



Distinguishing BAS risk for university students' drinking, smoking, and gambling behaviors

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ABSTRACT

Individual differences in Gray's Behavioral Approach System (BAS) and Behavioral Inhibition System (BIS) have been associated with young adults' substance misuse and gambling. To clarify the distinct and common etiology of these behaviors, the current study examined the unique influence of BAS sub-components (Reward Responsiveness, Drive, Fun Seeking) and BIS on university students' drinking, smoking, and gambling behaviors. Participants included 533 (361 females) undergraduate students who completed self reports of BIS/BAS (Carver & White, 1994) and retrospective reports of frequency and quantity/money spent of alcohol use, cigarette use, and gambling. Drinking, smoking, and gambling status were identified based on past month behavior. Logistic regressions revealed that Fun Seeking was associated with increased risk for being a drinker or smoker. BAS and BIS were not supported as unique predictors of gambling status. Linear regressions revealed that Fun Seeking was positively associated with drinking, and Drive and Fun Seeking were positively and negatively associated with gambling, respectively. Findings suggest that different components of BAS sensitivity contribute to drinking and smoking compared to gambling, such that the tendency to seek out new potentially rewarding experiences puts individuals at risk for drinking/smoking, while the tendency to pursue appetitive goals increases risk for gambling.

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1. Introduction

Rates of drinking among university students continue to be a concern, with 30–50% of those who drink engaging in heavy episodic use (e.g., Adlaf, Demers, & Gliksman, 2005). In addition, while the overall rates of cigarette smoking are declining (CDC, 2005), about 30% of university students smoke. Of these, almost 13% smoke at least a pack a day (Rigotti, Lee, & Wechsler, 2000). Gambling among university students also is a growing concern, with upwards of 42% of students gambling (LaBrie, Shaffer, LaPlante, & Wechsler, 2003), and more than 7% gambling at problematic levels (Shaffer, Hall, & Vander Bilt, 1999). Moreover, there is a high co-occurrence of these risk behaviors in undergraduates (e.g., Stuhldreher, Stuhldreher, & Forrest, 2007).

Personality has been identified as an important influence on drinking, smoking, and gambling during early adulthood (Gupta, Derevensky, & Ellenbogen, 2006; McChargue, Cohen, & Cook, 2004; Sher, Trull, Bartholow, & Vieth, 1999). Addiction models emphasize reinforcement as a critical factor, such that drinking, smoking, and gambling are motivated by either the desire to experience positive (e.g., euphoria) or decrease negative (e.g., offer escape) outcomes (Cooper, Frone, Russell, & Mudar, 1995; Doran, McChargue, & Cohen, 2007; Raylu & Oei, 2002). Accordingly, models of motivationally-relevant individual difference variables provide a useful framework for examining personality risk for addictive behaviors.

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and while the function of the BAS remained largely unchanged, a new conceptualization of the BIS was offered. Originally the BIS was thought to inhibit behavior in response to cues of potential punishment. However, the revised theory views the BIS as a conflict resolution system; one that moves an individual towards a decision of behavioral approach or avoidance by drawing attention to the potential dangers of a behavior. Thus, a high BIS individual will overattend to the warning signs of a behavior, leading to avoidance. A strong BIS gives rise to high levels of anxiety (Gray & McNaughton, 2000), which may lead to the inclination to self-medicate (Pihl & Peterson, 1995). Accordingly, those with a strong BIS may be at risk for engaging in addictive behaviors for negative reinforcement.

The BIS and BAS have been linked to many of the other personality constructs in the extant literature. For example, Eysenck's neuroticism and extraversion (Eysenck & Eysenck, 1991) are thought to map onto (although not directly) Gray's model (Corr, 2002). Extraversion is thought to reflect the balance of the BIS–BAS sensitivities, where an imbalance favoring BAS leads to elevated extraversion. Conversely, neuroticism is thought to reflect the strengths of the BIS–BAS, such that a strong BIS that disproportionately suppresses the BAS leads to elevated neuroticism.¹

While there is theoretical support for the BAS and BIS risk pathways to addictive behaviors, the BAS pathway has received much more attention and consistent empirical support. A strong BAS has been associated with elevated risk for alcohol and illicit drug abuse (e.g., Franken, Muris, & Georgieva, 2006), as well as the sub-clinical levels of alcohol misuse that are prevalent on university campuses (e.g., O'Connor & Colder, 2005). Research examining BAS as a risk factor for smoking and gambling is more limited. One study identified BAS as a predictor of substance use including cigarette smoking, but the direct link to smoking could not be disaggregated (Knyazev, 2004). BAS has also been associated with gambling indirectly. For example, a strong BAS was associated with poor performance on the Iowa Gambling Task (Suhr & Tsanadis, 2007), however this is not a direct measure of gambling propensity. While there is a paucity of research examining the direct association between BAS and smoking and gambling, there is evidence to suggest that disinhibited behavior and low constraint – indicators of a strong BAS – are associated with risk for these behaviors (e.g., Slutske, Caspi, Moffitt, & Poulton, 2005; White, Pandina, & Chen, 2002). Together these data suggest that BAS may be a common personality risk for heavy drinking, smoking, and problem gambling, however, research incorporating direct measures of BAS is needed.

Empirical research examining BIS as a risk factor for substance misuse and problem gambling is similarly limited. While there is an emerging literature supporting use of cigarettes and gambling for negative reinforcement purposes (e.g., Doran et al., 2007; Raylu & Oei, 2002) there appears to be no direct examination of the relations of BIS to smoking and gambling. Furthermore, examination of BIS-related constructs as risk factors for substance use and gambling have yielded inconsistent findings. Some evidence supports an anxiety-related pathway to heavy drinking, smoking, and problem gambling (e.g., Audrain, Lerman, Gomez-Caminero, Boyd, & Orleans, 1998; see Carrigan & Randall, 2003; el-Guebaly et al., 2006), while other findings do not support BIS and BIS-related constructs as significant predictors (e.g., O'Connor & Colder, 2005). Moreover, there is some theoretical support for a negative relation between BIS and these problem behaviors, such that those with a weak BIS are at greater risk for engaging in impulsive behaviors (Corr, 2002).

Research examining both BAS and BIS as predictors of problematic alcohol use suggests that a strong BAS may be particularly important among undergraduates (O'Connor & Colder, 2005). Accordingly, the primary goal of the current study was to directly examine BAS as a risk factor for heavy drinking, smoking, and high levels of gambling in university students. Research suggests that global BAS is comprised of distinct components (e.g., Carver & White, 1994), such that there are three lower-order BAS components: Reward Responsiveness (positive response to reward or anticipation of reward), Drive (pursuit of rewarding goals), and Fun Seeking (seeking out new rewards). Fun Seeking and (to a lesser degree) Drive, but not Reward Responsiveness, are associated with risk-taking and novelty seeking behavior (Carver & White, 1994; Smillie, Jackson, & Dalgleish, 2006). Moreover, only Fun Seeking and Drive have been linked to alcohol misuse and illicit drug use (Franken & Muris, 2006; Franken et al., 2006). These data suggest that there may be utility in considering the distinct lower-order BAS constructs when modeling risk for addictive behaviors. No research to date has elucidated the unique and shared associations between these three BAS constructs and smoking and gambling behavior. In the current study, Reward Responsiveness, Drive, and Fun Seeking were examined as unique predictors of undergraduates' drinking, smoking, and gambling behavior. This allowed us to consider the common and possibly distinct etiology of these behaviors. We hypothesized that like alcohol use, Fun Seeking and/or Drive would be important predictors of smoking and gambling. In addition, a secondary goal was to examine BIS as a predictor of these three behaviors.

2. Method

2.1. Participants and procedure

Participants included 533 (361 females) undergraduate students enrolled at an Eastern Canadian university. On average, participants were 18.9 years old ($SD = 3.0$), the majority (84%) were in their first year, and 58% were Euro-Canadian and 30% identified as "other". Minority groups included Aboriginal, Asian-Canadian, and African-Canadian. The measures for this study were completed as part of the Psychology Department's mass screening questionnaire battery. Participation was compensated with course credit.

2.2. Measures

BIS/BAS. Carver and White's (1994) 20-item measure, which is based on Gray's (1975) original BIS/BAS theory, includes one BIS scale (7 items, e.g., *I worry about making mistakes*) and three BAS scales: Reward Responsiveness (5 items, e.g., *When I get something I want, I feel excited and energized*), Drive (4 items, e.g., *If I see a chance to get something I want, I move on it right away*), and Fun Seeking (4 items, e.g., *I crave excitement and new sensations*). Responses were made on 4-point scales (1 = *strong disagreement* to 4 = *strong agreement*), and were totaled to form scale scores. The psychometric properties of these scales are well supported (e.g., Heubeck, Wilkinson, & Cologon, 1998; Ross, Millis, Bonebright, & Bailley, 2002). In the present study, the Cronbach's alpha for the BIS scale was .75, and for the BAS scales the alphas were .81 for Reward Responsiveness, .88 for Drive, and .82 for Fun Seeking.

Drinking, Smoking, and Gambling. Behaviors over the past 30 days were assessed. Four-point scales were used to assess frequency of alcohol use (*Did Not Drink* or 1 = *once* to 4 = 6 or more times), cigarette use (*Did Not Smoke* or 1 = 1 or 2 days to 4 = 15–30 days), and gambling (*Did Not Gamble* or 1 = *once* to 4 = more than 6 times) in the past 30 days. Five-point scales were used to assess quantity of alcohol use (*Did Not Drink* or 1 = *one [drink]* to 5 = 10 or

¹ Providing a full review of the theoretical links between Gray's model and the many other existing personality constructs is beyond the scope of this paper. The reader is referred to the very recently published book by Corr (2008) which provides an excellent review.

more [drinks]) and cigarette use (*Did Not Smoke* or 1 = <1 (couple of drags) to 5 = 1 pack or more), and money spent gambling (*Did Not Gamble* or 1 = \$1–\$10 to 5 = more than \$200) on a typical day in the past month. Dichotomous variables were also formed indicating whether or not the person was a drinker, smoker, or gambler. Individuals were identified as such if they engaged in the respective behavior at least once in the past month.

3. Results

3.1. Descriptives and correlation analysis

Ninety one percent of the sample were identified as drinkers, 21% as smokers, and 20% as gamblers, with 7% endorsing all three behaviors. Positive zero-order correlations were supported between the three BAS scales ($r_s = .36-.45, p_s < .001$). Zero-order correlations (Table 1) supported significant positive correlations between drinking behavior and the Drive and Fun Seeking scales and between being a smoker and the Fun Seeking scale. The BAS scales were not significant correlates of gambling behavior. The correlations between total BAS and the risk behaviors are also presented. Total BAS was significantly and positively correlated with drinking behaviors as expected and with being a smoker. BIS was a significant negative correlate of heavy drinking and being a gambler.

3.2. Regression analyses: BIS/BAS predicting risk behaviors

Age and sex were significant correlates of some of the criterion variables, and thus were controlled for in the models. Using hierarchical models, age and sex were entered on the first step. Final models and change in model fit from the first to final model are presented in Tables 2 and 3.

First, the utility of the BIS/BAS scales in predicting being a drinker, smoker, and gambler, respectively, were examined using a set of hierarchical logistic regressions (Table 2). The BIS/BAS scales predicted significant incremental variance over and above demographics for drinking and smoking, but not gambling. Examination of first order effects revealed that the odds of being a drinker and smoker significantly increased by 1.23 and 1.17, respectively, with each unit increase on Fun Seeking scores.

Next, the BIS/BAS scales were examined as predictors of drinking, smoking, and gambling behaviors using hierarchical linear regressions (Table 3). Cohen's (1988) f^2 was used as an index of ef-

fect size. BIS/BAS scales predicted significant incremental variance over and above demographics for drinking and gambling (marginal ΔR^2 for gambling frequency), but not smoking behaviors. First order effects revealed elevated Fun Seeking scores were significantly associated with risk for heavy and frequent drinking ($f^2_s = .03$), while low scores were associated with risk for increased spending when gambling ($f^2 = .04$). These effect sizes were in the small range. Elevated Drive scores were significantly associated with risk for frequent gambling ($f^2 = .07$) and increased spending when gambling ($f^2 = .08$). These effect sizes were in the moderate range.

4. Discussion

Consistent with motivational models of BIS and BAS (Fowles, 2001; Gray, 1975), and extant literature supporting distinct components of the BAS (Carver & White, 1994), we examined BIS, BAS-Reward Responsiveness, BAS-Drive, and BAS-Fun Seeking as unique predictors of drinking, smoking, and gambling. While the effect sizes of our findings were in the small to moderate range, the theoretical implications of clarifying the BIS/BAS risk specific to these potentially addictive behaviors supports the interpretation of these small and moderate effects (Cohen, 1988).

Our simultaneous examination of the BAS components revealed that Fun Seeking – the inclination to seek out new rewards – increased the risk for being a drinker, engaging in heavy and frequent drinking, and being a smoker. This positive relation between Fun Seeking and alcohol misuse has been previously documented in the literature (Franken & Muris, 2006). While not as consistently supported as Fun Seeking, some of this former work has also found a strong Drive to be predictive of alcohol misuse. In the current study a strong Drive was correlated with all of the alcohol use measures in bivariate correlations; however, Drive was not uniquely associated when examined in the context of the other predictors. The risk for smoking associated with a strong motivation to seek out fun is supported in the literature, as Fun Seeking is thought to capture impulsivity (Smillie et al., 2006) which has been implicated in smoking risk (e.g., Doran et al., 2007). Notably, the present findings suggest that the motivation to seek out fun and new reward put individuals at risk for being a smoker, but did not further influence the extent of cigarette use. Unlike alcohol use, which is more socially accepted and thus used by a broader range of individuals, smokers may be a distinct group from non-smokers. Accordingly, Fun Seeking may systematically increase risk for heavy and frequent drinking, while it may distinguish smokers from

Table 1
Descriptive statistics for all variables and correlations between predictor and criterion variables.

Predictor variables	Criterion variables										
	Drinker (N = 533)	Drinkers only (N = 485)		Smoker (N = 533)	Smokers only (N = 112)		Gambler (N = 533)	Gamblers only (N = 106)			
		Alc Frq	Alc Qty		Cig Frq	Cig Qty		Gmbl Frq	Gmbl \$Spent	M	SD
BAS	.14**	.15**	.16**	.11**	.04	-.02	.02	-.06	-.10	40.82	5.97
Reward Responsiveness	.05	.03	.02	.02	.01	-.01	-.04	-.15	-.19	17.72	2.40
Drive	.12**	.11*	.12**	.08	.05	.02	.06	.13	.11	10.93	2.65
Fun Seeking	.16**	.19**	.23**	.16**	.03	-.08	.03	-.12	-.18	12.18	2.60
BIS	-.02	-.05	-.17**	-.08	-.03	-.06	-.20**	-.16	-.08	20.74	3.48
Sex	.10*	-.10*	-.40**	-.08	-.04	-.10	-.32*	-.19	-.11	0.68	
Age	-.02	-.19**	-.21**	.03	.36**	.39**	-.03	.01	.29**	18.87	3.04
M	.91	3.10	3.27	.21	2.10	1.86	.20	1.76	1.30		
SD		.97	1.07		1.22	.95		.87	.69		

Note: Drinker, Smoker, Gambler: 1 = Yes, 0 = No; Sex: 1 = female, 0 = male; BAS = Behavioral Approach System; BIS = Behavioral Inhibition System; Alc Frq = Frequency of alcohol use in past month; Alc Qty = Quantity of alcohol use on a typical day in past month; Cig Frq = Frequency of cigarette use in past month; Cig Qty = Quantity of cigarette use on a typical day in past month; Gmbl Frq = Frequency of gambling in past month; Gmbl \$Spent = Money spent gambling on a typical day in past month.

* $p < .05$.

** $p < .01$.

Table 2
Final model of hierarchical logistic regression: BIS/BAS scales predicting drinking, smoking, and gambling status.

Predictor variables	Drinker (1 = Yes, 0 = No)			Smoker (1 = Yes, 0 = No)			Gambler (1 = Yes, 0 = No)		
	B	SE	Odds ratio	B	SE	Odds ratio	B	SE	Odds ratio
Sex (1 = female, 0 = male)	1.03**	.34	2.81	-.23	.24	.79	-1.43**	.24	.24
Age	-.01	.05	.99	.04	.03	1.04	-.04	.05	.96
Reward Responsiveness	-.09	.08	.91	-.04	.06	.97	.02	.06	1.02
Drive	.13	.07	1.14	.03	.05	1.03	.05	.05	1.05
Fun Seeking	.21**	.07	1.23	.16**	.05	1.17	-.04	.05	.96
BIS	-.03	.05	.97	-.04	.03	.96	-.10**	.04	.91
Cox and Snell (1989) Index of goodness of fit									
LR χ^2 Diff Test (df = 4)	19.94**			16.22**			8.75		

Note: BIS = Behavioral Inhibition System; LR χ^2 Diff Test = Logistic Regression χ^2 Difference Test (Cohen, Cohen, West, & Aiken, 2003), used to assess added predictability of final model over and above model including only sex and age; Wald χ^2 statistic used to assess significance of Bs.
** $p < .01$.

Table 3
Final model of hierarchical linear regression: BIS/BAS scales predicting drinking, smoking, and gambling behaviors.

Predictor variables	Drinkers only (N = 485)						
	Alcohol use frequency			Alcohol use quantity			
	B	SE	β	B	SE	β	
Sex (1 = female, 0 = male)	-.15	.10	-.07	-.88**	.10	-.38	
Age	-.06**	.02	-.17	-.07**	.02	-.19	
Reward Responsiveness	-.02	.02	-.04	.01	.02	.02	
Drive	.02	.02	.06	.02	.02	.04	
Fun Seeking	.06**	.02	.15	.07**	.02	.15	
BIS	-.00	.01	-.01	-.01	.01	-.04	
R ²			.08			.24	
ΔR^2			.03**			.03**	
	Smokers only (N = 112)						
	Cigarette use frequency			Cigarette use quantity			
	B	SE	β	B	SE	β	
Sex (1 = female, 0 = male)	-.02	.24	-.01	-.11	.18	-.05	
Age	.14**	.04	.38	.12**	.03	.42	
Reward Responsiveness	.02	.06	.04	.04	.04	.12	
Drive	-.00	.05	-.00	-.00	.04	-.00	
Fun Seeking	-.00	.05	-.00	-.05	.04	-.15	
BIS	.04	.04	-.11	-.04	.03	-.15	
R ²			.14			.19	
ΔR^2			.01			.03	
	Gamblers only (N = 106)						
	Gambling frequency			Gambling money spent			
	B	SE	β	B	SE	β	
Sex (1 = female, 0 = male)	-.21	.18	-.12	-.08	.14	-.06	
Age	.00	.05	.00	.12**	.04	.28	
Reward Responsiveness	-.05	.04	-.15	-.05	.03	-.20	
Drive	.10*	.04	.30	.08**	.03	.31	
Fun Seeking	-.07	.04	-.20	-.07*	.03	-.26	
BIS	-.02	.03	-.07	-.00	.02	-.01	
R ²			.12			.20	
ΔR^2			.08†			.11*	

Note: BIS = Behavioral Inhibition System; ΔR^2 : added predictability of final model over and above model including only sex and age.

† $p = .07$.
* $p < .05$.
** $p < .01$.

non-smokers, but have no additional impact on specific smoking behaviors.

In contrast to the BAS risk for drinking and smoking, BAS did not appear to be a risk factor for being a gambler. However, a strong Drive – the motivation to pursue rewarding goals – was found to increase the risk for frequent gambling and for heavy spending when

gambling. The former finding may reflect our overly broad definition of gambling, which allowed us to capture behaviors that are not typical of gambling (e.g., buying lottery tickets). It is possible that BAS would predict gambling status if a more narrow definition of gambling was used or if specific examples of types of gambling were given (e.g., slots, sports betting). In contrast, the latter finding

makes intuitive sense, as a strong drive to pursue rewarding goals seems essential for being a frequent, heavy spending gambler, where losses are frequent and wins are quite infrequent. Unexpectedly, Fun Seeking was found to be negatively associated with money spent when gambling, suggesting that low motivation to seek out new rewards increases gambling persistence. On the one hand, this makes conceptual sense as those who do not need immediate and new rewards may be able to endure the intermittent positive outcomes involved with gambling and thus continue to spend money. This would fit with new speculation (see Corr, 2008) that the BAS is a complex and multidimensional system, which may consist of separate but overlapping processes. At the early or anticipatory stage there is the drive process, and this concerns active pursuit of goals. At the later stage, the BAS is involved in the emotional excitement that is in response to the biological reinforcer. Corr (2008) suggests that Carver and White's (1994) Fun Seeking assesses the behaviors that are closer to the reinforcer. Taken together, variance in the strength of these different facets of the BAS may lead to risk for different behaviors.

The finding of a negative association between Fun Seeking and gambling is surprising, however, when considered in the context of drinking and smoking, which are positively associated with Fun Seeking, and which have been shown to co-occur with gambling (Stuhldreher et al., 2007). While replication and further investigation of this finding is needed, we can offer some speculations at this point. One possible explanation is that Fun Seeking is not the common risk factor for all three risk behaviors. Possibly elevated Fun Seeking is not even the broad risk factor for alcohol use, but rather it is linked to seeking out certain enjoyable social contexts, such as university house parties, where drinking (but not gambling) opportunities are typically present. Another explanation is that having both elevated Fun Seeking and Drive may put individuals at risk for all three risk behaviors as the strong Drive mitigates the negative effects of Fun Seeking on gambling behavior. Alternatively, those with a weak motivation for Fun Seeking may tend not to drink or smoke and, thus, the negative association with money spent when gambling may be driven by gamblers only. Additional analyses of the current data offer some preliminary support for this, in that the negative association between Fun Seeking and gambling behavior was not supported when only drinkers and gamblers were considered. An important direction for further research is to explicate the specific risk associated with being only a drinker, smoker, or gambler, compared with being some combination of these. The current study was limited for such an examination due to small sample size (e.g., only 7% identified as drinkers, smokers, and gamblers).

Contrary to theory (e.g., Pihl & Peterson, 1995), and our hypothesis – which was based on the emerging literature that supports a negative reinforcement pathway to smoking and gambling (e.g., Doran et al., 2007; Raylu & Oei, 2002) – a strong BIS was not associated with drinking, smoking, or gambling risk in the current study. In fact, zero-order correlations indicated that a weak BIS was associated with heavy drinking and being a gambler. There is some, albeit mixed, support for the role of a low BIS in externalizing behaviors (e.g., drug use; Hundt, Kimbrel, Mitchell, & Nelson-Gray, 2008). However, BIS was not supported as a unique predictor in the context of demographic and BAS influences in the present study. Our findings, as well as those of extant research (e.g., Hundt et al., 2008; O'Connor & Colder, 2005) suggest that the BIS influence on risk behaviors may be complex. For example, the null findings could reflect a curvilinear relation between BIS and addictive behaviors, such that those with either a strong or weak BIS are at risk. Alternatively, moderators may be involved in the complex influence of a strong BIS on these risk behaviors. On the one hand, those who are high on BIS may experience anxiety and be at risk for self-medicating with substances or using gambling as an avoid-

ance strategy. On the other hand, these individuals may avoid these types of behaviors because of their heightened focus on the associated potential dangers (e.g., hangovers; societal disapproval; loss of money). Finally, an alternative explanation for the null findings is that an elevated BIS (i.e., anxiety) may only be a risk factor for very heavy or disordered levels of substance use (e.g., Ball, 2005) and gambling, levels of use that were not assessed in this study.

While these findings do further the etiological addictions literature, and suggest directions for future research, a few limitations are noteworthy. First, BAS was originally theorized as a single construct; thus, examinations of sub-components may not capture the true aspect of BAS that is linked to substance use and gambling. Notably, however, a modified version of the widely used Sensitivity to Punishment and Sensitivity to Reward Questionnaire (Torrubia, Ávila, Moltó, & Caseras, 2001) which was designed to assess a single BAS construct, revealed the same three BAS components in factor analyses (Colder & O'Connor, 2004). Second, our definition of drinker, smoker, and gambler (i.e., drank/smoked/gambled ≥ 1 /past month) may have excluded those who engage in these behaviors less frequently. Also, our assessments of past month typical quantity and frequency of substance use and gambling may have been influenced by transient factors such as exam periods, and the lack of distinction between weekday and weekend behaviors may have obscured potential relations between Fun Seeking and elevated weekend risky behaviors, for example. Third, the Carver and White (1994) measure of BIS that was used is based on the original theory (Gray, 1975), and thus does not measure its potential role in conflict resolution (Gray & McNaughton, 2000). However, this measure does assess the heightened attention to warning signs that is paramount to anxiety, and which may be central to a negative reinforcement pathway to addictive behaviors. Lastly, caution should be given to the generalizability of these findings to students in their upper years and non-university student samples. An important direction for future research will be extending these risk models to other young adult samples.

In conclusion, our hypothesis that the Drive and Fun Seeking components of BAS, which are indicators of risk taking and novelty seeking (Carver & White, 1994; Smillie et al., 2006), would be positively associated with university students' drinking, smoking, and gambling behaviors was partially supported. Moreover, our findings generally supported an elevated BAS compared to BIS as an important predictor of undergraduates' risk behaviors. This could suggest an individual difference (i.e., gene) by environment interaction, such that during this period when parental control is low and availability of substances and opportunities to gamble are high, the predisposition for risk taking/novelty seeking manifests itself in substance use and gambling. In terms of clinical implications, these findings may suggest the need to target different motivations for drinkers and smokers compared to gamblers. For example, it may be beneficial for treatments to focus on identifying alternative novel and rewarding experiences for those at risk for drinking and smoking, while identifying alternative appetitive goals for those at risk for gambling. Furthermore, treatments may benefit from a multi-focus for those engaging in multiple addictive behaviors.

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