The Moderating Role of Cognitive Capacities in the Association Between Social Norms and Drinking Behaviors

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Abstract

Background—The literature documents two related yet distinct social normative influences on adolescent drinking. Descriptive norms refer to perceptions of how much others engage in a particular behavior whereas injunctive norms refer to the extent to which others approve of a particular behavior. Theoretical formulations suggest that whether descriptive or injunctive norms guide drinking behavior depends on cognitive factors related to executive functioning. Cognitive capacities, specifically inhibitory control and preplanning, were tested as moderators of the association between social norms and alcohol use using a longitudinal design and community sample of adolescents.

Method—This longitudinal study included 387 adolescents and three annual waves of data. Behavioral tasks assessed inhibitory control (Stop Signal Task) and preplanning (Tower of London) and social norms and drinking were assessed using self-report measures.

Results—Significant interactions were found for descriptive and injunctive norms with preplanning and descriptive norms with inhibitory control. As hypothesized, descriptive norms were stronger prospective predictors of alcohol use at low levels of cognitive preplanning whereas injunctive norms were stronger prospective predictors at high levels of cognitive preplanning. Descriptive norms prospectively predicted alcohol use at high, but not at low levels of inhibitory control.

Conclusion—These findings highlight the complexity of normative influences and suggest that descriptive and injunctive norms have differential effects on future drinking for individuals with different cognitive capacities.

Introduction

Adolescence is the developmental period most strongly associated with the initiation and escalation of alcohol use (Johnston et al., 2014). A multitude of adverse consequences are associated with adolescent drinking, including decreased academic performance (Thombs et al., 2009), heavy alcohol use in later adolescence and young adulthood (Hawkins et al., 1997), risky sexual behavior (Bonomo et al., 2001), and illicit drug use (Hill et al., 2000). The widespread use of alcohol and the potential consequences of adolescent drinking point to the need to better understand factors that lead to the initiation and escalation of alcohol

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use during this period. This study examined the influence of social norms on the early stages of adolescent alcohol use, and potential moderators of this association using a longitudinal design.

Social norms represent rules and standards that guide or constrain behavior (Cialdini and Trost, 1998) and they are considered important influences of adolescent alcohol use (Graham et al., 1991). Evidence suggests a robust association between social norms and adolescent drinking (for review see Borsari and Carey, 2001). Social norms not only impact adolescents' decision to drink and drink heavily (Larimer et al., 2004; Perkins, 2002), but also their decisions to reduce their own drinking (LaBrie et al., 2013). Longitudinal studies (Larimer et al., 2004; Voogt et al., 2013) have found associations between social norms and drinking even after controlling for prior levels of alcohol consumption, suggesting that norms are not simply a proxy for an individuals' level of drinking.

The literature documents two distinct yet related social normative influences, descriptive and injunctive norms. Descriptive norms refer to the perceptions of how much other individuals engage in a certain behavior. They provide information regarding the extent to which people engage in a behavior in a particular context (Cialdini and Trost, 1998) and provide quick and efficient means to engage in what is perceived to be appropriate behavior (Jacobson et al., 2011). Hence, descriptive norms allow people to act quickly and without much thought, leading to the prediction that conformity to descriptive norms is facilitated by lack of reflection.

In contrast to descriptive norms, which provide information regarding what behaviors people engage in, injunctive norms provide information about behaviors people *ought* to engage in (Cialdini et al., 1990). Injunctive norms influence behavior through fulfilling individuals' needs to build and maintain relationships with others. If you are invested in a particular relationship, such as a peer relationship, then you are likely to conform to what you perceive will be approved of by your peer. Therefore, conforming to an injunctive norm emanates from a desire to gain or maintain social approval (Jacobson et al., 2011). Whether injunctive norms influence behavior depends on an individual considering what constitutes socially approved behavior (Kredentser et al., 2012). Thus, in contrast to conformity to descriptive norms, which is thought to be facilitated by quick decision making and lack of reflection, conformity to injunctive norms is thought to be facilitated by deliberation and reflection.

Although there is ample evidence that both descriptive and injunctive norms play an important role in the etiology of adolescent alcohol use (Borsari and Carey, 2001; Elek et al., 2006), theoretical models suggest that individual differences that effect decision making may influence whether descriptive or injunctive norms will be invoked to guide behavior (Cialdini and Trost, 1998; Jacobson et al., 2011). This suggests the possibility of moderators of the impact of each norm on drinking. Considering for whom or when different social norms impact drinking has received little attention in the literature, and this is a particularly important question given the widespread use of normative feedback interventions, and the mixed efficacy of these interventions (Wechsler et al., 2013). That is, if different moderators

influence whether descriptive and injunctive norms impact future drinking behaviors, then this information might enhance the effectiveness of normative feedback interventions.

To date, prior research has identified a number of moderators that influence the strength of relationship between descriptive and injunctive norms and alcohol use (Dieterich et al., 2013; Elek et al., 2006; Larimer, et al., 2004; Litt et al., 2012; Neighbors et al., 2007; 2010). These studies, although informative, have not examined potential unique moderating mechanisms of descriptive versus injunctive norms. Elucidating such unique mechanisms remains a gap in the literature, and is the focus of the current study.

Despite their strong conceptual link to social norms (Cialdini, 2003), no studies to date have assessed cognitive capacities related to executive functioning as potential moderators of both descriptive and injunctive norms in a longitudinal framework. Several dual-process models of addictive behaviors posit that whether alcohol-related cognitions, such as alcohol expectancies and implicit alcohol associations, influence decisions to drink depends on executive functions related to self-regulation. Several studies have supported this moderating role of executive self-regulation (Jonker, Ostafin, Glashouwer, van Hemel-Ruiter, & de Jong, 2014; Peeters et al., 2013; van Hemel-Ruiter, de Jong, Ostafin, & Wiers, 2015). Similar to work on dual-process models, social norms researchers have forwarded the idea that two cognitive factors closely tied to executive functions, cognitive reflection and inhibitory control (IC), may influence whether a descriptive or injunctive norm will guide behavior (Jacobson et al., 2011; Kredentser et al., 2012). Cialdini (2003) suggested that injunctive norms demand more cognitive capacity than descriptive norms because injunctive norms require individuals to reflect and deliberate on whether a behavior is socially acceptable or not. A study manipulating college students' cognitive capacities to reflect on normative messages supported this idea. Kredentser et al. (2012) found that injunctive norms were stronger predictors of intentions to participate in a fictitious college health program than descriptive norms when restrictions were not placed on participants' ability to reflect on the normative message presented. Conversely, descriptive norms were stronger predictors of intentions to participate in the fictitious program when participants' abilities to reflect on the normative message were restricted. These findings suggest that individuals with greater cognitive capacities to reflect and deliberate should be more likely to rely on injunctive messages to guide their drinking behaviors.

IC is another cognitive variable strongly linked to executive functioning that represents the ability to refrain from engaging in a particular behavior for a less dominant, yet more desirable, behavior (Logan et al., 1997). Jacobson et al. (2011) argued that people with less self-regulatory capacity (low IC) would be more likely to use descriptive norms than injunctive norms because they would rely on quick automatic information processing that does not involve deliberation. In support of this argument, descriptive norms have been shown to have stronger influences on behavior than injunctive norms among individuals with lower IC (Jacobson et al., 2011). Adolescents with low IC are expected to rely on descriptive norms to guide behavior when drinking because descriptive norms require fewer cognitive resources than injunctive norms. Thus, individual differences in cognitive reflection and IC should influence which social norm will guide adolescent alcohol use.

The current study tested cognitive reflection and IC as moderators of the association between descriptive and injunctive norms and adolescent alcohol use. Four hypotheses were tested. (1) Injunctive norms were hypothesized to be a stronger predictor of alcohol use at high compared to low levels of cognitive reflection, and (2) descriptive norms were hypothesized to be stronger predictors of alcohol use at low compared to high levels of cognitive reflection. (3) Descriptive norms were hypothesized to be a stronger predictor of alcohol use at low levels of IC, and (4) injunctive norms were hypothesized to be stronger predictors of drinking behaviors at high compared to low levels of IC. Gender was also tested as a moderator in the current study because there is some evidence that social norms may operate differently for males and females (Elek et al., 2006; Larimer, et al., 2004). However, no a priori hypotheses were made because of prior mixed support for gender moderation (Larimer et al., 2004; Voogt et al., 2013).

Materials and Methods

Participants

The community sample was drawn from a longitudinal study examining risk factors associated with the initiation and escalation of early adolescent substance use, and included 387 families (1 child, 1 caregiver). Random-digit dialing (RDD) procedures were utilized to recruit the 387 families. RDD helps to provide a representative sample of a geographic region through using both listed and unlisted telephone numbers. Erie County is especially well suited for RDD because 98.5% of households have a landline. The sample was evenly split on gender (N=205 females, 55%), and included non-Hispanic Caucasian (83.1%), African American (9.1%), Hispanic (2.1%), and Asian (1.0), as well as youth of mixed ethnicity (4.7%). Median family income was $70,000 and ranged from $1,500 to $500,000, and 6.2% of the families received public income assistance. The majority of parents completed college or graduate/professional school (58.2%). These demographic characteristics are similar to those of Erie County from whence the sample came (see Trucco & Colder, 2014 for more complete details).

Data for this study was taken from Waves two (W2), three (W3), and four (W4) of the longitudinal project because one of the moderating variables of interest (cognitive preplanning) was not assessed at Wave one (W1). The sample at W2 (M=12.6), W3 (M=13.6) and W4 (M=15.08) included 373, 370, and 363 adolescents, respectively.

Overall attrition across W2 through W4 was 6.2%. Chi-sqaure and ANOVA tests were conducted to assess potential differential attrition. No significant differences (ps >.05) between targets who completed all interviews and those with missing data were found for race, gender, age, descriptive norms, injunctive norms, IC, lifetime alcohol use, parental education, parental martial status, or family income. The low attrition rate and lack of differences suggests that missing data did not have a substantial impact on the findings of the current study.

Procedures

For W2 and W3, interviews were conducted in university research offices. Before the interviews began, parents gave consent and adolescents gave assent. Parents and adolescents were interviewed in separate rooms to enhance privacy. Data collection included both laboratory tasks as well as questionnaires assessing a wide range of family, peer, and individual level risk and protective factors for adolescent drug use. Of interest to the current study are the tasks evaluating cognitive reflection (preplanning as assessed by the Tower of London) and IC (as assessed with the Stop Signal Task) and questionnaire items assessing social norms and alcohol use. Interviews took approximately 2.5–3 hours for each assessment. Families were compensated $85 and $125 dollars for W2 and W3 respectively and adolescents were given a small prize between $5 and $15 at each wave.

W4 consisted of a brief telephone based audio-CASI survey of substance use that took 10–15 minutes to complete. Parents provided consent over the phone and were given a phone number and PIN for their adolescent to use. Assent from the adolescent was obtained at the initiation of the audio-CASI survey.

Measures

Alcohol use—The National Youth Survey (NYS; Elliot and Huizinga, 1983) was used to assess past year alcohol use at W2–W4. Adolescents reported the frequency of alcohol use without their parents' permission. They also reported typical quantity of consumption on drinking days. Quantity and frequency were assessed at all three waves. These items were combined (quantity x frequency) to create a past year alcohol use variable. Several studies support the validity of self-reports of adolescent substance use (Del Boca and Darkes, 2003; Smith et al., 1995).

Given the ages of our community sample, rates and levels of use are expected to be low, reflecting the early stages of alcohol use. Indeed, the sample average number of drinks suggests that our participants were in the experimentation phase of alcohol use (see Table 1). Rates of drinking in the past year without parental permission were 10.5%, 21.8%, and 29.8% at W2–W4, respectively. In a large (N=1,420) similarly aged community sample, Sung et al. (2004) found rates of alcohol use in the past three months without parental permission to be 3.54%, 8.68% and 16.36% at 12, 13 and 15 years of age, respectively. These rates of alcohol use are comparable to those of our sample adjusting for differences in time frame (past year versus past three months).

Social Norms—Descriptive and injunctive norms were each assessed at W2 and W3 from three items from the Monitoring the Future Study (Johnston et al., 2003). The descriptive norms items asked participants to report how many of their friends drink occasionally, drink regularly, and consume more than five drinks during a single drinking occasion using six response options (1=none to 6=all). Injunctive norms were assessed with three items that asked participants to rate how their three close friends would feel about them doing each of the following behaviors drinking alcohol occasionally, drinking alcohol regularly, and having five or more drinks of alcohol at one time using a 5-point response scale (1=strongly

disapprove to 5=strongly approve). Cronbach's alpha for descriptive norms was .90 and .87 at W2 and W3, respectively, and .89 and .91 for injunctive norms.

Cognitive Preplanning—A computerized version of the Tower of London (TOL; Shallice, 1982) administered with Colorado Assessment Tests Tower of London software (Keller and Davis, 1998) was used to assess cognitive preplanning at W2 and W3. Cognitive preplanning refers to the process of reflecting on possible steps to achieve a goal directed behavior (Koppenol-Gonzalez et al., 2010). Participants used a computer mouse to rearrange beads on three pegs in the minimum number of moves to match a presented model of configured beads. The task consists of one demonstration trial, two practice trials, and then 10 test trials. Preplanning scores were calculated based on the time from item presentation until the completion of the first move (first move time; FMT). FMT is thought to represent the amount of time an individual spends reflecting on the possible moves they can make in order to solve the trial in the lowest number of moves (Albert and Steinberg, 2011; Berg and Byrd, 2002).

Preplanning is distinguishable from planning in that it refers to reflective processes occurring prior to the first move whereas planning encompasses reflection during any move on a TOL trial. FMT was positively correlated with total correct trials ($r=0.44$, $p<.0001$) and negatively correlated with total extra moves ($r=-0.29$, $p<.0001$). These correlations provide support for the validity of FMT by indicating that individuals who spend more time preplanning get more trials correct and make fewer extra moves (Berg & Byrd, 2002; Koppenol-Gonzalez et al., 2010).

Inhibitory Control—The Stop Signal Task (Logan et al., 1997) with adjusting procedure (Ashare & Hawk, 2012) was used to measure IC at W2 and W3. This task assesses participants' abilities to inhibit a dominant response through the use of two concurrent tasks, a go task and a stop task. During the go task participants are instructed to press the corresponding button (left button or right button) on a response box as quickly as they can based on a arrow displayed on the computer screen. The go task occurs on 75% of trials, thus making it the dominant response. The stop task involves the presentation of a tone (the stop signal), which indicates to participants that they should inhibit themselves from pressing the button for the corresponding arrow on the screen on that trial. The stop task occurs on 25% of go trials.

Participants first completed a practice go and a practice stop block to become oriented to the task, and then three experimental blocks (64 trials each). A stop signal reaction time (SSRT) was computed for each test block by subtracting the stop signal delay from mean go reaction time (Logan et al., 1997). The average across the blocks was computed to represent IC. Higher SSRT values indicate poor response inhibition. Prior work has supported the validity of this task through demonstrating an association between SSRT performance and brain regions associated with IC (Aron, and Poldrack, 2006) as well as with self-report measures of IC (Logan et al., 1997). Cronbach's Alpha for IC for the current sample computed using the SSRT from each of the three experimental blocks was .70 for W2 and .71 for W3.

Data Analytic Strategy

Hierarchical linear modeling (HLM) was used to assess cross-lagged associations between descriptive and injunctive norms and alcohol use using the PROC MIXED procedure in SAS 9.3 (SAS Institute Inc., 2011) with maximum likelihood estimation (ML). Repeated measures (level 1) were nested within participants (level 2), and cross-lagged models were arranged such that social norms at W2 predicted alcohol use at W3, controlling for W2 alcohol use, and social norms at W3 predicted alcohol use at W4, controlling for W3 alcohol use. The model included a random intercept. Age was included as level 1 time varying covariate and IC and cognitive preplanning were included as level 1 moderator variables. Gender was also included in the analyses as a level 2 moderator. To aid in the interpretation of the interaction effects and to reduce issues related to multicollinearity, all predictor variables and moderators were standardized at the sample level (Aiken and West, 1991; Hox, 2002).

To reduce the influence of extreme outliers, values that exceeded +3 standard deviations from the mean were recoded to 3 standard deviations from the mean (Tabachnick and Fidell, 2007). This resulted in 1% of IC and 3% of preplanning scores being recoded.

Results

Table 1 presents means, standard deviations, zero-order correlations, univariate skewness and kurtosis coefficients for the predictor, moderator and statistical control variables. As shown in Table 1, the dependent variables were not normally distributed, and therefore these variables were transformed using the reciprocal transformation. The transformed variables had skew = 1.58 and kurtosis = 0.84. Analysis of residuals in our final model suggested that this power transformation did a reasonable job of meeting the assumptions of the ML estimation (e.g., distribution of residuals had skew of 1.13 and kurtosis of 1.92). We note that analysis of untransformed dependent variables yielded the same pattern of results, however, given the normality assumption of ML, we present the results with transformed variables. A nested model test (χ^2 (1, N=386)=119.31, p<.0001) supported the inclusion of a random intercept, which was retained in subsequent models. Initial test suggested no evidence for two- and three-way gender interaction terms (all ps > .05). Thus, moderation by gender was not considered further.

A first-order effects model was run to assess the effects of age, gender, prior drinking, preplanning, IC, descriptive norms and injunctive norms on subsequent alcohol consumption. Age, prior drinking, descriptive norms and injunctive norms were all statistically significant predictors of subsequent alcohol use (see Table 2).

Next, two-way interaction terms were added to the model. A *Pseudo-R^2* value of 3.54% indicated that model fit improved when the interaction terms were added to the model. As seen in Table 2, results for the full model with two-way interactions supported interactions between descriptive norms and preplanning, injunctive norms and preplanning, and

descriptive norms and IC[1]. Statistically significant interactions were probed to better understand the nature of the interaction effects (Aiken and West, 1991).

Preplanning as a Moderator

The distribution of FMT was non-normal so values corresponding to the 85th (high) and 15th (low) percentile of FMT were used to probe the interactions of descriptive and injunctive norms with preplanning. Analyses of simple slopes indicated that descriptive norms were stronger predictors of subsequent alcohol consumption at low (β=0.11, p<.0001) compared to high (β=0.04, p=.02) levels of preplanning. Conversely, analyses of simple slopes for injunctive norms indicated that injunctive norms were stronger predictors of future alcohol consumption at high (β=0.11, p<.0001) compared to low (β=0.05, p=.0007) levels of preplanning. These simple slopes are plotted in Figures 1 and 2, and support the first set of hypotheses. The extent to which a descriptive or injunctive norm influences future drinking behaviors varies as a function of an adolescents' cognitive preplanning capacities.

IC as a Moderator

IC was approximately normally distributed (see Table 1), and therefore, the significant interaction of descriptive norms with IC was probed at high (+1 SD) and low (−1 SD) levels of IC. Contrary to our hypotheses, simple slopes indicated that descriptive norms were stronger prospective predictors of alcohol consumption at high (low SSRT; β=0.13, p<.0001) compared to low (high SSRT; β=0.03, p=.15) levels of IC.

Discussion

Although descriptive and injunctive social norms are strong predictors of adolescent alcohol use (Perkins, 2002), mechanisms that uniquely impact these normative influences on drinking have not been identified in the literature. Drawing on theoretical conceptualizations from social psychology, this study considered cognitive preplanning and IC as moderating mechanisms of descriptive and injunctive norms using a longitudinal design. Findings suggest that individual variation in these cognitive variables differentially impact the strength of association between descriptive and injunctive norms on future alcohol use in early to middle adolescence.

With respect to cognitive reflection, the perception that drinking was normative among peers (descriptive norms) more strongly predicted increases in drinking for individuals with low, compared to high, levels of cognitive preplanning. Individuals low in cognitive preplanning are expected to act quickly and without much thought, and our results suggest that low preplanners rely on descriptive norms to guide their drinking behavior. These findings support the argument that descriptive norms provide a quick and efficient heuristic to engage in what is perceived to be normative behavior (Jacobson et al., 2011). In contrast, preplanning was found to operate in the opposite direction with injunctive norms. High perceived approval of alcohol use more strongly predicted increases in alcohol use for adolescents high in cognitive preplanning compared to individuals low in in cognitive

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[1]The pattern of results was the same when IC and preplanning were run in separate models.

preplanning. Prior work has shown that injunctive norms have a stronger impact on future behavior when individuals reflect on a normative message (Kredentser et al., 2012). This suggests that individuals characterized by high levels of cognitive preplanning may be prone to conform to injunctive norms because they have the capacity to reflect on what friends deem acceptable drinking behavior. Overall, our moderational findings involving cognitive preplanning are in line with the argument proposed by Cialdini (2003) that different cognitive capacities support engagement of descriptive versus injunctive norm.

With regard to IC, results suggested that descriptive norms predicted increases in alcohol use for adolescents who had high levels of IC. This pattern was contrary to our hypotheses. It is unclear why IC operated opposite our prediction, and it may be useful to consider the broader context of adolescent development in understanding this pattern. During adolescence an increasing amount of time is spent outside of the home and in the context of peers (Barnes et al., 2007), and acceptance from peers is a dominant social goal (Ojanen et al., 2005). Conforming to what is perceived as normative and minimizing behavior that deviates from the norm increases acceptance, but also likely requires IC. Hence, high levels of IC may enable an adolescent to titrate his or her drinking to be in line with how much they perceive their peers to be drinking.

We also hypothesized that IC would moderate the association between injunctive norms and alcohol use, but this was not supported. It is unclear what might account for this null effect, but the results of the current study suggest that cognitive preplanning may be a more important moderator of injunctive norms than IC. One possible reason that IC operated opposite our prediction is that we conceptualized and assessed IC as a trait-like variable. In contrast, the work on which our hypotheses were based utilized experimental designs and manipulated state IC (Jacobson et al., 2011). State IC is conceptualized as IC that varies across situations and time (Muraven and Baumeiseter, 2000) and trait IC is viewed as being relatively stable across situations and time (Rothbart et al., 2003). It is possible that state and trait IC may be differentially related to whether an individual conforms to a descriptive or injunctive norm. Future work utilizing both experimental manipulations and assessments of state based IC would help elucidate whether moderational findings depend on state or trait IC.

Although not all of our findings conformed to our predictions, the current study adds to the small body of work demonstrating the moderating role of cognitive capacities on the impact of alcohol-related cognitions on adolescent alcohol use (Peeters et al., 2013; van Hemel-Ruiter et al., 2015). Additionally, the current study highlights the complexity of descriptive and injunctive norms and points to the need for future work to identify unique moderating mechanisms of these normative influences.

Limitations

Although this study had several strengths, including testing theoretically derived unique moderating effects for descriptive and injunctive norms, a longitudinal design, and laboratory assessments of the proposed cognitive moderating variables, it is important to note several limitations. There is a large body of work demonstrating that the reference group included in measures of descriptive and injunctive norms influences the strength of

the relation of these normative influences with drinking behaviors (Cho, 2006). In the current study, descriptive and injunctive norms were assessed using friends and close friends as referents. Our findings may not generalize to norms keyed to other referent groups (e.g., youth your age and gender). Future work would benefit from extending our work to a variety of referent groups to see the extent of generalization of our mode rational models.

A second limitation of the current study was the inability to test the interactions of interest using multiple methods. While the TOL and Stop Signal Task are reliable and valid measures, the utilization of a multi-method designs would have helped strengthen the current findings. Lastly, current findings should not be generalized outside early to middle adolescence. Peers are a particularly important social influence on behavior during this period (Elek et al., 2006; Teunissen et al., 2012), and it is not clear if our findings would generalize to later adolescence or young adulthood when alcohol use escalates to heavy more problematic levels. Future work would benefit from extending the current study to other developmental periods such as college-aged individuals to test if our mode rational findings are replicated at older ages.

Despite these limitations, the current study makes an important contribution to the literature by elucidating mechanisms that uniquely impact the strength of descriptive and injunctive norms on future drinking behaviors. Study findings highlight the need of future work that looks to clarify the mechanisms through which social norms impact adolescent drinking behaviors. This work may be central to improving normative feedback interventions whose efficacy has not been consistently demonstrated. Better understanding for whom and when different social norms impact drinking behaviors may lead to the improvement of social norms interventions.

Acknowledgments

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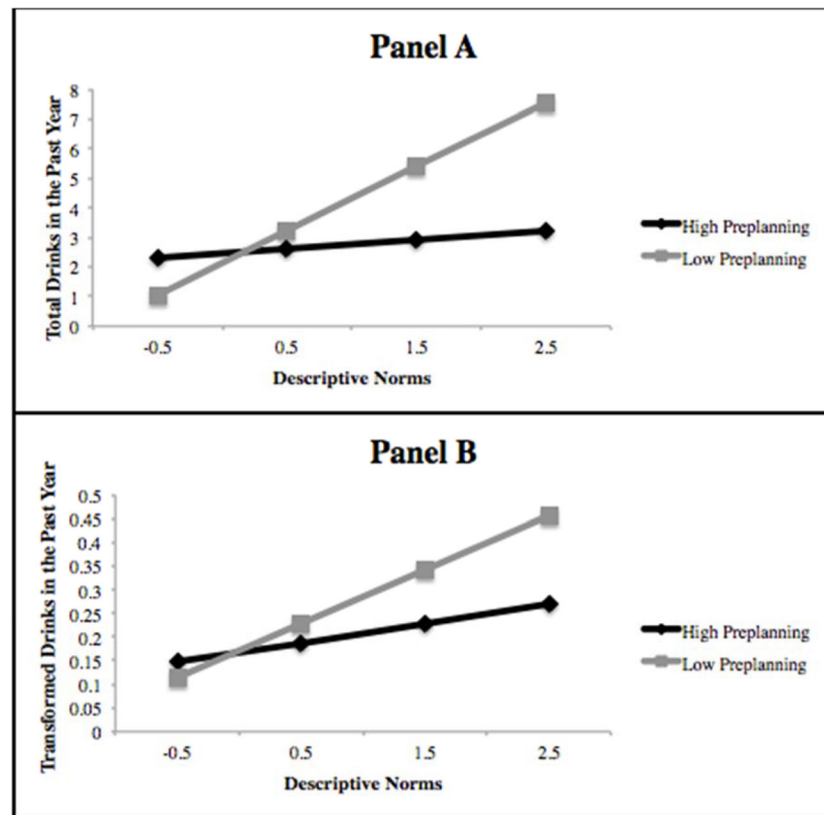
Figure 1.
Simple slopes for descriptive norms at high and low cognitive preplanning
Note. Panel A depicts simple slopes for the non-transformed drinks in the past year and Panel B depicts simple slopes for the reciprocally transformed drinks in the past year variable. The value of −0.5 corresponds to none and the value of 2.5 corresponds with the midpoint of most and all on the descriptive norms scale.
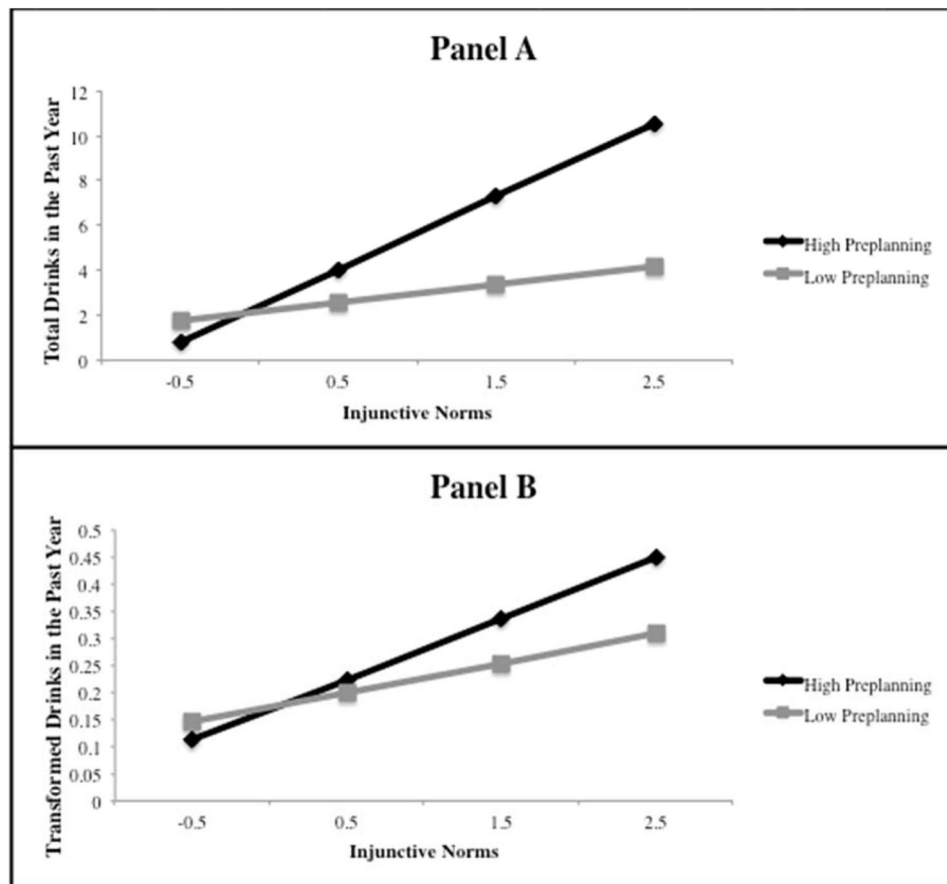
Figure 2.
Simple slopes for injunctive norms at high and low cognitive preplanning
Note. Panel A depicts simple slopes for the non-transformed drinks in the past year and Panel B depicts simple slopes for the reciprocally transformed drinks in the past year variable. The value of −0.5 corresponds to strongly disapprove and the value of 2.5 corresponds with the midpoint of approve and strongly approve on the injunctive norms scale.

Figure 3.
Simple slopes for descriptive norms at high and low inhibitory control
Note. Panel A depicts simple slopes for the non-transformed drinks in the past year and
Panel B depicts simple slopes for the reciprocally transformed drinks in the past year
variable. The value of −0.5 corresponds to none and the value of 2.5 corresponds with the
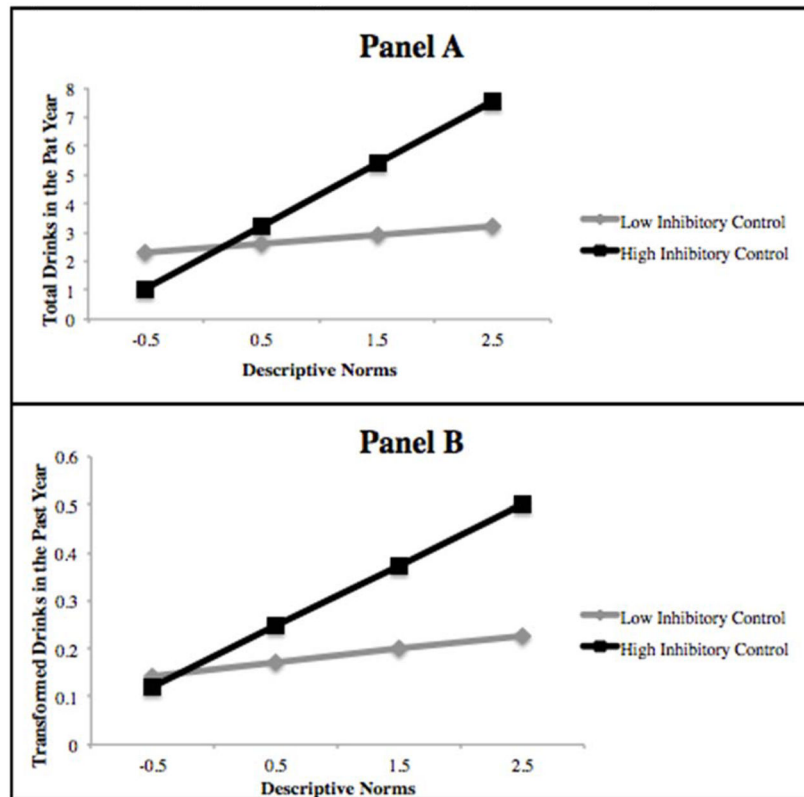midpoint of most and all on the descriptive norms scale.

Table 1

Bivariate Correlations among predictor variables and their means, standard deviations, skew, and kurtosis

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Wave 2 Alcohol Use	-												
2. Wave 3 Alcohol Use	.41	-											
3. Wave 4 Alcohol Use	.38	.34	-										
4. Wave 2 Descriptive Norms	.39	.26	.35	-									
5. Wave 3 Descriptive Norms	.32	.41	.49	.57	-								
6. Wave 2 Injunctive Norms	.37	.30	.39	.56	.49	-							
7. Wave 3 Injunctive Norms	.31	.38	.51	.04	.65	.57	-						
8. Wave 2 Preplanning	-.01	-.02	.05	-.04	-.02	-.05	-.03	-					
9. Wave 3 Preplanning	-.03	.03	.04	-.04	.05	-.03	.00	.48	-				
10. Wave 2 SSRT	-.02	-.07	-.06	-.02	-.05	.01	-.07	-.09	-.10	-			
11. Wave 3 SSRT	.11	-.02	.01	.09	.02	.04	-.04	-.11	-.11	.49	-		
12. Age	.12	.13	.22	.13	.26	.17	.25	.01	.12	-.09	-.10	-	
13. Gender	-.03	.07	.02	-.01	.02	-.04	-.08	-.03	-.02	-.12	-.10	.04	-
M	0.46	0.92	3.84	1.33	1.54	1.41	1.62	5.14	5.41	158.06	144.06	12.09	0.55
SD	3.10	3.69	11.42	0.76	0.86	0.74	0.85	2.14	2.41	53.66	48.35	0.59	0.50
Skew	8.75	5.53	4.04	3.32	1.84	2.04	1.43	1.45	1.43	1.20	0.74	-0.16	-0.20
Kurtosis	80.53	31.64	16.96	12.31	2.96	3.85	1.33	1.94	2.07	3.65	2.11	-1.12	-1.97

Note: Values with an absolute value correlation coefficient of $r=.11$ are significant at $p<.05$, $r=.14$ at $p<.01$, and $r=.17$ at $p<.001$

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Table 2

Regression results (unstandardized regression coefficients)

	Model 1			Model 2		
	B	S.E.	t value	*B*	S.E.	t value
Intercept	0.17	0.01	16.04***	0.17	0.01	16.19***
Age	0.03	0.01	3.11**	0.03	0.01	3.12**
Gender	0.01	0.01	0.88	0.01	0.01	0.74
Prior Alcohol Use	0.05	0.01	4.24***	0.05	0.01	4.22***
SSRT	−0.01	0.01	−0.49	−0.01	0.01	−1.25
First Move Time	0.00	0.01	−0.01	0.00	0.00	−0.24
Descriptive Norms	0.08	0.01	5.42***	0.08	0.01	5.44***
Injunctive Norms	0.08	0.01	6.26***	0.08	0.01	6.38***
Descriptive Norms X SSRT				−0.05	0.01	−3.80***
Injunctive Norms X SSRT				0.01	0.01	1.09
Descriptive Norms X First Move Time				−0.04	0.01	−3.14**
Injunctive Norms X First Move Time				0.03	0.01	2.64**

Note: Model 1 is the first-order effects model and Model 2 is the full model including interaction terms.

*
p<.05,

**
p<.01,

***
p<.001. SSRT=Stop Signal Reaction Time