WHY DOES DRINKING ALCOHOL AFFECT RISK-SEEKING BEHAVIOR? A TEST OF THE NEED FOR COGNITIVE CLOSURE HYPOTHESIS

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WHY DOES DRINKING ALCOHOL AFFECT RISK-SEEKING BEHAVIOR?

A TEST OF THE NEED FOR COGNITIVE CLOSURE HYPOTHESIS

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Research suggests that the drinking environment can affect dynamic processes involved in group decision making. The current study evaluated the need for cognitive closure (NFCC) as a mechanism underlying previously observed effects of alcohol dosage-set (i.e., beliefs persons have about the content of their beverages) on risk-seeking behavior. Five-hundred-four social drinkers (261 female) were assembled into 168 three-person groups and randomly assigned to one of three beverage conditions: alcohol, placebo, and no-alcohol control. Following beverage consumption, groups were asked to choose between two options of equal expected value, one of which offered a greater yet less certain (i.e., "riskier") outcome. Groups were given 150-sec to make a decision and were required to reach consensus. Group discussion was video-recorded, and behavioral measures of NFCC were systematically coded by three independent raters. Results did not support NFCC as a mechanism explaining the earlier finding; however, results suggested that the decision making task used here may not have offered a sensitive test of NFCC. Though methodological limitations were detected, supplemental analyses indicate that dosage-set affected group decision making *prior* to observable deliberation, and that groups valued affiliation more than they valued specific decision making outcomes regardless of which beverage was consumed or which decision was initially endorsed. These findings raise new questions regarding the effects of implicit cognitions and normative influence on decisions made in drinking contexts.

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1.0 INTRODUCTION

Drinking is an important social experience in cultures across the world. While drinking is associated with many positive social encounters, rituals, and celebrations, so too is it linked to a range of risky decisions and hazardous outcomes. Recent epidemiologic data suggest that in 2010 alone, 1.9 million U.S. hospital discharges had an alcohol-related diagnosis (Chen & Yi, 2012) and 112 million U.S. adults reported episodes of alcohol-impaired driving (Centers for Disease Control and Prevention, 2011). The current study aimed to build upon these findings, examining the possibility that the drinking experience—defined here as both alcohol consumption as well as merely the belief that one has been drinking alcohol—affects dynamic processes involved in group decision making. Specifically, this study evaluated the role that the need for cognitive closure plays in explaining the association between drinking and group decision making. In doing so, the current study aimed to enhance our understanding of the effects of drinking on cognitive and motivational factors that may account in part for decision making deficits.

1.1 EFFECTS OF DRINKING ON DECISION MAKING: EARLY WORK

Most experimental researchers have emphasized the pharmacologic effects of alcohol consumption on decision making, suggesting that ethanol's effects on the central nervous system

alter decision making processes in relatively direct ways. Though many studies have tested for such effects, their findings have been surprisingly inconsistent. That is, some have observed pharmacologic effects of alcohol consumption on decision making (e.g., Marinkovic, Rickenbacher, Azma, & Artsy, 2012; Miller & Fillmore, 2013), while others have failed to do so (e.g., Peacock, Bruno, Martin, & Carr, 2013; Caswell, Morgan, & Duka, 2013). In attempting to understand these inconsistencies, one must consider that most alcohol administration studies have tested participants in isolation. This individualized approach is limited given that the majority of "real world" drinking occurs in a social context (Bachman, Johnston, O'Malley, & Bare, 1985). Moreover, as demonstrated by research on conformity (Asch, 1956), obedience (Milgram, 1963), bystander intervention (Darley, & Latané, 1968), risky shift (Stoner, 1968), and groupthink (Janis, 1972), the social context itself has a major influence on decision making. Therefore, it is unlikely that research could assess the totality of drinking's effects on decision making when participants drink in isolation.

A small number of alcohol administration studies have tested decision making in a social context, with mixed results. For example, Sayette, Kirchner, Moreland, Levine, and Travis (2004) found that groups were more likely to propose a risky decision after consuming alcohol than after consuming a placebo (i.e., a nonalcoholic beverage designed to appear to participants as if it contains alcohol), whereas Abrams, Hopthrow, Hulbert, and Frings (2006) found no effect of alcohol on risk attraction among groups. One should interpret these findings with caution, though, given that both studies used small samples (i.e., 9-12 groups per drink condition) and neither included a no-alcohol control condition (i.e., groups consumed only alcohol or placebo beverages). By informing all participants that they would consume alcohol, these two studies could not

manipulate *dosage-set* (i.e., "beliefs persons have about the alcoholic content of beverages they have consumed"; Martin & Sayette, 1993, p. 759), discussed further in the following section.

1.2 PHARMACOLOGIC AND DOSAGE-SET EFFECTS OF DRINKING

For decades, anthropologists have demonstrated that non-pharmacologic factors can affect the ways in which groups behave while drinking. In their classic volume, "Drunken Comportment," MacAndrew and Edgerton (1969) describe the effects of drinking across many different societies. Their conclusion is that alcohol has extremely variable effects on behavior (e.g., disinhibited behavior), and how one reacts while drinking largely depends on the beliefs that a society holds about how one should act while intoxicated. These authors highlight the power of context in shaping drinking's effects across cultures and situations, which argues against the common belief that ingestion of alcohol inevitably reduces one to a "mere creature of impulse" (1969, p. 36). This notion is echoed by Fromme and D'Amico, who note in their review of the neurobiological consequences of drinking that "many complex social and behavioral aspects of alcohol use cannot be readily explained by neurochemical actions" (1999, p. 444).

Despite the importance of one's attitudes and beliefs about drinking, many experimental researchers have emphasized the pharmacologic aspects of drinking (see Sher, 1987; Steele & Josephs, 1990). This pharmacologic bias can be justified to some extent, as many studies find similar effects between placebo and control conditions, suggesting a weak effect of dosage-set (e.g., Bradlyn, Strickler, & Maxwell, 1981; Sutker, Allain, Brantley, & Randall, 1982). Inspection of this literature suggests, however, that in many instances the placebo condition has been executed

poorly, likely failing to instill the belief that one has been consuming alcohol. Stated differently, the placebo condition often has functioned more like a no-alcohol control condition in which participants are truthfully informed that they are drinking a nonalcoholic beverage, than a condition that aims to deceive participants that they have been consuming alcohol. Consistent with this concern, reviewers have identified particular methods needed to successfully implement a viable placebo beverage; these include (1) mixing beverages in the presence of participants, (2) providing false BAC feedback, and (3) creating a stimulating social environment, which shifts participants' focus away from physiological cues (see Hull & Bond, 1986; Marlatt & Rohsenow, 1980; Rohsenow & Marlatt, 1981). When these conditions are satisfied, placebo conditions are more likely to induce an alcohol dosage-set and less likely to function as de facto control conditions. The current study derives from a parent study that aimed to employ these enhanced placebo beverage procedures in order to provide a sensitive test of both the pharmacologic and dosage-set effects of drinking on group decision making processes.

While methodological limitations associated with placebo manipulations may have led to difficulties teasing apart pharmacologic and non-pharmacologic effects of drinking, there has been some laboratory evidence that converges with the anthropological observations noted by MacAndrew and Edgerton (1969) to support effects of dosage-set on "drunken" behavior. For example, data comparing the sexual response of men consuming a placebo and a no-alcohol control beverage find dramatic effects of dosage-set. Male social drinkers listened to recorded descriptions of heterosexual intercourse, forcible rape, and nonsexual sadistic aggression. Placebo participants, who were falsely informed that they had consumed alcohol, experienced greater levels of physiological sexual arousal than did participants in the no-alcohol control condition, who were correctly instructed that they had received a non-alcohol control beverage. In contrast to those who

thought they were not consuming alcohol, participants who believed they were consuming alcohol were as aroused by the account of forcible rape as by the account of heterosexual intercourse (Briddell, Rimm, Caddy, Krawitz, Sholis, & Wunderlin, 1978).

Pertinent to the current study, Hull and Bond (1986) conclude in their meta-analysis of placebo effects that social behaviors are especially affected by dosage-set, with actual consumption of alcohol having "nonsignificant effects on social behaviors." (p. 350). They argue that the effects of dosage-set may be explained by an attributional mechanism first proposed by Marlatt and Rohsenow (1980). Specifically, consuming a placebo may provide an excuse to "engage in what would otherwise be considered inappropriate acts" (Hull & Bond, 1986, p. 347).

In their recent review of dosage-set effects, Moss and Albery (2009) suggest that the drinking environment can prime people with mental representations of behaviors associated with drinking (e.g., increased sociability; Sheeran, Aarts, Custers, Rivis, Webb, & Cooke, 2005), which can make certain responses more accessible than they otherwise would be. For example, people who believe that drinking gives them "Dutch courage" may be primed to perform risky behaviors even before experiencing the pharmacologic effects of ethanol. Our research team (Sayette, Dimoff, Levine, Moreland, & Votruba-Drzal, 2012b) recently explored this idea, using a three drink condition design (alcohol, placebo, and a no-alcohol control) to test the impact of alcohol consumption and dosage-set on decision making in groups. We observed that, relative to no-alcohol control groups, alcohol and placebo groups were more likely to make a risky decision—that is, to toss a coin to determine the amount of time in which they would complete a series of questionnaires—compared to a safe (no coin toss) decision in which the amount of time was fixed. The mechanisms underlying this effect of drinking on decision making, however, remain unclear and were the focus of the current study. The following section explores a theory of decision making

that may improve our understanding of how risky decisions are affected by drinking and dosage-set.

1.3 NEED FOR COGNITIVE CLOSURE

Various decision making theories have bid to explain the mechanisms underlying decision making. Some theories target one's cognitive processes (Evans, 2006), or both cognitive and motivational processes (Kunda, 1990). More germane to social decision making, other researchers have focused on social processes such as normative influence (see Asch, 1956; Latané, 1981) and group polarization (Isenberg, 1986). One theory that has distinguished itself by focusing on cognitive and motivational factors in both individual and social settings, and which may be especially well suited to illuminate the impact of alcohol on group decision making, is the need for cognitive closure (NFCC).

NFCC refers to "individuals' desire for a firm answer to a question, any firm answer as compared to confusion and/or ambiguity" (Kruglanski, 2004, p. 6). This desire to resolve uncertainty as quickly as possible motivates people to seek closure with urgency ("seize" upon a solution) and maintain the permanence of such closure ("freeze" on that solution). At moderate levels, NFCC aids people in efficiently evaluating information, drawing conclusions, and retaining knowledge—processes essential for everyday functioning (Kruglanski, 1989). At high levels, however, NFCC may increase the likelihood of problematic behaviors (e.g., making hasty decisions, safeguarding prejudiced beliefs).

Researchers have measured NFCC in myriad ways. In group decision making studies, it has been measured most often in terms of decision making latency (Mayseless & Kruglanski, 1987; Kruglanski & Webster, 1996; Webster, Richter, & Kruglanski, 1996) and member participation (De Grada, Kruglanski, Mannetti, & Pierro, 1999; Pierro, Mannetti, De Grada, Livi, & Kruglanski, 2003; Kruglanski, Pierro, Mannetti, & De Grada, 2006). Specifically, high NFCC tends to reduce (1) the time taken to initiate task-oriented discussion, (2) the time taken to discontinue task-oriented discussion (a proxy for consensus) (3) the number of speaking turns taken by group members, and (4) the equality of speech distribution across group members. (Note that these four measures were used in the current research.) This suggests that when NFCC is high, groups tend to orient quickly to tasks, rush to consensus, share minimal information, and favor hierarchical (as opposed to egalitarian) structure

NFCC can be influenced by situational manipulations, which subsequently can affect group phenomena. For instance, studies have stimulated a group's NFCC by increasing ambient noise (Kruglanski & Webster, 1991) and inducing mental fatigue (Webster, Richter, & Kruglanski, 1996). Most often, however, researchers have used time pressure to enhance NFCC using groups of three or four people (see Isenberg, 1981; De Grada et al., 1999; Pierro et al., 2003; Chirumbolo, Livi, Mannetti, Pierro, & Kruglanski, 2004). Time pressure appears to increase NFCC by making groups feel as though they are in danger of missing an important deadline, which leads to an acute increase in the motivation to achieve closure (Kruglanski & Webster, 1996). Such pressure is particularly salient when groups are required to reach consensus, given that this requirement encourages deliberate exchanges of information (Nijstad & Oltmanns, 2012). The current study aimed to include many of these features to provide a test of the impact of alcohol and dosage-set on NFCC in a group decision making task.

1.4 NFCC, DRINKING, AND DECISION MAKING

Webster (1993) examined decision making in three-person groups across three beverage conditions (moderate alcohol, low alcohol, placebo). Relative to low alcohol and placebo groups, moderate alcohol groups reported a greater desire to reach agreement quickly and shared fewer pieces of information while deliberating. The idea that the drinking experience would increase NFCC is bolstered by other research indicating that dosage-set can quicken the perception of time (Lapp, Collins, Zywiak, & Izzo, 1994). This latter finding raises the possibility that drinking may exacerbate and make especially salient any existing time pressure, and thereby heighten NFCC, especially when groups must reach a consensus under this time pressure.

Taken together, the data reported by Webster (1993) and by Lapp and colleagues (1994) suggest an association between drinking and NFCC, and raise questions for further research. For example, what is the role of dosage-set? While the study by Lapp et al. (1994) suggests that time urgency may be intensified primarily by an alcohol dosage-set (rather than the pharmacologic effects of alcohol), Webster's experiment did not feature a no-alcohol control condition. Moreover, Webster's placebo condition may have been suboptimal for leading participants to believe that they had consumed an alcoholic beverage, as she reported using only one of the recommended dosage-set techniques (smearing vodka on the rims of participants' glasses). As detailed earlier, mixing beverages in the presence of participants and providing false BAC feedback can enhance the effectiveness of the placebo deception, above and beyond the effect of singular manipulations. In addition, Webster does not report any manipulation check data; therefore, it is unclear how successfully participants in her placebo condition were deceived. Accordingly, Webster's study

suggests that alcohol's effects on decision making may be mediated by NFCC, but leaves open whether this effect on NFCC may be based on pharmacologic or dosage-set effects of alcohol.

It also should be noted that Webster's decision making task—determining which of three student government candidates was most qualified for office—was hypothetical and free of consequences. This may be important, as in many cases hypothetical responding corresponds weakly to actual behavior (see Krasnor, 1983). Therefore, it remains to be seen how drinking would affect groups making what they perceived to be a non-hypothetical decision of consequence. Finally, while Webster's study was able to detect a main effect of alcohol consumption, it was insufficiently powered to conduct mediation analyses. As a result, it was unable to test whether high NFCC mediated the relation between alcohol consumption and poor decision making. We recently expanded upon a number of these procedures, and are in position to investigate the questions raised by Webster's interesting study.

1.5 EFFECTS OF DRINKING ON DECISION MAKING: RECENT WORK

As noted earlier, we observed an effect of dosage-set on risky decision making in three-person groups (Sayette et al., 2012b). This initial study left open consideration of potential mechanisms underlying this association. In addition, it offered a unique opportunity to evaluate the link between drinking and group decision making using NFCC, a novel measure underutilized in the alcohol literature.

Consistent with previous studies of NFCC, we placed groups under high time pressure (150-sec, a time interval that is consistent with the highest pressures found in the NFCC literature;

e.g., Kruglanski, Peri, & Zakai, 1991). Our study also required groups to reach a consensus, which, as noted earlier, increases NFCC. In contrast to the study by Webster, we included beverage conditions designed to tease apart pharmacologic and dosage-set effects of alcohol. Specifically, we used (1) a no-alcohol control condition, (2) a placebo condition featuring multiple dosage-set manipulations (including false BAC feedback presented immediately before the decision making task), and (3) a moderate alcohol dose condition[1]. In addition, while our decision making task was less complex than the one used by Webster, it nonetheless had perceived actual (i.e., non-hypothetical) consequences and used a sample large enough to conduct mediation analyses. Importantly, the 150-sec discussions during which groups decided whether or not to toss the coin were videotaped, which allowed us to evaluate the potential role of NFCC in understanding the association between drinking and decision making. In the current study these videos were coded to examine the effects of alcohol and dosage-set on NFCC.

1.6 HYPOTHESES

We observed that, relative to groups consuming a no-alcohol control beverage, groups believing that they had consumed alcohol were more likely to choose a riskier option during a time-limited discussion (Sayette et al., 2012b). In the current study, I aimed to elaborate on this initial finding

[1] While some researchers (e.g., Marlatt, Demming, & Reid, 1973) have included a fourth, "antiplacebo" condition in which participants receive an unexpected dose of alcohol, research has accumulated suggesting that this condition cannot be executed reliably (see Martin & Sayette, 1993). Importantly, the remaining three groups still permit tests of the main effects of pharmacology and dosage–set (Martin & Sayette, 1993).

by testing the role of NFCC as a mediator of the impact of drinking on group decision making. Specifically I aimed to test the following hypotheses.

1.6.1 H1: There will be a main effect of dosage-set on NFCC

There is considerable research suggesting that the effect of drinking on decision making is pharmacologically driven. However, based on our prior coin toss findings (Sayette et al., 2012b) and the work of others detailed earlier in this proposal (e.g., Hull & Bond, 1986; Lapp et al., 1994), I predicted that alcohol and placebo groups would similarly demonstrate higher NFCC, relative to control groups. They would do so by demonstrating (a) reduced decision making latency and (b) restricted participation of members.

1.6.2 H2: NFCC will mediate the association of dosage-set and risk-seeking

As noted earlier, preliminary analysis of these data revealed an effect of dosage-set on risk-seeking behavior. I predicted that NFCC would mediate this effect, such that (a) alcohol and placebo groups (who had an alcohol dosage-set) would demonstrate higher NFCC as defined earlier, relative to control groups (who had a no-alcohol dosage-set), and that (b) high NFCC would be positively associated with risk-seeking behavior, defined as choosing the less certain of two options in a decision making (coin toss) task. These predictions were based on the notion that alcohol dosage-set may increase perceived time pressure, which may promote subsequent risk-seeking by pressuring groups into making heuristic judgments shaped by salient cues (e.g., impulsive cognitions may be particularly accessible in drinking environments). Stated in terms of

Baron and Kenny's (1986) mediation model, I predicted that alcohol dosage-set (*X*) would increase NFCC (*M*) (Path *a*); NFCC (*M*) would promote risk-seeking behavior (*Y*) (Path *b*); and the previously observed effect of dosage-set (*X*) on risk-seeking behavior (*Y*) (Path *c*') would no longer be significant when Paths *a* and *b* were controlled.

2.0 RESEARCH DESIGN AND METHODS

2.1 PARTICIPANTS

The current study included 504 participants from the parent study conducted by Sayette et al. (2012b). These participants engaged in the coin toss discussion in three-person groups[2] and video of their discussion was digitally recorded[3]. Participants (261 female) were between the ages of 21 and 28, recruited from community newspapers, and screened using telephone and laboratory interviews. All eligible participants reported social drinking practices (e.g., drinking an average of at least four drinks per month); no eligible participants reported dependence on substances other than nicotine or caffeine, or medical conditions that ethically contraindicated alcohol use.

2.2 PROCEDURES

2.2.1 Predrink Assessment

After successful completion of screening procedures, eligible participants were invited to an experimental session. Prior to the experimental session, participants were asked to abstain from

[2] An additional 180 participants completed the coin toss task in isolation (i.e., not in three-person groups). These participants were excluded from the current study given its focus on group decision making.

[3] While a total of 540 participants made their decisions in groups, the first 10 group discussions were not recorded and two others were lost due to technical problems. Therefore, an additional 36 participants were excluded.

alcohol and drugs for 24-hr, caffeine for 4-hr, and nicotine for 1-hr prior to arrival. Participants were told that abstinence would be confirmed using breath instruments. Participants also were told that they could not drive to or from the experimental session, and that they would be provided with bus passes if needed. Upon arrival, all participants provided a breath sample. Participants in the placebo condition were asked to use mouthwash before providing their sample, as doing so minimizes taste cues (Rohsenow & Marlatt, 1981). Participants who registered a positive blood alcohol content (BAC) were rescheduled; participants who registered a negative BAC then ate a weight-adjusted amount of food (bagel) to standardize the rate of alcohol absorption across participants.

2.2.2 Drink administration

Participants were randomly assigned to groups of three unacquainted persons. Each group in turn was randomly assigned to drink a beverage containing a moderate dose of alcohol (alcohol condition; group n = 57), a placebo (placebo condition; group n = 57), or no alcohol (control condition; group n = 54). Alcohol participants were given a beverage that was 1 part 100-proof vodka (males: 0.82 g/kg; females: 0.74 g/kg) and 3.5 parts cranberry juice cocktail; placebo participants were given a beverage that was 1 part flattened tonic water, poured from a vodka bottle, and 3.5 parts cranberry juice cocktail. Control participants were told that they would not receive alcohol and were given cranberry juice cocktail in equal volume. To enhance credibility in the placebo condition, drinks were mixed in front of all participants, and the glasses of placebo participants were smeared in vodka (Rohsenow & Marlatt, 1981; Schlauch, Waesche, Riccardi,

Donohue, Blagg, Christensen, et al., 2010). Each group drank together over a 36-min interval while sitting around a circular table in the experimental room.

2.2.3 Postdrink assessment

Following beverage consumption, participants' BAC levels were measured individually. To help control for dosage-set, placebo participants were randomly assigned a BAC reading ranging from .041% to .043%, which is about the highest credible level one can use (see Martin & Sayette, 1993). Following BAC assessment, participants returned to the experimental room, reforming their original groups. At this point, groups learned that they soon would complete tasks related to memory and cognitive performance, after which they would remain in the laboratory for a few more hours. Alcohol and placebo participants were told that they would remain in order to allow their BACs to drop; control participants were told that they would remain in order to standardize the amount of time participants had between tasks.

2.2.4 Decision making (coin toss) task

Following postdrink assessment, participants were asked to complete additional questionnaires while in the laboratory, which the experimenter was considering for use in a future study. However, participants were given two options: (1) they could decide as a group to complete about 30-min worth of questionnaires and spend the remaining time reading or relaxing; (2) alternatively, they could choose to toss a coin and, pending the outcome, either complete no questionnaires or about 60-min worth of them. In this paradigm, choosing to toss the coin is considered a riskier decision

than choosing not to toss given that the decisions share an expected value (i.e., a 50% chance of 60-min = a 100% chance of 30-min), yet the former offers a less certain outcome (see also Rothschild & Stiglitz, 1970; Tversky & Kahneman, 1983). They then were informed that they would have 150-sec to make their decision, and that all group members must choose the same option (i.e., the group would need to reach consensus within the context of time pressure).

The experimenter subsequently left the room for 150-sec, during which the participants were digitally recorded while they made their decision. Separate wall-mounted cameras faced each participant, and a common microphone was located at the center of the table. (Participants had been told that the cameras would be used to monitor their rate of consumption during drink administration.) After 150-sec had elapsed, the experimenter returned to the room and asked for the group's decision. Decisions were documented by the experimenter at that time, and later verified from video by a rater blind to condition. After making their decision, participants completed additional tasks and self-report measures, which are not reported here.[4] At the end of the study, participants were debriefed, paid $60, and allowed to leave.

[4] The parent research project collected self-report measures of personality, alcohol expectancies, sensation seeking, self-consciousness, and other individual differences. The complete list of measures is available upon request.

2.3 DEPENDENT MEASURES

2.3.1 Decision making latency

Decision making latency was operationalized as time to initiation and time to discontinuation of discussion related to the coin toss task. Time to initiation reflected the urgency with which groups sought closure (groups are unlikely to delay task-oriented discussion when NFCC is high); time to discontinuation reflected the tendency of groups to "close" task-oriented discussion once a definite answer was proposed (groups are unlikely to elaborate on or to challenge early ideas when NFCC is high). These measures required the coding of proposals, which were defined as declarations that a group member either did or did not want to toss the coin. To aid in the coding of proposals, discussions during the coin toss task were transcribed. Transcripts were used by three independent raters to code for first, second, and final proposals. Interrater agreement was good (≈ 77%); when one rater disagreed, the proposal which had been agreed upon by the two other raters was counted. To measure time to initiation, I calculated the number of seconds preceding first proposals; to measure time to discontinuation, I calculated the number of seconds between first and final proposals.

2.3.2 Member participation

Member participation was operationalized as the number of speaking turns taken by the group and the equality of speech distribution across group members. Three independent raters coded speech behavior according to Dabbs and Ruback's (1987) Grouptalk model. [Reliability coding for a

random subset of 87 participants revealed good levels of interrater agreement (κ = .82).] Within this model, an individual speaking turn consisted of one participant's vocalizations and pauses that led to further vocalizations. By using the Grouptalk model, I could measure each group member's speaking turns and speech duration. Given my focus on group-level processes, I then summed group members' speaking turns to calculate one total number of turns for each group, and used individual-level measures of speech duration to calculate a group-level intraclass correlation coefficient (ICC). High ICCs indicated equitable speech distribution; low ICCs indicated inequitable distribution.

3.0 RESULTS

Four groups were excluded from analysis due to missing or corrupted video files. Therefore, the final sample consisted of 164 three-person groups randomly assigned to one of three beverage conditions: alcohol (n = 57), placebo (n = 56), and no-alcohol control (n = 51).

3.1 BASELINE MEASURES

Eighty-three percent of participants identified themselves as Caucasian, 10% as African American, 2% as Asian, 1% as Hispanic, and 3% as other. Age, marital status, income, smoking status, and race/ethnicity were equivalent across beverage conditions, as were responses to questions about drinking history and current drinking patterns. Participants reported drinking on average a bit more than twice a week [M = 3.7 (SD = 0.9) using a 7-point scale with "3" = 1-2 occasions/week and "4" = 2-3 occasions/week] and consuming an average of 4.3 (SD = 1.9) drinks per occasion. All participants reported that they could comfortably drink at least 3 drinks in 30-40 min.

3.2 MANIPULATION CHECK

Participants who consumed alcohol were on the ascending limb of the BAC curve with a mean BAC of .054 (SD = .012) at the time of the coin toss task. As shown in Table 1, all beverage manipulation measures revealed greater effects for alcohol than for placebo and control

participants (*p*s < .001). On a measure of subjective intoxication preceding the coin toss task, alcohol participants reported higher levels of intoxication [*M* = 38.2 (*SD* = 17.1)] than did placebo participants [*M* = 14.0 (*SD* = 10.1)], who in turn reported higher levels of intoxication that did control participants [*M* = 0.1 (*SD* = 0.7)]. On a post-experimental questionnaire, all alcohol and placebo participants reported drinking at least 1 oz. of vodka. Alcohol participants estimated drinking more vodka [*M* = 7.1 oz. (*SD* = 10.4)] and reported a higher peak intoxication level [*M* = 43.5 (*SD* = 18.7) on a scale from 0 (not at all intoxicated) to 100 (the most intoxicated you have ever felt)] than did placebo participants, who in turn estimated drinking more vodka (*M* = 4.9 oz. (*SD* = 6.3)] and reported a higher peak intoxication level [*M* = 14.98 (*SD* = 10.6)] than did control participants [vodka estimate *M* = 0.4 oz. (*SD* = 3.3); peak intoxication *M* = 0.6 (*SD* = 3.4)]. Results indicate that, consistent with our prior studies (e.g., Sayette et al., 2004; Sayette, Martin, Perrott, Wertz, & Hufford, 2001), placebo participants reported experiencing some level of intoxication. That is, they felt significantly more intoxicated than control participants and significantly less intoxicated than participants consuming alcohol.

3.3 TEST OF HYPOTHESES

Before testing my hypotheses, I analyzed all four dependent measures using Shapiro-Wilk tests of normality (Shapiro & Wilk, 1965). Analysis revealed that all measures were positively skewed (*p*s < .001). Square root transformations failed to reduce skew; therefore, logarithmic transformations were used for all regression analyses. (Note that transformations did not affect the key findings reported below.)

As noted earlier, I predicted that (1) there would be a main effect of dosage-set on NFCC and (2) NFCC would mediate the association of dosage-set and risk-seeking. Implicit in these predictions was that alcohol and placebo groups, each of whom had an alcohol dosage-set, would have similar findings. If similarities were found, alcohol and placebo groups would be combined into one alcohol dosage-set group; if similarities were not found, each group would be analyzed separately. Therefore, prior to testing my first hypothesis, I examined raw means (i.e., means calculated using non-transformed data, which appear in Table 2) and used multiple regression analyses to assess whether beverage condition affected time to initiation, time to discontinuation, number of speaking turns, and equality of speech distribution. More specifically, dichotomous indicators of beverage condition, with the no-alcohol control condition as the reference group, were used to predict each of the four dependent measures individually, though the same overall model structure was used in each analysis. These analyses did not demonstrate consistent similarities between alcohol and placebo groups; therefore, each group was analyzed separately.

As illustrated in Table 3, the three beverage conditions did not differ in time to initiation or in time to discontinuation. [Raw means suggested that alcohol-consuming groups took more time to discontinue (M = 41.9 sec), relative to non-alcohol-consuming groups (placebo M = 27.9 sec; control M = 29.8 sec). Though this difference did not reach standard levels of significance (p = .11), there nonetheless was a small effect of alcohol consumption on time to discontinuation (d = .27; Cohen, 1992).] Dosage-set appears to have influenced number of speaking turns, although not in the predicted direction (i.e., control groups took *fewer* turns relative to alcohol and placebo groups). To assess equality of speech distribution, ICCs were calculated for each beverage condition and then compared using Fisher transformations (Fisher, 1915). Comparisons revealed

that neither alcohol (z = 1.54, p = .12) nor placebo (z = 1.14, p = .25) groups differed from control groups with regards to equality of speech distribution.

3.4 SUPPLEMENTAL ANALYSES

Given that my first hypothesis was not supported (i.e., dosage-set did not enhance NFCC), mediation analysis was discontinued as recommended by Baron and Kenny (1986). However, in an effort to better understand the findings, I conducted a series of supplemental analyses. These analyses examined the following questions: (1) to what extent did our coin toss task satisfy the assumptions of NFCC and (2) why, though only a trend (p = .11), did alcohol-consuming groups demonstrate *greater* time to discontinuation relative to non-alcohol-consuming groups?

3.4.1 Methodological assumptions for testing NFCC

In order to best interpret these null findings, I first re-examined the extent to which our experiment provided a fair test of NFCC. As noted earlier, our coin toss task appeared to satisfy many assumptions needed to test NFCC. For example, we placed groups under time pressure and forced them to reach consensus in a task perceived to have real consequences. Presumably, group discussions in which the second proposal generated was in opposition to the first would lead to lengthier debates than when the first two proposals were for the same option. Consistent with this assumption, agreement between first and second proposals was negatively correlated with time to discontinuation ($r = -.43$, $p < .001$). Unfortunately, agreement between first and second proposals

was found in 87.20% of groups, and 90.24% of groups ultimately chose the option proposed first. Taken together, these findings suggest that nearly all groups reached consensus well before the 150-sec time limit was reached. In fact, 90.24% of groups completed the task in less than 120-sec (i.e., time to initiation + time to discontinuation < 120-sec). Thus, despite our best intentions, participants may have failed to experience time pressure to reach a decision regarding the coin toss.

Another key assumption was that the perceived actual consequences in our task (completing 0-, 30-, or 60-min of additional questionnaires) would create a significant enough consequence that the outcome would matter to participants. Post-hoc analyses suggested, however, that participants may not have cared very much about whether the risky or cautious option was selected. While both options were initially proposed with reasonable frequency (36% choosing the riskier option), the particular direction of the initial proposal had no impact on the likelihood that the second person would agree. (In other words, consensus was reached in similar times regardless of decision making outcome.) In addition, agreement between first and second proposals was not affected by beverage condition. Therefore, while groups made both risky and cautious decisions, their decisions do not appear to be the result of extensive debate. Rather, it seemed like the group's desire to agree may have overridden any individual's desire to have one option or the other prevail. In this sense it may be that NFCC was high in all beverage conditions; however, it also may be that groups used agreement as a way to satisfy other motives, such as the need to belong. Thus while we aimed to create a real consequence that would add to the pressure to reach a preferred outcome, it appears that the consequences of the task were perceived to be of such low stakes that agreeing with the initial proposal (regardless of which one it was) proved to be more important to

participants than reaching a particular resolution. Given these findings, it is unclear that our coin toss task did create ideal conditions for testing NFCC.

3.4.2 Effects of alcohol consumption on time to discontinuation

As noted earlier, alcohol-consuming groups demonstrated greater time to discontinuation relative to non-alcohol-consuming groups. Though this finding did not reach standard levels of significance ($p = .11$), it nonetheless reflected a small effect. For the purpose of exploring in a post hoc fashion any unexpected effects, these data suggest an effect of alcohol on decision making latency in the opposite direction to what Webster (1993) found. To better understand this potential finding, I first tested whether alcohol groups experienced lower agreement between first and second proposals, relative to non-alcohol groups. This analysis revealed no difference ($p = .88$), suggesting that the pharmacologic effects of alcohol consumption did not affect agreement between first and second proposals. Additional analyses were conducted to determine if this small alcohol effect was driven by a greater number of long utterances. I therefore examined the frequency of long utterances (i.e., utterances > 20 words) and task orientation of long utterances (i.e., related or unrelated to the coin toss), neither of which differed between alcohol and non-alcohol groups ($p = .19$; $p = .49$).

Finally, I tested the association of time to discontinuation and time spent talking during the 36-min group drink administration interaction (occurring just prior to the coin toss task), given that alcohol-consuming groups spoke longer during the drinking phase compared to non-alcohol-consuming groups (see Sayette, Creswell, Dimoff, Fairbairn, Cohn, Heckman et al., 2012a). These measures were not associated ($r = .04$, $p = .63$); therefore, it does not appear as though the

additional time required to make a decision when consuming alcohol was due simply to being more talkative during the social bonding portion of the study. In sum, to the degree that alcohol extended the time required to make a decision, it appears as though it did so by slightly extending the mean length of utterances without increasing the actual number of utterances [alcohol M = 5.25 sec/utterance (SD = 7.01); non-alcohol M = 3.04 sec/utterance (SD = 3.22); p = .42].

4.0 DISCUSSION

The current study was inspired by our observation that groups that believed they had consumed alcohol were less cautious during a coin toss task than were groups that did not hold this belief. I aimed to enhance understanding of this earlier finding, and in light of work by Webster (1993) and by Lapp et al. (1994), I evaluated NFCC as a novel mechanism that might explain the association of dosage-set and group decision making. Specifically, I predicted that there would be a main effect of dosage-set on NFCC, and that NFCC would mediate the association of dosage-set and risky decision making. The current study appeared to offer a fair test of NFCC, given that the coin toss task was thought to feature high time pressure, forced consensus, and perceived real consequences. In addition, given its large sample size, this study had robust power to test the proposed main effect of dosage-set (of a medium-sized effect) on NFCC. Results did not, however, indicate a dosage-set effect on NFCC. To the contrary, though the differences in number of speaking turns and equality of speech distribution did not reach significance, they nevertheless were in the opposite direction of what would be predicted by NFCC. Results did suggest that dosage-set affects the initial proposed selection, rather than the ensuing discussions, and that actual alcohol consumption (as opposed to dosage-set) may have extended decision making latency. Although the NFCC hypothesis was not supported, review of the data suggests that our assessment of NFCC may have been hampered by certain methodological limitations.

4.1 METHODOLOGICAL LIMITATIONS

Despite sharing similarities with classic tests of NFCC, the coin toss task did not induce NFCC as hoped. In fact, post-hoc analyses revealed that the features most relevant to NFCC—time pressure, forced consensus, and perceived real consequences—all performed below expectations. Specifically, more than 90% of groups completed the task well before the time deadline approached, 87% of groups reached immediate consensus (as measured by agreement between first and second proposals), and immediate consensus was observed regardless of which option was proposed first. Taken together, these findings suggest that (1) most groups did not experience optimal time pressure, (2) consensus was reached easily and quickly, and (3) most groups did not care enough about the task's consequences to disagree with first proposals, regardless of which option was initially suggested. In other words, due to the task's relatively low stakes and its simple design compared to other tests of NFCC, groups' desire for agreement may have outweighed their NFCC, thus rendering the decision making interval irrelevant for most. It is interesting to note, though, that disagreements *were* positively associated with time to discontinuation. Therefore, we may have observed greater variation in time to discontinuation had our task had higher stakes, which presumably would have induced more dissent.

Though the coin toss task may have offered a suboptimal test, I found no evidence to suggest that NFCC explains the effect of dosage-set on risk-seeking behavior. Rather, given that groups typically reached consensus quickly and without disagreement, my findings suggest that dosage-set affected decision making *before* explicit proposals were raised and discussed. It is notable that across the different beverage conditions the cautious solution (30-min of additional questionnaires) was more likely to be selected than the risky decision to toss the coin. This cautious

bias was especially evident for the control condition groups while the groups expecting to drink alcohol were more balanced in their choices. It may be that a cautious mindset is the rule in the official laboratory environment where one's behavior is being monitored by experimenters.

These findings suggesting a more cautious initial proposal among control group members may be explained by Stacy and Weirs' (2010) model of implicit cognition, which suggests that decision making is influenced by spontaneous thoughts that are learned through experience, stored in memory, and activated by environmental cues. (In other words, decision making often depends on context more than it depends on reflective debate, especially when drinking cues are salient.) Importantly, many people report thinking that alcohol facilitates impulsivity and disinhibition (Brown, Christiansen, & Goldman, 1987; Wall, McKee, & Hinson, 2000). In addition, various studies have demonstrated that alcohol cognitions are particularly accessible in alcohol-related contexts, such as actual or simulated bars (see Reich, Goldman, & Noll, 2004; Wall, Hinson, McKee, & Goldstein, 2001; Wall et al., 2000). Thus, group members believing they had consumed alcohol may have accessed less cautious thoughts related to the coin toss task than those aware they were drinking a nonalcoholic beverage. To some extent this alcohol context effect may have attenuated the otherwise cautious response bias evident among the control groups.

In sum, the present findings do not elucidate whether an alcohol dosage-set increases NFCC, and whether NFCC mediates the association of dosage-set and risk-seeking behavior. Rather, they suggest that NFCC may be assessed better by a more complex task of greater consequence. Nonetheless, the present findings do leave open the possibility that an alcohol dosage-set activated enough alcohol cognitions to liberate alcohol and placebo groups from the sterility of our control condition, though not enough to entirely overcome their conservative bias. That is, participants may have loosened their standards of acceptable behavior when they believed

they were drinking in the laboratory. Such a perspective is consistent with recent findings that alcohol cognitions were more strongly related to drinking behavior when participants were assessed in a naturalistic setting than in a laboratory setting without alcohol cues, leading these authors to wonder whether certain laboratory environments may be too sterile to trigger cognitions relevant to behavior (Houben & Wiers, 2008).

4.2 EFFECTS OF NORMATIVE INFLUENCE

While it does not seem as though groups experienced NFCC, it does appear as though they experienced normative influence (i.e., the tendency to comply with the desires of others in order to be accepted as opposed to rejected; see Deutsch & Gerard, 1964). As noted earlier, there was striking agreement between first and second proposals (≈ 90%), which was consistent across beverage conditions and first proposals (i.e., group members were equally likely to agree with cautious and "risky" proposals). This suggests that group members valued affiliation more than they valued a specific decision making outcome, and that first proposals had a potent effect on subsequent proposals. These observations are consistent with classic research suggesting that normative influence can lead people to agree with statements they know to be untrue (Asch, 1956) or to fail to intervene in emergency situations (Latané & Darley, 1970). More recently, research has revealed that normative influence can be induced by minor experiences such as short, casual dialogue (Dolinski, Nawrat, & Rudak, 2001) and fleeting exposure to a stranger without *any* direct interaction (Burger, Soroka, Gonzago, Murphy, & Somervell, 2001). In addition, Kallgren, Reno, and Cialdini (2000) found that people are most susceptible to normative influence when they

recognize that certain responses are more desirable than others. This is germane to the present study given that first proposals clearly established which option was more desirable for one group member. Therefore, those who disagreed with the first proposal could be rejected by as many as two people, while those who agreed would be accepted by at least one. Therefore, second proposals may have been influenced by affiliation-oriented goals.

4.3 EFFECT OF ALCOHOL CONSUMPTION ON TIME TO DISCONTINUATION

A small effect (that failed to reach significance at $p < .05$) was observed suggesting that alcohol-consuming groups may have demonstrated greater time to discontinuation relative to non-alcohol-consuming groups. Supplemental analyses did not suggest that this potential effect of alcohol could be attributed to differences in agreement between first and second proposals, frequency of long utterances, task orientation of long utterances, or time spent talking during the social bonding portion of the study.

Taken together, these findings suggest that alcohol consumption may exert a small effect on the amount of time groups spend talking across various settings. To the extent that this effect is real (i.e., can be replicated), what might it mean? Although speculative, alcohol may have compromised the ability of alcohol-consuming participants to articulate their points as efficiently as non-alcohol-consuming participants, which has been observed in other studies of speech production as well. For example, Moskowitz and Roth (1971), Sobell and Sobell (1972, 1982), Klingholz, Penning, and Liebhardt (1988), and Hollien, Liljegren, Martin, and DeJong (2001) found that alcohol consumption slowed speech production, even at low levels of intoxication.

These findings suggest that the physiological consequences of alcohol consumption (e.g., slowed laryngeal functioning) can compromise the efficiency with which people speak, without necessarily affecting the ideas expressed by speech (Klingholz et al., 1988).

4.4 FUTURE DIRECTIONS

As noted earlier, our coin toss task may not have offered the desired conditions for testing NFCC, due to its relatively low stakes. Therefore, future alcohol research on group decision making would do well to use tasks of greater complexity and consequence, each of which presumably would increase people's motives to disagree and facilitate greater deliberation. (For example, how might alcohol affect groups given the choice to be paid a $30 bonus or to toss a coin and, pending the outcome, earn either no bonus or a $60 bonus instead?) In addition, our task forced groups to decide between one of two dichotomous options; by doing so, the current study could not examine such processes as group polarization, which require continuous outcome measures (see Myers & Lamm, 1975). Also, given that we did not assess group members' initial preferences, we could not determine the extent to which members publicly supported decisions they privately opposed. Finally, given that laboratories may feel sterile to some participants (particularly those consuming no-alcohol control beverages), future research would do well to examine group decision making in more naturalistic settings (e.g., actual or simulated bars).

4.5 SUMMARY

The current research aimed to evaluate the mechanisms underlying the effects of alcohol dosage-set on risk-seeking behavior. In particular, I posited that NFCC would explain the previously observed association between believing one is consuming an alcoholic beverage and the likelihood of choosing the "riskier" coin toss option (Sayette et al., 2012b). Results did not support NFCC as the mechanism underlying this finding; however, results also suggested that the coin toss task used here may not have offered a sensitive test of NFCC. Therefore, it remains possible that NFCC may affect group decisions made under different circumstances. Though methodological limitations were detected, the current study nonetheless revealed a small, non-significant effect of alcohol consumption on decision making latency, which may reflect speech production deficits unrelated to decision making outcomes. Moreover, findings indicate that dosage-set affected group decision making *prior* to observable deliberation, and that groups value affiliation more than they value specific decision making outcomes regardless of which beverage is consumed or which decision is initially endorsed. These findings raise new questions regarding the effects of implicit cognitions and normative influence, which are important to alcohol research given that risky decisions often have serious real-world consequences, and even minor reductions in cautiousness due to drinking can have major ramifications.

APPENDIX

TABLE 1

Table 1. Beverage response variables

	Alcohol (n = 57)		Placebo (n = 56)		Control (n = 51)		
Characteristic	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F***
Pre-coin task BAC	$.054^{a}$	.012	$.001^{b}$	.001	$.001^{b}$	.001	2353.55**
Post-coin task BAC†	$.062^{a}$	.012	$.001^{b}$	.001	—	—	679.18**
Pre-coin task SIS	38.22^{a}	17.05	13.98^{b}	10.05	0.10^{c}	0.72	451.60**
Post-coin task SIS†	35.43^{a}	17.02	8.58^{b}	11.14	—	—	297.55**
Vodka estimate (oz.)	7.07^{a}	10.35	4.91^{b}	6.31	0.44^{c}	3.3	38.71**
Peak intoxication	43.46^{a}	18.67	14.98^{b}	10.61	0.64^{c}	3.42	475.88**

* $p = < .05$

** $p = < .001$

†Analyses did not include control participants, as they were not asked to provide these data.

Notes. BAC = blood alcohol concentration. SIS = subjective intoxication scale (ranging from 0 = *not at all intoxicated* to 100 = *the most intoxicated I have ever been*). SIS and Highest Intoxication scored on scales ranging from 0 to 100. BAC and SIS were not recorded post-coin task for the Control group. Groups with non-overlapping superscripts differed significantly ($p < .05$).

TABLE 2

Table 2. Non-transformed mean values of NFCC measures

	Alcohol (n = 57)		**Placebo (n = 56)**		**Control (n = 51)**	
Characteristic	***M***	***SD***	***M***	***SD***	***M***	***SD***
Time to initiation (sec.)	22.16	26.21	20.37	20.14	21.52	18.60
Time to discontinuation (sec.)	41.94	41.72	27.91	34.91	29.82	32.95
Number of speaking turns	23.51	17.40	22.64	16.60	17.37	13.14
Equality of speech distribution†	.67	—	.63	—	.47	—

† Value reported = intraclass correlation coefficient.

Notes. Shapiro-Wilk tests of normality (Shapiro & Wilk, 1965) revealed that all measures were positively skewed (ps < .001). Therefore, comparisons of non-transformed values are not reported.

TABLE 3

Table 3. Effects of drink condition on NFCC

	TTI		***TTD***		***NST***		***ESD***
	B	***SE***	***B***	***SE***	***B***	***SE***	***Z-score***
Constant	1.197	.049	1.205	.080	1.132	.044	—
Alcohol	-.042	.067	.111	.111	.122*	.061	1.54
Placebo	-.012	.067	-.079	.111	.117	.061	1.14
R^2	.003	—	.019	—	.030	—	—

* p = < .05 when compared to constant

Notes. Alcohol and placebo values compared to constant. Constant = no-alcohol control condition. *B* = unstandardized regression coefficient derived from logarithmically transformed data. TTI = time to initiation. TTD = time to discontinuation. NST = number of speaking turns. ESD = equality of speech distribution. ICC = intraclass correlation coefficient. ICCs compared to constant using Fisher's *r*-to-*z* transformation.

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