

## Original Article

### Drinking Games as a Venue for Sexual Competition

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**Abstract:** Based on sexual selection theory, we hypothesized that sex differences in mating effort and social competitiveness—and subsequent sex differences in sexual and competitive motivations for participating in drinking games—are responsible for the well-documented sex differences in college students’ drinking game behaviors. Participants in a cross-sectional study were 351 women and 336 men aged 17 to 26. In a mediation model, we tested sex differences in mating effort, social competitiveness, sexual and competitive motivations for participating in drinking games, drinking game behaviors, and alcohol-related problems. Men participated in drinking games more frequently, consumed more alcohol while participating in drinking games, and experienced more problems associated with drinking. These sex differences appeared to be partially mediated by mating effort, social competitiveness, and sexual and competitive motivations for participating in drinking games. Drinking games are a major venue in which college students engage in heavy episodic drinking, which is a risk factor for college students’ behavioral and health problems. Thus, the functional perspective we used to analyze them here may help to inform public health and university interventions and enable better identification of at-risk students.

**Keywords:** drinking games, college students, sexual selection theory, sex differences

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### Introduction

When young adults drink alcohol, they often engage in risky, heavy episodic (“binge”) drinking, which is defined as consuming five (four for women) drinks or more in two hours (Substance Abuse and Mental Health Services Administration (SAMHSA), 2007; U.S. Department of Health and Human Services (DHHS), 2004). Young adults’ tendency to engage in risky drinking behaviors is particularly pronounced among full-time

college students, with 40% of college students reporting binge drinking (O'Malley and Johnston, 2001; SAMHSA, 2007). In the U.S., heavy episodic drinking among students results in close to 2,000 deaths, 599,000 injuries, 646,000 physical assaults, and 97,000 sexual assaults annually (Hingson, Zha, and Weitzman, 2009). Thus, understanding factors contributing to risky drinking among college students is a public health concern (DHHS, 2007).

Drinking games are venues in which college students engage in heavy episodic drinking, and up to 77% of college students report having participated in drinking games (Borsari, 2004; Cameron et al., 2010; Polizzotto, Saw, Tjhung, Chua, and Stockwell, 2007; Simons, Lantz, Klichine, and Ascolese, 2005). Moreover, drinking game participation is partially responsible for the negative consequences of heavy episodic drinking (Borsari et al., 2007; Cameron et al., 2010; Johnson and Stahl, 2004; Pedersen and LaBrie, 2006; Polizzotto et al., 2007). Students are aware of the negative consequences of drinking (Leigh, 1987), so students' motivations for participating in an activity they acknowledge to be dangerous is an interesting biological problem, and understanding them is a potentially useful step in developing effective interventions.

We propose a functional explanation for college students' drinking game behaviors and problems associated with drinking that emphasizes the role of trait-level variables and situation-specific motives for participating in drinking games. Sex differences in risk taking in general (Byrnes, Miller, and Schafer, 1999; Wilson and Daly, 1985) and in rates of alcohol-induced liver disease and cirrhosis (Becker et al., 1996; Kruger and Nesse, 2004) are well established, but the fundamental cause of sex differences in drinking game behaviors (Borsari, 2004; Engs and Hanson, 1993; Engs, Diebold, and Hanson, 1996; Johnson et al., 1998; Pedersen and LaBrie, 2006) is unknown (Carman, Fitzgerald, and Holmgren, 1983; DHHS, 2007). We conceptualized these sex differences using sexual selection theory, which describes how natural selection gives rise to sex-specific mating strategies that solve problems associated with reproductive constraints (Bateman, 1948; Buss and Schmitt, 1993; Darwin, 1859; Gangestad and Simpson, 2000; Geary, 2006; Trivers, 1972).

Reproductive constraints result from asymmetries in parental investment (females invest more due to anisogamy) and reproductive rate (males rejoin the mating pool sooner; Bateman, 1948; Buss and Schmitt, 1993; Darwin, 1859; Gangestad and Simpson, 2000; Geary, 2006; Trivers, 1972). Due to these asymmetries, the fitness of the higher investing/slower reproducing sex (usually female) is constrained by the quality of mates, whereas the fitness of the lesser investing/faster reproducing sex (usually male) is constrained by the quantity of mates (Bateman, 1948; Buss and Schmitt, 1993; Darwin, 1859; Gangestad and Simpson, 2000; Geary, 2006; Trivers, 1972). These selection pressures likely led to the evolution of psychological mechanisms that motivate females to select high-investing mates with good genes and that motivate males to signal their mate quality and compete for access to receptive females (Bateman, 1948; Buss and Schmitt, 1993; Darwin, 1859; Gangestad and Simpson, 2000; Geary, 2006; Trivers, 1972).

Based on sexual selection theory, we hypothesized that part of the appeal of drinking games for college students is that they provide a venue for male intrasexual competition and female intersexual choice (Hill and Chow, 2002). Specifically, we hypothesized that certain students participate in drinking games because drinking games enable: (1) males to compete with other males; (2) males to display to females their

physical dexterity, coordination, fortitude, strength, mental prowess, willingness to use force, and willingness to take risks; and (3) females to observe these competitions and displays. Our proposal shares much in common with recent proposals that, for example, conspicuous consumption (Saad, 2007; Saad and Vongas, 2009; Sundie et al., 2011), male-male aggression (Daly and Wilson, 1988), displays of generosity (Iredale, Van Vugt, and Dunbar, 2008), and athletic competition (Miller, Maner, and McNulty, 2012) are used by some individuals as venues for intrasexual competition or for manipulating opposite-sex mating choices. We do not imply that humans possess “drinking game adaptations;” instead, we assume that humans possess sexually selected motivations to engage in intrasexual and intersexual competition, that they seek venues in which such motivations can be enacted, and that drinking games might be a particularly propitious setting for implementing sexual strategies which some students are motivated to pursue.

Our proposal gains indirect support from the fact that drinking games are often competitive in nature. To wit, certain drinking games require players to assign drinks to other players and insult players who break rules (Green and Grider, 1990; Zamboanga, Calvert, O’Riordan, and McCollum, 2007). Others require the skills to bounce quarters into shot glasses, throw ping-pong balls into cups, or repeat tongue-twisters (Green and Grider, 1990; Zamboanga et al., 2007). Still others require ingesting high volumes of alcohol in short amounts of time, keeping one’s wits about oneself despite high alcohol intake, drinking until vomiting, and risking blackouts and severe hangovers (Green and Grider, 1990; Zamboanga et al., 2007). Furthermore, players cite *because I want to win* and *to take a risk* as common reasons for participating in drinking games (Johnson and Sheets, 2004). The presence of attractive females increases risk taking in males (Ronay and von Hippel, 2010) and indeed, students observe that drinking games enable males to compete and demonstrate the aforementioned abilities (Borsari, 2004)—often in the presence of females (Borsari, Bergen-Cico, and Carey, 2003; Polizzotto et al., 2007) who also participate and take an interest in the outcomes (Rhoads, 1995).

Many drinking games are also a prelude to sexual activity. In fact, sexual activity is a commonly reported reason for why drinking games end (Johnson, 2002). For example, drinking games reportedly end for men because *I have gotten someone to have sex with me*, or *another person showed sexual interest in me* (Borsari, 2004; Johnson, 2002; Johnson, Hamilton, and Sheets, 1999). Additionally, many players report that they participate in drinking games *in order to have sex with someone* (Johnson and Sheets, 2004). Both competitive and sexual motivations therefore seem to play a role in students’ reasons for participating in drinking games.

On this basis, we hypothesized that sex differences in drinking game behaviors and consequent drinking problems are due, in part, to sex differences in trait-level measures of mating effort (Jackson and Kirkpatrick, 2007; Simpson and Gangestad, 1991) and social competitiveness (Simmons, Wehner, Tucker, and King, 2001), as well as to sex differences in sexual and competitive motivations for participating in drinking games per se. Specifically, we predicted that sex differences in trait-level variables would be partially responsible for sex differences in drinking game behavior and problematic drinking directly, and partially responsible for sex differences in students’ motivations for participating in drinking games, which, in turn, would help to explain sex differences in drinking game behaviors and problematic drinking. We tested these predictions in a cross-sectional study. We also developed new self-report measures for assessing individual

differences in sexual and competitive motivations for participating in drinking games.

## **Materials and Methods**

### *Participants*

Participants were 698 students from the University of Miami who were enrolled in Introductory Psychology in the fall of 2010 and the spring of 2011. All participants reported drinking and participating in drinking games at least occasionally. The sample comprised 351 women aged 17-26 ( $M = 18.77$ ,  $SD = 1.36$ ) and 336 men aged 17-26 ( $M = 19.00$ ,  $SD = 1.29$ ; 11 participants did not report their sex). Students 18 and older provided written documentation of informed consent and parental consent was obtained for students under 18. Participants obtained course credit for participating. The study was approved by the University of Miami's Institutional Review Board.

### *Procedure*

During the first week of the semester, we administered a battery of questionnaires to all participants.

### *Measures*

*Frequency of drinking game participation and alcohol consumption during drinking game participation.* We measured participants' frequency of drinking game participation and alcohol consumed during drinking game participation with two single Likert-type self-report items. The item "How often do you play drinking games?" was endorsed on an eight-point scale ranging from *never* to *daily or almost daily*, and the item "How much alcohol do you tend to consume when you play drinking games ("drink" = 1 beer or 1 shot)?" was endorsed on a six-point scale ranging from *none* to *seven or more drinks*.

*Alcohol Use Disorders Identification Test (AUDIT).* Participants completed six items from the Alcohol Use Disorders Identification Test (Babor, Higgins-Biddle, Saunders, and Monteiro, 2001). The AUDIT includes items to screen for problematic alcohol use and measures intake, dependence, and negative outcomes (Reinert and Allen, 2002). The AUDIT has good reliability ( $\alpha = 0.75-0.97$ ) and validity in diverse samples, including college students (Reinert and Allen, 2007). We omitted four items from the AUDIT on the premise that the high severity of some items are generally irrelevant to a population of college students (e.g., "How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?"; Babor et al., 2001). In our sample, reliability of the six-item AUDIT was acceptable ( $\alpha = 0.78$ ).

*Sociosexual Orientation Inventory (SOI).* To measure mating effort, we used the seven-item Sociosexual Orientation Inventory (SOI). The SOI measures individual differences in sociosexual orientation, that is, a set of strongly covarying attitudes and behaviors that reflect history of and preference for engaging in uncommitted sexual activities with multiple concurrent partners (Simpson and Gangestad, 1991). Specifically, sociosexual orientation consists of: (1) preferred frequency, number, and concurrence of uncommitted sexual partners; (2) attitudes toward engaging in uncommitted sexual activities; and (3) frequency of sexual fantasies involving extra-pair partners (Simpson and Gangestad, 1991). Convergent and discriminant validity for the seven-item aggregate was originally established in six studies (Simpson and Gangestad, 1991). Additionally, the SOI

correlates positively with impulsive decision-making and risk-taking (Seal and Agostinelli, 1994). Reliability of the SOI in our sample was acceptable ( $\alpha = 0.81$ ).

*Social competitiveness.* We measured social competitiveness with three items from the Cooperative/Competitive Strategy Scale (Simmons et al., 2001). These items positively loaded on a factor representing the use of competition to both motivate and achieve success (Simmons et al., 2001). Items were endorsed on a five-point Likert-type scale from *strongly disagree* to *strongly agree*. In our sample, reliability was acceptable ( $\alpha = 0.74$ ).

*Motivations to participate in drinking games.* Based on the qualitative work in the extant literature (e.g., Borsari, 2004), we wrote 34 self-report items to measure the motivations underlying drinking game participation. Participants rated items on a six-point Likert-type scale from *strongly disagree* to *strongly agree*. We conducted an exploratory factor analysis using a random sample of 50% of the data. Using principal components analysis and a direct oblimin rotation with Kaiser Normalization, we found the 34 items yielded a six-factor solution that accounted for 70.97% of the variance in the items: Fortitude-display, sexual, competitive, reputational, skill-display, and social motivations.

Because our interest was in sexual and competitive motivations specifically (and because the principal components for fortitude-display, sexual, and competitive motivation manifested substantial sex differences with effect size *ds* ranging from 0.38–0.93), we focused on the items that loaded on these principal components. We re-factored the items to derive measures of fortitude-display, sexual, and competitive motivation that had maximal content heterogeneity and reasonable internal consistency reliability. Nine items yielded a three-factor solution that accounted for 75.25% of the item variance: Fortitude-display ( $\alpha = 0.78$ ), sexual ( $\alpha = 0.90$ ), and competitive ( $\alpha = 0.79$ ) motivations.

We conducted a confirmatory factor analysis using the remaining 50% of the data to cross-validate the three-factor model. Results suggested an excellent fit,  $\chi^2(24) = 83.56$ ,  $p < 0.001$ , Comparative Fit Index (CFI) = 0.96, Root Mean Square Error of Approximation (RMSEA) = 0.09, Standardized Root Mean Square Residual (SRMR) = 0.05, and Bayesian Information Criterion (BIC) = 8305.42. In contrast, the fit for a one-factor model was poor,  $\chi^2(27) = 409.14$ ,  $p < 0.001$ , CFI = 0.75, RMSEA = 0.20, SRMR = 0.10, and BIC = 8613.51. Because the BIC difference between the three-factor and one-factor model was 308.09, and because differences of 10 or more are considered “very strong” evidence in favor of the model with the smaller BIC (analogous in frequentist statistical terms to  $p < 0.01$ ), we retained the three-factor model (Raftery, 1995) for subsequent analyses. The items that load on each factor appear in Appendix A.

## **Results**

### *Sex Differences*

We conducted independent samples *t*-tests to examine sex differences in the major variables of interest using data from only participants who reported their sex. Without exception, males scored higher than did women in the trait-level measures of mating effort and social competitiveness, the situation-specific measures of sexual, competitive, and fortitude-display motivations for participating in drinking games, and the measures of drinking game behavior and problematic drinking. See Table 1 for means, standard deviations, and tests of sex differences.

**Table 1.** Sex Differences in Trait-level Variables, Situation-Specific Motivations, Drinking Game Behaviors, and Problematic Drinking

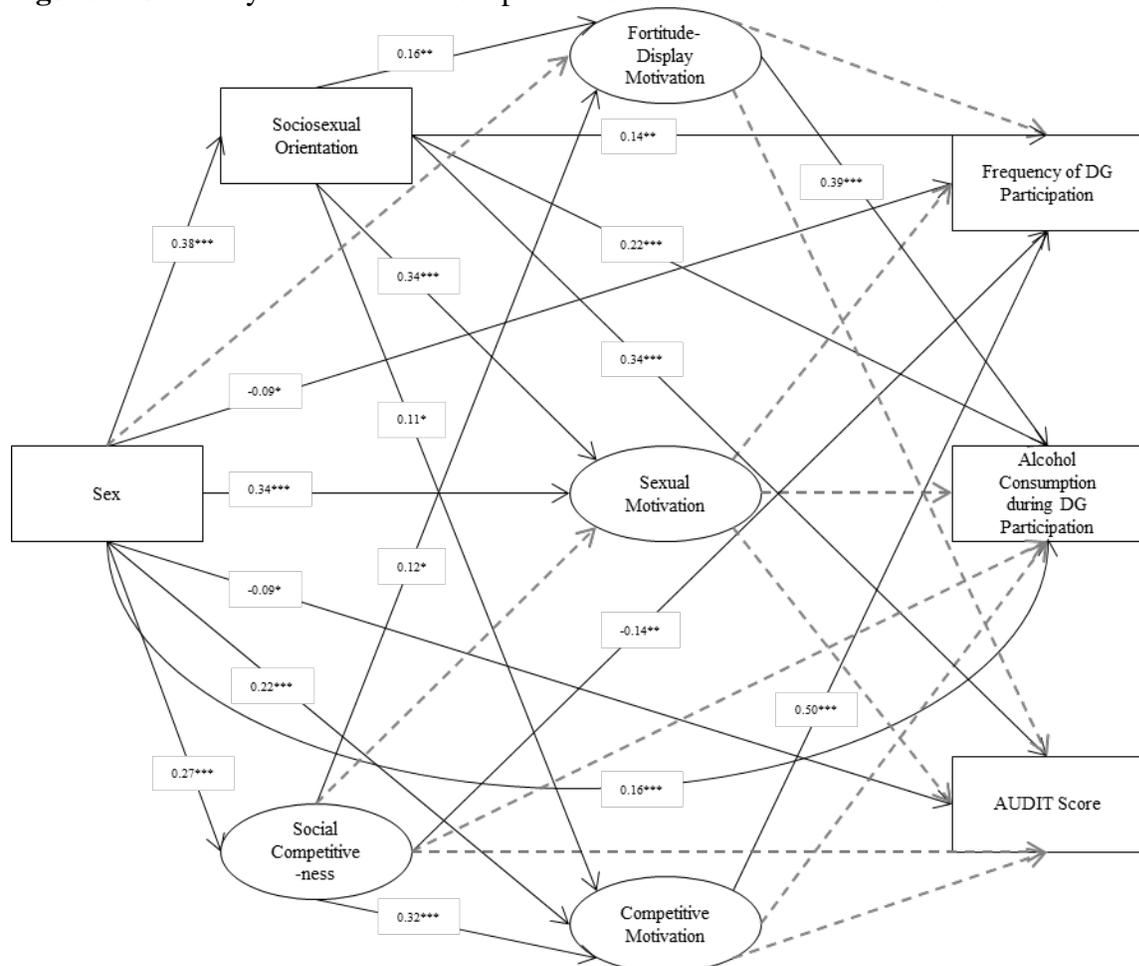
	Descriptive Statistics						Independent Samples t-Test										
	Female			Male			Levene's Test			t-Test			95% CI				
	N	M	SD	SE	N	M	SD	SE	Equal variances	F	t	df	d	Lower	Upper		
Sociosexual Orientation	351	5.31	3.85	0.21	335	9.02	5.12	0.28	not assumed	25.00	-10.70***	25.00	-10.70***	619.55	0.79	-3.71	0.35
Social Competitiveness	349	3.22	0.85	0.05	332	3.62	0.87	0.05	assumed	0.01	-6.09***	0.01	-6.09***	679.00	0.44	-0.40	0.07
Fortitude-Display Motivation	350	1.29	0.66	0.04	334	1.52	0.81	0.04	not assumed	14.24	-3.97***	14.24	-3.97***	645.01	0.34	-0.22	0.06
Sexual Motivation	350	1.72	0.96	0.05	334	2.79	1.25	0.07	not assumed	29.95	-12.52***	29.95	-12.52***	625.39	0.68	-1.07	0.09
Competitive Motivation	350	2.10	1.04	0.06	334	2.71	1.10	0.06	assumed	0.06	-7.48***	0.06	-7.48***	682.00	0.47	-0.61	0.08
Frequency of DG Participation	351	2.47	1.32	0.07	336	2.85	1.41	0.08	assumed	0.27	-3.64***	0.27	-3.64***	685.00	0.32	-0.38	0.10
Alcohol Consumption during DGs	351	2.75	0.98	0.05	336	3.35	1.03	0.06	assumed	2.53	-7.87***	2.53	-7.87***	685.00	0.44	-0.60	0.08
AUDIT Score	351	1.03	0.56	0.03	336	1.21	0.59	0.03	assumed	1.34	-3.99***	1.34	-3.99***	685.00	0.33	-0.17	0.04

Note: DG = drinking game. All tests were 2-tailed. \*\*\*  $p < 0.001$ .

Model Fit

We tested whether sex differences in the trait-level variables were related to intermediate increases in the situation-specific motivations, and whether those drinking game motivations, in turn, appeared to lead to drinking game behaviors and problematic drinking via a structural equation model (see Figure 1). We analyzed data with Mplus version 6 (Muthén and Muthén, 1998-2010). Because we assumed missing data to be missing at random, missing data were estimated using full information maximum likelihood estimation, which is the default in Mplus (Muthén and Muthén, 1998-2010). The chi-square test of model fit to these data was significant,  $\chi^2(82) = 188.39, p < 0.001$ ; however, we obtained a CFI of 0.98, indicating that the proposed model provided better fit than a baseline model (Schreiber, Stage, King, Nora, and Barlow, 2006). Moreover, we observed a RMSEA of 0.04 (95% CI: 0.04, 0.05), and we retained the close-fit hypothesis and rejected the poor-fit hypothesis (Schreiber et al., 2006). Finally, we obtained a SRMR of 0.03, indicating that the average residual of the difference between the observed and proposed variance/covariance matrix was low and that our model provided acceptable explanatory power (Schreiber et al., 2006).

Figure 1. Summary of direct effects reported as standardized coefficients



Notes: Solid lines indicate significant results. Dashed lines indicate non-significant results ( $p > 0.05$ ). DG = drinking game. All tests were 2-tailed. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

*Direct Effects*

See Figure 1 for a summary of the direct effects we tested and the standardized coefficients of significant direct effects we found.

*Sex*

Men reported investing more in mating effort (i.e., higher sociosexual orientation scores) and higher levels of socially competitiveness (i.e., higher social competitiveness scores) than did women. Men were also more motivated to participate in drinking games for sexual and competitive reasons to a greater extent than were women. Finally, men participated in drinking games less frequently, consumed more alcohol while participating in drinking games, and experienced fewer problems associated with drinking than did women when all other variables in the model were simultaneously controlled.

It is noteworthy that the significant direct effects of sex on frequency of drinking game participation and AUDIT scores in the mediation model are in the opposite direction of what we found when the same associations were tested as univariate mean differences: These direct effects exist only when trait-level variables and situation-specific motivations for participating in drinking games were simultaneously controlled. Such “bouncing betas” are not uncommon when predictors are highly intercorrelated, as was the case with the variables that we used to predict the drinking game and problematic drinking endpoints (Pedhazur, 1982). In the absence of any substantive reasons for believing that they accurately reflect actual sex differences in drinking behavior, we are inclined to believe that they are statistical artifacts. See Table 2 for the correlation matrix for the study variables.

*Trait-Level Variables: Sociosexual Orientation and Social Competitiveness*

Both male and female students who invested more in mating effort were more motivated to participate in drinking games for fortitude-display, sexual, and competitive reasons. Additionally, students who invested more in mating effort participated more frequently in drinking games, consumed more alcohol while participating in drinking games, and experienced more problems associated with drinking. More socially competitive students were more motivated to participate in drinking games for competitive and fortitude-display reasons. More socially competitive students also participated in drinking games less frequently when all other variables in the model were controlled.

*Situation-Specific Motivations: Fortitude-Display, Sexual, and Competitive*

Both male and female students who were more motivated to participate in drinking games for fortitude-display reasons consumed more alcohol while participating and students more motivated to participate in drinking games for competitive reasons participated in drinking games more frequently.

**Table 2.** Correlation matrix for study variables Pearson  $r$  ( $N$ )

	Sociosexual Orientation	Social Competitive-ness	Fortitude-Display Motivation	Sexual Motivation	Competitive Motivation	Frequency of DG Participation	Alcohol Consumption during DGs
Social Competitive-ness	0.19** (691)						
Fortitude-Display Motivation	0.20** (694)	0.12** (689)					
Sexual Motivation	0.44** (694)	0.16** (689)	0.54** (695)				
Competitive Motivation	0.21** (694)	0.29** (689)	0.53** (695)	0.54** (695)			
Frequency of DG Participation	0.25** (697)	0.06† (692)	0.32** (695)	0.39** (695)	0.41** (695)		
Alcohol Consumption during DGs	0.35** (697)	0.10* (692)	0.36** (695)	0.37** (695)	0.29** (695)	0.35** (698)	
AUDIT Score	0.41** (697)	0.09* (692)	0.32** (695)	0.39** (695)	0.29** (695)	0.59** (698)	0.50** (698)

Notes: DG = drinking game. All tests were 2-tailed. \*  $p < 0.05$  level, \*\*  $p < 0.01$  level, †  $p = 0.12$ .

### Indirect Effects

Figure 2 depicts the standardized coefficients for all two-step and three-step indirect effects we tested. Note that we tested all possible indirect effects but we did not detail statistically non-significant indirect effects. Mplus uses the Delta method (Bollen, 1989) to calculate the significance of the indirect effects (the product of the direct effects).

### Sex on Situation-Specific Motivations: Fortitude-Display, Sexual, and Competitive (Two-Step Mediation)

As Figure 2a shows, men were more motivated to participate in drinking games for fortitude-display, sexual, and competitive reasons, in part, because they invested more in mating effort than did women. Men were also more motivated to participate in drinking games for competitive and fortitude-display reasons because they were more socially competitive in general than were women.

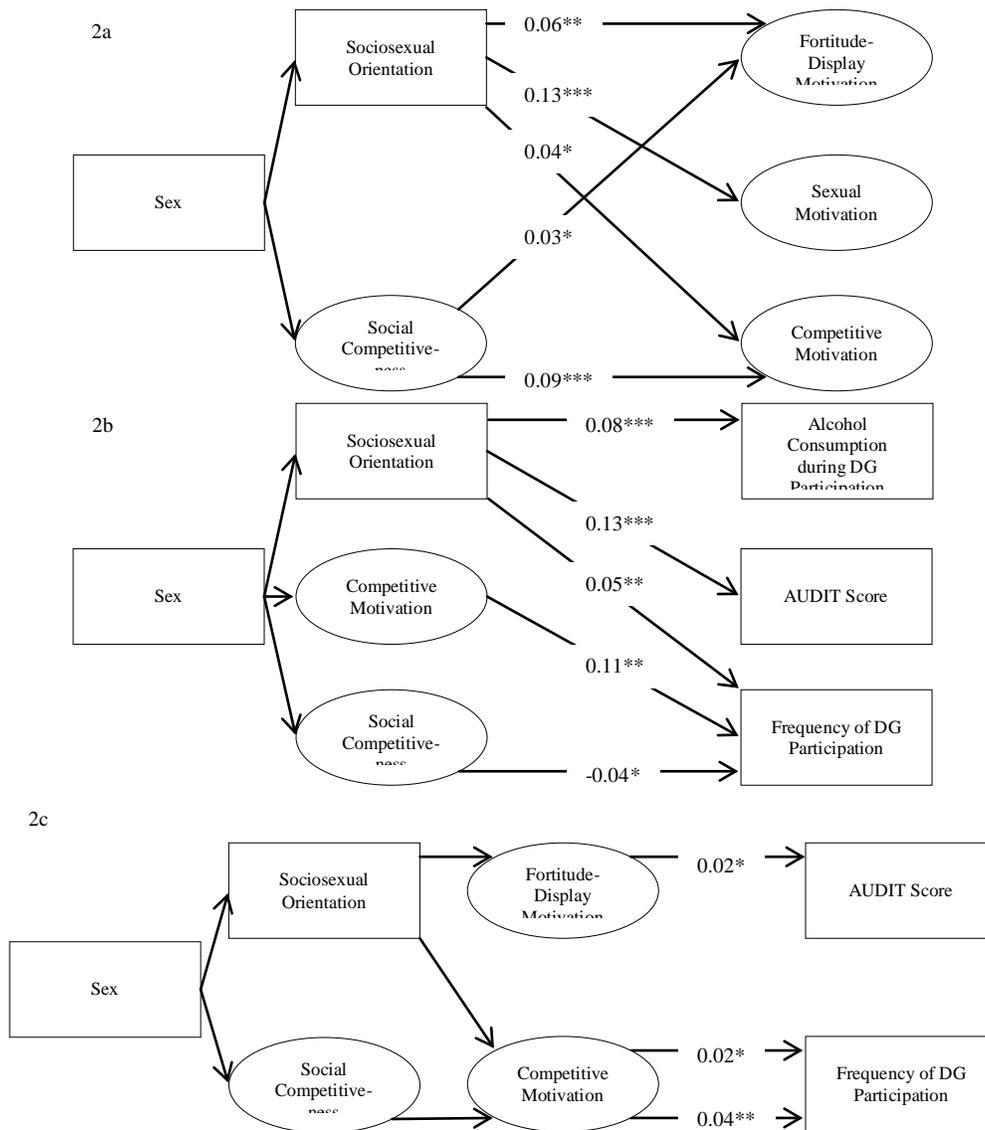
### Sex on Drinking Game Behaviors and Problematic Drinking (Two-Step Mediation)

As shown in Figure 2b, because men reported higher investment in mating effort than did women, they participated in drinking games more frequently, consumed more alcohol during drinking game participation, and experienced more problematic drinking than did women. Conversely, men who were more socially competitive participated in drinking games less frequently when all other variables were simultaneously controlled, again possibly due to aforementioned “bouncing betas” (Pedhazur, 1982). Finally, men participated in drinking games more often than did women, in part, because they were more competitively motivated to participate in drinking games.

*Sex on Drinking Game Behaviors and Problematic Drinking (Three-Step Mediation)*

As Figure 2c indicates, because men (1) invested more in mating effort and (2) were more socially competitive than women, they also tended to be more competitively motivated to participate in drinking games, which in turn caused them to participate in drinking games more frequently. Similarly, because men invested more in mating effort than women, they tended to be more motivated to participate in drinking games to display their fortitude, which in turn cause them to consume more alcohol during drinking game participation.

**Figure 2.** Summary of indirect effects (calculated via delta method) reported as standardized coefficients



Notes: DG = drinking game. All tests were 2-tailed. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

### *Variance Explained by Model*

Jointly, the predictors in the model predicted 27%, 26%, and 27% of the variation in frequency of drinking game participation, alcohol consumed during drinking games, and problematic drinking, respectively. Moreover, trait-level variables and situation-specific motivations jointly accounted for 23%, 13%, and 24% of the variation in frequency of drinking game participation, alcohol consumed during drinking games, and problematic drinking, respectively, that was attributable to sex differences.

### **Discussion**

According to sexual selection theory, females possess evolved psychological systems that motivate them to select high-investing mates with good genes, whereas males possess evolved psychological systems that motivate them to signal their mate quality and to compete for access to receptive females (Bateman, 1948; Buss and Schmitt, 1993; Darwin, 1859; Gangestad and Simpson, 2000; Geary, 2006; Trivers, 1972). In line with sexual selection theory—and based on prior evidence that drinking games are frequently sexual and competitive in nature (Johnson, 2002; Johnson and Sheets, 2004)—we hypothesized that part of the appeal of drinking games for college students is that they provide a venue for male intrasexual competition and female intersexual choice.

In keeping with this hypothesis, we found sex differences in trait-level variables (mating effort and social competitiveness) and situation-specific motivations (sexual, competitive, and fortitude-display) for participating in drinking games: Males report greater levels of mating effort, social competitiveness, and drinking game motivations than do women. In line with previous findings (Borsari, 2004; Engs and Hanson, 1993; Engs et al., 1996; Johnson et al., 1998; Pedersen and LaBrie, 2006), we also found sex differences in frequency of drinking game participation, alcohol consumption during drinking game participation, and problematic drinking: Men participate in drinking games more frequently, consume more alcohol while participating, and experience more problems associated with drinking than do women. In addition, it appears investment in mating effort and social competitiveness predict certain sexual, competitive, and fortitude-display motivations for participating in drinking games, drinking game behaviors, and problematic drinking in male and female college students. Finally, both male and female students' competitive and fortitude-display motivations for participating in drinking games predict frequency of drinking game participation and quantities of alcohol consumed during drinking games, respectively (i.e., competitive motivation predicted frequency of drinking game participation and fortitude-display motivation predicted quantities of alcohol consumed during drinking games for both sexes).

More importantly, our results shed light on the causal pathways by which sex, trait-level variables, and situation-specific motivations might eventuate in drinking game behavior and its alcohol-related consequences. Men appear to participate in drinking games more frequently than do women because their high investment in mating effort and high levels of social competitiveness cause them to be more motivated to participate in drinking games for competitive reasons. Men also experience more problems associated with drinking than do women because they are highly invested in mating efforts and are subsequently motivated to participate in drinking games in order to display their fortitude.

Our findings comport well with Hill and Chow's (2002) conclusion that risky drinking is more common among young men than among young women or older adults because risk-taking was associated with reproductive success in young men in ancestral populations, which gave rise to risk-taking adaptations in young men that are still enacted today.

Our findings also complement other evidence that sociosexual orientation is correlated with risk-taking (Seal and Agostinelli, 1994), and suggest that it is, in part, because of men's preference for high mating investment that they (1) participate in drinking games for sexual, fortitude-display, and competitive reasons to a greater extent than do women; (2) participate in drinking games more frequently than do women; (3) consume more alcohol during participation in drinking games than do women; and (4) encounter more negative consequences of drinking than do women. Thus, understanding students' levels of mating effort and social competitiveness helps to explain important sex differences in their behavior.

Our model explained 26-27% of the variation in drinking game behaviors and problematic drinking. Thus, taking college students' sex, trait-level variables, and drinking game-specific motivations into account helps to explain why they participate in drinking games, how much alcohol they consume when they participate, and the alcohol-related consequences they subsequently encounter. These findings also support previous longitudinal findings that trait-level variables are associated with health-risk behaviors, including problematic alcohol use (e.g., Caspi, Begg, Dickson, Harrington, Langley, Moffitt, and Silva, 1997), giving credence to the use of trait-level variables to identify at-risk students for interventions.

### *Limitations*

Our results are cross-sectional and non-experimental in nature, limiting our ability to draw causal conclusions (Finkel, 1995). For example, there are other plausible causal orderings of some of the relationships we tested, and we cannot rule out such alternative interpretations statistically (though, based on theory, we believe our ordering is the most reasonable). In future studies, it would be useful to collect data from participants at multiple time points so causality can be tested more rigorously (Finkel, 1995). It might also be useful to test these hypotheses using samples of students from other institutions, or even other nations, where drinking games are also common (Pedersen, 1990; Polizzotto, Saw, Tjhung, Chua, and Stockwell, 2007).

We also cannot rule out that our findings are caused by sex differences in unmeasured variables—for example, sex differences in social norms about risk-taking. However, norm-based explanations do little independent causal work because sex differences in norms themselves ultimately require causal explanations of their own. Moreover, our findings are consistent with a large body of human and animal literature outlining how sexual selection might give rise to sex-specific adaptive behaviors (Bateman, 1948; Buss and Schmitt, 1993; Darwin, 1859; Gangestad and Simpson, 2000; Geary, 2006; Trivers, 1972). Nevertheless, we cannot rule out the possibility that unmeasured third variables may be responsible for the pattern of results we obtained here.

### *Implications*

Our results suggest that men's high rate of drinking game participation is linked to competitive motivation. Identifying and targeting competitively motivated students,

therefore, may be a key to ameliorating problems associated with drinking games. One population especially motivated by competition and known to be at-risk for negative consequences of drinking games is student athletes (Larimer and Cronce, 2002): In two studies, Grossbard, Geisner, Neighbors, Kilmer and Larimer (2006) found that in college student athletes, drinking game participation mediated the relationship between alcohol consumption and negative alcohol-related consequences. Interventions that emphasize the negative consequences of risk behavior (Nell, 2002; Saad and Peng, 2006) and of drinking games (Hingson, Berson, and Dowley, 1997; Larimer and Cronce, 2002; Wechsler et al., 2002) have generally not been shown to be effective and might ironically increase participation in competitive men. Therefore, public health and university policies aimed at targeting at-risk students for interventions should therefore consider the competitive dynamics (as well as sexual ones) that apparently motivate drinking game participation and consider how to frame the risks associated with drinking games so as to discourage rather than inadvertently encourage drinking game participation as a venue for displaying one's competitiveness and fortitude.

Identifying new directions for effective assessment of at-risk college students is a major problem for university and public health officials (Larimer and Cronce, 2002). Our results indicate that men who score high on the Sociosexual Orientation Inventory and Cooperative/Competitive Strategy Scale tend to be more sexually and competitively motivated to participate in drinking games and thus are more at risk of negative consequences of drinking games than their peers. Thus, most fundamentally, our results suggest that adding the seven-item the Sociosexual Orientation Inventory (Simpson and Gangestad, 1991) or a multidimensional measure of mating strategies (Jackson and Kirkpatrick, 2007) and the three-item Cooperative/Competitive Strategy Scale (Simmons et al., 2001) to assessment tools would be an efficient way to help identify at-risk students (i.e., these items could be added to university drug and alcohol education program or health center intake questionnaires).

### *Conclusions*

Many models of adolescent substance abuse have been proposed (e.g., Cooper, Frone, Russell, and Mudar, 1995; Newcomb and Felix-Ortiz, 1992; Wills, DuHamel, and Vaccaro, 1995), but the model presented here is, to our knowledge, the first model to test functional hypotheses (based on sexual selection theory) about the causes of sex differences in drinking game behaviors and problematic drinking in college students. Understanding the causes of these sex differences is a substantial public health concern (Carman, Fitzgerald, and Holmgren, 1983; DHHS, 2007). The functional explanation we tested here may provide a useful way of assessing and framing interventions for this problem—as well as for other risky problem behaviors that are differentially associated with being both young and male (Hill and Chow, 2002). Future studies examining these relationships from a functional perspective may also be useful in informing public health and university interventions and enabling better identification of at-risk students.

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**Appendix A: Motivation Factor Loadings**

Item	Fortitude- Display	Sexual	Competitive
I like to play drinking games that show who can go the longest without passing out.	0.93		
I like to play drinking games that show who can last the longest without throwing up.	0.90		
I like to play drinking games in which sometimes people need to be put to bed.	0.67		
I like to play drinking games that give me an opportunity to have fun with people I'd like to have sex with.		-0.98	
I like to play drinking games that loosen people up for fooling around or having sex later.		-0.88	
I like to play drinking games that give me an opportunity to hit on people I'm interested in.		-0.87	
I like to play drinking games in which people are really serious about winning.			0.94
I like to play drinking games that have clear winners and losers.			0.86
I like to play drinking games in which people get teased or respected depending on how they played.			0.46