the past year. Approximately 45% used amphetamines, crack cocaine, and other forms of cocaine; 25% used heroin; 37% used other narcotics; and 21% used ecstasy in the past year. Approximately 29.5% of the sample reportedly had used a needle to inject drugs.

Procedure

Participants completed an anonymous survey assessing spontaneous cognition and other variables, followed by measures of drug use and sexual behavior. Guarantees of anonymity have been found to lead to more confidence in the validity of self-reports in sensitive surveys (e.g., Murray & Perry, 1987; Stacy, Widaman, Hays, & DiMatteo, 1985). Participants were tested in small groups of 5–15 individuals. They were informed that their participation in this research was voluntary and that they could withdraw at any time without prejudice. Less than 1% of the drug diversion sample refused to participate for various reasons (e.g., physical disabilities, including inability to write, inability to concentrate, inability to read). All participants completed the battery of assessments.

Measures of Spontaneous Cognition

Three indicators of spontaneous sex-related cognitions were used in the analyses.

Letter-completion task. The letter-completion task, a variant of word-association methods, is a very minimally cued test of spontaneous cognitions. The 20-item task consisted of series of single letters followed by blank spaces (e.g., *t*_____). Participants were instructed to "Fill in the missing letters of the words with the VERY FIRST word that comes to mind (even if it is not nice)." Open-ended responses were coded as sex related (e.g., kissing, making love) or not sex-related by two independent coders (average interrater κ = .600), with consensus reached by a third coder. The sum of sex-related responses constituted a continuous score for the letter-completion items, representing the strength of spontaneous sex-related cognitions.

Behavior-completion task. The behavior-completion task is a more highly cued test of associations between cues and sex-related behaviors. This task consisted of 18 open-ended situations adapted from the Inventory of Drinking Situations (Annis, 1982). Participants were instructed to "Fill in the missing word that completes the sentence with the VERY FIRST word that comes to mind, whatever it is (even if it is not nice)." Representative items included "When I feel angry, I just want to: _____" and "When I want to feel happy, I just want to: _____." Open-ended responses were coded as sex related (e.g., kissing, making love) or not sex related by two coders (average interrater κ = .695), with consensus reached by a third coder. The sum of sex-related responses was used as a continuous score for the behavior-completion items.

Event-completion task. The event-completion task is a cued test of associations between ambiguous situations and spontaneous sex-related cognitions. The task consisted of seven open-ended social contexts likely to precede risky sexual behaviors. For each situation, participants were asked to "Write the first behavior or action that comes to mind, whatever it is." Representative items included "Two people meet at a party. Later on they: _____" and "A man and a woman meet at a bar. Later on they: _____." Open-ended responses were then coded as sex related (e.g., kissing, making love) or not sex-related by two independent coders (average interrater κ = .864), with consensus reached by a third coder. The sum of sex-related responses was used as a continuous score for the event-completion items.

Measures of Risky Sexual Behavior

Condom use tendency. Participants were asked "How likely is it that you would use a condom (or get the other person to use one) in each of these situations? 1) With someone you have never had sex with before; 2) With someone you have known only for a few weeks or less; 3) With someone you know had other sexual partners; 4) With someone you have dated for a long time; and 5) With someone with whom you have already had sexual intercourse" (Cronbach's alpha = .87). Response options were *definitely yes*, *probably yes*, *probably not*, and *definitely not*. These types of likelihood measures have been found to be a very good correlate of condom use behavior (e.g., Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Morrison, Baker, & Gillmore, 1998).

Multiple sexual partners tendency. Participants were asked "Within the next year, do you think you will: 1) Have sex with more than one sexual partner? 2) Try to have sex with at least several new sexual partners? 3) Have sex with three or more different people? 4) Have sex with a new partner the same day you first meet him or her?" (Cronbach's alpha = .93). Response options were *definitely yes*, *probably yes*, *probably not*, and *definitely not*.

Other Measures

Impulsive sensation seeking. Impulsive sensation seeking was assessed with the Impulsivity and Sensation Seeking subscales of the Zuckerman–Kuhlman Personality Questionnaire (Zuckerman, Kuhlman, Thornquist, & Kiers, 1991). The Sensation Seeking subscale consisted of 10 scale items as in a previous study (see Stacy, 1997), and the Impulsivity index consisted of 8 scale items. Participants were asked to respond "true" or "false" to statements that they might use to describe themselves. The Sensation Seeking subscale included such items as the following: "I like to have new and exciting experiences and sensations even if they are a little frightening," "I sometimes do 'crazy' things just for fun," and "I like doing things just for the thrill of it." The Impulsivity subscale included items such as "I often do things on impulse," "I am an impulsive person," and "I very seldom spend much time on the details of planning ahead."

Drug use. For each of 14 drug classes (including alcohol, marijuana, speed, and opiates), participants were asked to rate how often in the last year they used the substance without a doctor's prescription or used more than prescribed on a 9-point rating scale with endpoints 1 (*never used*) and 9 (*used every day*). In a separate question, respondents wrote the number of days (from 0 to 30) that they used the substance in the last month. A third question asked respondents to indicate how "high, loaded, or intoxicated" they usually get when using each substance (response options were *very high*, *high*, *a little high* and *not high at all or never used this drug*). The reliability and predictive validity of many of these items had been previously established (Graham et al., 1984).

Acculturation. Acculturation was assessed with a previously validated scale of acculturation consisting of items regarding how close individuals are to different cultures or groups (Oetting & Beauvais, 1990). We included four questions about closeness to the Latino or Hispanic way of life and the same four questions regarding the White American way of life: "1) Some families have special activities every year at particular times (such as holiday parties, special meals, religious activities, trips or visits). How many of these activities or traditions does your family have that are based on the [Latino or Hispanic] [White American] way of life; 2) Does your family live by or follow the [Latino or Hispanic] [White American] way of life; 3) Do you live or follow the [Latino or Hispanic] [White American] way of life; and 4) Are you successful in the [Latino or Hispanic] [White American] way of life." Response options included *a lot*, *some*, *not much*, and *not at all* (Oetting & Beauvais, 1990). Cultural learning experienced by immigrants is reflected in measures of acculturation, which may predict behavior patterns or at least the accessibility of various cognitions reflected in associated responses (Szalay, Strohl, & Doherty, 1999).

Results

Analysis Plan

After the statistical assumptions underlying the analysis were evaluated with SPSS 11.5 and EQS 6.0 (Bentler, 1995), a series of structural equation models were estimated with maximum-likelihood estimation and evaluated with the Satorra–Bentler scaled chi-square to account for the violation of multivariate normality (Satorra & Bentler, 1988). The standard errors of the parameter estimates were adjusted to the degree of nonnormality (Bentler & Dijkstra, 1985). The chi-square test statistic is notoriously sensitive to sample size; therefore, the fit of the models was evaluated with two additional fit indices, robust comparative fit index (robust CFI; Bentler, 1988) and root-mean-square error of approximation (RMSEA; Browne & Cudeck, 1993; Steiger, 2000; Steiger & Lind, 1980).

We first estimated confirmatory factor models separately for women and men. Following evidence of satisfactory measurement structures for both men and women, we estimated sequential models for each group separately to examine the predictors of the tendency to have multiple partners and use condoms. In these models, sets of variables were sequentially added to test for improvement in model fit. Satorra–Bentler scaled chi-square difference tests were used to test for model improvement.

Next, we tested the role of gender as a moderating variable in the relationship between the psychosocial and substance use predictors and risky sex behavior. Moderation was examined through estimation of a series of multiple-group models in which the parameter estimates were successively constrained (Byrne, Shavelson, & Muthén, 1989).

In both data sets there was very little missing data. The majority of the variables in both data sets were missing fewer than 5% of the data. In the data set for the men, only the following three variables were missing more than 5% of the data: (a) "how much marijuana was used in the past year," 7.7% (28 cases); (b) "how high participants were when using marijuana," 5.8% (21 cases); and (c) "how often have you used a condom with someone you know had other sexual partners," 6.1% (22 cases). For the data set containing the women's responses, only one variable had more than 5% (6 cases) of the data missing: "how often have you used a condom with someone you know had other sexual partners." The pattern of missing data was evaluated, and there was evidence that the data were missing at random; therefore the expectation-maximization algorithm was used to impute the missing data. The analysis was performed with data from 131 women and 354 men.

As expected, several variables had significant univariate skewness in both data sets. Additionally, with Mardia's normalized estimate of multivariate kurtosis as our criteria for violation of multivariate normality, both the men's and women's data were significantly nonnormal. There were no significant univariate or multivariate outliers in either group. Given the violation of multivariate normality, we used maximum-likelihood estimation in the analysis with the Satorra–Bentler scaled chi-square. The standard errors were also adjusted to the extent of the nonnormality.

Confirmatory Factor Analysis (CFA) Models of Men and Women

An initial CFA model was first evaluated separately for each gender. In this model, only those indicators hypothesized to provide reliable assessments of one particular factor were allowed to load on the assigned construct mentioned in the measures section and listed in Table 1. In addition, covariances were estimated among each of the factors and single-indicator constructs as well as among any drug indicator residuals that shared a common method. In the final CFA model, nonsignificant correlations were subsequently removed. The overall fit of the final CFA model for men was evaluated with the fit indices outlined earlier, Satorra–Bentler scaled $\chi^2(502, N = 354) = 804.68$, $p < .05$, robust CFI = .96, RMSEA = .04, 90% confidence interval (CI) = .036 to .046. The overall fit of the final CFA model for women was evaluated with the same fit indices, Satorra–Bentler scaled $\chi^2(479, N = 131) = 722.20$, $p < .05$, robust CFI = .91, RMSEA = .06, 90% CI = .053 to .071. The correlations among the constructs for men and women are given in Table 2.

Single-Group Structural Equation Models

Following the recommendations of Byrne et al. (1989), structural models were first estimated separately for each gender. Subsequently, these models were incorporated into a multiple-group analysis that modeled data from both groups simultaneously.

Model 1 was the a priori model that specified the hypothesized central paths from sensation seeking and spontaneous cognition to the dependent variable constructs: multiple partner tendency and condom use tendency. Subsequent models were then tested in which sets of additional paths from conceptually related factors or variables representing potential confounding variables or alternative hypotheses with regard to other predictors of HIV risk were added to the hypothesized model. All of the models representing

Table 1
Means, Standard Deviations, Unstandardized and Standardized Factor Loadings Following Multiple Group Model Estimation (n = 131 for Women and n = 354 for Men)

	Men			Women		
Factors/indicators	Mean (*SD*)	Unstandardized coefficient (*SE*)	Standardized coefficient	Mean (*SD*)	Unstandardized coefficient (*SE*)	Standardized coefficient
Spontaneous cognition						
Letter-completion task	0.08 (0.10)	0.05 (0.01)	.47	0.04 (0.06)	0.05 (0.01)	.72
Behavior-completion task	0.07 (0.17)	0.09 (0.01)	.54	0.04 (0.09)	0.09 (0.01)	.86
Event-completion task	0.32 (0.28)	0.19 (0.02)	.68	0.24 (0.25)	0.19 (0.02)	.69
Sensation seeking						
Sensation seeking	15.95 (2.64)	1.89 (0.15)	.72	15.39 (2.87)	2.55 (0.26)	.89
Impulsivity	11.51 (0.23)	1.70 (0.15)	.75	11.68 (2.43)	1.70 (0.19)	.70
Latino acculturation						
Latino activities	1.84 (0.84)	0.93 (0.04)	.83	1.93 (1.14)	0.93 (0.04)	.83
Latino family life	1.75 (1.07)	1.06 (0.04)	.93	1.89 (1.13)	1.06 (0.03)	.95
Latino life you follow	1.80 (1.09)	1.02 (0.03)	.92	1.96 (1.11)	1.02 (0.03)	.92
Latino success	1.74 (1.08)	0.86 (0.04)	.78	1.82 (1.04)	0.86 (0.04)	.84
White acculturation						
White activities	2.60 (1.18)	0.91 (0.04)	.77	2.56 (1.26)	1.02 (0.04)	.80
White family life	2.60 (1.24)	1.11 (0.03)	.90	2.63 (1.28)	1.22 (0.05)	.94
White life you follow	2.59 (1.20)	1.09 (0.03)	.90	2.66 (1.28)	1.09 (0.03)	.85
White success	2.46 (1.19)	0.90 (0.04)	.77	2.49 (1.17)	0.90 (0.04)	.75
Alcohol use						
Past year use	6.17 (2.59)	2.29 (0.13)	.89	5.77 (2.71)	2.72 (0.11)	1.00
Past year intoxicated	2.78 (1.03)	0.73 (0.05)	.70	2.74 (1.01)	0.63 (0.07)	.62
Past month use (log)	0.59 (1.24)	0.29 (0.02)	.53	.46 (0.52)	0.28 (0.04)	.54
Marijuana use						
Past year use	4.56 (3.19)	2.74 (0.15)	.86	3.71 (3.05)	2.21 (0.34)	.73
Past year high	2.46 (1.17)	1.01 (0.05)	.87	2.24 (1.17)	1.08 (0.11)	.95
Past month use (log)	0.39 (0.57)	0.32 (0.03)	.58	0.18 (0.41)	0.15 (0.04)	.38
Stimulant use						
Past year use	3.07 (2.94)	2.73 (0.12)	.92	3.12 (3.16)	2.68 (0.19)	.88
Past year high	1.93 (1.24)	1.08 (0.04)	.86	1.83 (1.24)	1.08 (0.04)	.92
Past month use (log)	0.15 (0.37)	0.24 (0.02)	.64	0.18 (0.43)	0.24 (0.02)	.58
Multiple partners tendency						
More than one partner	2.72 (1.03)	1.00 (fixed)	.90	2.02 (1.00)	1.00 (fixed)	.79
At least several partners	2.42 (1.08)	1.04	.90	1.49 (0.72)	0.88 (0.06)	.94
3 or more partners	2.42 (1.06)	1.00	.89	1.59 (0.83)	1.00 (0.03)	.91
New partner same day	2.26 (1.01)	0.86	.80	1.51 (0.82)	0.74 (0.09)	.69
Condom use tendency						
New partner	3.23 (0.91)	1.00 (fixed)	.90	3.39 (0.77)	1.00 (fixed)	.85
Someone known a few weeks	3.05 (0.92)	1.07 (0.04)	.94	3.25 (0.79)	1.07 (0.04)	.91
Someone you know had other partners	3.24 (0.90)	0.92 (0.04)	.83	3.42 (0.73)	0.92 (0.04)	.85
Someone you have dated	2.15 (0.98)	0.60 (0.06)	.50	2.16 (0.92)	0.60 (0.06)	.45
Someone you had sex with	2.33 (0.98)	0.64 (0.06)	.53	2.26 (1.00)	0.82 (0.08)	.55

potential alternative hypotheses were nested, thus allowing chi-square difference tests of model improvement.

Structural Models for Men

Model 1 reproduced the sample covariance matrix well, Satorra–Bentler scaled $\chi^2(499, N = 354) = 796.15$, $p < .05$, robust CFI = .96, RMSEA = .04, 90% CI = .036 to .046. All four hypothesized paths were statistically significant, demonstrating unique predictive effects.

The next model examined the hypothesis that drug use predicted the dependent variables. Therefore predictive effects of alcohol use, marijuana use, and stimulant use were added to Model 1, representing six predictive effects of drug behavior involvement. The fit of this model, $\chi^2(493, N = 354) = 792.06$, was not significantly better than the fit of Model 1 ($p > .05$). In addition, none of the additional paths were statistically significant according to z tests (all $ps > .05$).

The paths from the set of cultural predictors (Latino acculturation and White acculturation) to the dependent factors were added to Model 1. The model fit significantly better than Model 1 only at the .10 level, not at the .05 level, Satorra–Bentler scaled χ^2 difference test ($4, N = 354$) = 8.55, $p < .10$ (Satorra, 2000; Satorra & Bentler, 2001). Inspection of the z tests of individual paths revealed that only one of the additional paths was statistically reliable. A new model was estimated adding only this single path to Model 1. As expected this model fit the data, Satorra–Bentler scaled $\chi^2(498, N = 354) = 790.34$, $p < .05$, robust CFI = .96, RMSEA = .04, 90% CI = .036 to .047. This model was a significant improvement over Model 1, Satorra–Bentler scaled χ^2 difference test ($1, N = 354$) = 6.93, $p < .05$.

Table 2
Correlations Among Constructs for Men (n = 363) and Women (n = 131)

	1	2	3	4	5	6	7	8	9
1. Spontaneous cognition	—	.34	−.20	−.22	.03	.47	.33	.49	−.32
2. Sensation seeking	.41	—	−.12	−.04	.20	.34	.37	.35	−.47
3. Latino acculturation	−.08	−.04	—	−.02	.11	−.11	−.27	−.01	.22
4. White acculturation	−.04	.07	−.10	—	.02	−.04	.14	.08	−.11
5. Alcohol use	.28	.19	−.04	.06	—	.11	−.08	.14	.02
6. Marijuana use	.34	.32	−.17	−.03	.17	—	.43	.15	−.25
7. Stimulant use	.26	.41	−.10	.14	.06	.42	—	.15	−.46
8. Multiple partners	.37	.39	.09	.06	.17	.23	.23	—	−.36
9. Condom use	−.34	−.32	.07	−.05	−.18	−.12	−.21	−.28	—

Note. Correlations for women are above the diagonal; correlations for men are below the diagonal.

Finally, we evaluated whether the set of ethnicity variables, represented by the four ethnic effect codes, yielded significant predictors of the two dependent variables. This model did fit the data well, Satorra–Bentler scaled $\chi^2(490, N = 354) = 784.98$, $p < .05$, robust CFI = .96, RMSEA = .04, 90% CI = .036 to .047. Although this model fit the data, it was not a significant improvement over the prior model.

In an effort to present a more parsimonious model, nonsignificant parameter estimates were removed from the model. The final trimmed model fit the data well, Satorra–Bentler scaled $\chi^2(527, N = 354) = 816.34$, robust CFI = .96, RMSEA = .04, 90% CI = .034 to .045. This model was not significantly different from the full model, Satorra–Bentler scaled χ^2 difference $(28, N = 354) = 23.17$, $p > .05$. The significant paths from this model were incorporated into multiple-group models addressed below, where final parameter estimates are summarized.

Structural Models for Women

We evaluated the structural models for women with the same model-testing procedure used for men. Model 1 reproduced the sample covariance matrix adequately, Satorra–Bentler scaled $\chi^2(498, N = 131) = 773.48$, $p < .05$, robust CFI = .90, RMSEA = .06, 90% CI = .056 to .074. Alternative hypotheses were evaluated in a series of a priori intermediate models by using the strategy explained earlier for men.

A final model for women was estimated in which the nonsignificant parameter estimates were dropped. This final model fit the data well, Satorra–Bentler scaled $\chi^2(532, N = 131) = 801.62$, $p < .05$, robust CFI = .90, RMSEA = .06, 90% CI = .053 to .071, and was not significantly different from the untrimmed model, Satorra–Bentler scaled χ^2 difference $(40, N = 131) = 55.25$, $p < .05$. The significant paths from this model were incorporated into multiple-group models addressed below, where final parameter estimates are summarized.

Multiple-Group Models

The final single-group models, with nonsignificant paths dropped, provided the basis for multiple-group analysis. The multiple-group model testing followed the guidelines presented in Ullman (2001) and Byrne et al. (1989). Given that good-fitting single-group models were established, we began the multiple-group analysis by estimating a baseline model that allowed the model for men and women to have completely different parameter estimates. We used this step to simultaneously estimate the two single-group models to provide a multiple-group baseline model for use in comparisons with more restricted models. Next, gradually constrained nested models were evaluated to isolate the moderating effects of gender. The goal of this portion of the analysis was to estimate a more restrictive model (i.e., one with fewer parameters) that does not significantly differ from the baseline model. The baseline model that allowed all the parameters to be freely estimated fit the data well, Satorra–Bentler scaled $\chi^2(1059, N = 629) = 1{,}618.13$, $p < .05$, robust CFI = .94, RMSEA = .03, 90% CI = .030 to .036. We continued by constraining the measurement portion of the model. Although the constrained model fit well, it was significantly different from the baseline model, Satorra–Bentler scaled χ^2 difference test $(28, N = 629) = 363.67$, $p < .05$. The constructs in the model are at least partially different for men and women. The Lagrange multiplier test was used to probe the location of the differences in the models. Factor loadings that were different for men and women were freely estimated; with 14 factor loadings estimated separately for men and women, the model was not significantly different from the baseline model, Satorra–Bentler scaled χ^2difference test $(15, N = 629) = 17.84$, $p > .05$. The unstandardized and standardized factor loadings and corrected standard errors are presented in Table 1.

After evaluating the equality of the regression coefficients in the measurement model, we examined the structural model. Note, only the structural paths that were significant in both single-group models were included in this analysis. Next, the regression coefficients among the latent constructs were constrained to equality and evaluated. In both the men's and women's model, tendency to have multiple partners was predicted by spontaneous cognition and sensation seeking. Condom use tendency was predicted by sensation seeking for both men and women. In this model, we tested if the strength of the prediction was the same for men and women. These relationships were not the same strength, Satorra–Bentler scaled χ^2difference test $(3, N = 629) = 9.15$, $p < .05$. A model was estimated that allowed the strength of the predictive relationship between condom use tendency and sensation seeking to differ for men and women. Men had a significantly weaker relationship between sensation seeking and condom use than did women (unstandardized coefficient for men = −.159, unstandardized coefficient for women = −.217). This model fit the data well, Satorra–Bentler scaled $\chi^2(1076, N = 629) = 1{,}634.93$, $p < .05$, robust

CFI = .94, RMSEA = .03, 90% CI = .029 to .036, and was not significantly different from the partially constrained model, Satorra–Bentler scaled χ^2 difference test $(2, N = 629) = 0.82, p > .05$. The final models with significant unstandardized regression coefficients are presented in Figure 1 and Figure 2.

Predicting tendency to have multiple partners. As revealed in the figures, the tendency to have multiple partners was predicted by greater spontaneous cognition and greater sensation seeking in both genders. For men, a greater degree of Latino acculturation was also predictive. Spontaneous cognition, sensation seeking, and Latino acculturation accounted for 21.8% of the variance in tendency to have multiple partners in men. For women, being Latina was associated with less tendency toward multiple partners, whereas being Asian was associated with higher scores on this dependent variable. Ethnicity, spontaneous cognition, and sensation seeking accounted for 27.1% of the variance in tendency to have multiple partners in women.

Condom-use tendency. The predictors and strength of prediction of condom use tendency were different for men and women. For men, less spontaneous cognition and sensation seeking predicted more condom use tendency. Spontaneous cognition and sensation seeking accounted for 12.4% of the variance in tendency to use condoms. For women, less sensation seeking and stimulant use predicted more condom use tendency. Sensation seeking and stimulant use accounted for 30.3% of the variance in tendency to use condoms.

Exploratory analysis. Although a mediational model was not part of the hypotheses, a reviewer suggested analyzing a model in which spontaneous cognition mediates the predictive effects of sensation seeking on HIV risk behavior. In this exploratory analysis, an indirect predictive effect was obtained in one out of four comparisons. Sensation seeking indirectly predicted multiple partner tendency through spontaneous cognition in men ($z = 2.17, p < .05$), in the positive direction.

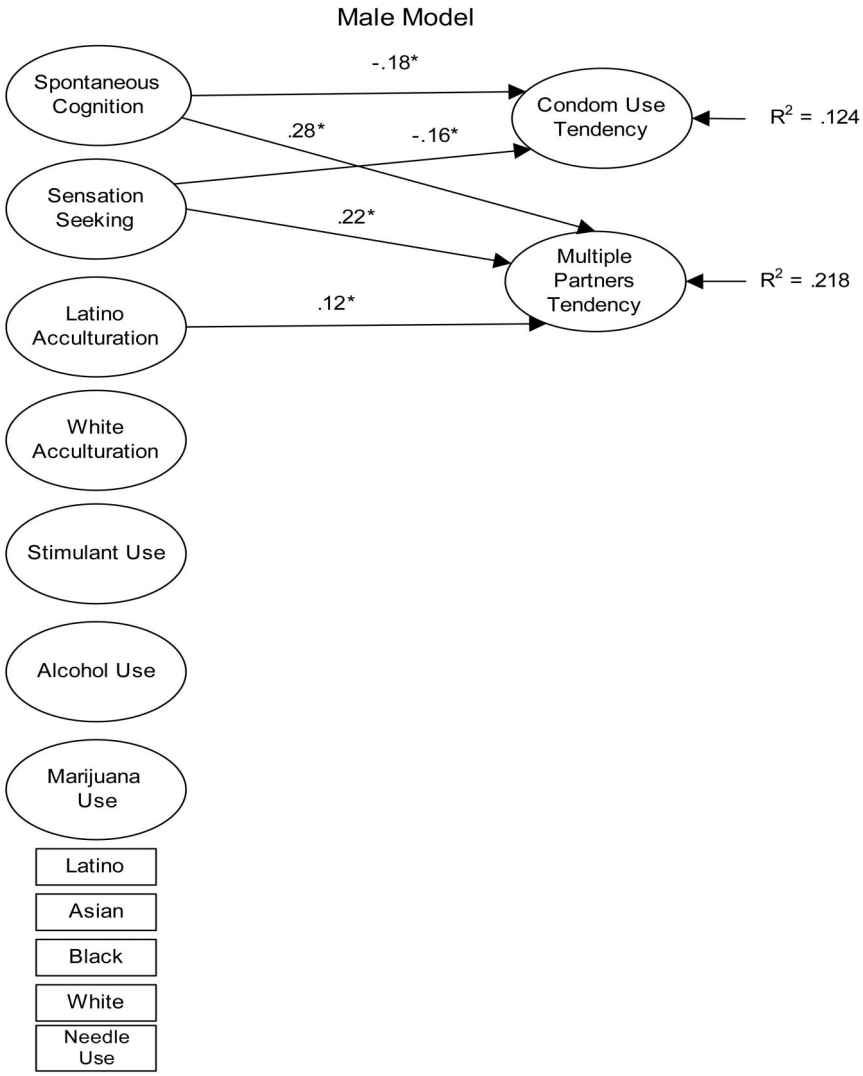

Figure 1. Final structural multiple-group equation model for men with unstandardized coefficients and variance in outcomes accounted for by predictors. Correlations among the independent variables were calculated and for clarity are presented in Table 2. Residuals were also estimated but for ease of reading are not included in this diagram.

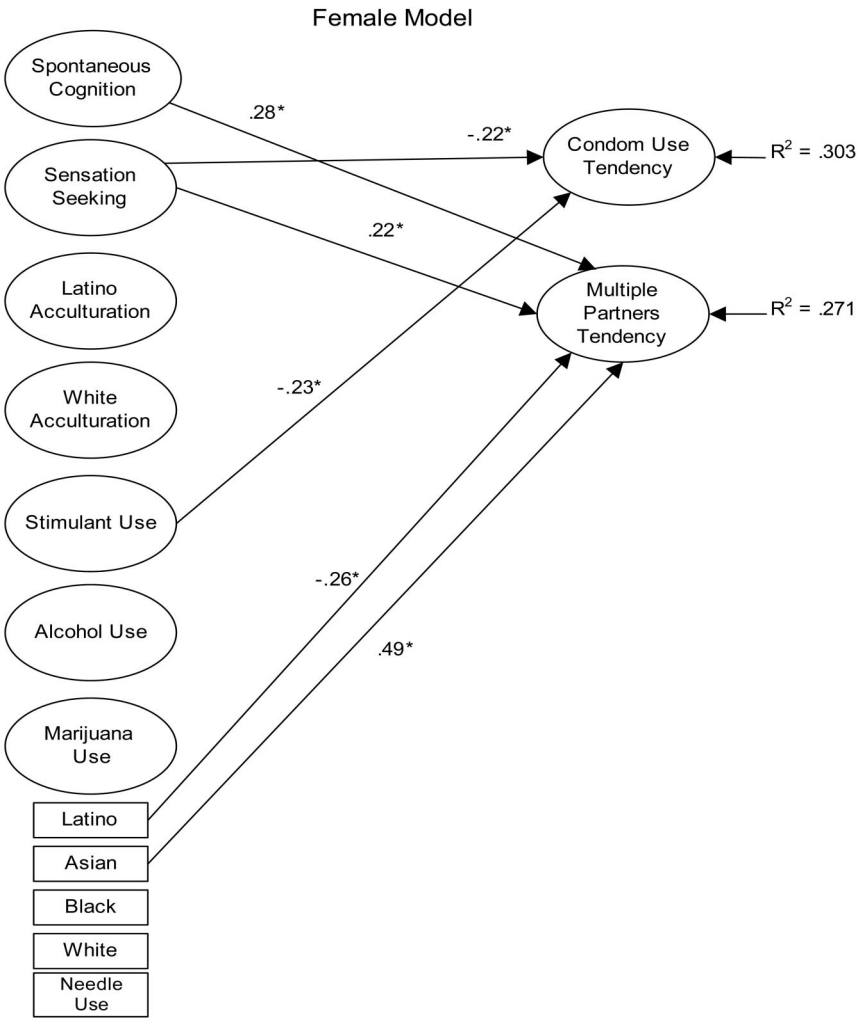

Figure 2. Final structural multiple-group equation model for women with unstandardized coefficients and variance in outcomes accounted for by predictors. Correlations among the independent variables were calculated and for clarity are presented in Table 2. Residuals were also estimated but for ease of reading are not included in this diagram.

Discussion

The results clearly show that spontaneous cognition has statistically predictive effects on risk tendencies, even in competition with much more frequently emphasized constructs of major focus in HIV-related research. Spontaneous cognition was a better independent predictor of HIV risk behavior tendencies overall than was drug use, which is often a focus of sex-related research. Spontaneous cognition is not merely a symptom of problem behaviors associated with drug use. The independent predictive effects of spontaneous cognition usually were comparable with the prediction power of sensation seeking, a personality trait frequently related to HIV risk behavior. Spontaneous cognition also fared well when investigated after adjusting for a range of other variables, including possible ethnic or acculturation effects. The primary results have several important theoretical implications.

A Mixed Cognitive-Trait Model

The hypothesis from the cognitive perspectives suggested that spontaneous cognition should independently predict HIV risk behavior tendencies. An alternative based on a trait approach emphasizing sensation seeking suggested that spontaneous cognition would be an epiphenomenon, or mere correlate, of this trait. The results supported a mixed cognitive-trait model, wherein both spontaneous cognition and sensation seeking were predictors. More specifically, spontaneous cognition predicted tendencies toward multiple partners equally well in both genders but predicted less condom use only among men. Sensation seeking predicted multiple partners as well as less condom use in both genders. These predictive effects maintained despite adjusting for predictive effects of other variables.

The data are consistent with the view that spontaneous cognition and sensation seeking have different types of influences on risky

tendencies involving sex. The importance of the cognitive variable would not be predicted on the basis of any well-recognized theory of HIV risk behavior, in which the cognitive and affective variables usually focus on rational or deliberately weighed variables such as outcome expectancies, beliefs, utilities, attitudes, values, or similar constructs pervasive in survey research.

Association and Frequency

Earlier, we outlined the difficulty in disentangling associative from frequency processes in cognition. The present assessment focuses on the common variance, via a common factor, of spontaneous cognition assessed with three quite different types of tests designed to reflect both types of processes. The results show that the tests shared significant common variance and together predicted HIV risk behavior tendencies. The findings are consistent with the view that associative and frequency effects on assessments may reflect essentially two sides of the same coin. More frequently activated constructs become connected to a greater number of other constructs; constructs with more associations are activated more frequently (cf. Nelson & McEvoy, 2000). This view does not preclude the strong possibility that motivational set or current concerns (Cox, Fadardi, & Klinger, 2006) are also involved in the process.

Implicit Cognition?

An important question about the measures of spontaneous cognition used in the present study concerns the nature of the underlying cognitive process. We have classified responses in a general manner as *spontaneous*, because we requested that participants provide the first word that comes to mind, because the target behavior is not mentioned in the assessment, which is hence indirect, and because no response options are given. Such instructions have a long history of fruitful use in various areas, including basic research on word association (Nelson, McEvoy, & Dennis, 2000), implicit memory (e.g., Shimamura & Squire, 1984), and even advertising research (Woodside & Trappey, 1992). Yet, the present study's observational design did not manipulate the type of process invoked. Nevertheless, the measures did not encourage explicit cognitive processes such as deliberate retrieval of previous events from long-term memory. At least the attempt was made to encourage spontaneity. Even if such assessments are best construed as measures of involuntary explicit memory (Richardson-Klevehn & Gardiner, 1996), assessments within this category are likely to involve an initial automatic component that is the primary determinant of the response (Schacter & Badgaiyan, 2001).

In the future, researchers should consider alternative processes. One strong possibility is that the responses involved an implicit cognitive process. Contrary to some implications of characterizations of implicit cognitive processes, implicit processes can indeed produce content that pops to mind. For example, several compelling studies have demonstrated that word association could detect normal levels of implicit memory in amnesic patients, despite impaired levels of conscious recollection (Levy, Stark, & Squire, 2004; Schacter, 1985; Shimamura & Squire, 1984; Vaidya, Gabrieli, Keane, & Monti, 1995). Content derived from previous experience does pop to mind in the absence of knowledge of the source of that content, knowledge about the process, or introspections other than accessed content.

Although the present design did not guarantee that the responses were implicit, one measure, the letter-completion test, is rather difficult to explain in terms of explicit cognition variables. Other measures such as the event-completion and behavior-completion tests could have involved a greater degree of conscious recollection or deliberation. All tasks encouraged spontaneous responses, but in any word-completion paradigm respondents can filter or edit their responses. For example, respondents might access a response that they do not want to write down. It is possible that an unmeasured confounding variable might influence both the tendency to edit sexually related responses and to engage in risky behavior. Nevertheless, word-association responses consistently have been found to predict health behavior (for a review, see Ames, Franken, & Coronges, 2006), and some studies find these effects even when controlling for effects of explicit cognition and other variables (Palfai & Wood, 2001; Stacy, 1997). It is difficult to explain all the patterns of findings with a filtering or editing explanation (Stacy, Leigh, & Weingardt, 1997). Converging findings from diverse basic and applied research suggest that various word-association tests are likely to tap into some implicit processes but that these tests also probably involve some conscious processes, allowing for the chance of edits or other forms of contamination from explicit cognitive processes for as long as the content remains in working memory (Stacy, Ames, & Grenard, 2006). Future research may derive effective ways to differentiate among the possibilities.

Gender Differences and Other Predictors of HIV Risk Behavior Variables

It was not the study's goal to derive detailed hypotheses about possible gender differences or the effects of other variables investigated as potential confounders. These variables were used as possible confounders or moderators. It is interesting to note that drug use variables, including alcohol, marijuana, and stimulant use, predicted HIV risk tendencies in only 1 of 12 possible comparisons. Regardless of some predictive effects of confounders, and the investigation of many potential correlates, the unique predictive effect and theoretical potential of spontaneous cognition were affirmed.

Limitations and Conclusions

Some specific limitations were addressed previously. A more general limitation of this study is ambiguity of causal direction between spontaneous cognition and HIV risk behavior variables. The cross-sectional, observational design of this study cannot rule out an alternative directional model hypothesizing that HIV risk behavior predicts spontaneous cognition and sensation seeking. Nevertheless, the study adjusted for numerous potential confounders of the relationships among these variables and thus shows that the cognitive and personality constructs are important and have potential causal effects. In addition, the results are limited in generalizability in terms of the population and the types of HIV risk measures (e.g., self-reported likelihood) used as dependent variables, although risky tendencies among the drug offender population are important targets of intervention efforts. Finally, the study focused on only one aspect of cognition. Future research

may find it useful to integrate some of the important developments in research on explicit cognition (expectancy) models of HIV risk behavior (e.g., Corbin & Fromme, 2002; D'Amico & Fromme, 1997) with work on spontaneous or implicit cognition, as has been useful in the alcohol research area (e.g., Palfai & Wood, 2001; Reich, Goldman, & Noll, 2004; Wiers, Houben, Smulders, Conrod, & Jones, 2006). The present study's effects of spontaneous cognition are not anticipated by existing theories of health-related expectancies, which do not focus on such variables as frequency or chronic accessibility.

Future research may further elucidate the process through which spontaneous cognition and risky sex are linked. This endeavor should advance theories relating basic processes to behavior as well as interventions that typically focus only on explicit cognition or rational models of a frequently irrational behavior.

References

Albarracin, D., Johnson, B. T., Fishbein, N., & Muellerleile, P. A. (2001). Theories of reasoned action and planned behavior as models of condom use: A meta-analysis. *Psychological Bulletin, 127,* 142–161.

Ames, S. L., Franken, I. H. A., & Coronges, K. (2006). Implicit cognition and drugs of abuse. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 363–378). Newbury Park, CA: Sage.

Annis, H. M. (1982). *Inventory of drinking situations.* Ontario, Canada: Addiction Research Foundation.

Bargh, J. A., Bond, R. N., Lombardi, W. J., & Tota, M. E. (1986). The additive nature of chronic and temporary sources of construct accessibility. *Journal of Personality and Social Psychology, 50,* 869–878.

Bargh, J. A., Lombardi, W. J., & Higgins, E. T. (1988). Automaticity of chronically accessible constructs in Person × Situation effects on person perception: It's just a matter of time. *Journal of Personality and Social Psychology, 55,* 599–605.

Beck, A. T., & Weishaar, M. E. (1989). Cognitive therapy. In R. J. Corsini & D. Wedding (Eds.), *Current psychotherapies* (4th ed., pp. 285–320). Itasca, IL: F. E. Peacock Publishers.

Bentler, P. M. (1988). Causal modeling via structural equation systems. In J. R. Nesselroade & R. B. Cattell (Eds.), *Handbook of multivariate experimental psychology: Perspectives on individual differences* (2nd ed., pp. 317–335). New York: Plenum Press.

Bentler, P. M. (1995). *EQS structural equations program manual.* Los Angeles: BMDP Statistical Software.

Bentler, P. M., & Dijkstra, T. (1985). Efficient estimation via linearization in structural models. In P. R. Krishnaiah (Ed.), *Multivariate analysis VI* (pp. 9–42). Amsterdam: North-Holland.

Berry, J. W. (1998). Intercultural relations in plural societies. *Canadian Psychology, 40,* 12–20.

Boyer, C. B., Tschann, J. M., & Shafer, M. A. (1999). Predictors of risk for sexually transmitted diseases in ninth grade urban high school students. *Journal of Adolescent Research, 14,* 448–465.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural models* (pp. 136–162). Newbury Park, CA: Sage.

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin, 105,* 456–466.

Cloninger, C. R. (1994). Temperament and personality. *Current Opinion in Neurobiology, 4,* 266–273.

Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of General Psychiatry, 50,* 975–990.

Corbin, W. R., & Fromme, K. (2002). Alcohol use and serial monogamy as risks for sexually transmitted diseases in young adults. *Health Psychology, 21,* 229–236.

Cox, W. M., Fadardi, J. S., & Klinger, E. (2006). Motivational processes underlying implicit cognition in addiction. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 253–266). Newbury Park, CA: Sage.

D'Amico, E. J., & Fromme, K. (1997). Health risk behaviors of adolescent and young adult siblings. *Health Psychology, 16,* 426–432.

De Houwer, J. (2006). What are implicit measures and why are we using them? In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 11–28). Newbury Park, CA: Sage.

Dixon, P., & Twilley, L. C. (1999). Context and homograph meaning resolution. *Canadian Journal of Experimental Psychology, 53,* 335–346.

Dohr, K. B., Rush, A. J., & Bernstein, I. H. (1989). Cognitive biases and depression. *Journal of Abnormal Psychology, 98,* 263–267.

Donohew, L., Zimmerman, R., Cupp, P. S., Novak, S., Colon, S., & Abell, R. (2000). Sensation seeking, impulsive decision-making, and risky sex: Implications for risk-taking and design of interventions. *Personality and Individual Differences, 28,* 1079–1091.

Graham, J. W., Flay, B. R., Johnson, C. A., Hansen, W. B., Grossman, L., & Sobel, J. L. (1984). Reliability of self-report measures of drug use in prevention research: Evaluation of the project SMART questionnaire via the test–retest reliability matrix. *Journal of Drug Education, 14,* 175–193.

Higgins, E. T., King, G. A., & Mavin, G. H. (1982). Individual construct accessibility and subjective impressions and recall. *Journal of Personality and Social Psychology, 43,* 35–47.

Hoyle, R. H., Fejfar, M. C., & Miller, J. D. (2000). Personality and sexual risk taking: A quantitative review. *Journal of Personality, 68,* 1203–1231.

Jung, C. G. (1910). *Studies in word association.* New York: Moffat, Yard & Company.

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

Kandel, E. R. (1999). Biology and the future of psychoanalysis: A new intellectual framework for psychiatry revisited. *American Journal of Psychiatry, 156,* 505–524.

Leigh, B. C., & Stall, R. (1993). Substance use and risky sexual behavior for exposure to HIV: Issues in methodology, interpretation, and prevention. *American Psychologist, 48,* 1035–1045.

Levy, D. A., Stark, C. E. L., & Squire, L. R. (2004). Intact conceptual priming in the absence of declarative memory. *Psychological Science, 15,* 680–686.

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

Morrison, D. M., Baker, S. A., & Gillmore, M. R. (1998). Condom use among high-risk heterosexual teens: A longitudinal analysis using the theory of reasoned action. *Psychology and Health, 13,* 207–222.

Murray, D. M., & Perry, C. L. (1987). The measurement of substance use among adolescents: When is the "bogus pipeline" method needed? *Addictive Behaviors, 12,* 225–233.

Nelson, D. L., & McEvoy, C. L. (2000). What is this thing called frequency? *Memory & Cognition, 28,* 509–522.

Nelson, D. L., McEvoy, C. L., & Dennis, S. (2000). What is free association and what does it measure? *Memory & Cognition, 28,* 887–899.

Nelson, D. L., McKinney, V. M., Gee, N. R., & Janczura, G. A. (1998). Interpreting the influence of implicitly activated memories on recall and recognition. *Psychological Review, 105,* 299–324.

Oetting, G. R., & Beauvais, F. (1990). Orthogonal cultural identification theory: The cultural identification of minority adolescents. *International Journal of the Addictions: Use and Misuse of Alcohol and Drugs: Ethnicity Issues, 25*(Suppl. 5-A-6-A), 655–685.

Olson, M. A., & Fazio, R. H. (2004). Trait inferences as a function of automatically activated racial attitudes and motivation to control prejudiced reactions. *Basic & Applied Social Psychology, 26,* 1–11.

Palfai, T. P. & Wood, M. D. (2001). Positive alcohol expectancies and drinking behavior: The influence of expectancy strength and memory accessibility. *Psychology of Addictive Behaviors, 15,* 60–67.

Reich, R. R., Goldman, M. S., & Noll, J. A. (2004). Using the false memory paradigm to test two key elements of alcohol expectancy theory. *Experimental and Clinical Psychopharmacology, 12,* 102–110.

Richardson-Klevehn, A., & Gardiner, J. M. (1996). Cross-modality priming in stem completion reflects conscious memory, but not voluntary memory. *Psychonomic Bulletin & Review, 3,* 238–244.

Royall, D. R., Lauterbach, E. C., Cummings, J. L., Reeve, A., Rummans, T. A., Kaufer, D. I., et al. (2002). Executive control function: A review of its promise and challenges for clinical research. A report from the Committee on Research of the American Neuropsychiatric Association. *Journal of Neuropsychiatry and Clinical Neurosciences, 14,* 377–405.

Satorra, A. (2000). Scaled and adjusted restricted tests in multi-sample analysis of moment structures. In D. D. H. Heijmans, D. S. G. Pollock, & A. Satorra (Eds.), *Innovations in multivariate statistical analysis: A festschrift for Heinz Neudecker* (pp. 233–247). Dordrecht, Netherlands: Kluwer Academic Publishers.

Satorra, A., & Bentler, P. M. (1988). Scaling corrections for chi-square statistics in covariance structure analysis. *Proceedings of the American Statistical Association, 36,* 308–313.

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 66,* 507–514.

Schacter, D. L. (1985). Priming of old and new knowledge in amnesic patients and normal subjects. *Annals of the New York Academy of Sciences, 444,* 41–53.

Schacter, D. L., & Badgaiyan, R. D. (2001). Neuroimaging of priming: New perspectives on implicit and explicit memory. *Current Directions in Psychological Science, 10,* 1–4.

Shimamura, A. P., & Squire, L. R. (1984). Paired-associate learning and priming effects in amnesia: A neuropsychological study. *Journal of Experimental Psychology: General, 113,* 556–570.

Stacy, A. W. (1997). Memory activation and expectancy as prospective predictors of alcohol and marijuana use. *Journal of Abnormal Psychology, 106,* 61–73.

Stacy, A. W., Ames, S. L., & Grenard, J. L. (2006). Word association tests of associative memory and implicit processes: Theoretical and assessment issues. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 75–90). Thousand Oaks, CA: Sage.

Stacy, A. W., Leigh, B. C., & Weingardt, K. (1997). An individual difference perspective in word association. *Personality and Social Psychology Bulletin, 23,* 229–237.

Stacy, A. W., Widaman, K. F., Hays, R., & DiMatteo, M. R. (1985). Validity of self-reports of alcohol and other drug use: A multitrait–multimethod assessment. *Journal of Personality and Social Psychology, 49,* 219–232.

Steiger, J. H. (2000). Point estimation, hypothesis testing, and interval estimation using the RMSEA: Some comments and a reply to Hayduck and Glaser. *Structural Equation Modeling, 7,* 149–162.

Steiger, J. H., & Lind, J. (1980, May). *Statistically based tests for the number of common factors.* Paper presented at the meeting of the Psychometric Society, Iowa City, IA.

Szalay, L. B., Strohl, J. B., & Doherty, K. T. (1999). *Psychoenvironmental forces in substance abuse prevention.* New York: Kluwer Academic.

Todorov, A., & Bargh, J. A. (2002). Automatic sources of aggression. *Aggression & Violent Behavior, 7, 53*–68.

Ullman, J. B. (2001). Structural equation modeling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using multivariate statistics* (4th ed., pp. 653–771). Boston: Allyn & Bacon.

Vaidya, C. J., Gabrieli, J. D. E., Keane, M. M., & Monti, L. A. (1995). Perceptual and conceptual memory processes in global amnesia. *Neuropsychology, 9,* 580–591.

Wiers, R. W., Houben, K., Smulders, F. T. Y., Conrod, P. J., & Jones, B. (2006). To drink or not to drink: The role of automatic and controlled cognitive processes in the etiology of alcohol-related problems. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 339–361). Newbury Park, CA: Sage.

Wiers, R. W., & Stacy, A. W. (2006). *Handbook of implicit cognition and addiction.* Thousand Oaks, CA: Sage.

Woodside, A. G., & Trappey, R. J., III (1992). Finding out why customers shop your store and buy your brand: Automatic cognitive processing models of primary choice. *Journal of Advertising Research, 32,* 59–78.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking.* New York: Cambridge University Press.

Zuckerman, M., Kuhlman, D. M., Thornquist, M., & Kiers, H. (1991). Five (or three) robust questionnaire scale factors of personality without culture. *Personality and Individual Differences, 12,* 929–941.

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