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Being Controlled by Normative Influences: Self-Determination as a Moderator of a Normative Feedback Alcohol Intervention

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Abstract

The objectives of this research were to evaluate the efficacy of computer-delivered personalized normative feedback among heavy drinking college students and to evaluate controlled orientation as a moderator of intervention efficacy. Participants (N = 217) included primarily freshman and sophomore, heavy drinking students who were randomly assigned to receive or not to receive personalized normative feedback immediately following baseline assessment. Perceived norms, number of drinks per week, and alcohol-related problems were the main outcome measures. Controlled orientation was specified as a moderator. At 2-month follow-up, students who received normative feedback reported drinking fewer drinks per week than did students who did not receive feedback, and this reduction was mediated by changes in perceived norms. The intervention also reduced alcohol-related negative consequences among students who were higher in controlled orientation. These results provide further support for computer-delivered personalized normative feedback as an empirically supported brief intervention for heavy drinking college students, and they enhance the understanding of why and for whom normative feedback is effective.

Keywords

social norms; feedback; intervention; self; determination; alcohol

Social factors are the strongest and most consistent predictors of heavy drinking among college students (Perkins, 2002). In particular, student drinking is strongly related to perceptions of peer drinking (Borsari & Carey, 2001). Norms-based prevention strategies have evolved within this context on the basis of the implicit assumption that if normative influence causes problem drinking, the same influence can reduce problem drinking. Previous work has found general support for this assumption, but investigations of why and for whom this approach is effective have been limited (Walters & Neighbors, 2005). The present research evaluates a brief

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normative feedback intervention and examines the extent to which the impact of normative feedback depends on students' levels of self-determination.

Personalized Normative Feedback Interventions

Previous work has indicated that students' drinking is linked to perceptions of other students' drinking, such that heavier drinking is associated with believing heavy drinking is the norm (Borsari & Carey, 2001). The rationale for normative feedback interventions comes from the consistent finding that students' perceptions of the "norm" are exaggerated (Baer & Carney, 1993; Baer, Stacy, & Larimer, 1991; Borsari & Carey, 2003; Lewis & Neighbors, 2004; Perkins & Berkowitz, 1986). Norms-based interventions are designed to correct exaggerations by providing students with accurate norms. Social norms marketing attempts to do this by providing students with accurate norms in mass-marketing campaigns. Messages such as "75% of University of X students have four or fewer drinks when they party" are widely disseminated by using posters, newspaper ads, et cetera. Evidence for effectiveness of this approach has been mixed, suggesting social norms marketing can reduce drinking (e.g., Haines & Spear, 1996; Mattern & Neighbors, 2004) but that it does not always work (e.g., Clapp, Lange, Russell, Shillington, & Voas, 2003; Wechsler et al., 2003). A tentative conclusion is that this marketing strategy is effective for reducing drinking to the extent that it effectively reduces normative misperceptions (Mattern & Neighbors, 2004).

Personalized normative feedback as an intervention strategy shares its theoretical rationale with social norms marketing, but it offers distinct advantages that increase the likelihood that implementation will correct normative misperceptions and reduce drinking. Because social marketing campaigns are delivered by using mass media, it is not clear how many students are actually exposed to the messages. Many students may never read the campus newspaper, may never see the social norms ads placed there, and may never look at social norms posters as they walk by them. Personalized normative feedback is presented individually rather than via mass marketing, thus, at the very least, students are exposed to the interventions. In addition, when students view social norms marketing ads, it is not clear whether they compare the advertised norms with either their own behavior or their own prior perception of typical behavior. In contrast, whereas social norms marketing ads provide only information about other students' drinking (actual norm), personalized normative feedback interventions provide information regarding one's own drinking, one's perceptions of other students' drinking, and other students' actual drinking.

By explicitly providing students information about their own behavior, perceptions of typical behavior (*perceived norm*), and actual student behavior (*actual norm*), personalized feedback highlights two important discrepancies. The first focuses on a comparison of the perceived norm and the actual norm. Because most students think other students drink more than other students actually do, this discrepancy has been referred to as *pluralistic ignorance* (Prentice & Miller, 1993; Suls & Green, 2003). Exposing this discrepancy reveals heavy drinking is not as prevalent or "normal" as students think it is. The second discrepancy focuses on a comparison between other students' actual drinking and one's own drinking. This comparison functions as a relatively direct social influence manipulation, not unlike classic social influence paradigms (e.g., Asch, 1951; Deutsch & Gerrard, 1955; Sherif, 1936).

The efficacy of personalized normative feedback in reducing drinking among heavy drinking students has been previously demonstrated for up to 6 months (Neighbors, Larimer, & Lewis, 2004). Consistent with the theoretical foundation behind the approach, changes in drinking as a function of normative feedback were mediated by changes in perceived norms. In addition, at 3-month follow-up students who drank primarily for social reasons were more influenced by normative feedback than were students whose drinking was less motivated by social factors.

The latter finding suggests individual differences in self-determination, as assessed by being more or less controlled by extrinsic factors, may be important for understanding why and for whom normative feedback is effective. Thus, the present research was designed to extend previous work by differentiating for whom normative feedback is more effective.

Controlled Orientation

Self-determination theory suggests that individual differences, to the extent to which individuals are more or less autonomous or controlled, emerge over time as a function of exposure to autonomy-supportive versus controlled environments (Deci & Ryan, 1985a, 2002). As a result of prolonged exposure to environments that emphasize submission to authority, living up to others' expectations, inadequate opportunity for self-expression, and pressure to engage in specific behaviors, individuals presumably develop a more controlled motivational orientation (Williams & Deci, 1998; Williams, Deci, & Ryan, 1995). The *controlled orientation* refers to a general tendency to perceive pressure from one's environment and to experience a lack of true choice in one's behavior (Deci & Ryan, 1985a, 1985b).

A number of studies suggest controlled orientation is strongly associated with sensitivity to social expectations and pressures (e.g., social norms). The controlled orientation is positively associated with public *self-consciousness* (viewing oneself as a social object) and *self-monitoring* (regulating one's behaviors as a function of social context; Deci & Ryan, 1985b; Zuckerman, Gioioso, & Tellini, 1988). Research has also suggested that people higher in controlled orientation are more likely to engage in impression management strategies aimed at bolstering self-image (Lewis & Neighbors, 2005). College students who are more controlled are also more likely to drink for social reasons (Knee & Neighbors, 2002; Neighbors, Larimer, Geisner, & Knee, 2004). The relationship between controlled orientation and drinking for social reasons may be due in part to differential exposure to heavier drinking situations or to the tendency to associate with heavier drinking peers, although no research has yet directly examined this issue. Evidence does suggest more controlled students are more likely to drink as a function of perceived social pressure (Knee & Neighbors, 2002). In addition, the link between heavier drinking and the perceived positive effects of alcohol (e.g., social lubrication) is stronger among more controlled individuals (Neighbors, Walker, & Larimer, 2003).

Summary and Hypotheses

The brevity, immediacy, ease of implementation, and low cost of computer-delivered personalized normative feedback underscores the potential value of this intervention approach. However, to date, only one published study has evaluated the efficacy of personalized normative feedback as a stand-alone intervention for heavy drinking college students (Neighbors, Larimer, & Lewis, 2004). The primary aim of this research was to replicate and extend those findings. Accordingly, we posed three hypotheses. First, we expected that normative feedback would reduce perceived norms, weekly drinking, and alcohol-related negative consequences. Second, we expected that the effect of normative feedback on drinking and alcohol-related consequences would be due to its impact on perceived norms. Moreover, changes in perceived norms would mediate the influence of normative feedback on drinking and related consequences. Third and finally, because controlled orientation is associated with social influences on drinking, we expected that controlled orientation would moderate the effects of normative feedback on perceived norms, alcohol consumption, and alcohol-related problems, such that the intervention would be more effective among more controlled students.

Method

Participants

Participants were screened from a sample of 950 students (51.26% men, 48.74% women) enrolled in introductory and lower division psychology courses at a medium-sized Midwestern university. Screening for this study was administered in a voluntary mass-testing session. Students reported peak drinking in the previous month, potential interest in the study, and contact information if interested. Eligibility criteria consisted of reporting at least one heavy drinking episode (four and five drinks at one sitting for women and men, respectively) in the previous month. Criteria similar to this have been used in previous intervention studies to identify high-risk samples (e.g., Marlatt et al., 1998; Neighbors, Larimer, & Lewis, 2004). Of the 950 students, 419 (44.10%) met screening criteria and provided contact information. Attempts were made to recruit each of these participants, with 214 (51%) successfully recruited. Those not successfully recruited declined, were scheduled and did not show, or could not be contacted despite repeated attempts.

Participants included 214 (95 men, 119 women) heavy drinking students at baseline. The average age of participants was 19.67 years (*SD* = 2.02). Ethnicity was 98.04% Caucasian and 1.96% other. Students received extra course credit for participation. Participants included 59.80% freshman, 25.00% sophomores, 9.31% juniors, and 5.88% seniors.

Multiple attempts were made to contact participants for follow-up. Despite these efforts, a portion of participants were unable to be scheduled or were scheduled and did not show after repeated reminders and attempts to reschedule. Retention efforts ultimately resulted in 185 (86.45%) participants completing follow-up.

Procedure

The procedure included baseline assessment, normative feedback intervention, and follow-up assessment. Baseline assessments were conducted in February and March, approximately 3–4 weeks after the screening in late January. Follow-up assessments were scheduled approximately 2 months postbaseline (April and May) and were concluded before final exam week. Participants completed all assessments in private, on computers, in a laboratory setting. After students provided informed consent, they completed baseline assessment. Baseline assessment included measures of perceived drinking norms, drinking behavior, as well as controlled orientation. Participants were randomly assigned to the intervention (*n* = 108; 58 women and 50 men) or assessment-only control (*n* = 106; 61 women and 45 men). After completing baseline assessment, participants in the intervention group received personalized normative feedback delivered via computer. All participants were thanked for their participation and were informed that they would be contacted at a later date to schedule an appointment for follow-up assessment. Procedures for follow-up assessment were similar, with the exception that no feedback was provided. Upon completion of follow-up assessment, participants were provided with a written debriefing that explained the purpose and design of the study. Participants were invited to ask any questions they might have had about the study and were thanked for their participation. All procedures were reviewed and approved by the University Institutional Review Board.

Participants in the intervention condition received personalized normative feedback immediately after completing baseline assessment. They viewed the feedback on the computer screen for approximately 1 to 2 min while it was being printed. Participants were given the printout to take with them.

Actual campus drinking norms were based on the screening questionnaire. Personalized normative feedback was modeled on the normative feedback component of the Brief Alcohol

Screening and Intervention for College Students (BASICS); (Dimeff, Baer, Kivlahan, & Marlatt, 1999) and was identical in format to that used in Neighbors, Larimer, and Lewis (2004). Normative feedback included a summary of the student's perceived drinking norms for quantity and frequency of alcohol consumption compared with actual quantity and frequency norms and a summary of the student's reported consumption compared with actual norms. Each participant's percentile ranking, which was based on typical number of drinks per week and that compared his or her drinking with other college students' drinking, was also included.

Measures

Perceived norms—The Drinking Norms Rating Form (Baer et al., 1991) was used to assess perceived norms. Participants were asked to estimate drinking practices for the typical college student, such as the quantity of alcohol consumed each day of the week by a typical student. Participants were also asked to estimate the number of drinks consumed by the typical student on a given occasion (e.g., "How many drinks on average do you think a typical student at your college consumes on a given occasion?"). This measure has previously demonstrated good convergent validity with measures of drinking (Baer et al., 1991; Borsari & Carey, 2000; Neighbors, Larimer, & Lewis, 2004).

Alcohol consumption—We measured alcohol consumption with the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985). With this measure, participants fill in the average number of standard drinks consumed as well as the time period of consumption for each day of the week over the previous 3 months. Final scores represent the average number of drinks consumed each week over the previous 3 months. Weekly drinking has previously been shown to be a reliable index of alcohol-related problems among college students relative to other drinking indices (Borsari, Neal, Collins, & Carey, 2001).

Alcohol-related problems—A modified version of the Rutgers Alcohol Problems Index (RAPI; White & Labouvie, 1989) was used to assess alcohol-related problems. Although this measure was originally developed for adolescents 14–18 years of age, it has been used extensively in the college student drinking literature and has demonstrated good reliability and convergent validity (e.g., Borsari & Carey, 2000; Collins, Carey, & Sliwinski, 2002; Larimer et al., 2001; Marlatt et al., 1998; Neighbors, Larimer, Geisner, & Knee, 2004). The original RAPI assesses how often participants have experienced 23 alcohol-related consequences (e.g., "I was told by a friend or neighbor to stop or cut down drinking") over the previous 3 months. In this study the RAPI was modified to include two additional items (i.e., "I drove after having two drinks" and "I drove after having four drinks"). Item responses range from 0 (*never*) to 4 (*more than 10 times*). The RAPI was scored by taking the sum of all items with possible scores ranging from 0 to 100. Alphas in this study were .91 at baseline and .90 at follow-up.

Controlled orientation—The General Causality Orientation Scale (Deci & Ryan, 1985b; revised: Ryan, 1989) was used to assess controlled orientation. The revised form of the General Causality Orientation Scale is comprised of 17 scenarios. Three responses follow each scenario: an autonomous response, an impersonal response, and a controlled response. Participants rated the extent to which each response would be characteristic for him or for her. An example scenario is "Within your circle of friends, the one with whom you choose to spend the most time is _____." The controlled orientation is then measured by the response "The one who is the most popular of them." Participants rated each response on a scale ranging from 1 (*very unlikely*) to 7 (*very likely*). Internal consistency reliability (Cronbach's alpha) in this study was .83 for controlled orientation at baseline and .92 at follow-up.

Results

Analysis Strategy

Preliminary analyses were conducted to evaluate recruitment biases, randomization effectiveness, differential attrition, and gender differences. Primary analyses utilized a regression approach as outlined by Cohen, Cohen, West, & Aiken (2003). This approach was chosen because we were interested in evaluating drinking outcomes as a function of both categorical (i.e., treatment condition) and continuous (i.e., baseline outcomes and controlled orientation) variables. As an exception to this, we elected to use path analysis to evaluate the theoretical model (feedback reduces perceived norms which in turn reduces drinking), given its ability to provide an evaluation of overall model fit.

Primary analyses proceeded as follows: To evaluate whether normative feedback reduced alcohol consumption and alcohol-related problems (Hypothesis 1), we conducted two multiple regression analyses (one for each outcome) to examine the follow-up drinking variable as a function of treatment condition, controlling for the baseline drinking variable. Mediation analyses were conducted to evaluate whether effects of normative feedback on alcohol consumption and alcohol-related problems were due to reductions in perceived norms (Hypothesis 2). We also used path analysis to test the overall theoretical model (Hypotheses 1 and 2). Finally, three regression analyses (one for each outcome) were conducted to evaluate controlled orientation as a moderator of the effect of normative feedback on perceived norms, alcohol consumption, and alcohol-related consequences (Hypothesis 3).

Effect sizes are presented for all intervention and moderation effects. Cohen's *d* was calculated by using the following formula: $d=2t/\sqrt{df}$ (Rosenthal & Rosnow, 1991). By convention, effects in the .20 range are considered small, effects in the .50 range are considered medium, and effects in the .80 range are considered large (Cohen, 1992). In its simplest form, Cohen's *d* represents the standardized mean difference between two groups (e.g., a medium intervention effect [$d = .50$] represents one-half standard deviation difference in outcome between intervention and control group.)

Preliminary Analyses

Table 1 presents means and standard deviations of all study variables by treatment condition. In addition to drop out, in a few cases participants did not complete one or more measures at baseline or at follow-up. Minor discrepancies in degrees of freedom are due to these missing responses. Preliminary analyses were conducted to evaluate recruitment bias, randomization effectiveness, and differential attrition.

Fifty-one percent of eligible participants were successfully recruited. To evaluate recruitment bias, we examined mean differences between those successfully recruited and those who were not recruited on drinking variables assessed at screening (peak number of drinks in the previous month, drinking frequency, and typical number of drinks consumed on a given occasion). We also examined gender differences in recruitment. Drinking rates did not differ between participants and nonparticipants on peak number of drinks, frequency, or typical quantity (all *p*s were nonsignificant). However, women were significantly more likely to participate (66%) than were men (42%), $\chi^2(1, N = 405) = 22.90$, $p < .001$.

Effectiveness of randomization was evaluated by examining mean differences between the intervention and the control groups at baseline. At baseline, the intervention and the control groups did not differ with respect to perceived norms, alcohol consumption, alcohol-related problems, or controlled orientation. In addition, the gender distribution was not significantly

different between groups (all *p*s were nonsignificant). Thus, randomization appeared to be effective in creating equivalent groups at baseline.

To evaluate potential differences in attrition, we examined completion rate by treatment condition. We also examined mean differences between study completers and noncompleters on all baseline study variables as well as gender differences in attrition. Overall, 86% of participants completed the follow-up assessment. The completion rate did not differ significantly between intervention participants (91%) and control participants (82%) or between men (84%) and women (87%; all *p*s were nonsignificant). In addition, although participants who dropped out reported somewhat higher perceived norms at baseline, $t(212) = 2.01$, $p < .05$, they did not differ with respect to other participants in baseline alcohol consumption, alcohol-related negative consequences, or controlled orientation (all *p*s were nonsignificant).

Gender

Consistent with previous research (Lewis & Neighbors, 2004), men reported higher perceived norms and more alcohol consumption at the baseline and follow-up assessments (all *p*s < .001). Men also reported more alcohol-related negative consequences than did women at baseline ($p < .05$) and somewhat more alcohol-related consequences at follow-up ($p < .05$). In addition, men were more controlled than were women ($p < .01$). However, as in a previous evaluation that used the same intervention format (Neighbors, Larimer, & Lewis, 2004), the effects of normative feedback did not differ as a function of gender in any case, neither did the inclusion of gender as a covariate in any case change the results presented in the following paragraphs. Thus, all results are presented collapsed across gender.

Changes in Perceived Norms, Drinking, and Alcohol-Related Negative Consequences (Hypothesis 1)

Changes in perceived norms were examined by using multiple regression in which perceived norms at follow-up were regressed on intervention condition (dummy coded), controlling for baseline perceived norms. Consistent with expectations, perceived norms were reduced at follow-up for intervention participants relative to control participants, $t(1, 182) = -5.80$, $p < .0001$, $\beta = -.32$, $d = .86$. Figure 1 presents perceived norms means for the intervention and the control groups at baseline and at follow-up.

Changes in weekly drinking were examined by using multiple regression in which drinking at follow-up was regressed on intervention condition, controlling for drinking at baseline. Results for alcohol consumption revealed that students who received personalized feedback reduced their weekly consumption relative to the no feedback group, $t(181) = -2.05$, $p < .05$, $\beta = -.10$, $d = .30$. Figure 1 presents weekly drinking means for the intervention and the control groups at baseline and at follow-up.

Changes in alcohol-related negative consequences were similarly evaluated by using multiple regression, in which consequences at follow-up were regressed on intervention condition, controlling for consequences at baseline. Results revealed that students who received personalized feedback did not significantly reduce their alcohol-related negative consequences relative to the no feedback group, $t(181) = -1.53$, *ns*, $\beta = -.08$, $d = .23$.

Changes in Drinking as a Function of Changes in Perceived Norms (Hypothesis 2)

Mediation analyses were conducted to evaluate the theoretical foundation of social norms interventions, specifically to determine whether changes in drinking result from correction of normative misperceptions (i.e., changes in perceived norms). Mediation was evaluated by using criteria established by Baron and Kenny (1986) and that was expanded upon by MacKinnon

and Dwyer (1993). As demonstrated earlier, feedback reduced alcohol consumption and perceived norms. Additional evidence needed to demonstrate mediation in this case requires that changes in perceived norms are associated with changes in drinking, and the effect of feedback on drinking is no longer significant or is significantly reduced when changes in perceived norms are statistically controlled. Path analysis with AMOS 4.0 (Arbuckle & Wothke, 1999) was used to evaluate these requirements. Figure 2 provides the mediation model with standardized path coefficients. As is evident from the figure, changes in norms were significantly associated with changes in drinking. Most important, the effect of feedback on drinking ($\beta = -.09$, $p < .05$) was no longer significant when controlling for changes in perceived norms ($\beta = -.03$, $p = .49$). A Sobel (1982) test further indicated that this reduction was significant ($Z = -3.48$, $p < .001$). Moreover, the overall model provided an excellent fit with the observed data, $\chi^2(4, N = 214) = 3.48$, *ns* (NFI = 1.00, CFI = 1.00, RMSEA = .000), and provided strong support for mediation.

Controlled Orientation as a Moderator of Changes in Perceived Norms, Weekly Drinking, and Alcohol-Related Negative Consequences

Hierarchical regression was used to examine changes in perceived norms in which follow-up perceived norms were examined as a function of intervention group and controlled orientation, controlling for baseline perceived norms. Controlled orientation was mean centered. Main effects were entered at Step 1. The interaction between controlled orientation and feedback was tested at Step 2 (Cohen et al., 2003). The same strategy was used to evaluate the interaction between controlled orientation and intervention condition on drinks per week and alcohol-related negative consequences. There were no main effects of controlled orientation on perceived norms, weekly drinking, or consequences. More important, controlled orientation did not interact with the intervention condition in predicting changes in perceived norms or weekly drinking (all *p*s were nonsignificant). In contrast, controlled orientation did moderate the effect of feedback on changes in negative consequences, $t(180) = -2.08$, $p < .05$, $\beta = -.14$, $d = .30$. Figure 3 presents predicted values derived from the regression equation in which high and low values of controlled orientation were specified as one standard deviation above and below the mean, respectively (Aiken, 1991). The resulting pattern indicates that normative feedback had little impact on drinking consequences among individuals who were less controlled. In contrast, more controlled students who received normative feedback reduced their alcohol-related consequences relative to assessment-only students.

Discussion

Computer-delivered personalized normative feedback offers an alternative approach to social norms marketing interventions and offers a more sensitive test of the assumptions underlying social-norms-based interventions. The rationale for social-norms-based interventions is typically described in terms of the following three assumptions: (a) students overestimate descriptive drinking norms, (b) overestimation of drinking norms is causally associated with heavier drinking, and (c) correction of normative overestimations should reduce drinking. The present results are consistent with these assumptions and add to the evidence that personalized normative feedback reduces perceived norms and alcohol consumption. Mediation results also provide strong evidence for the theoretical foundation of the approach. Results suggest that the impact of normative feedback on drinking is due to its impact on perceived norms, which is consistent with previous studies showing that changes in perceived norms are associated with changes in drinking (Borsari & Carey, 2000; Mattern & Neighbors, 2004; Neighbors, Larimer, & Lewis, 2004).

Beyond evaluation of intervention efficacy and correction of normative misperception as its mechanism, we were also specifically interested in further investigating for whom this

approach is most and least effective. Self-determination and controlled orientation, more specifically, have been associated with regulating behavior according to extrinsic factors (e.g., perceived expectations of others), drinking more for social reasons, and greater susceptibility to perceived peer approval of drinking (Knee & Neighbors, 2002; Neighbors, Larimer, Geisner, & Knee, 2004). Thus, we expected that normative feedback would be especially influential among controlled students. Results did not support a differential impact of feedback on perceived norms or on weekly drinking by more controlled or by less controlled students. However, results for negative consequences were consistent with expectations and revealed that feedback was more effective in reducing alcohol-related problems among more controlled students.

It is interesting that controlled orientation moderated the impact of normative feedback on problems but not on perceived norms or consumption. There are at least three plausible explanations for this unexpected pattern of results. First, concerns about how others perceive one's drinking, which are more evident among students who are higher in controlled orientation, might be more likely to motivate reduction of indicators of concern (i.e., alcohol-related negative consequences) rather than the quantity of consumption per se. Moreover, the number of drinks consumed per week is less socially salient than is getting sick, missing school or work, or getting into fights because of alcohol. It is also possible that the interaction between controlled orientation and feedback on problems might be related to social desirability. However, it seems likely that if more controlled students were simply responding in a more socially desirable way they would have done so for both drinking and for problems. Moreover, in previous nonintervention research we have found more controlled students to report more, not fewer, problems (Neighbors, Larimer, Geisner, & Knee, 2004).

A more direct explanation may relate to the fact that consequences are more likely to be experienced following heavy drinking on a given occasion rather than as a function of typical number of drinks over some period of time. Although controlled orientation did not moderate the intervention's impact on the typical number of drinks per week, it is possible that more controlled participants in the intervention condition reduced how much they drank on specific occasions. In future research, more specific assessment of when problems occur and how much drinking is associated with each consequence (e.g., time line follow-back; Sobell & Sobell, 2000) would illuminate this issue.

Among more controlled, heavier drinking students, there is also an apparent disconnect between the effects of normative feedback on perceived norms versus its impact on alcohol-related consequences. Personalized normative feedback is designed to correct normative misperceptions, which are in turn associated with reduced drinking. However, personalized normative feedback also presents students with a direct comparison of their own drinking to typical student drinking, which is independent from their perceptions of typical student drinking before or after receiving feedback. It is unclear whether presenting students with feedback about their perceptions of typical student drinking is a necessary component of personalized normative feedback, especially among students who are more susceptible to social influences. Among more controlled students, understanding how their own perceptions deviate from the true norm may be less meaningful for them than more overt behavioral deviations. Additional work comparing personalized normative feedback with and without perceived norms information as a function of controlled orientation would shed further light on this issue.

Related to this issue is the possibility that the relationship between controlled orientation and drinking for social reasons may be due in part to differences in social networks. Previous research suggests that more controlled students drink more for social reasons and that they care more about how other students perceive their drinking behavior (Knee & Neighbors, 2002; Neighbors, Larimer, Geisner, & Knee, 2004). It is plausible that students who tend to be more

controlled are more likely to associate with heavier drinkers, which might attenuate the effects of normative feedback on perceived norms and on subsequent drinking among these students. Moreover, if controlled students tend to associate with heavier drinking peers, it may offset the otherwise greater likelihood that normative feedback would be effective in correcting their normative misperceptions. Additional work evaluating drinking in the social networks of more controlled and less controlled students would clearly be informative.

This research includes a number of limitations that are common in college student intervention research and that are important to recognize. Generalizability is always an issue. Students were recruited from introductory psychology courses and may not be representative of the broader campus. The campus itself was demographically homogenous, and it is not clear whether normative feedback operates similarly among students from different ethnic and racial backgrounds. The consistency of these findings with previous findings from a different, more ethnically diverse campus (Neighbors, Larimer, & Lewis, 2004) somewhat attenuates these concerns. Another concern is the self-reported nature of the data. Self-reported drinking has been found to be relatively reliable and valid (Johnston & O'Malley, 1985), but collateral reports, behavioral outcomes, and/or controls for self-report biases would make a valuable addition to this line of research. It should also be noted that individual differences in self-determination have frequently been operationalized by examining individual differences in both controlled and autonomy orientations. We have previously found the extent to which students are more controlled (rather than the extent to which they are autonomous) to be the more relevant dimension with respect to normative influences on drinking (Neighbors, Larimer, Geisner, & Knee, 2004). Preliminary analyses of these data were consistent with our previous findings, thus autonomy orientation is not discussed here. Additional work is needed to clarify the roles of controlled versus autonomy orientations to provide a better understanding of which orientation is more strongly associated with which behaviors and under what conditions. An additional limitation concerns the representativeness of the sample, which included 51% of those eligible from screening. Although, participants did not differ from nonparticipants on drinking variables, women were more likely to participate than men and it is not clear how results might have differed if recruitment rates had been equivalent across genders. In addition, participants may have differed from nonparticipants on other variables that were not assessed. Finally, the brevity of the follow-up assessment (2 months) is a clear limitation. Although these results are comparable to previous results that used this approach at 3- and 6-month follow-ups (Neighbors, Larimer, & Lewis, 2004), additional research with longer follow-ups is needed to evaluate the duration of effects. Furthermore, in this study the RAPI assessed alcohol-related problems during the previous 3 months, which, at follow-up, overlapped the baseline assessment by a few weeks. This may have impeded our ability to detect differences in alcohol-related problems as a function of the intervention.

This research suggests a number of important future directions in addition to those already mentioned. In this and in previous work, the normative reference group has most often been defined as the typical student at one's university. Some evidence suggests that gender-specific normative feedback might be more effective, especially for females (Lewis & Neighbors, 2004). Additional work is needed to determine the optimal level of specificity of the normative reference group with regard to gender, ethnicity, fraternity or sorority affiliation, et cetera (Borsari & Carey, 2003). It will also be important to continue to examine potential moderators of normative feedback. Determining for whom this and similar interventions are most (and least) effective has important theoretical and practical implications. Results from this research suggest that the comparisons presented by personalized normative feedback may have differential impact on students, depending on their individual characteristics such as controlled orientation, and that differential efficacy may vary by outcome. Additional work is also needed to evaluate whether all three types of feedback information (personal drinking behavior, perceived norm, and actual norm) are necessary components of this intervention and/or whether

this differs as a function of individual characteristics. In particular, it may not be as important to provide feedback regarding the participant's own perceived norms to those who are more susceptible to social influence.

In conclusion, in combination with previous work (Neighbors, Larimer, & Lewis, 2004), this research provides support for computer-delivered personalized normative feedback as an empirically supported brief intervention for heavy drinking college students. The relatively small effect sizes of this intervention are offset by its brevity and its potential to reach a large number of students at very low cost. In this study, intervention participants viewed normative feedback for less than 5 min and consequently experienced almost one-third of a standard deviation reduction in weekly drinking (d = .30) 2 months later. It is also important to note that the effect sizes of this intervention on drinking are comparable to other more intensive, empirically supported brief interventions for heavy drinking college students in studies that have used samples comparable to the sample used in this study (Walters & Neighbors, 2005). Other brief interventions that have included additional feedback components, including summaries of drinking consequences, risk factors, review of alcohol expectancies, didactic information, and moderation strategies, have reported comparable reductions in weekly drinking relative to control groups (e.g., 6-week follow-up effect size = .21 for weekly drinking, Borsari & Carey, 2000; 6-week follow-up effect size = .28 for heaviest weekly drinking, Collins et al., 2002). This research presents an important step in understanding why and for whom normative feedback is effective.

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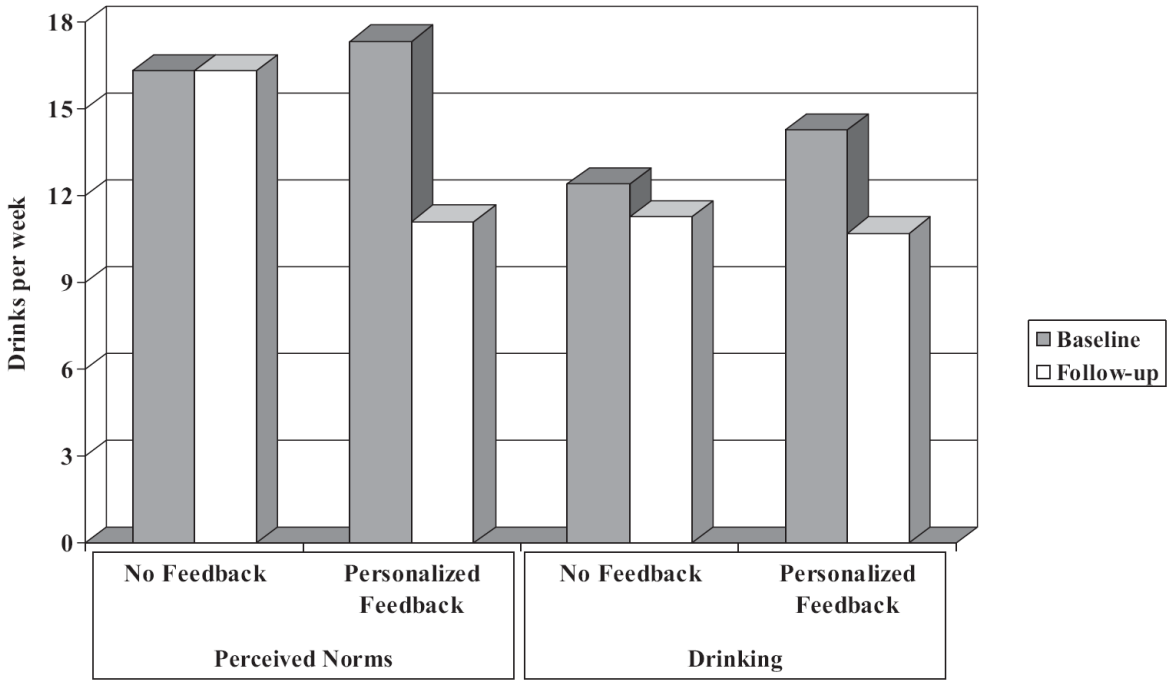

Figure 1.
The effect of normative feedback on perceived norms and drinking.

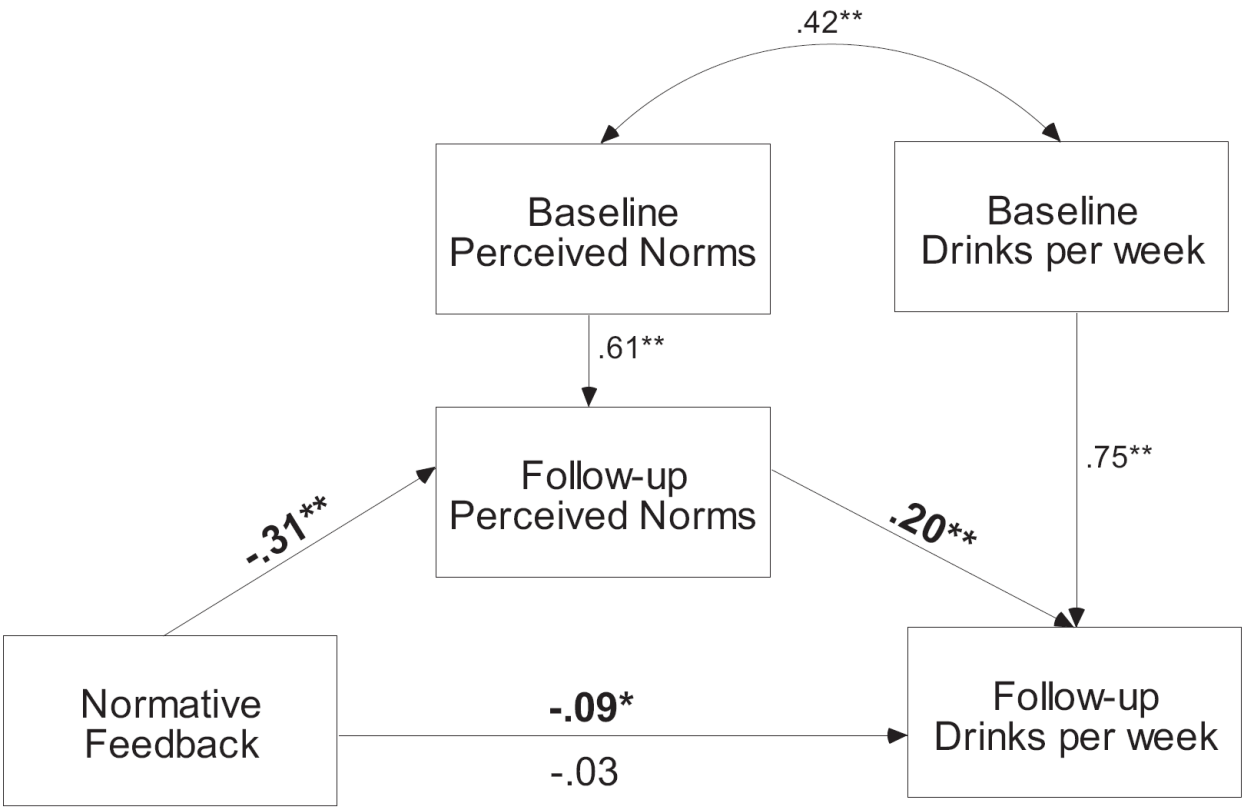

Figure 2.
Changes in perceived norms as a mediator of normative feedback efficacy. *$p < .05$. **$p < .001$.

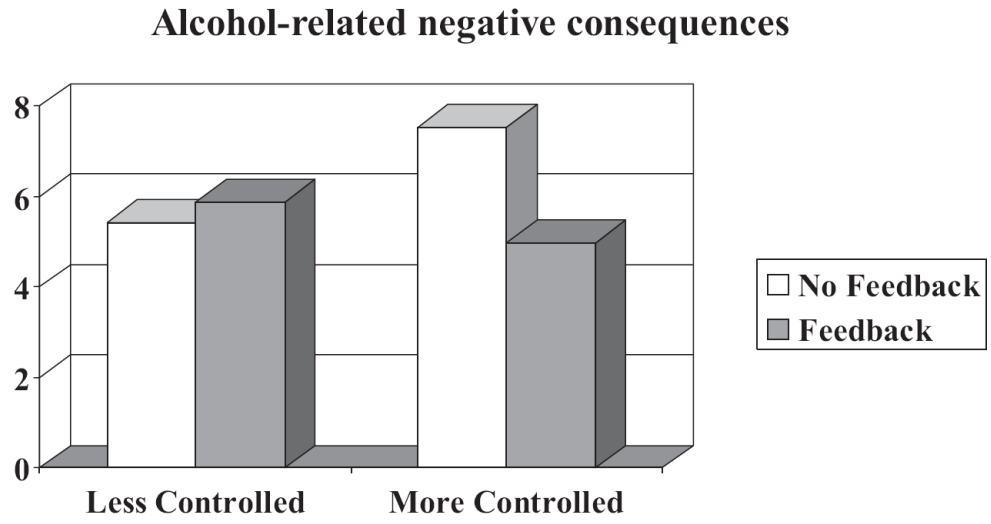

Figure 3.
The effect of normative feedback on typical drinks per week by controlled orientation.

Table 1

Means and Standard Deviations for Study Variables by Treatment Condition

	Control		Intervention	
Variable	***M***	***SD***	***M***	***SD***
Baseline controlled orientation	4.22	0.73	4.28	0.64
Baseline alcohol consumption	12.84	11.75	14.30	11.75
Follow-up alcohol consumption	11.56	10.68	10.70	9.14
Baseline alcohol-related problems	7.56	7.64	8.18	7.42
Follow-up alcohol-related problems	6.40	8.05	5.69	6.43
Baseline perceived norms	16.79	9.16	17.87	10.61
Follow-up perceived norms	16.33	9.86	11.11	7.36