

DECISIONAL BALANCE: THEORY, HISTORY, RESEARCH, AND DIRECTIONS FOR
ALCOHOL RESEARCH

A Dissertation

Presented to

The Faculty of the Department

of Psychology

University of Houston

In Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Philosophy

By

Dawn W. Foster

May, 2013

DECISIONAL BALANCE: THEORY, HISTORY, RESEARCH, AND DIRECTIONS FOR
ALCOHOL RESEARCH

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ABSTRACT

This study seeks to replicate and extend decisional balance (DB) research by implementing a DB intervention among heavy drinking undergraduates, and comparing the traditional non-weighted DB proportion (DBP; Collins, Carey, & Otto, 2009) to a DBP that is weighted based on the relative importance of items. We expected that consistent with previous findings, the intervention would result in decreased drinking compared to control. We further expect that the weighted DBP would be a better predictor of reduced drinking compared to the non-weighted DBP or control. Additionally, we expect that intervention efficacy would be moderated by initial DBP. One hundred and eighty heavy drinking undergraduates (Mean age = 24.37, SD = 6.81, 27% male) completed study materials including measures of alcohol consumption and DB at baseline (pre- and post-intervention) and again during a one month follow-up assessment. Results showed that consistent with expectations, the intervention predicted follow-up drinking (drinks per week). Furthermore, consistent with expectations, the weighted DBP was associated with reduced drinks per week and marginally associated with reduced problems. Results further indicated that the actual weight values did not moderate intervention efficacy. This finding suggests that the *process* of weighting pros and cons may be instrumental in moving individuals toward change, regardless of the *actual* values of the weights. The broad, long-term objective of the current study is to lay the groundwork for enhancing future interventions by increasing empirical knowledge of the role motivation plays in heavy alcohol use and factors in predicting drinking.

Keywords: motivation to change; motivational interviewing; ambivalence

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Decisional balance: Theory, history, research, and directions for alcohol research

The overarching goal of this paper is to provide a review of the theory, history, and research related to decisional balance (DB), and to propose strategies for improving DB with respect to alcohol brief intervention for college drinkers. There are six specific goals of this paper; 1) provide a brief overview of college drinking; 2) discuss motivation to change and related theory; 3) discuss motivational interviewing and related theories; 4) provide a review of DB research; 5) consider strategies for improving DB measurement with respect to alcohol intervention for college drinking; and 6) evaluate a unique alcohol intervention that seeks to extend previous research by applying and evaluating a new DB measure among college drinkers.

1. College drinking

Compared to non-college peers, undergraduate students are at increased risk for heavy episodic drinking (more than five drinks in a row during the past two weeks; Substance Abuse and Mental Health Services Administration [SAMHSA], 2009). Problematic drinking and related consequences among undergraduates remains prevalent (Johnston, O'Malley, Bachman, & Schulenberg, 2012) with estimates indicating that 80% of undergraduate students drink, 67% drink at least once per month, and 40% frequently drink several alcoholic beverages on an occasion (Johnson et al., 2006). Research further shows that college students who drink experience alcohol-related consequences that range in severity including poor class attendance, trouble with authorities, hangovers, injuries, (Hingson, Hereen, Winter, & Wechsler, 2005; Hingson, 2010; Wechsler, Kuo, Lee, & Dowdall, 2000; Wechsler, Davenport, Dowdall, & Moeykens, 1994), depression (Geisner, Larimer, & Neighbors, 2004), eating disorders (Dunn, Larimer, & Neighbors, 2002), risky sexual behavior, and sexual assault (Abbey, Buck, Zawacki, & Saenz, 2003; Kaysen, Neighbors, Martell, Fossos, & Larimer, 2006; Koss & Gaines, 1993;

Larimer, Lydum, Anderson, & Turner, 1999). Morbidity and mortality trends related to college drinking indicate that almost 20% of undergraduates meet DSM-IV criteria for alcohol dependence or abuse (NIAAA, 2007), yet less than 5% seek alcohol treatment or counseling. Existing alcohol interventions for college drinking are widely available, however, many undergraduates do not perceive any need to change their drinking behavior (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Larimer & Cronce, 2002). Innovative intervention strategies that encourage students to consciously consider reasons for changing problem behaviors by increasing MTC may provide unique benefit (e.g., Collins, Carey, & Otto, 2009).

2. Motivation to change

Motivation to change (MTC), a state of readiness or eagerness to change, is a dynamic, multidimensional, and fluctuating state, and since it can be influenced by both internal and external conditions, it is a significant factor to consider in alcohol intervention (Miller, 1999; Miller & Rollnick, 1991). Five related aspects of motivation have been identified (Miller, 1999): readiness to change (stages of change), motives for substance use, self-efficacy, goals/values, and decisional balance. MTC has been conceptualized as an increasingly thoughtful process wherein individuals begin to more fully consider reasons for change and is operationalized as openness to enter into a strategy for behavior change (Miller, 1999; Miller & Rollnick, 1991).

2.1. MTC strategies

Various approaches and strategies have been used during interventions to target motivational aspects regarding drinking behavior change. Motivational approaches range from confrontational procedures to empathic interaction styles. Aggressive confrontational tactics do not stem from a single clear historic source but have risen gradually, guided by the psychodynamic belief that individuals addicted to alcohol are characterized by strong defenses

and an ‘addictive personality’ (e.g., Johnson, 1973). However, this perspective has not been empirically supported (Vaillant, 1983). Thus, although motivational approaches emphasizing confrontation, coercion, or external contingencies (e.g., threatened loss of job) may have a place in evoking behavioral change (e.g., Conner, Longshore, & Anglin, 2009), the importance of building intrinsic motivation should not be overlooked (Miller & Rollnick, 2002). Eight broad strategies are described for empathically encouraging MTC during motivational interventions (Miller & Rollnick, 1991): giving advice, removing barriers, providing choice, decreasing desirability, practicing empathy, providing feedback, clarifying goals, and active helping.

Giving advice, at minimum should consist of clear identification of the problem area, explanation of the importance of change, and advocating for specific change. Advice alone is not likely to induce change, but compassionate and clear advice has a motivating influence (e.g., McCambridge, Slym, & Strang, 2008). *Removing barriers* refers to identification and removal of common barriers to MTC. These might include economic factors or access to treatment, or may be specific to gender, ethnicity, or the individual. *Providing choice* involves the fostering of intrinsic motivation through building the perception of freedom to choose the next course of action without external influence (Deci, 1975, 1980). *Decreasing desirability* involves the identification of positive incentives for substance use (e.g., pros of drinking) and counterbalancing them (e.g., make the cons of drinking salient) to decrease the behavior’s perceived desirability (Karoly, 1980). *Practicing empathy* is a learnable skill that applies reflective listening (e.g., Feldstein & Forcehimes, 2007). *Providing feedback* can be done in various forms including objective tests, a self-monitoring diary, or expression of concern from significant others (e.g., Ceperich & Ingersoll, 2011). *Clarifying goals* involves the comparison between status (e.g., feedback) and goals (e.g., personal standards). *Active helping* is described as

a therapist being actively and affirmatively interested in the change process (Miller & Rollnick, 1991). When used in the context of theory-based interventions, these motivational strategies can increase MTC.

2.2. *Theoretical background regarding MTC*

MTC strategies implemented in theory-driven alcohol intervention increase the likelihood of successful and maintained change in drinking. The MTC construct includes elements of theories such as theory of planned behavior (Ajzen, 1991) and social learning theory (Bandura, 1977), but the main focus stems from the transtheoretical model (TTM; Prochaska, DiClemente, & Norcross, 1992). The TTM proposes two dimensions that help us understand when and how shifts in behavior, attitude, and intention occur with respect to alcohol use; 1) stages of change (*when* changes occur); and 2) processes of change (*how* changes occur).

2.2.1. *Stages of change*

The first major dimension proposed by the TTM is *stages of change* (Prochaska et al., 1992). The TTM proposes five stages of change ascertained by discrete categorical self-report (DiClemente et al., 1991) and continuous (McConaughy, DiClemente, Prochaska, & Velicer 1989; McConaughy, Prochaska, & Velicer, 1983) measures: precontemplation, contemplation, preparation, action, and maintenance (Prochaska & DiClemente, 1986; Prochaska et al., 1992). Each successive stage indicates increased motivation for the continuation of behavior change and represents temporal dimensions, allowing us to understand when a shift in attitude, intention, or behavior occurs (Prochaska & DiClemente, 1986). The *precontemplation* stage is characterized by unawareness or under-awareness that there is a problem, even if it is apparent to friends or family. Precontemplators might be identified through routine medical exams such as blood tests that indicate heavy drinking. Precontemplators in therapy are often there due to coercion and

may be resistant to recognizing that a problem exists or to modifying their drinking. During the *contemplation* stage, people are aware of an alcohol problem, however, they have not yet made a commitment to changing behaviors. Ambivalence (described further in the *Motivational Interviewing* section) is a hallmark of this stage. Contemplators can remain “stuck” in this stage for long periods, going back and forth between reasons for change and reasons for staying the same (weighing the pros and cons). Contemplators tend to struggle with positive evaluations of drinking and the effort or energy it will cost to overcome it (DiClemente, 1991; Prochaska & DiClemente, 1992; Velicer, DiClemente, Prochaska, & Brandenburg, 1985). The *preparation* stage is characterized by intention and behavioral criteria. Individuals in this stage intend to take action in the near future (e.g., within the next month), have not been successful in taking action in the past year, and have not reached criteria for effective action (e.g., abstinence). The *action* stage involves overt modification of drinking behaviors to an acceptable criterion and requires considerable commitment of time and effort. For example, a person in the action stage might abstain from alcohol. The *maintenance* stage is a continuation, not absence, of change and is characterized by working to prevent relapse. Maintaining drinking behavior change may require different skills from initial change, such as identifying strategies to prevent relapse (Lundahl, Kunz, Brownell, Tollefson, & Burke, 2010). Criteria for maintenance include remaining free of the problem behavior (drinking) and consistently engaging in a new, incompatible behavior for more than six months. Should relapse occur, the challenge is to not get stuck in relapse, but to renew the process of progressing through the stages of change (Prochaska & DiClemente, 1986; Prochaska et al., 1992).

In light of these stages, implications for alcohol treatment include the consideration that motivational strategies and approaches should be targeted to particular stages (Davidson,

Rollnick, & MacEwan, 1991). Each specific stage of change provides proscriptive and prescriptive information on treatments most likely to induce desired changes. For example, the majority of addicted individuals are not in the action stage (Abrams, Follick, & Biener, 1988; Gottlieb, Galavotti, McCuan, & McAlister, 1990), and action-oriented therapies may be less effective for those in the precontemplation stage (Ockene, Ockene, & Kristellar, 1988). Telling someone *how* to change if they do not perceive that they have a problem might even elicit counterproductive defensiveness (Miller & Rollnick, 1991). While linear progression through stages is possible, it is more common for individuals to cycle through these stages several times before eventual termination of alcohol addiction, with or without expert assistance (Orford, 1985; Tuchfeld, 1981).

2.2.2. *Processes of change*

The second major dimension of the TTM, *processes of change* (Prochaska et al., 1992), enables us to understand *how* shifts in drinking behavior, attitude, and intention occur. Processes of change are broad categories encompassing multiple methods and techniques, and they differ from stages of change in that they are overt and covert experiences or activities that an individual may engage in when attempting to modify their drinking (Prochaska et al., 1992). Processes include: *self-reevaluation* (assessing how one thinks or feels about oneself regarding drinking), *counterconditioning* (substituting alternatives for drinking), *stimulus control* (avoiding or countering stimuli that may elicit drinking), *reinforcement management* (rewarding oneself for reducing drinking), *environmental reevaluation* (assessing how the physical environment is affected by one's drinking), *dramatic relief* (experiencing and expressing feelings about drinking or reducing drinking), *helping relationships* (being open and trusting about drinking problems with someone who cares), *consciousness raising* (increasing one's information about oneself and

one's drinking), *self-liberation* (committing to act or to the belief in one's ability to change), and *social liberation* (increasing alternatives for nonproblem behaviors available in society). These processes are potent predictors of change across problems (Prochaska et al., 1992).

2.2.3. Stages and processes of change integrated

The TTM offers an approach to combining the stages and processes of change by emphasizing specific processes at each stage of change (please see Table 1; DiClemente et al., 1991; Prochaska & DiClemente, 1983, 1984; Prochaska et al., 1992) which has direct applicability to alcohol use. During the precontemplation stage, people tend to devote less time and energy to self-reevaluation, process less drinking-related information, are less open with others about their drinking, experience fewer emotional reactions to negative drinking-related aspects, and tend to be the most resistant to change. People in the contemplation stage tend to be more conscious of the self and the nature of their drinking, and are more open to consciousness raising techniques, dramatic relief experiences, self-reevaluation, and environmental reevaluation. Movement from the precontemplation to contemplation and progression through the contemplation stage involves cognitive, evaluative, and affective processes of change, some of which may continue during the preparation stage. Individuals in the preparation stage tend to begin taking steps towards action by using stimulus control and counterconditioning to begin controlling the situation and start reducing drinking (DiClemente et al., 1991; Prochaska et al., 1992). Individuals in the action stage tend to endorse higher levels of willpower or self-liberation, increasingly believe that they can change, and engage in effective behavioral processes such as stimulus control and counterconditioning to modify stimuli that prompt drinking relapse. The action stage is quite stressful, and individuals tend to rely increasingly on understanding and support from helping relationships as they move through the action stage

towards the maintenance stage. Successful maintenance builds on each of the processes of change through assessment of conditions under which relapse is likely, through the development of alternative coping responses and generally involves the increasing sense that one is becoming the person one wants to be (Prochaska et al., 1992).

Although there has been some debate regarding efficacy of TTM tenets in encouraging and predicting change (e.g., Guo, Aveyard, Fielding, & Sutton, 2009a), research evaluating the predictive validity of combining stages and processes of change has demonstrated that not only do these dimensions predict behavior change, but when they are further combined with a decisional balance measure, they predict which patients drop out of psychotherapy prematurely with 92% accuracy (Brogan, Prochaska, & Prochaska, 1999). Additionally, research has shown varying patterns of behavior change, including *stable* (remaining in the same stage for a long period of time), *progressive* (advancing from one stage to the next in linear movement, which is ideal but rare; Prochaska et al., 1992), *regressive* (moving to an earlier stage), and *recycling* (revolutions through the stages; Prochaska, DiClemente, Velicer, & Rossi, 1992).

Thus, the TTM provides an integrative perspective on the structure of intentional change. Systematic integration of the stages and processes of change is recommended, and the TTM suggests that though it is likely that individuals struggling with alcohol addiction will experience a cyclical pattern of movement before change is maintained, successful change can be facilitated by doing the right things (processes) at the right time (stages; Prochaska et al., 1992). This emphasizes the importance of considering stages and processes of change in tailoring alcohol intervention strategies to enhance MTC (Miller & Rollnick, 1991, 2002; Prochaska et al., 1992).

2.3. *MTC Brief intervention*

One of the effective methods in building MTC is the brief intervention. Theory-based brief interventions (termed ‘brief’ because they typically consist of one to three sessions) have been implemented to impact motivation for modifying problem behaviors (e.g., Collins, Eck, Torchalla, Schroter, & Batra, 2010; LaBrie, Pedersen, Thompson, & Earlywine, 2008; Miller & Rollnick, 1991, 2002). Because conditions for motivating change can be captured in relatively brief counseling spans, brief intervention methods for substance use are not only more effective than no intervention at all, but can also be just as effective, if not more so, compared to more intensive treatment (Bien, Miller & Tonigan, 1993; Kahan, Wilson, & Becker, 1995; Miller & Taylor, 1980; Miller, Taylor, & West, 1980; Wilk, Jensen, & Havighurst, 1997). As such, brief interventions have been widely applied to decrease drinking among populations including adolescents (e.g., Walton et al., 2010), mandated students (e.g., Barnett et al., 2004; Tevyaw, Borsari, Colby, & Monti, 2007; White et al., 2006), and college students (e.g., Borsari & Carey, 2005; Carey, Carey, Maisto, & Henson, 2006; Collins & Carey, 2005; Dimeff, Baer, Kivlahan, & Marlatt, 1999; McNally & Palfai, 2003; Murphy et al., 2001; Rollnick, Heather, Gold, & Hall, 1992; Stamper, Smith, Grant, & Bogle, 2004; Tollison, Lee, Neighbors, Neil, Olson, & Larimer, 2008).

2.3.1. *Elements of brief intervention*

Six elements of brief interventions have been identified, and these elements have some overlap with the eight MTC strategies described above. The first element is *feedback*, which consists of either a structured or unstructured comprehensive assessment through which feedback of current status is provided. The second element, *responsibility*, involves emphasizing personal responsibility for change. The third element, *advice*, refers to clear advice regarding making a

change in substance use. The fourth element, *menu*, provides alternative strategies for changing. The fifth element, *empathy*, emphasizes an empathic manner when interacting with clients, and the sixth element, *self-efficacy*, involves building the perspective that successful change is possible by reinforcing the belief in one's own ability to succeed (Miller & Rollnick, 1991). The acronym "FRAMES" has been used to refer to these elements (**F**eedback, **R**esponsibility, **A**dvice, **M**enu, **E**mpathy, and **S**elf-efficacy; Miller & Rollnick, 1991). Motivational interviewing, in particular, emphasizes these elements and has been applied in the context of brief alcohol interventions to increase MTC alcohol use (Miller & Rollnick, 2002).

3. Motivational interviewing

Motivational interviewing (MI) is a counseling style that has been widely applied as a form of brief intervention to reduce substance use (Branscum & Sharma, 2010; Burke, Arkowitz, & Menchola, 2003; Carey, Carey, Maisto, & Henson, 2006; Feldstein & Forcehimes, 2007; Lundahl & Burke, 2009; McNally, Palfai, & Kahler, 2005; Tevyaw, Borsari, Colby, & Monti, 2007; Tollison et al., 2008). MI is an evidence-based psychotherapeutic method and is specifiable to problem areas (Miller & Rose, 2009). MI is a non-judgmental, client-centered, counseling style for eliciting behavior changes by enhancing MTC and helping individuals explore and resolve ambivalence (Miller & Rollnick, 2002). Resolving ambivalence is the goal of MI (Miller & Rollnick, 1991). Ambivalence, a complex phenomenon, is a defining characteristic of addictive behaviors (Orford, 1985). Individuals struggling with addiction typically experience coexisting, discordant motivations such as simultaneously wanting to quit (e.g., recognizing the harm involved with drinking) and not wanting to quit (e.g., being attached to drinking; Walker, Stephens, Rowland, & Roffman, 2011). This conflict, termed ambivalence,

can exist in degrees that increase or decrease with time, and can develop when a person becomes attached to a behavior and finds the behavior difficult to resist (Miller & Rollnick, 2002).

Attachment to a behavior can form through physiological dependence, tolerance, or learning/conditioning patterns. It is not that an alcoholic is not motivated, but rather, he or she may experience conflicting motivations and be “stuck” in ambivalence. A person feeling ambivalent about their drinking might struggle with dissonant cognitions such as “Drinking makes me more social,” and “Drinking is bad for my health.” The objective of MI is to understand and ultimately resolve ambivalence, particularly by highlighting discrepancies between a person’s behaviors and goals, and increasing MTC (Miller & Rollnick, 1991, 2002).

3.1. Theoretical background regarding MI

MI’s discrepancy-focused tenet stems from theories related to the awareness of discord: cognitive dissonance theory (Festinger, 1957), self-perception theory (Bem, 1965), self-discrepancy theory (Higgins, 1987), and the self-regulation model (Kanfer, 1987).

3.1.1. Cognitive dissonance theory

Cognitive dissonance theory (Festinger, 1957), one of the most influential and documented theories in social psychology (e.g., Aronson, 1992; Cooper, 1992; Jones, 1976; Visser & Cooper, 2003), can be applied to a variety of psychological topics involving the interplay of motivation, cognition, and emotion. As presented by Leon Festinger (1957), dissonance theory postulates that pairs of cognitions (pieces of knowledge) can be consonant or dissonant with each other and with behaviors. As dissonance is psychologically uncomfortable and aversive, individuals experiencing it strive to reduce or resolve it. The greater the degree of discrepancy between attitudes and/or behaviors, the greater the level or magnitude of dissonance is experienced. The magnitude of dissonance is proportional to the number of discrepant

cognitions and inversely proportional to the number of consonant cognitions held by an individual (Festinger, 1957). This is summarized using this formula:

$$\frac{[(\text{number of discrepant cognitions}) * (\text{importance of discrepant cognitions})]}{[(\text{number consonant cognitions}) * (\text{importance of consonant cognitions})]}$$

For example, a habitual drinker, Jane, who learns that drinking is bad for her health will experience dissonance because the knowledge that drinking is bad for her health is dissonant with the cognition that she continues to drink. If both drinking and health are highly important to Jane, her dissonance will be larger in magnitude than if either drinking or health is not highly important to her. Jane can reduce her dissonance by modifying her behavior (stop drinking) such that it becomes consonant with the cognition that drinking is bad for health. Alternatively, Jane can reduce dissonance by changing her cognition about the effect of drinking on health by believing that drinking does not have harmful health consequences (eliminate dissonant cognition). To this end, Jane may look for positive effects of drinking and believe that drinking reduces tension or allows her to fit in with peers (adding consonant cognitions). Additionally, she might believe that the health risk from drinking is negligible compared to the danger of, say, dying in a car crash (reducing the importance of the dissonant cognition), or she may consider the enjoyment she gets from drinking to be a very important part of her life (increasing the importance of consonant cognitions; Festinger, 1957). Dissonance theory has generated a variety of research and has been evaluated in the context of four paradigms. These include the free-choice paradigm, the belief-disconfirmation paradigm, the effort-justification paradigm, and the induced-compliance paradigm (Harmon-Jones & Mills, 1999).

3.1.1.1. Free-choice paradigm. The *free-choice paradigm* (e.g., Brehm, 1956; Brehm & Cohen, 1959, 1962; Festinger, 1964; Shultz & Lepper, 1996) suggests that dissonance is aroused

once a decision is made, and the more difficult the decision, the greater the dissonance. This is due to; 1) positive aspects of the rejected alternative and negative aspects of the chosen alternative being dissonant with the decision; and 2) positive aspects of the chosen alternative and negative aspects of the rejected alternative being consonant with the decision (Harmon-Jones, 1999). Dissonance can be reduced through “spreading of alternatives,” which refers to the removal of the dissonant aspects (positive aspects of the rejected alternative or negative aspects of the chosen alternative) and addition of consonant aspects (negative aspects of the rejected alternative and positive aspects of the chosen alternative; Harmon-Jones, 1999). The first experiment using this paradigm to test dissonance theory predictions involved female participants who rated products (e.g., toaster) in terms of desirability. They were either asked to choose between two highly desirable products (difficult decision) or between one highly desirable and one not desirable product (easy decision; Brehm, 1956). Results showed that those making the difficult decision modified their evaluations of the products such that the chosen product was viewed more favorably and the rejected product less favorably (Brehm, 1956). Recent research evaluating dissonance-related attitude change, such as attitude change associated with physical activity (e.g., Chatzisarantis, Hagger, & Wang, 2008), is consistent with this perspective, and demonstrates that free choice is associated with positive attitude.

3.1.1.2. Belief-disconfirmation paradigm. The *belief-disconfirmation paradigm* (e.g., Burris, Harmon-Jones, & Tarpley, 1997; Festinger, Riecken, & Shachter, 1956) suggests that when individuals are exposed to information that is inconsistent with beliefs, dissonance is aroused (Harmon-Jones, 1999). If changing one’s belief does not reduce dissonance, the dissonance can lead to; 1) misinterpretation or misperception; 2) refutation or rejection of the information; 3) attempts to persuade others to accept one’s belief; or 4) seeking support from

others who agree with the belief (Harmon-Jones, 1999). In a study of belief disconfirmation, Festinger, Riecken, and Shachter (1956) acted as participant observers in a group that believed they were chosen to be saved from a flood that would engulf the continent based on a prophecy from extra-terrestrial beings. After the disconfirmation of belief (no flood), the group engaged in significantly more proselytizing compared to before the disconfirmation. They sought to persuade others to accept their beliefs (adding consonant cognitions; Festinger et al., 1956).

3.1.1.3. Effort-justification paradigm. The *effort-justification paradigm* (e.g., Aronson & Mills, 1959; Beauvois & Joule, 1996) suggests that when an individual engages in an unpleasant behavior/activity to obtain a desired outcome, dissonance is aroused (Harmon-Jones, 1999). The cognition that the activity is unpleasant is dissonant with the cognition that one is engaging in it, and the greater the effort to obtain the outcome, the greater the dissonance (Harmon-Jones, 1999). Dissonance can be reduced by focusing on or exaggerating the outcome's desirability (adding consonant cognitions; Harmon-Jones, 1999). The first study designed to evaluate these ideas involved female participants undergoing either a severe or mild initiation in order to become a group member (Aronson & Mills, 1959). Women in the severe initiation condition rated the group more favorably compared to those in the mild initiation condition (Aronson & Mills, 1959).

3.1.1.4. Induced-compliance paradigm. The *induced-compliance paradigm* (e.g., Aronson & Carlsmith, 1963; Festinger & Carlsmith, 1959; Linder, Cooper, & Jones, 1967), previously termed "forced-compliance," suggests that when a person says or does something inconsistent with a belief or attitude, dissonance is aroused (Harmon-Jones, 1999). On the one hand, the belief or attitude would be consistent with the cognition that one would not engage in the behavior. On the other hand, cognitions that are consonant with the behavior may include

threats of punishment or promises of reward, which might provide justification for engaging in it (Harmon-Jones, 1999). The greater the number and importance of the cognitions justifying the behavior, the lower the magnitude of experienced dissonance (Harmon-Jones, 1999). Dissonance can be reduced by modifying beliefs or attitude to be more consistent with the behavior, or modifying the behavior such that it becomes consistent with attitude or beliefs. Thus, behavior change can be encouraged by increasing and/or highlighting dissonance. This can be accomplished by making salient the discrepancies between cognitions or behaviors to the individual.

The first experiment designed to evaluate this paradigm was conducted by Festinger and Carlsmith in 1959. This now classic study was designed to test whether opinion change following dissonance would occur after being forced to lie and whether this would depend on level of reward (Festinger & Carlsmith, 1959). Participants included 71 male college students who were asked to tell a fellow student that a boring task (placing and moving spools on a tray for 30 minutes) was enjoyable, and they were either paid one dollar (low reward), 20 dollars (high reward), or were not asked to lie (control; Festinger & Carlsmith, 1959). Findings revealed that a low reward for counterattitudinal behavior led to a more positive attitude, a phenomenon termed “negative-incentive effect” due to a negative relationship between the amount of attitude change in the direction of the counterattitudinal behavior and the actual reward (Harmon-Jones, 1999). These results corroborated the hypothesis that the greater the reward, the smaller the opinion change (Festinger, 1957; Festinger & Carlsmith, 1959). Participants in the high reward and control conditions rated the task as boring, whereas participants in the low reward condition rated the task as more enjoyable (Festinger & Carlsmith, 1959). Thus, those in the high reward condition did not experience as much dissonance as those in the low reward condition because

the reward (20 dollars) was enough to justify their actions. Those in the low reward condition resolved the dissonance between their attitude (“the task was boring”) and behavior (“I said the task was enjoyable”) by changing their attitude to be more in line with their behavior (e.g., rating the experiment as pleasant; Festinger & Carlsmith, 1959). Additional research revealed that the negative-incentive effect occurs when an individual perceives freedom to choose to engage in counterattitudinal behaviors. However, in the absence of perceived freedom, the opposite effect occurs wherein greater incentives correlate with a more positive attitude (Linder, Cooper, & Jones, 1967). Thus, when there is no choice about engaging in counterattitudinal behavior, dissonance is minimal due to sufficient justification for engaging in the behavior (Linder, Cooper, & Jones, 1967). A variant of the induced-compliance paradigm involves the threat of punishment rather than the promise of reward, and this phenomenon is known as the *forbidden toy paradigm* (Aronson & Carlsmith, 1963). Children were threatened with a mild or severe punishment if they played with a toy (Aronson & Carlsmith, 1963). Children who received a mild punishment threat evaluated the toy less positively compared to those who received a severe punishment threat (Aronson & Carlsmith, 1963). Recent induced-compliance research related to the writing of counter-attitudinal essays has demonstrated that, consistent with expectations, participants in a high or low level construal mindset (e.g., focusing on more important concerns versus secondary issues) who engaged in a counter-attitudinal task demonstrated greater attitude change in high choice conditions compared to low choice conditions (Wakslak, 2012).

3.1.1.5. Revisions of and alternatives to dissonance theory. Since its inception, dissonance theory has continued to generate not only research, but also revision. This is partly due to the general and abstract form in which it was originally proposed, which allows for application to a variety of psychological topics. The original theory assumes that dissonance-

inducing situations lead to a motivation resulting in genuine cognitive changes. Revisions differ in what is proposed as the underlying motivation for dissonance effects, and include the *self-consistency* interpretation of dissonance (Aronson, 1968, 1992), the *new look* version of dissonance (Cooper & Fazio, 1984; Scher & Cooper, 1989), and *self-affirmation theory* (Steele, 1988; Steele, Spencer, & Lynch, 1993).

The *self-consistency* interpretation of dissonance (Aronson, 1968, 1992) suggests that dissonance is evoked following an inconsistency between the self-concept and a behavior. Most individuals strive to maintain consistent, positive self-concepts. Thus, when own behaviors contradict the rosy self-image, dissonance occurs (Aronson, 1968, 1992). For example, an individual who strives to maintain a self-concept that is consistent with the cognition “I am a person who values my own health” may experience dissonance following a heavy drinking episode because their drinking behavior contradicts their health-related self-concept. This revision interprets the Festinger-Carlsmith (1959) effects as resulting from inconsistency between a moral self-concept and lying behavior (Aronson, 1968, 1992). The *new look* interpretation of dissonance (Cooper & Fazio, 1984; Scher & Cooper, 1989) proposes that the attitude change observed in the Festinger-Carlsmith (1959) study resulted from a desire to avoid feeling personally responsible for causing harm through lying. *Self-affirmation theory* (Steele, 1988; Steele, Spencer, & Lynch, 1993) suggests that dissonance effects are a result of behaving in a manner that threatens one’s sense of adaptive and moral integrity. This theory interprets the Festinger-Carlsmith (1959) results by assuming that the attitude change observed was a result of participants feeling foolish and having their sense of self-worth threatened.

3.1.2. *Self-perception theory*

In addition to the aforementioned revisions, *self-perception theory* (Bem, 1967, 1972) was proposed to offer an alternative explanation for the dissonance effects. Self-perception theory proposes that dissonance effects are due to nonmotivational processes whereby individuals infer attitudes from own behaviors and the circumstances under which behaviors are observed. Self-perception theory suggests that own behavior is the source of evidence for beliefs and attitudes to the extent that the reinforcement contingencies for engaging in the behavior are vague or less discriminable (Bem, 1967, 1972). If external contingencies seem sufficient to justify a behavior, a person will not use own behavior as a source for self-attributions. The theory proposes; 1) Inferences about the self are based on observations of own behaviors as they provide important clues to the inner state; and 2) to the extent that internal cues are ambiguous/weak, external cues are relied on to infer internal states (functionally, one is in the same position as an outside observer; Bem, 1972). Thus, self-perception theory assumes that a participant in the Festinger-Carlsmith (1959) experiment would observe his own behavior and either attribute the behavior to a high reward (in the 20 dollar condition) based on the assumption that the reward is sufficient incentive to evoke the behavior regardless of internal views, or he might modify his attitude to be consistent with his behavior (one dollar condition) based on the assumption that the small reward is not enough of a motivational factor to induce the behavior.

The “cartoon experiment,” the first study to test self-perception theory, used disguised tape-recording sessions during which participants were asked to answer truthfully when a certain color light was on (e.g., amber), and falsely when another color light was on (e.g., green; Bem, 1964). The participant learned that he could believe himself in the presence of the “truth” light, but not in the “lie” light (the colors of the lights were reversed for half of the participants).

Participants were then asked to rate cartoons as funny or not funny under the truth or lie light. Findings show that statements made under the truth light led to attitude change. A cartoon rated as funny under the truth light later received higher funny ratings than if it had been rated as funny under the lie light (Bem, 1964). This supports self-perception theory and replicates the Festinger-Carlsmith (1959) experiment such that the truth light matched the low reward (one dollar) condition, signifying to the participant that his behavior could be used as a proxy for attitude, and the lie light matched the high reward (20 dollar) condition, signifying to the participant that his behavior was irrelevant to internal attitude.

Among the research that corroborates self-perception theory are; 1) studies that manipulate external cues and evoke differential self-descriptions of operationally identical emotional states (e.g., euphoria versus anger; Schachter & Singer, 1962); 2) studies showing that cues associated with lying can create self-disbelief in true statements, leading to distortions in recall of behavior (e.g., false confession experiment; Bem, 1966; Maslach, 1971); and 3) studies supporting predictions that freely choosing to escape shocks will result in higher pain ratings compared to shocks that are freely chosen to endure (Bandler, Madaras, & Bem, 1968; Corah & Boffa, 1970). Research further shows that participants in a belief-relevant condition were more in favor of the position they were to advocate than participants in either a belief-irrelevant condition or control (e.g., pro-attitudinal advocacy; Kiesler, Nisbett, & Zanna, 1969). Additionally, research demonstrates that participants who observed themselves decline a chance to substitute a different, more extreme speech than the one initially given attributed themselves an attitude toward the issue that was correspondingly less extreme (more in line with the speech) compared to participants who were not given the opportunity to substitute a different speech (e.g., rejection of alternative action; Harvey & Mills, 1971). In a recent study using self-

perception theory predictions that one's attitude is inferred by observing one's own behavior, findings demonstrated support for self-perception theory such that identity cues provided via digital self-embodiment enhance behavioral outcomes (Yee & Bailenson, 2009). In another recent study evaluating smoking cessation interventions, a condition was evaluated wherein primary care physicians were given self-perception theory based feedback convincing them that they were doing well in helping smokers to quit (consistent with the self-concept that they are aiding smokers; Vogt, Hall, Hanskins, & Marteau, 2009). Results from this study did not support self-perception theory predictions, as the means of effectiveness related expectations did not differ between the intervention and control (Vogt et al., 2009). It is possible that the feedback might have been more effective had it been individually tailored, and this suggests that further research is needed in order to determine whether the application of personalized feedback increases intervention efficacy.

3.1.3. Self-discrepancy theory

In addition to dissonance theory and self-perception theory, MI's focus on discrepancy also stems from self-discrepancy theory (Higgins, 1987). Self-discrepancy theory proposes that the greater the magnitude and accessibility of incompatible self-beliefs, the more an individual will experience discomfort (DeMartini, Carey, Lao, & Luciano, 2011; Higgins, 1987; Neal & Carey, 2004). The theory was guided by two goals; 1) distinguish types of discomfort that people experience; and 2) relate types of emotional vulnerabilities to the different discrepancies that individuals may possess among their self-beliefs (Higgins, 1987). There are three domains of the self; 1) *actual self*, which includes the person's representation of attributes the self or another person believes the individual possesses; 2) *ideal self*, which consists of the person's representation of attributes that the self or another person believes the individual ideally

possesses (e.g., hopes, goals); and 3) *ought self*, which includes a person's representation of attributes that the self or another person believes the individual should or ought to possess (e.g., duty, obligations; Higgins, 1998). In addition to these three domains of the self are two standpoints of the self; 1) *own personal standpoint*; and 2) *other standpoint* (e.g., parent, friend; Higgins, 1998). The three domains and two standpoints can be combined to yield six kinds of self-state representations which include '*actual and own personal*,' '*actual and other*,' '*ideal self and own personal*,' '*ideal self and other*,' '*ought self and own personal*,' and '*ought self and other*' (Higgins, 1998). Thus, individuals experience discomfort when certain domains of the self are inconsistent with one another. Simply put, self-discrepancy theory provides a basis on which to build understanding about where discrepancies arise.

Self-discrepancy theory takes motivational and cognitive aspects about the self into account (Strauman & Higgins, 1998). Theory suggests that different discrepancies render an individual vulnerable to particular negative motivational states and specific negative emotions (Strauman & Higgins, 1998). Individuals are motivated to reach a state where the self-concept is matched by self-guides such that the discrepancy between the actual self-state and the self-guide will be associated with a motivational predisposition (Strauman & Higgins, 1998). The actual/ideal discrepancy is a state where actual attributes do not match the ideal state that one aspires to attain, and it represents a negative psychological situation (absence of positive outcomes) which increases vulnerability to dejection-related emotions such as sadness and discouragement (Strauman & Higgins, 1998). The actual/ought discrepancy is a state where actual attributes do not match the ought state that one feels obligated to fulfill and is represented by the anticipation of negative outcomes. This state is characterized by vulnerability to agitation-related emotions such as apprehension and tension (Strauman & Higgins, 1998). Findings from a

study testing this model support the self-discrepancy theory predictions in that the actual/ideal discrepancy was linked with dejection-related emotions, whereas the actual/ought discrepancy was associated with agitation-related emotions (Higgins, Klein, & Strauman, 1985).

Research has revealed that that the self-discrepancy model goes beyond the predictions of general emotional vulnerability and is relevant to the phenomenon of multiple affective responses to a single event (Strauman & Higgins, 1998). For example, an individual who receives a grade that is lower than expected might feel both disappointment and frustration due to the discrepancy between the actual and ideal self, or the individual may feel both anxious and resentful due to the discrepancy between the actual and ought self (e.g., failing to meet parental expectations). An important contribution was made to self-discrepancy theory by Carver, Lawrence, and Scheier (1999) who designed a study to evaluate discrepancies between the actual, ought, ideal, and *feared* self (the self one worries about being, defined by traits an individual thinks they might develop in the future, but would rather not). Findings revealed that among those who's actual and feared self were less discrepant, discrepancies from ought selves were not related to agitation-related affect (Carver, Lawrence, & Scheier, 1999). However, among participants who's actual and feared self were more discrepant, discrepancies from ought self predicted agitation-related affect (Carver et al., 1999). These findings support the perspective of two motivational forces at work: one creating movement *toward* a reference point (approach force), and one creating movement *away* from it (avoidance force), and as such, they help bridge the self-discrepancy and self-regulation literatures (Carver et al., 1999).

3.1.4. Self-regulation model

In addition to the previously discussed theories, MI's focus on discrepancy also stems from the self-regulation model (Kanfer, 1987). Self-regulation is described as the ability to form

and implement a long-term plan or goal even in the absence of immediate external rewards (Brown, 1998). Those with a high capacity for self-regulation may be more likely to choose to modify behavior, monitor progress, and maintain change over time. The self-regulation model attempts to elucidate the underlying psychological mechanisms that create changes in drinking behavior (Kanfer, 1987). Six phases of self-regulation were proposed by Miller and Brown (1991) to expand Kanfer's self-regulation model and provide a more inclusive explanation of addictive behavior change. These are: informational input, self-evaluation, instigation of change, planning, implementation, and plan evaluations. The first three phases are relevant to motivating individuals to consider behavioral change, and the last three are phases where change occurs. During the informational input phase, an individual gains increased awareness of the impact and nature of the behavior. The awareness that a current behavior might be problematic leads to the second phase, self-evaluation. This phase involves comparing observed behavior to some internal personal criterion (e.g., comparing the actual with the ideal self) or external criterion (e.g., comparing the self with social norms), and this comparison may induce realization that current behavior falls short from relevant standards. This realization can trigger negative affect. These affective, cognitive, and behavioral reactions to the highlighting of discrepancy can lead to the third phase, instigation of change, as an individual attempts to reduce negative affect through either modifying behaviors or reducing inconsistent cognitions (Miller & Brown, 1991). Thus, developing discrepancy is key in progressing through the self-regulation phases and reaching the three phases where change occurs. This discord-awareness view is consistent with theoretical perspectives discussed previously.

While much of published research supports developing discrepancy as an important strategy to encourage behavior change (e.g., Carver et al., 1999; Higgins, 1999; Higgins, Roney,

Crowe, & Hymes, 1994; Scott & O'Hara, 1993; Heidrich & Powwattana, 2004; Tangney, Niedenthal, Covert, & Barlow, 1998; Orellana-Damacela, Tindale, & Suarez-Balcazar, 2000), there is some inconclusive evidence with respect to the *values clarification* technique. This technique relates to self-reevaluation, which is one of the processes of change described by the TTM (Prochaska et al., 1992). To reiterate, self-reevaluation involves assessing how one thinks or feels about oneself with respect to a problem (Prochaska et al., 1992). Particularly regarding decision-making (discussed further in the *Decisional Balance* section) and behaviors related to alcohol, it is logical to assume that individuals who experience discrepancy-induced dissonance following consideration of how one thinks or feels about oneself with respect to one's drinking would be more motivated to decrease dissonance by reducing drinking compared to individuals who do not experience dissonance. That is, the values clarification technique is expected to be associated with increased intention to reduce drinking and decreased drinking levels. Alcohol interventions using a values clarification approach (e.g., Larimer & Cronce, 2002, 2007; Neal & Carey 2004; Smith, 2004; Stamper, Smith, Grant, & Bogle, 2004) attempt to help individuals clarify how they feel and think about themselves with respect to their drinking. Neal and Carey (2004), in particular, sought to determine if techniques for developing discrepancy work with respect to intention to reduce drinking by designing a study that randomized 92 participants to one of three conditions: attention-control (information condition against which to evaluate intervention conditions), personalized normative feedback, and personal strivings assessment (this was a modified values clarification). The modified values clarification condition was comprised of feedback regarding the participants' reported goals and how drinking affected these goals (Neal & Carey, 2004). Findings revealed that contrary to predictions, the modified values

clarification condition did not have the intended effect of increasing intention to reduce drinking (Neal & Carey, 2004).

There are several potential reasons for this lack of significant effect. One potential reason is related to the manipulation checks indicating that participants did not see conflict between their current drinking level and their strivings (goals; Neal & Carey, 2004). As such, neither discrepancy nor ensuing intention to change was likely to develop. For example, if a person does not perceive that their use of alcohol interferes with their goals or values, they may not feel the need to modify their drinking behavior. This seems consistent with the precontemplation stage, described by the TTM (Prochaska et al., 1992). Moreover, the sample was comprised solely of freshmen (Neal & Carey, 2004), and it is likely that freshmen students, though they may meet heavy drinking criteria (at least four/five drinks on one occasion for women/men respectively; Wechsler, Davenport, Dowdall, & Moeykens, 1994), they may not yet experience undesired consequences to the extent that they feel behavior modification is needed. Due to an absence of awareness that a problem exists (e.g., precontemplators), the participants may not have felt that their drinking conflicted with their goals and thus did not develop dissonance. A second potential reason is perhaps when listing personal strivings, college students may focus on long-term (e.g., “Be an entrepreneur”) rather than short-term (e.g., “Pass my exam”) outcomes. Relatedly, it is possible that students rate distal goals as more important than proximal goals (e.g., “Being an entrepreneur in the future is more important than passing my exam”). Thus, it follows that it may not be likely that undergraduates perceive a relationship or resulting conflict between current alcohol use and distal goals, and therefore results evaluating discrepancy may not detect an effect. A third potential reason is perhaps self-efficacy (specifically, drink-refusal self-efficacy; e.g., Baldwin, Oei, & Young, 1993; Morawska & Oei, 2005) moderates the effect of values

clarification on intention to reduce drinking. That is, perhaps values clarification induced discrepancy is associated with increased intention to reduce drinking among students who feel confident that they can resist alcohol. Thus, skills training to build drink-refusal self-efficacy might be useful in conjunction with values clarification. A fourth potential reason for the lack of significant findings relates to alcohol being enmeshed with the college social scene (Thombs, Wolcott, & Farkash, 1997). Perhaps drinking is not only *not* inconsistent with personal strivings, it might actually *facilitate* strivings related to social goals. This would help to explain why students in the values clarification condition did not exhibit increased intention to reduce drinking (Neal & Carey, 2004) and would be consistent with research demonstrating that social goals positively correlate with drinking (Maggs, 1997).

Future research evaluating the efficacy of values clarification in alcohol intervention might consider; 1) including a more representative sample of college students (e.g., juniors and seniors); 2) controlling for TTM stage of change (Prochaska et al., 1992); 3) asking participants to specifically list short and/or long term goals; 4) identifying goals that are consistent and inconsistent with drinking; and 5) incorporating a skills-training component.

3.1.5. Conclusions regarding discrepancy-based theoretical approaches

Theoretical perspectives underlying MI's focus on discrepancy include the four discord-awareness theories discussed in previous sections. The overarching MI goals of ambivalence resolution and building MTC (Miller & Rollnick, 1991) can be achieved through the careful and guided highlighting of discrepancies between an individual's behaviors and goals. Practically speaking, specific principles and strategies to facilitate behavior change can be utilized.

3.2. *MI principles and strategies*

MI, noted above as a nonjudgmental style of counseling, is founded on five general principles: expressing empathy, avoiding argumentation, rolling with resistance, supporting self-efficacy, and developing discrepancy (Miller & Rollnick, 1991, 2002; Miller & Sovereign, 1989). The first MI principle, *express empathy*, involves the therapist's acceptance of the client seeking treatment. This does not mean agreement with the client's behavior, but rather refers to skills such as reflective listening (a skill that overlaps conceptually with the fifth strategy described in the *MTC Strategies* section). The second principle, *avoid argumentation*, recognizes that arguments are counterproductive because they breed defensiveness. *Roll with resistance*, the third principle, suggests that if resistance arises, it is a signal to the therapist to change strategies and encourage a shift in perspective. *Support self-efficacy*, the fourth principle, suggests that belief in the possibility of change is a key motivator. As the client is ultimately responsible for deciding to change and maintaining change, it is important to build change-related self-efficacy. The fifth MI principle, *develop discrepancy*, as noted previously, involves highlighting and amplifying the discrepancy between the client's behavior and goals until attachment to the problem is overridden, and ambivalence is resolved (Miller & Rollnick, 1991). It bears repeating that the uncomfortable awareness of a discrepancy between where one *is* versus where one *wants to be* is related to aspects stemming from previously discussed discord-awareness theories.

In light of these principles, there are five strategies designed to build MTC and resolve ambivalence (Miller & Rollnick, 1991) with the assumption that the client is either in the precontemplation or contemplation stage of change (Prochaska et al., 1992). These strategies are; 1) ask open-ended questions; 2) listen reflectively (this skill conceptually overlaps with the fifth MTC strategy, described in the *MTC Strategies* section, and the first MI principle, described in

the previous paragraph); 3) affirm; 4) summarize what has been said; and 5) elicit self-motivational statements. Self-motivational statements reflect cognitive, affective, emotional, and behavioral dimensions of commitment to change (see Table 2 for list of MTC strategies, MI principles, and MI strategies; Miller & Rollnick, 1991, 2002). One of the methods designed to elicit self-motivational statements and resolve ambivalence is the decisional balance procedure, which is described in detail in the following section.

4. Decisional balance

4.1. Decisional balance through the decades

Decisional balance is a method for representing the benefits (pros) and costs (cons) of different choices and has been used to facilitate decision-making. Decisional balance (DB) is a motivational tool with a history dating to Irving Janis and Leon Mann (1977). Originally, DB was proposed as a descriptive representation of cognitive-motivational aspects of the process of decision-making (Janis, 1959; Janis & Mann, 1977). It stems from the notion of motivation as a balance between two opposing forces, and in order for a person to be motivated for change, the costs of a behavior must outweigh its benefits and the pros of a new behavior must outweigh its cons. DB assumes that effectual decision-making involves careful consideration of relevant factors, such as potential gains and losses. DB has been applied as a counselor-facilitated or written exercise to reduce errors in decision-making by helping individuals become more cognizant of their decision-making processes. Thus, DB facilitates a comprehensive and realistic assessment of the net gain of a current or potential behavior. Data generated during a DB may serve as a proxy for MTC as it reflects an individual's resolve to enter into a course of action (Janis & Mann, 1977). This perspective is echoed in research supporting the view that DB is a marker for the initiation of specific stages of change (Pollak, Carbonari, DiClemente, Niemann,

& Mullen, 1998). In this view, stages of change are operationalized algorithmically as a function of changes in DB (Hall & Rossi, 2008; Prochaska, 1994). Engaging in DB allows for the examination of ambivalence regarding current behavior to determine whether the weight of the evidence accumulates towards a need for behavior change (Miller, 1999). Thus, the development of the DB construct over the course of history demonstrates its potential to reflect *and* enhance motivational states, and it can be used as an assessment tool as well as an intervention procedure.

4.2. DB literature

DB has been applied to many fields, across cultures, and among varying age groups. The objective in many studies using DB is to build motivation to avoid risky behaviors or adopt healthy behaviors (Burbank & Riebe, 2002). DB has been applied in the context of substance use, weight control, cancer, diabetes screenings, and a myriad of additional behaviors. The following sections review the DB literature. As this paper's objective is to propose future directions with respect to alcohol-related DB, the literature review will focus particularly on alcohol-related studies. Other literature bodies will be covered more broadly.

4.2.1. DB in alcohol studies.

Enhancing awareness that an alcohol problem exists is an important factor in initiating movement towards making a decision to reduce drinking (Miller & Rollnick, 1991; 2002). Table 5 presents evidence and characteristics of alcohol-related studies using DB. Alcohol-related DB can be used to overcome denial and enhance alcohol problem recognition (McCrady & Epstein, 1999; Nye, Agostinelli, & Smith, 1999). Studies show alcohol-related DB is significantly related to MTC (e.g., stages of change) in varying populations such as at-risk college drinkers (Collins et al., 2009; Morgen & Gunneson, 2008; Velasquez et al., 1999), heavy drinking non-college individuals (Share, McCrady, & Epstein, 2004), middle school students (Babbin et al., 2011;

Talpade, Lynch, Lattimore, & Graham, 2008), women at risk for HIV (Semaan, Lauby, O'Connell, & Cohen, 2003), cross cultural populations (Johnson et al., 2006), and clinical populations (Grothues et al., 2005; Velasquez, Carbonari, & DiClemente, 1999). Although various behaviors (e.g., alcohol and smoking) may be comorbid, research indicates little correspondence between the behaviors' stages of change (Thyrian, Rumpf, Meyer, Hapke, & John, 2004), indicating a need for behavior-specific interventions.

Alcohol-related interventions incorporating a DB component are generally associated with favorable outcomes including decreased drinking levels or increased motivation for reducing drinking (LaBrie, Cail, Pedersen, & Migliuri, 2011; LaBrie, Lamb, Pedersen, & Quinlan, 2006; LaBrie, Pedersen, Earleywine, & Olsen, 2006; LaBrie, Thompson, Huchting, Lac, & Buckley, 2007; Talpade et al., 2008; Walton et al., 2010). Additionally, research has shown that DB may have increased predictive ability with respect to drinking compared to alcohol expectancies (Noar, LaForge, Maddock, & Wood, 2003).

Many of the alcohol interventions that have included a DB component are MI-based. These MI-based alcohol interventions have found that DB correlates with family history of alcohol problems (Carey & DeMartini, 2010), and DB may increase the salience of costs and benefits of reducing heavy drinking (Carey et al., 2006). Morgen and Gunneson (2008) evaluated how the DSM-IV diagnostic status for alcohol abuse/dependence related to a DB measure in a non-clinical college sample and found that students may not seek alcohol services because they do not believe they have a problem. An examination of the relationship between stage of change and DB among a treatment-seeking group of women showed that consistent with Janis and Mann's (1977) theory of decision-making, salience of pros and cons of changing behavior was associated with a decision to take action (Share, McCrady, & Epstein, 2004).

In many of the aforementioned studies, researchers have utilized several DB measures for drinking. The Alcohol Decisional Balance Scale (King & DiClemente, 1993) measures the pros and cons of *maintaining* current drinking behavior. The Alcohol and Drug Consequences Questionnaire (Cunningham, Gavin, Sobell, Sobell, & Breslin, 1997) measures the pros and cons of *changing* alcohol or drug use. The Decisional Balance for Immoderate Drinking (Migneault, Velicer, Prochaska, & Stevenson, 1999) measures the pros and cons of “*immoderate*” drinking. However, as noted by Collins and colleagues (2009), these measures suffer from a number of weaknesses. All of these measures focus on the pros and cons of current alcohol use *or* the pros and cons of reducing/changing alcohol use, which is not a *comprehensive* DB. An incomplete DB is not ideal and may even be problematic in the decision-making process based on the potential for overlooking consequences that may create new ambivalence following the decision (Janis & Mann, 1977). Moreover, an incomplete DB may not take into account all aspects of an individual’s current MTC, and thus, focuses on only half of the decision-making processes (e.g., *either* the pros and cons of current behavior *or* the pros and cons of an alternative behavior). Additionally, these measures include pros and cons that are generated by the researcher rather than by the participant, an approach that may not be adequate in capturing authentic and accurate MTC (Collins et al., 2009). Pros and cons generated by a researcher might not overlap with those generated by participants, given the differences in backgrounds, interpretations, and perspectives (Beyth-Marom, Austin, Fischhoff, Palmgren, & Jacobs-Quadrel, 1992; Fischhoff & Quadrel, 1991). Relatedly, researchers may be creating an artificially constructed decision-making process to which participants passively respond, an approach that may result in the undesired effect of making participants aware of pros and cons that may not represent their own unique decision-making process or which they may not have considered otherwise (Collins et al., 2009).

In light of these concerns and with the understanding that participant-generated DB may provide a more accurate measure of MTC and better predict alcohol-related outcomes than researcher-generated DB, an open-ended, comprehensive response format is preferred (Collins & Carey, 2005). Each of the four DB fields yields unique information that contributes to a fuller and deeper understanding of the change process. The broader problem-solving literature suggests that how a question/message is framed (positively versus negatively) can substantially affect decisions (Tversky & Kahneman, 1981). Additionally, loss- and gain-framed messages can be differentially persuasive depending on factors such as health behavior, perceived risk, expectancies, or gender (e.g., Apanovitch, McCarthy, & Salovey, 2003; Kiene, Barta, Zelenski, & Cothran, 2005; Mann, Sherman, & Updegraff, 2004; Schneider et al., 2001). Therefore, so as not to unequally favor the gain (benefit) or loss (cost) perspective with respect to the other, structuring the DB such that participants generate responses to all four fields is recommended. As such, a four-field DB worksheet that prompts participants to report the pros and cons for each behavior alternative (specifically, current drinking and reducing drinking) has been applied (e.g., Carey et al., 2006). In filling out the worksheet, the individual becomes more aware of conflict between behaviors and goals, and as the person understands and works through awareness-induced ambivalence, he or she progresses along the stages of change (e.g., moving from the contemplation to preparation stage; Prochaska & DiClemente, 1992).

One of the methodological limitations of existing brief intervention research related to alcohol is that the interventions involve multiple components. When DB is applied, it has generally been in the context of multi-component alcohol programs, which prohibits the evaluation of DB as a unique contributor. Only a few published studies have evaluated DB as a stand-alone alcohol intervention, and they have revealed mixed findings. LaBrie and colleagues

(2006) evaluated the effectiveness of DB in a sample of high-risk male college students. In this study, there was no control group to serve as a comparison group; 47 males participated in an assessment session (pre-intervention, intervention, and post-intervention) and a one month follow-up assessment (LaBrie et al., 2006). Findings revealed that the DB exercise led to reported decreases in alcohol consumption (e.g., number of drinks consumed per month and maximum number of drinks consumed on one occasion), increased motivation to decrease drinking, and decreased intention to drink (e.g., decreased number of drinks intended to consume). These findings are in support of the use of DB as a stand-alone intervention.

In contrast, two studies did not find support for a stand-alone DB intervention (Collins & Carey, 2005; Carey et al., 2006). Collins and Carey (2005) compared two forms of DB (in-person and written) and a control group in a study including 234 undergraduate students who reported at least one heavy drinking episode in the previous 30 days (Wechsler et al., 2002). Findings revealed that although in-person DB generated significantly more drinking cons and behavior change pros compared to the written DB, there were no significant differences among the two intervention (DB) groups and the control group with respect to drinking outcomes. Moreover, Carey and colleagues (2006) examined brief MI with and without a DB component in a study including 509 heavy drinking college students. Eligible participants were randomized to one of six possible conditions and completed follow-up assessments at one month, six months, and twelve months. No condition evaluated DB as a stand-alone intervention, but findings suggest that the addition of a DB component do not improve outcomes. Contrary to the findings published by LaBrie and colleagues (2006), these results do not support DB as a stand-alone intervention. Thus, although alcohol interventions that incorporate a DB component tend to have favorable outcomes, research assessing DB's unique effects show mixed findings.

A new measure for DB, termed the decisional balance proportion (DBP), has recently been proposed (Collins et al., 2009), and it evaluates the *ratio* of pros and cons. Unlike previous research including a DB measure (e.g., Cunningham et al., 1997; Migneault et al., 1993; Velicer, et al., 1985), the DBP is an open-ended generation of pros and cons that integrates a comprehensive, four-field DB: pros and cons of drinking *and* reducing drinking. Collins and colleagues (2009) converted the number of pros and cons in each field of the DB worksheet into a DBP and tested its validity as a new measure of MTC. Counts of pros and cons were obtained by summing the filled-in lines (main explanatory variable of the study) by using the formula:

$$\frac{(\text{pros}_{\text{red}} + \text{cons}_{\text{cur}})}{(\text{pros}_{\text{red}} + \text{cons}_{\text{cur}} + \text{pros}_{\text{cur}} + \text{cons}_{\text{red}})}$$

In this formula, “red” is reducing drinking and “cur” is current drinking (see Table 3 for an example of DBP). Scores at 0.5 represent an even balance between the pros and cons of current drinking and reducing drinking (high ambivalence), scores between 0 and 0.5 indicate that the balance is tipping toward maintaining current drinking (indicating low MTC), and scores between 0.5 and 1.0 indicate that the balance is tipping toward reducing drinking (indicating high MTC; Collins et al., 2009). Findings suggest that initial DBP correlated with readiness to change as measured by the Readiness to Change (RTC) Questionnaire (Rollnick, Heather, Gold, & Hall, 1992), and the DBP was correlated with weighted importance of current negative outcomes as measured by the Decisional Balance for Immoderate Drinking scale (DBID; Migneault, Pallonen, & Velicer, 1997). Although the DBP correlates with RTC and DBID, the DBP corresponds to DB and MTC theory better than either the RTC or DBID (Collins et al., 2009). Drinking outcomes were significantly and consistently predicted by DBP models, and changes in DBP (from pre- to post-treatment) predicted drinking for up to six months following the brief

intervention (Collins et al., 2009). Analyses showed an increase in MTC and a decrease in heavy drinking as a result of the intervention, but there was an apparent decay in this effect after the twelve month follow-up.

This DBP study was replicated by Collins, Eck, Torchalla, Schroter, and Batra (2010) in the context of a smoking intervention to test whether the predictive effects of the DBP were generalizable beyond alcohol use. Although this particular study was not an alcohol intervention per se, it is discussed here due to its direct relevance to the DBP. The development of MTC as measured by the DBP over the course of the intervention was an effective predictor of smoking outcomes and abstinence (Collins et al., 2010). The DBP predicted smoking cessation outcomes in that increased MTC led to longer abstinence than stable or decreased MTC, and increased DBP predicted fewer smoking lapses and less smoking on smoking days during the one year follow-up period (Collins et al., 2010). This suggests that higher MTC was related to favorable behavioral movement along the continuous index of smoking intensity (Collins et al., 2010).

Thus, the DBP seems to be a valid and intuitively interpretable measure of MTC (Collins et al., 2009; Collins et al., 2010) and represents a step forward in DB measurement. Additionally, as DBP input is participant (not researcher) generated, this measure is likely more personally relevant and accurate than other indicators of MTC such as the RTCQ and DBID (Fischhoff & Quadrel, 1991). Furthermore, the DBP draws on the strengths of the TTM (Prochaska et al., 1992), decision-making (Janis & Mann, 1977), and MI (Miller, 1999; Miller & Rollnick, 1991; 2002) theory and research. The DBP format (open-ended worksheet) lends itself to quantitative and qualitative representations of MTC, is easily converted into deciles of motivation ranging from 0% to 100%, and provides practical solutions to challenges encountered in predicting substance use behaviors through MTC measurement (Collins, 2010).

4.2.2. *DB in smoking studies.*

As this paper's ultimate objective is to propose future directions with respect to alcohol-related DB interventions, the non-alcohol literatures will be covered broadly, beginning with the DB and smoking literature. Historically, DB is shown to be a powerful construct for application in smoking behavior (Fava, Velicer, & Prochaska, 1995; Ferketich, Week, Shultz, & Wewers, 2007; Goldberg & Velicer, 2006; Lubetkin, Wu, Krebs, Yeung, & Ostroff, 2010; Pallonen, 1998; Prochaska, 1985; Velicer, DiClemente, Prochaska, & Brandenburg, 1985; Velicer et al., 2000; Velicer, Prochaska, Fava, Norman, & Redding, 1998; Schumann et al., 2005). MTC smoking studies that incorporate DB elements indicate that DB exercises influence progression toward behavior change (e.g., DiClemente et al., 1991; Kalra, Carey, & Folk, 1992; Pollak, Carbonari, DiClemente, Niemann, & Mullen, 1998; Prokhorov et al., 2008; Rodriguez & Londono, 2010; Tsoh & Hall, 2004). Furthermore, with few exceptions (Lafferty, Heany, & Chen, 1999; Tonjes et al., 2007), many studies have established a relationship between the DB and MTC such that in general, as DB scores increase (e.g., more pros relative to cons of changing the behavior), MTC also increases (Ames et al., 2008; Bledsoe & Birkimer, 2004; Boudreaux, Carmack, Scarinci, & Brantley, 1998; Boudreaux, Francis, Taylor, Scarinci, & Brantley, 2003; Collins et al., 2010; Correia, Ballard, Henslee, Irons, 2006; Fitzgerald, & Prochaska, 1990; Harmsen, Bischof, Brooks, Hohagen, & Rumpf, 2006; Herzog, Abrams, Emmons, & Linnan, 2000; Johnson, Fava, Velicer, Monroe, & Emmons, 2002; Kohler, Fish, & Davies, 2004; Okechukwu, Krieger, Sorensen, Li, Barbeau, 2011; Park et al., 2001; Snow, Prochaska, & Rossi, 1992; Wagner, Burg, & Sirois, 2004; Ward, Velicer, Rossi, Fava, Prochaska, 2004). Findings are consistent among adolescents (Dalum, Schaalma, Kok, 2012; Guo et al., 2009a; Guo, Aveyard, Fielding, & Sutton, 2009b; Plummer et al., 2001; Prochaska et al., 1994; Rossi et al., 2001; Velicer, Redding,

Anatchkova, Fava, & Prochaska, 2007), African Americans (Ahijevych & Parsley, 1999; Hoffman et al., 2006; O’Hea, Wood, Brantley, 2003), Britains (Guo, Aveyard, Fielding, & Sutton, 2008), pregnant women (Bane, Ruggiero, Dryfoos, & Rossi, 1999; Huang, Guo, Wu, & Chien, 2011; Ussher, Etter, & West, 2006), Taiwanese children (Chen, Horner, & Percy, 2003; Chen, Horner, Percy, & Sheu, 2008), Germans (Jakle, Keller, Baum, Basler, 1999; Keller, Nigg, Jakle, Baum, Basler, 1999; Schumann, Rumpf, Meyer, Hapke, & John, 2003), Czechoslovakians (Svetlak & Kukleta, 2006; Svetlak, Konecny, & Kukleta, 2007), Koreans (Ham, 2007), Turkish samples (Bektas, Ozturk, & Armstrong, 2010; Yalcinkaya-Alkar & Karanci, 2007), Japanese youth (Otake & Shimai, 2001), Chinese samples (Chen, Sheu, Percy, Brown, & Yang, 2006; Chen, Sheu, Chen, 2006) Spanish adults (Font-Mayolas, Planes, Gras & Sullman, 2007), Bulgarians (Anatchkova, Redding, & Rossi, 2006, 2007), community samples (Carlson, Taenzer, Koopmans, & Casebeer, 2003), post-partum women (Roske et al., 2008; Simonelli & Velicer, 2012), the clinical population (Schorr et al., 2009; Solty, Crockford, White, & Currie, 2009), physician samples (Park, et al., 2003), and military samples (Martinelli, 1999).

Research indicates multiple factors that may have implications for future interventions. One study found that experienced smokers generated more pros and fewer cons compared to naïve smokers (Hudmon, Prokhorov, Koehly, DiClemente, & Gritz, 1997), and thus smoking status may be an important variable to consider in interventions. Additionally, gender-specific interventions may be useful due to gender differences in smoking behaviors such as females reflecting higher MTC (O’Hea et al., 2003). Exercise may be an additional factor to consider in smoking interventions. Smoking cons were associated with the exercise pros such that regularly exercising smokers reported higher smoking-refusal self-efficacy than those not exercising regularly (King, Marcus, Pinto, & Emmons, 1996). Also important in the design of tailored

interventions is the consideration that the stages of change may not necessarily be uniform. For example, the contemplation stage has been shown to be comprised of distinct subtypes (classic contemplators, progressing, early contemplators, and disengaged; Anatchkova, Velicer, & Prochaska, 2005) and profiles (stable, progressing, vacillating, and regressing; Norman, Velicer, Fava, & Prochaska, 1998). Lastly, the DBP, a newly proposed measure of MTC (Collins et al., 2009) is discussed in detail in the *Alcohol use* section above. To date, only one study (Collins et al., 2010) has applied the DBP in the context of a smoking intervention. Aside from alcohol and smoking, no published studies have evaluated the DBP with respect to any other behaviors.

4.2.3. DB in other substance use studies.

DB has been applied to other substance use behaviors (Elliott, Carey, & Scott-Sheldon, 2011; Migneault, Adams, & Read, 2005). Generally, studies incorporating a DB element to evaluate substance use behavior have demonstrated that DB is a useful indicator of MTC substance use behaviors (Prochaska et al., 1994), and interventions incorporating DB are associated with favorable outcomes related to substance use (Apodaca & Longabaugh, 2009; Patten, 2004; Velasquez, von Sternberg, Dodrill, Kan, & Parsons, 2005). Findings are consistent for substance using clinical (Carey, Maisto, Carey, & Purnine, 2001; Carey, Purnine, Maisto, Carey, & Barnes, 1999; Finnell & Lee, 2011; Nidecker, DiClemente, Bennett, & Bellack, 2008) and community (Carise et al., 2009) populations.

4.2.4. DB in obesity prevention studies.

DB has been applied to obesity prevention and weight loss (O'Connell & Velicer, 1988) and is associated with MTC such that as DB scores increase (e.g., more pros relative to cons of changing the behavior), MTC also increases (Baughman et al., 2003; Hagler et al., 2007; Latimer, Walker, Kim, Pasch, & Sterling, 2011; Smith, Griffin, Fitzpatrick, 2011; Pokrajac-

Bulian, Tkalcic, Guina, Stimac, 2005; Robinson et al., 2008; Steele, Steele, & Cushing, 2012; Stoltz, Reysen, Wolff, & Kern, 2009). Results are consistent cross-culturally, including Japanese undergraduates (Akamatsu, Otake, & Shimai, 2003), Croatians (Tkalcic, Pokrajac-Bulian, 2006), and Koreans (Chae, Kwon, Kim, & Jang, 2010).

4.2.5. DB in physical activity studies.

DB's applications also include physical activity studies (Bopp, Wilcox, Oberrecht, Kammermann, & McElmurray, 2004; Cox, Gorely, Puddey, Burke, & Beilin, 2003; Dishman, 1994; Lewis et al., 2006; Nigg, & Courneya, 1998; Spencer, Adams, Malone, Roy, & Yost, 2006). It likely comes as no surprise that, as evidenced in the alcohol use, smoking, and weight control literatures, DB is associated with MTC with respect to physical activity and exercise behavior (Astroth, Fish, Mitchell, Bachman, Hsieh, 2010; Bogg, 2008; Boudreaux et al., 2003; Cardinal, 2005; Clarke & Eves, 1997; Cox, Stimpson, Poole, & Lambur, 2003; Fahrenwald & Walker, 2003; Fallon, Hausenblas, & Nigg, 2005; Fischer & Bryant, 2008; Griffin-Blake & DeJoy, 2006; Heesch, Masse, Dunn, & Frankowski, 2006; Jordan, Nigg, Norman, Rossi, & Benisovich, 2002; King, Marcus, & Pinto, 1996; Kosma, Cardinal, & McCubbin, 2004; Marcus et al., 1998; Marcus, Rakowski, & Rossi, 1992; Norman et al., 2004; Paxton et al., 2008; Smith et al., 2011; Sullum, Clark, & King, 2000; Towers, Flett, & Seebeck, 2005; Uechi, Takenaka, Suzuki, 2003). With few exceptions (Berry & Howe, 2005; Greaney et al., 2008; Horn, Gilbert, Gilbert, Lewis, 2011; Leffingwell, Rider, & Williams, 2001; Rau, Teichmann, Petermann, 2008, 2009;), these findings have been consistently demonstrated in cross-cultural samples such as Koreans (Kim, Kim, Chae, 2010; Kim, Kim, & Park, 2011; Kim & Cardinal, 2009), Germans (Jakle et al., 1999), French (Eeckhout, Francaux, Philippot, 2012), Chinese (Callaghan, Eves, Norman, Chang, & Lung, 2002; Callaghan, Khalil, & Morres, 2010), Greeks (Karteroliotis,

2008), Mexican Americans (Laffrey & Lee, 2005), employees (Herrick, Stone, Mettler, 1997; Marcus, et al., 1994), low-income samples (Taylor, Boudreaux, Jeffries, Scarinci, Brantley, 2003), persons at risk for coronary disease (Basler, Jakle, Keller, & Baum, 1999; Bock et al., 1997), middle school samples (Berry, Naylor, Wharf-Higgins, 2005; Hausenblas, Nigg, Downs, Fleming, & Connaughton, 2002), and the elderly (Cheung et al., 2007; Gorely & Gordon, 1995).

Research suggests multiple factors that may have implications for future interventions. Some support has been found for the assumption that DB mediates the physical activity level and behavior change relationship (Lewis, Marcus, Pate, & Dunn, 2002; Napolitano et al., 2008; Papandonatos et al., 2011; Pinto, Lynn, Marcus, DePeu, & Goldstein, 2001), however, additional research is needed to determine whether DB for exercise is influenced by factors such as skills training or perceived barriers. Additionally, gender-specific interventions may be useful, particularly in building MTC for exercise adoption among women (Cardinal, Lee, Kim, Lee, Li, Si, 2009). Also important in the design of tailored interventions is the consideration that as subtypes of the contemplation stage have been identified (Gorely & Bruce, 2000) stage of change may not be uniform.

4.2.6. DB in disordered eating and nutrition studies.

DB is associated with motivation for modifying behaviors regarding disordered eating (Delinsky et al., 2011; Rieger, Touyz, & Beumont, 2002) and demonstrates good internal consistency and test-retest reliability (Cockell, Geller, & Linden, 2002, 2003). With respect to nutrition studies, commitment to changing diet has been demonstrated as the best predictor of dietary change (Kelly, 2011), and DB has been associated with MTC nutrition (Di Noia & Prochaska, 2010; Di Noia, Schinke, Prochaska, & Contento, 2006; Horwath, Nigg, Motl, Wong, & Dishman, 2010; Ma et al., 2002; Mainvil, Lawson, Horwath, McKenzie, & Hart, 2010; Shirazi

et al., 2006). Research consistently shows that methods for encouraging progression through stages of change influence motivation for fruit and vegetable intake (Archuleta, 2009; de Vet, Nooijer, Vries, & Brug, 2005; Ling & Horwath, 2001; Hildebrand & Betts, 2009; Ma, Betts, Horacek, Georgiou, & White, 2003; Nitzke et al., 2007; Park et al., 2008; Shriver, Hildebrand, & Austin, 2010). These results extend to carbonated drink consumption (Buchanan & Coulson, 2007) and folic acid consumption (Milan & White, 2010). Further research incorporating gender-specific interventions for motivation related to diet and nutrition may be warranted based on results showing gender differences with respect to motivations for healthy diet and nutrition (O’Hea et al., 2003).

4.2.7. DB in cancer prevention studies.

With few exceptions (Rau et al., 2009), DB is, not surprisingly, shown to be associated with MTC for a variety of cancer prevention behaviors (Manne et al., 2009), including sun protection to prevent skin cancer (Adams, Norman, Hovell, Sallis, & Patrick, 2009), outpatient chemotherapy (Hirai, Arai, Tokoro, & Naka, 2009), colorectal cancer screening (Christie et al., 2005, 2006; Manne et al., 2009; Philip, DuHamel, Jandorf, 2010), chemoprevention (Gorin, Wang, Raich, Bowen, & Hay, 2006), pap smear screening (Hogenmiller et al., 2007), cervical cancer screening (Kelaher et al., 1999; Luszczynska, Goc, Scholz, Kowalska, & Knoll, 2011), self-breast exams for the prevention of breast cancer (Rimer et al., 1996), and mammograms for the prevention of breast cancer (Rakowski et al., 1997; Spencer, Pagell, & Adams, 2005).

Much of the cancer prevention research involving a DB component relate to motivation for mammogram adoption. DB related to mammography adoption has been associated with MTC (Clark et al., 1998; Crane et al., 1998; Jacobsen, Valdimarsdottir, Brown, & Offit, 1997; Lauver, Henriques, Settersten, & Bumann, 2003; Phillips, Green, & Morrissey, 2012; Rakowski, Ehrich,

Dube, & Pearlman, 1996; Rakowski et al., 1997; Rakowski, Fulton, & Feldman, 1993; Schwartz et al., 1999). These results have been established among older populations (Rakowski et al., 1992) and have consistently been demonstrated cross-culturally, including Asian Americans (Wu, Hsieh, & West, 2009), Asian Indians and Filipino Americans (Wu & West, 2007; Ryu et al., 2008), Koreans (Kang, Thomas, Kwon, Hyun, & Jun, 2008), Hispanic (Palmer, Fernandez, Tortolero-Luna, Gonzalez, & Mullen, 2005), and multi-ethnic and multi-lingual (Otero-Sabogal, Stewart, Shema, & Pasick, 2007) samples. Further research is needed to evaluate motivation for health behavior adoption following cancer diagnosis, and to evaluate whether MTC is influenced by factors that have previously been shown to facilitate stress management such as benefit finding (e.g., Antoni et al., 2001).

4.2.8. DB in sexual behaviors and contraceptive use studies.

DB is shown to be related to MTC with respect to sexual abstinence (Wang, Cheng, & Chou, 2009; Hulton, 2001; Wang & Hsu, 2006), condom use (Burkholder & Harlow, 2003; Grimley, Prochaska, Velicer, & Prochaska, 1995; Grimley, Prochaska, Prochaska, Velicer, 1996; Grimley, Riley, Bellis, & Prochaska, 1993; LaBrie et al., 2008; Lauby et al., 1998), oral contraceptives (Emmett & Ferguson, 1999; Galavotti et al., 1995; Hanna, 1994). Findings with respect to motivation for condom use adoption have been demonstrated among African American stimulant users (Gullette, Wright, Booth, Feldman, & Stewart, 2009), Koreans (Kwon, Yeun, Youn, Cho, Lee, 2008), and the Taiwanese (Tung, Farmer, Ding, Tung, & Hsu, 2009; Wang, Wang, Cheng, Hsu & Lin, 2007).

4.2.9. DB in HIV/AIDS and STD studies.

DB's applications extend to studies on HIV/AIDS and STDs (Kiene & Barta, 2003; Prochaska, Redding, Harlow, & Rossi, 1994). These studies have shown that, consistent with the

research discussed previously, DB is significantly associated with motivation for engaging in behaviors to prevent HIV/AIDS and STD risk (Burkholder & Harlow, 2003; Lauby, Bond, Eroglu, & Batson, 2006; Riley & Fava, 2003; Semaan, Lauby, O'Connell, & Cohen, 2003). These behaviors include adherence to medication (Highstein, Willey, & Mundy, 2006; MacDonell, Naar-King, Murphy, Parsons, & Harper, 2010), number of sexual partners (Bauermeister, Carballo-Diequez, Ventuneac, & Dolezal, 2009) and STD testing (Banikarim, Chacko, Wiemann, & Smith, 2003).

4.2.10. DB in domestic violence and sex offender studies.

DB has been applied to the study of motivations regarding domestic violence (Brown, 1997; Burke, Denison, Gielen, McDonnell, & O'Campo, 2004) and treatment with respect to sex offenders (Tierney & McCabe, 2001, 2005). Most domestic violence interventions for offenders are standardized, however research indicates that tailored interventions may provide benefit by increasing readiness to end the violence through behavior and attitude change (Levesque, Driskell, Prochaska, & Prochaska, 2008). Although this indicates support for tailored interventions, findings related to the inclusion of a DB component are mixed. A recent study found that DB did not predict drop-out from treatment programs (Brodeur, Rondeau, Brochu, Lindsay, & Phelps, 2008), indicating a need for additional research to evaluate whether DB is a useful predictor of MTC behaviors related to domestic violence and sex offenders.

4.2.11. DB for additional behaviors.

Over time, the DB procedure has been extended even further to a myriad of additional health related and non-health related behaviors. Research supports the use of interventions including a DB component to promote behaviors related to health care and administration such as advance care planning (Fried et al., 2012), completion of health care proxies (Jezewski et al.,

2009), patient education counseling (Faulkner, Taylor, Munro, Selby, & Gee, 2007), genetic counseling related to dementia (Binetti et al., 2006), family service agencies movement to time-limited therapy (Prochaska, 2000), decisions related to advanced directives (Finnell et al., 2011; Medvene, Base, Patrick, & Wescott, 2007), commitment to health-promoting behaviors (Kelly, 2005), organizational change research (Levesque, Prochaska, & Prochaska, 1999), and Medicare health plans (Levesque, Cummins, Prochaska, & Prochaska, 2006). Research further demonstrates support for the application of DB to increase motivation for behaviors related to stress management among adolescents (Mauriello et al., 2007) and HIV-positive women (Riley & Fava, 2003), physician motivations and barriers for prescribing beta blockers following myocardial infarction (Kavookjian & Mamidi, 2008), polypharmacy and health beliefs (Rossi et al., 2007), mental skills training (Zizzi & Perna, 2003), relaxation exercises (Strobl, Reusch, & Ellgring, 2004), and hearing protection device use among workers exposed to hazardous noise levels (Raymond & Lusk, 2006). Furthermore, findings suggest that DB increases motivations for pediatric genetic testing (Tercyak et al., 2011), child care (Knorth, Van den Bergh, & Smit, 1997), readiness to return to work following injury or illness (Franche & Krause, 2002), family planning (Ha, Jayasuriya, & Owen, 2003), diabetes screening (Hanna & Guthrie, 2000; Kellar et al., 2008), blood donation (Burditt et al., 2009; Hall et al., 2007), transplant education (Robbins et al., 2001; Waterman, Robbins, Paiva, & Hyland, 2010), and medication or program adherence (Atkinson, Kumar, Cappelleri, & Hass, 2005; Basler, Quint, & Wolf, 2004; Belleville, Morin, 2008; Brogan, et al., 1999; Everett, Salamonson, Zecchin, & Davidson, 2009; Martin, et al., 2011; Schmalting, Afari, & Blume, 2000).

Finally, DB has been applied to behaviors not related to health promotion or disease prevention, and research supports the use of DB to target behaviors such as study skills and

studying (Grant & Franklin, 2007), driving among older adults (Tuokko, McGee, & Rhodes, 2006), ethical decision-making among consumers of environmentally responsible products (Freestone & McGoldrick, 2008), readiness for advancing female scientists (Prochaska et al., 2006), coaching (Franklin & Doran, 2009; Passmore, 2011), gaming-related motivations among adolescents (Tan et al., 2008), and divorce decision-making (Turner, 1985).

5. Inferences and alternative strategies for improving DB

As has been noted, this paper's ultimate objective is to propose strategies for improving DB in interventions, particularly in alcohol-related interventions. There are a few inferences that can be extrapolated from previous DB research which can help inform the strategies that are proposed for improving alcohol intervention with respect to DB measurement.

5.1. Inferences

The first inference that can be made, based on the vast DB literature body, is that it is clear that a relationship exists between DB and MTC. That is, DB is associated with stage of change and, consistent with the Janis and Mann perspective (1977), DB data can serve as a proxy for MTC. The relationship between DB and MTC has consistently been replicated across a broad range of behaviors and in varying populations. Although the relationship between DB and MTC is clearly evident, the precise nature of this relationship has been presented differently in different theoretical contexts. For example, some researchers posit that DB represents one dimension of MTC (Miller, 1999), whereas others suggest that it is a covariate or mechanism involved in transitioning through the stages of change (Prochaska, Redding, Harlow, & Rossi, 1994), and still others assert that DB represents the process of decision-making (Fischhoff & Quadrel, 1991; Janis & Mann, 1977). Miller and Rollnick's (1991, 2002) conceptualization of MTC has received increasing focus in the addictions literature. That is, addictions researchers

generally concur that MTC is a dynamic, fluctuating, and multidimensional construct that is influenced both by internal and external conditions (Miller, 1999; Miller & Rollnick, 1991, 2002) and encompasses elements of theories such as the TTM (Prochaska et al., 1992).

The second inference that can be made, based on the alcohol and DB literature, is that the DBP represents a new and promising way to conceptualize MTC (Collins et al., 2009, 2010). As noted earlier, while DB has been used as a tool in many brief MI interventions (Dimeff et al., 1999; Miller, 1999), DB has rarely been examined independently (Carey et al., 2006; Collins & Carey, 2005; LaBrie et al., 2006), and rarer still has the newly proposed DBP been examined as a stand-alone intervention (Collins et al., 2009; Collins et al., 2010). Even though it has not been widely applied, the DBP shows promise as a stand-alone alcohol intervention (Collins et al., 2009; Collins et al., 2010). To date, only one published study has evaluated the DBP with respect to alcohol use (Collins et al., 2009), and therefore, further research is needed to better understand the unique contribution of DBP to enhancing MTC and reducing alcohol use behavior among college students.

The third inference stems from the second in that although the DBP is a promising step forward in DB measurement, there are ways in which the DBP can be improved. Specific alternative strategies for improving the DBP in alcohol intervention include; 1) a participant-weighted DBP (in terms of relative importance); 2) coding the DBP; and 3) providing personalized DBP feedback. These strategies are discussed in the following section.

5.2. Alternative strategies for improving DBP.

As previously noted, morbidity and mortality trends related to college drinking indicate that almost 20% of college students meet DSM-IV criteria for alcohol dependence or abuse (NIAAA, 2007), yet less than 5% seek alcohol treatment or counseling. Although existing

alcohol interventions for college drinking are widely available, many undergraduates do not perceive any need to change their drinking (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Larimer & Cronce, 2002). Intervention strategies that encourage students to consciously consider reasons for changing problem behaviors by increasing MTC may provide unique benefit (e.g., Collins, Carey, & Otto, 2009). As such, and in light of the inferences drawn from the DB literature, three strategies are presented as ways to potentially increase the DBP's predictive validity in alcohol interventions among undergraduate students.

5.2.1. Participant-weighted DBP.

The first strategy for improving DBP is related to its implicit assumption of equally weighted pros and cons. The DBP implicitly assumes that all pros and cons are equally weighted as it is calculated based on a simple count of the number of pros and cons for changing and the number of pros and cons for not changing. However, it seems reasonable to assume that some motivations for or against change (e.g., fear of losing friends or desire to keep a significant relationship) may carry greater weight than others (e.g., liking the taste of beer or desiring to reduce calories). Furthermore, it is important to note that what is highly valued or carries great weight to some individuals (e.g., being employed) may not be of any importance to others. Incorporating weights into the DBP seems like an important and innovative advance for future alcohol interventions to consider. In addition to the *proportion* (DBP) of pros and cons, the *weight* (i.e., importance) of pros and cons may provide significant information. Specifically for alcohol-related brief intervention among college students, researchers might consider evaluating differences between the originally proposed, non-weighted alcohol-related DBP (Table 3; Collins et al., 2009) and a weighted alcohol-related DBP (Table 4). Additionally, including a control group (e.g., no DB at all or DB related to a non-alcohol behavior) to serve as comparison

would provide added benefit. Participants in the weighted condition may be asked to complete the open-ended, four-field DB sheet, and assign personalized weights of relative importance to each pro and con listed, ranging from 1 (*not at all important*) to 7 (*extremely important*). Each item's weight can be added to its score using this modified DBP formula:

$$\frac{[(\text{pros}_{\text{red}} + W_{\text{prosred}}) + (\text{cons}_{\text{cur}} + W_{\text{conscur}})]}{[(\text{pros}_{\text{red}} + W_{\text{prosred}}) + (\text{cons}_{\text{cur}} + W_{\text{conscur}}) + (\text{pros}_{\text{cur}} + W_{\text{proscur}}) + (\text{cons}_{\text{red}} + W_{\text{consred}})]}$$

Here, as with the original DBP formula, “red” is reducing drinking and “cur” is current drinking. However, new to this formula is “W,” which is the sum of the weights for that particular field (see Table 4 for an example of a weighted DBP calculation). This proposed formula creates a composite score that incorporates weights of importance. As a weighted DBP likely provides a closer approximation of an individual's MTC compared to a non-weighted DBP, it is logical to assume that the weighted DBP will extend the strengths of the original non-weighted DBP and be a better predictor of both proximal (up to six months) and distal (more than six months) drinking outcomes.

Moreover, it is possible that specific items will be differentially weighted over time as they become more salient and more important, or less salient and less important. For example, Sally might indicate during her initial assessment that one of the pros of drinking is to fit in with her friends and that this is highly important to her (e.g., rated as a 6). However, over time, as Sally's motivation for reducing her drinking increases and she progresses towards making and committing to a decision to reduce her drinking, it is possible that a follow-up assessment might reveal that although she still lists “fitting in with friends” as a pro of drinking, she now rates it as *less* important (e.g., a 3 on the scale) than during the initial assessment. In this example, a

weighted DBP would not only be able to distinguish changes in the pro-con *proportion*, it would also help extricate changes in the *relative importance* of specific items that affect overall MTC.

In summary, potential strengths of a weighted DBP include increased predictive ability for drinking behavior and identification of items likely to affect MTC. Therefore, a weighted DBP has potential utility in alcohol brief intervention among college students and may represent a significant leap forward in DB measurement.

5.2.2. Coding participant-generated DBP.

The second strategy for improving DBP, like the first strategy, is related to the DBP's implicit assumption of equally weighted pros and cons. However, the second strategy specifically targets the fact that the original DB uses *uncoded* pros and cons. As has been noted, the original DBP is calculated as a simple count of the number of pros and cons. It seems rational to assume that in addition to the *proportion* (DBP) and *relative importance* (weighted DBP) of pros and cons, the actual *content* of the participant-generated responses to the open-ended balance sheet holds significant information. In the context of alcohol brief intervention among college students, categorizing participant-generated reasons for and against drinking, and for and against reducing drinking, might help alcohol researchers understand common reasons why undergraduates choose to drink or not to drink. In particular, qualitative analyses via the coding of responses from heavy drinkers will facilitate the tailoring of interventions to make salient the reasons for drinking less in this high risk population.

Previous research has examined drinking motives via *researcher-generated* scales such as the drinking motives questionnaire (Cooper, 1994) to determine self-reported frequency of drinking for social, enhancement, coping, and conformity motives (e.g., Norberg, Norton, Olivier, & Zvolensky, 2010). However, there is a lack of published research focusing on the

coding of *participant-generated* reasons for drinking or choosing not to drink, and thus, coding the DBP seems like an innovative and important advance in alcohol intervention. Identifying, for example, the five most common reasons that heavy drinking undergraduates list for drinking and the five most common reasons they list for not drinking may help researchers understand what affects alcohol-related motivation among college students, which in turn helps researchers design more effective interventions. Additionally, if the coded DBP is used in conjunction with the weighted DBP, researchers would be able to identify whether certain common reasons for or against drinking are, on average, more important (carry higher average weights) than other common reasons. Furthermore, longitudinal evaluation may help researchers clarify whether changes in the weight of certain common reasons for drinking are more strongly associated with increased MTC or decreased drinking than changes in the weight of other common reasons.

In sum, a coded DBP extends the strengths of a weighted DBP by allowing for identification of common participant-generated reasons that undergraduates have for drinking or not drinking, which in turn facilitates the tailoring of interventions. Therefore, a coded DBP has potential intervention utility and may represent a useful advance in DB measurement.

5.2.3. Personalized DBP feedback.

The third strategy for improving DBP relates to personalized feedback, draws from theoretical predictions involving dissonance, and can be applied in conjunction with the previous two strategies. Generally, feedback-based interventions involve the presentation of discrepant information and, in particular, personalized feedback has been shown to reduce drinking, whether it is delivered via mail, an individual interview, or computer (for reviews, see Larimer & Cronce, 2002; Walters & Neighbors, 2005). In the context of an alcohol brief intervention, personalized DB feedback may consist of; 1) self-reported drinking (e.g., “*You reported drinking*

6 drinks on average per week during the past month.”); 2) weighted or non-weighted DBP (e.g., *“The proportion of your responses for and against drinking indicate that you are very motivated to reduce your drinking.”*); and 3) common reasons for choosing not to drink, derived from the coded DBP (e.g., *“Many college students report that academic performance and saving money are extremely important factors in making the choice not to drink.”*).

It is important to note that *just* completing the balance worksheet (without feedback) is shown to highlight the discrepancy between current behaviors and goals/values (e.g., Collins et al., 2009). However, it is possible that personalized DBP feedback will further enhance the experience of dissonance. Moreover, if relevant and viable reasons for the alternative behavior are presented (e.g., reasons for not drinking, determined via coded DBP), the feedback is likely to encourage greater increases in MTC compared to just completing the worksheet alone.

In summary, personalized DBP feedback draws from theoretical predictions involving dissonance by making an individual’s weighted DBP salient and highlighting relevant reasons for decreasing alcohol use, derived from the coded DBP. Therefore, when used in conjunction, the weighted DBP, coded DBP, and personalized DBP feedback have the potential to greatly increase the efficacy of brief alcohol interventions among college students (see Figure 1).

5.3. Conclusions.

This paper’s objective is to provide a review of DB theory, history, and research, and to propose strategies for improving DB with respect to alcohol brief interventions for college students. In summary, many motivational interventions are based on the TTM (Prochaska et al., 1992), which suggests stages and processes of change. Many individuals struggling with addiction are “stuck” in ambivalence. Theories related to discord-awareness (e.g., dissonance theory, self-perception theory, self-discrepancy theory, and the self-regulation model; Bem,

1965; Festinger, 1957; Higgins, 1987; Kanfer, 1987) suggest that behavior change begins with awareness of a behavior-goal discrepancy and resolution of ambivalence. MI-based brief interventions have used techniques such as the DB, formulated as a guided consideration of pros and cons associated with a behavior (Miller, 1999), to highlight behavior-goal discrepancies and resolve ambivalence. DB has been applied in the context of MI-based brief interventions, but rarely has it been evaluated as a stand-alone intervention. The DB and alcohol literature suggest; 1) a relationship exists between DB and MTC; 2) DBP represents a new and promising way to conceptualize MTC (Collins et al., 2009, 2010); and 3) while the DBP is a step forward in DB measurement, its predictive validity may be improved via the application and incorporation of specific strategies. These strategies include; 1) a *weighted DBP*, which may increase predictive ability and provide a closer approximation of an individual's MTC compared to the original DBP; 2) a *coded DBP*, which may allow for identification of common reasons why college students choose to drink or not drink; and 3) *personalized DBP feedback*, which may increase intervention efficacy by further highlighting the behavior-goal discrepancy. These strategies can be applied separately or in conjunction, and represent a promising new avenue for DB research. It is worth noting that evaluation of DB as a stand-alone intervention is limited because when DB is applied, it has generally been in the context of multi-component programs, with only a few studies applying DB as a unique intervention. This methodological limitation can be addressed by implementing each of the proposed strategies separately to determine differential efficacy prior to applying them in conjunction.

In closing, although existing alcohol interventions for college drinking are widely available, many undergraduates do not perceive any need to change their drinking (Carey et al., 2007; Larimer & Cronce, 2002). Intervention strategies that encourage students to consciously

consider reasons for changing problem behaviors, increase MTC, and resolve ambivalence may provide unique benefit. While there have been recent advances in alcohol-related DB measurement among undergraduates, further research is needed to understand whether application of the proposed strategies increase intervention efficacy beyond the original DBP.

6. Current study

The broad, long-term objective of the current study is to lay the groundwork for enhancing future interventions by increasing empirical knowledge of the role motivation plays in heavy alcohol use and factors in predicting drinking. The current study seeks to implement an alcohol intervention that incorporates the *first* of the aforementioned strategies to reflect and enhance motivational states among college students. That is, the current study evaluates an alcohol intervention that compares the weighted DBP with a non-weighted DBP among college drinkers. The present research implements a 2X2 factorial design (see Figure 2) in evaluating an alcohol DB intervention. Participants were randomly assigned to consider pros and cons of drinking or pros and cons of physical activity (control) during a baseline and one month follow-up assessment. Half of participants were randomly assigned to weigh each pro and con by assigning weights of importance, and a DBP was computed for each participant. Participants in the non-weight conditions received a DBP computed in accordance with procedures outlined by Collins and colleagues (2009; Table 3). Participants in the weighted conditions received a weighted DBP that incorporated the relative importance of each pro and con (Table 4).

This study is designed to replicate previous alcohol DB research (Collins et al., 2009) by applying a stand-alone DB intervention among college drinkers and using a DBP to predict drinking outcomes. Further, this study seeks to extend previous research by evaluating a weighted DBP in comparison to the originally proposed non-weighted DBP. Moreover, DB data

generated during the baseline assessment of the proposed study will serve as a basis on which to begin coded DBP evaluation. These common reasons can facilitate the tailoring of future interventions and be applied in personalized feedback to increase feedback efficacy and make salient the most important common reasons that college students list for reducing drinking.

6.1. Aims and hypotheses

This research has several specific aims and hypotheses (see Table 6). The first aim of this research is to evaluate cross-sectional associations between the DBP (non-weighted) and drinking. Hypotheses associated with this aim include; 1) as RTC is negatively associated with drinking and the experience of alcohol-related consequences is related to increased MTC, initial DBP scores (cross-sectional, assessed during baseline) are expected to positively correlate with baseline alcohol use and alcohol-related problems; and 2) as DBP has been shown to correlate with RTC, initial DBP scores are expected to positively correlate with RTC, measured via the RTC questionnaire (Rollnick et al., 1992).

The second aim of this research is to evaluate a weighted and non-weighted alcohol DB intervention in comparison to a control condition. Hypotheses associated with this aim include; 3) participants will have increased RTC drinking following the alcohol intervention (weighted or non-weighted intervention) compared to control; 4) participants in the weighted intervention (WI) condition will have increased drinking-related RTC following the intervention, as evidenced by increases in DBP and RTC scores, in comparison to participants in the control condition who list pros and cons of physical activity and either assign weights of importance to each pro/con (weighted control; WC) or not (non-weighted control; NC), or to participants in the non-weighted intervention (NI) condition who complete the DBP without assigning weights of importance to pros and cons (see Figure 2); 5) participants in the WI and NI conditions will

report greater decreases in alcohol use following the intervention relative to control (participants in the NI or NC conditions); and 6) participants in the WI condition will report decreased alcohol consumption following the intervention, as evidenced by decreases in reported quantity and frequency of drinking, in comparison to control.

The third aim of this research is to evaluate DBP as a moderator of intervention efficacy such that individuals with higher motivation to reduce drinking will consume less alcohol following the intervention relative to individuals with lower motivation to reduce drinking. The seventh hypothesis is associated with this aim and stems from the understanding that the DBP reflects MTC and is related to RTC. Thus, the intervention is expected to be more effective among participants with higher initial DBP (increased MTC assessed at baseline). While the intervention (weighted or non-weighted DBP) is expected to be associated with decreased drinking, participants with higher initial DBP scores are specifically expected to report significantly decreased alcohol consumption following the intervention (either weighting or not weighting the pros and cons of drinking or reducing drinking) in comparison to participants with lower initial DBP scores in any condition.

7. Method

7.1. Participants

Recruitment procedures included in-class recruitment and the placement of flyers (see Figure 3) containing information about the study and compensation (course credit) on a large public university campus. Data collection continued until at least 200 participants were recruited. Participants provided consent via a computer-based informed consent document. Additionally, participants were prompted to provide demographic and contact information. Inclusion criteria were such that in order to participate, individuals had to be at least 18 years of age, a registered

student at the University of Houston (UH), and provide consent to participate in the baseline assessment of this study. Participants who met heavy drinking criteria (those who report consuming at least five, for men, or four, for women, drinks on an occasion at least once in the previous month) were invited to complete the one month follow-up assessment roughly 30 days following completion of the baseline assessment. See Figure 4 for a consort table depicting study flow and Table 7 for a summary of data collection procedures.

7.2. Measures

7.2.1. Demographics

Participants completed a demographics survey and provided information such as gender, weight (for blood alcohol content and body mass index calculations), racial background, student status, and age. If the participant was not yet 18 years of age, he or she was exited from the survey (all participants met the age criteria and thus, none were sent out of the survey).

7.2.2. Alcohol-related measures

7.2.2.1. Quantity/Frequency Scale. Alcohol consumption was measured using the Quantity/Frequency Scale (Baer, 1993; Marlatt et al., 1995), which is a five-item scale that assessed the number of drinks and the number of hours spent drinking on a peak drinking event within the last month, as well as the number of days out of the month that the individual consumed alcohol (0 = *I do not drink at all*, 1 = *about once per month*, 2 = *two to three times a month*, 3 = *once or twice per week*, 4 = *three to four times per week*, 5 = *almost every day*, or 6 = *I drink once daily or more*).

7.2.2.2. Daily Drinking Questionnaire. Alcohol consumption was also measured using the Daily Drinking Questionnaire (DDQ; Collins et al., 1985; Kivlahan et al., 1990), which measures the number of standard drinks that are consumed on every day of a normal week

(Monday-Sunday) within the last three months. Scores represent the average number of drinks that are consumed over the course of each week during the previous month. Relative to other drinking indices, weekly drinking has been shown to be a reliable index of problems related to alcohol among college students (Borsari, Neal, Collins, & Carey, 2001).

7.2.2.3. Rutgers Alcohol Problem Index. The Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989) is a 23-item measure that was used to assess alcohol related negative consequences in the last month, and responses ranged from *never* (0) to *10 times or more* (4). Items were rated based on how many times each problem has occurred while consuming alcohol, such as “went to work or school high or drunk” and total summed scores for the RAPI range from 0 to 100 (White & Labouvie, 1989). Cronbach α for the RAPI was .93.

7.2.3. Motivation-related measures

7.2.3.1. Decisional Balance Sheet. The Decisional Balance (DB) Sheet is a free recall task that evaluates the accessibility of alcohol expectancies. Participants were asked to record each advantage and disadvantage of “continuing to drink as you are now” and “drinking less than you do now.” Participants in weighted conditions were asked to assign weights of relative importance to each pro and con listed, ranging from *not at all important* to *extremely important* on a 7-point Likert scale.

The non-weighted DBP for the NI and NC conditions were scored in accordance with Collins and colleagues (2009). To calculate the weighted DBP for the WI WC conditions, reported weights were summed and added to total pros and cons prior to computing the DBP formula (Table 4). As proposed earlier, here is the formula that was used to calculate the weighted DBP:

$$\frac{[(\text{pros}_{red} + W_{\text{prosred}}) + (\text{cons}_{cur} + W_{\text{conscur}})]}{[(\text{pros}_{red} + W_{\text{prosred}}) + (\text{cons}_{cur} + W_{\text{conscur}}) + (\text{pros}_{cur} + W_{\text{proscur}}) + (\text{cons}_{red} + W_{\text{consred}})]}$$

Should MTC for a participant in any condition have been very low such that no items were listed for reducing drinking and no cons are listed for current drinking (e.g., the numerator in the above formula is zero), the corresponding DBP was made equal to zero. Additionally, as previously noted, “W” in the above formula is arrived at by summing the weights for that particular field. Variations of this weighted DBP formula were tested to determine whether differentially computed weights afford the resulting weighted DBP with increased predictive utility compared to others. The two alternative calculations for “W” that were tested include the multiplying (rather than summing) weights in each field, and the averaging (rather than summing or multiplying) weights in each field. For example, the “pros of drinking” field in Table 4 indicates that the items that are incorporated into W_{prosred} have been assigned weights of 5, 4, and 1 on a scale ranging from 1 to 7 in terms of importance. W_{prosred} can be computed three alternative ways; 1) Table 4 reflects a *summed* W_{prosred} , which be computed by adding the weights for the “pros of drinking” field and, as such, 5+4+1 yields a W_{prosred} equal to 10; 2) a *multiplied* W_{prosred} can be computed by multiplying the weights for the “pros of drinking” field, and as such, 5*4*1 yields a W_{prosred} equal to 20; and 3) an *averaged* W_{prosred} can be computed by averaging the weights for the “pros of drinking” field, and as such, (5+4+1)/3 yields a W_{prosred} equal to 3.33. It is possible that one of these alternative formulas for incorporating weights into the DBP may increase the predictive validity of the weighted DBP compared to other formulas, and thus, each alternative method for incorporating weights into the DBP was evaluated.

7.2.3.2. Readiness to Change Questionnaire. The Readiness to Change Questionnaire (RTCQ; Rollnick et al., 1992) was used to rate level of agreement with 12 items containing

statements about how participants feel about their drinking right now. Participants responded on a 5-point Likert scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*) to items such as “I should cut down on my drinking” and “My drinking is a problem.” Items assess ambivalence, problem recognition, and active attempts to modify drinking. The RTC scale consists of three validated scales: precontemplation, contemplation, and action. Items associated with precontemplation were reverse-coded and added to the contemplation and action scores to create a continuous RTC score. This score served as a predictor and an outcome variable in analyses. Internal consistency of baseline RTC was adequate ($\alpha = 0.86$). Cronbach α for post-intervention RTC was .86 and the RTC α for follow-up was .84.

7.2.3. Physical Activity Measure

A Physical Activity scale (Fisher, Spicer, Race, & Melnik, 2003) was used to rate level and frequency of physical activity with six items containing questions about how many days per week participants engage in moderate or vigorous activities. Participants also indicated the number of minutes spent engaging in these activities.

7.3. Design and procedures

7.3.1. Recruitment and screening

Interested students signed up for participation via the Sona Systems website.

7.3.2. Informed consent and demographics

Participants were able to sign in to the survey and view the informed consent document from any computer with internet access. Participants who indicated consent via the computer-based informed consent document and were at least 18 years of age were directed to a demographics questionnaire and subsequent measures.

7.3.3. Assessments

7.3.3.1. Baseline assessment. Participants were randomized to one of four conditions after signing up for the study via Sona. The four conditions are described above in the *Current Study* section and listed in Figure 2. Participants were asked to complete a one hour (60 minute) computer-based baseline assessment during which they completed online measures on a computer at the location of their choice. Participants in the WI condition completed an alcohol DB and assigned personalized weights of relative importance ranging from 1 (*not at all important*) to 7 (*extremely important*) to each item that they listed. Each item's weight was included in the calculation of an alcohol-related weighted DBP (Table 4), a composite score that incorporates weights of importance. Participants in the NI condition completed an alcohol DB and a subsequent non-weighted alcohol DBP was calculated for these participants, using procedures detailed by Collins and colleagues (2009; Table 3). Participants in the WC condition were asked to complete a physical activity DB. This involves a similar balance worksheet used in the alcohol DB conditions with the main difference being that instead of listing the pros and cons of drinking and reducing drinking, participants were asked to list the pros and cons of current physical activity and increasing physical activity. Participants were then asked to assign weights of relative importance to each item that they listed. These participants subsequently received a weighted physical activity DBP. Participants in the Non-Weighted Control (NC) condition completed the physical activity DB and were not asked to assign weights of importance. A non-weighted physical activity DBP was calculated for these participants.

Participants were first asked to complete a battery of measures assessing their drinking or physical activity, and personality characteristics, followed by a DB measure. Depending on the condition to which the participant was randomly assigned, the participant was either asked to

report pros and cons of current drinking and reducing drinking (WI or NI conditions), or pros and cons of current physical activity and increasing physical activity (WC or NC conditions). Participants in weighted conditions (WI or WC conditions) were asked to assign weights of importance to each item, whereas participants in non-weighted conditions (NI or NC conditions) were not. Following the DB procedure, participants then completed post-manipulation measures including assessments of readiness to change (Table 7). Participants received compensation in the form of course extra credit in exchange for completing the baseline assessment.

7.3.3.2. One month follow-up assessment. Participants who met heavy drinking criteria were invited to complete a follow-up assessment approximately 30 days following the baseline assessment. These participants were contacted via email or phone approximately one month (about 30 days) following the completion of their baseline assessment. Procedures for the follow-up assessment closely mirror those of the baseline assessment. Participants were asked to complete a one hour (60 minute) follow-up assessment online, and similar to the baseline assessment, participants filled out measures on a computer at the location of their choice. Participants completed either an alcohol or physical activity DB sheet and either assigned weights to each pro and con or not, according to the condition to which they were previously assigned. This allowed for the evaluation of whether changes in the weighted or non-weighted DBP were associated with changes in drinking or physical activity outcomes. Additionally, participants completed a battery of measures (Table 7), and received compensation in the form of course extra credit in exchange for completing the follow-up assessment.

8. Results

8.1. Descriptive statistics

Means and standard deviations of alcohol use and predictor variables were computed. Bivariate correlation coefficients were also computed (Table 8).

8.2. Primary analyses

The first and second hypotheses are associated with the first aim of this study, which was to evaluate the cross-sectional associations between the non-weighted DBP and drinking. The first hypothesis predicted that initial DBP scores would positively correlate with reported drinking at baseline. Contrary to predictions, initial weighted and non-weighted DBP scores were not significantly related to baseline alcohol consumption variables, however, initial weighted DBP was significantly and negatively related to alcohol-related problems at baseline (Table 8). The second hypothesis was that initial DBP scores would positively correlate with RTC. Consistent with this prediction, initial non-weighted DBP scores were marginally and positively associated with baseline RTC (see Table 8).

The third, fourth, fifth, and sixth hypotheses are associated with the second aim of this study, which is to evaluate the intervention compared to a control condition. The *third hypothesis* predicted that the intervention conditions (WI and NI) would be associated with increased DBP and RTC scores compared to the control conditions (WC and NC). This hypothesis was tested by examining correlations between condition and DBP scores, which showed that the intervention was significantly and negatively associated with follow-up weighted DBP, but was not associated with RTC. Additionally, regression analyses were used to indicate whether the intervention condition significantly predicted increased DBP and RTC scores by examining condition as the independent variable and DBP and RTC as dependent variables. The regression

model included a dummy-coded condition variable where intervention conditions (WI and NI) were coded as 1 and control conditions (WC and NC) as 0. This dummy-coded condition variable was entered into the regression model as the independent variable. Dependent variables included RTC and weighted and non-weighted DBP assessed at follow-up. Baseline readiness was included as a covariate. Baseline DBP was not included as a covariate because it was part of the intervention itself. Results indicated that consistent with expectations, the condition variable marginally predicted non-weighted follow-up DBP, and significantly predicted weighted follow-up for the summed and multiplied DBP, however results were not significant for the averaged DBP (Table 9).

The *fourth hypothesis* was that the WI condition would be associated with increased RTC, as evidenced by increases in DBP scores and RTC, compared to any other condition. This hypothesis was tested via regression analyses where the weighted condition was included in the model as an independent variable and follow-up RTC and DBP scores were included as dependent variables. This regression was evaluated with baseline RTC included as a covariate. As initial DBP (assessed at baseline) was part of the intervention, it was not included as a covariate. Results showed that, the WI condition did not predict an increase in post-intervention or follow-up RTC (Table 10). The results further showed that, consistent with expectations, the WI significantly predicted follow-up averaged DBP but not the summed or multiplied DBP (Table 10).

The *fifth hypothesis* was that participants in the WI and NI conditions would report greater decreases in alcohol use following the intervention relative to control (participants in the NI or NC conditions). Following an examination of correlations between condition and DBP scores (Table 8), regression analyses were used to indicate whether the intervention condition

significantly predicted decreased drinking outcomes. The regression model included drinking variables (peak drinks, drinking frequency, drinks per week, and alcohol-related problems) as dependent variables, and the intervention condition was entered as the independent variable. The intervention was dummy coded such that participants in either the weighted or non-weighted intervention conditions (WI or NI) received a 1 and those in the control conditions (WC or NC) received a 0. For each drinking outcome (e.g., drinks per week at follow-up), the corresponding baseline drinking variable (e.g., drinks per week assessed at baseline) was included in the regression model as a covariate. Results indicated that the alcohol intervention (WI and NI) significantly predicted decreases in drinks per week, however no effects were observed for peak drinks, drinking frequency, or alcohol-related problems (Table 11).

The *sixth hypothesis* was that participants in the WI condition would report decreased alcohol consumption following the intervention compared to control. This hypothesis was tested via regression analyses where the WI condition was included in the model as an independent variable and follow-up drinking outcomes were included as dependent variables. Intervention condition was defined as two dummy coded variables. The first variable coded participants in the weighted intervention condition (WI) as 1 and all others (NI, WC, NC) as 0. The second variable coded participants in the non-weighted intervention condition as 1 (NI) and all others as 0 (WI, WC, NC). Tests of each dummy code thus represent contrasts between each intervention condition and control. Baseline drinking was controlled using the same method described above for the fifth hypothesis. Analyses evaluated weighted & non-weighted DBP separately compared to control. Doing so revealed marginal reductions in drinks per week and alcohol-related problems only for the weighted intervention (Table 12).

The *seventh hypothesis* is associated with the third aim of this study, which is to evaluate DBP as a moderator of intervention efficacy (Table 6). The seventh hypothesis predicted that DBP would moderate the effect of the intervention on drinking such that higher initial DBP would be associated with greater reductions in drinking, and that this relationship would be strongest for the WI condition. Intervention condition was defined as a dummy coded variable where participants in the weighted intervention condition received a 1 and all others received a 0. Tests of this dummy code thus represent contrasts between the weighted intervention condition and control. To test this hypothesis, analyses were conducted in two steps. Initial DBP (assessed at baseline) and condition were entered into the regression model as independent variables at Step 1, and follow-up drinking variables as dependent variables. Baseline drinking variables were covariates. Step 1 results showed significant effects for DBP on peak drinking and drinking frequency, and a significant effect of the weighted intervention on problems (Table 13). Additionally, there was a marginal effect of the weighted intervention on drinks per week. Step 2 evaluated two-way interactions (product terms) between initial DBP and the intervention to predict drinking variables. None of the two-way interactions were significant at Step 2 (Table 13).

Analyses involving condition effects (Hypotheses 3-7) were re-run using factorial analyses. Main effects of alcohol conditions relative to non-alcohol conditions (A), main effects of weighted versus non-weighted conditions (B), and their product terms (AB) were examined. This is a traditional factorial ANOVA model. All covariates were the same.

The *third* and *fourth hypotheses* focused on changes in RTC and DBP as a function of condition. For averaged weighted follow-up DBP, there were main effects of alcohol intervention ($p=.01$) and weighted intervention ($p<.0001$) but no interaction. For multiplied

weighted DBP, there were marginal effects of alcohol intervention ($p=.06$) and weighted intervention ($p=.08$) but no interaction. For summed weighted DBP, there was a main effect of alcohol intervention ($p=.03$) but no main effect for weighted intervention and no interaction. For non-weighted DBP, there was a marginal effect of alcohol intervention ($p=.06$) but no main effect for weighted intervention and no interaction. There were no main effects and no interaction for post-intervention and follow-up RTC. The *fifth*, *sixth*, and *seventh hypotheses* focused on changes in drinking as a function of condition. For follow-up drinks per week, there was a main effect for alcohol intervention ($p=.04$) but no main effect for weighted intervention and no interaction. There were no significant main effects or interactions when examining changes in drinking as a function of condition.

In reviewing factorial ANOVA results, primary conclusions remain unchanged. When predicting changes in RTC and DBP, generally there were main effects of alcohol intervention, but main effects of weighted intervention and interactions were less common. Consistent with regression analyses, findings predicting drinks per week as a function of condition were significant, but significant results did not emerge when predicting other drinking variables.

9. Discussion

The present study replicates and extends previous research by providing an examination of weighted and non-weighted DBP as a measure of MTC among a sample of heavy drinking undergraduate students. DBP data were generated from responses to an open-ended DB worksheet which assesses the pros and cons of current drinking and reducing drinking – designed to reflect the extent to which the individual's DB was tipped towards making a change.

The first hypothesis predicted that initial DBP would correlate with drinking at baseline, based on the negative relationship between RTC and drinking and the positive relationship

between alcohol-related problems and MTC (Rollnick et al., 1992). In other words, it was expected that heavy drinkers would exhibit greater motivation to make changes in drinking behavior due to awareness of the risks associated with heavy drinking. Evidence did not support this hypothesis, and came out opposite with respect to problems. Initial DBP scores were not significantly associated with baseline consumption. Initial weighted DBP was negatively related to baseline alcohol-related problems (Table 8). These findings may reflect a lack of motivation to reduce drinking leading to increased consumption such that heavier drinkers have fewer reasons to change their drinking (lower DBP). Stated simply, it is likely that if an individual is not motivated to drink less, they will not drink less.

The second hypothesis was based on the previously established positive correlation between DBP and RTC (Collins et al., 2009) and predicted that the same correlating relationship would emerge for the current study. This hypothesis had limited support in that initial DBP scores were positively associated with baseline RTC for one of the three weighted DBP measures (Table 8). This implies that the more reasons a heavy drinking individual has for making a change in their drinking (e.g., more pros for change and cons of not changing), the higher their motivation to change their drinking, and this would be reflected in that individual's RTC score. Additionally, the positive correlation between RTC, baseline drinking, and baseline problems suggests that heavier drinkers are more ready to change their drinking compared to those who do not drink as heavily, which might be due to the increased experience and cognizance of the harmful consequences related to alcohol. Taken together, findings are somewhat consistent with theoretical predictions related to alcohol intervention strategies in that targeting heavy drinkers high in RTC may be an effective method and would likely result in increased DBP and decreased drinking.

The third hypothesis was that the intervention conditions (WI and NI) would predict post-intervention and follow-up DBP and RTC relative to control (NI and NC). Results indicated that, consistent with expectations, the intervention significantly predicted two out of the three weighted DBP and marginally predicted non-weighted DBP at follow-up (Table 9). Stated differently, these findings indicate that participants who received the alcohol intervention (whether they were asked to assign weights to each item during the DB procedure or not) exhibited increases in DBP at follow-up. This finding is consistent with motivation literature which largely suggests that motivation toward drinking is a fluid, not stable trait (Miller, 1999). Additional research is needed to better understand the temporal robustness of changes in motivation evaluated via the DBP. It is reasonable to assume that models assessing parallel and time-varying change in DBP and alcohol consumption may help to further elucidate this relationship (Collins et al., 2009).

The fourth hypothesis predicted that the WI would predict increased RTC and DBP relative to any other condition. This hypothesis was partially supported. On the one hand, with respect to RTC and non-weighted DBP, results were nonsignificant (Table 10). On the other hand, and consistent with expectations, the WI significantly predicted one of the weighted DBP variables, the averaged weighted DBP, assessed at follow-up (Table 10). It is likely that this effect emerged for weighted DBP but not RTC or non-weighted DBP as a result of assigning weights of importance to items. More specifically, these findings suggest that in comparison with the non-weighted intervention, the weighted intervention provided a means by which to closer approximate each individual's readiness to reduce drinking in the form of a weighted DBP score. This is consistent with theoretical expectations.

The fifth hypothesis suggested that the alcohol intervention (WI and NI) would predict decreased drinking at follow-up relative to control (NI and NC), and this prediction was supported for drinks per week but not for the other three drinking outcomes (Table 11). This is in line with previous work which has used the DB procedure in alcohol intervention, regardless of whether the DB was implemented as a stand-alone intervention, and regardless of whether DBP was subsequently calculated (Carey et al., 2006; Collins & Carey, 2005; Dimeff et al., 1999; LaBrie et al., 2006; Miller, 1999). These findings further emphasize the importance of encouraging heavy drinkers to consciously consider reasons for changing their drinking through strategies such as DB.

The sixth hypothesis was that the WI would predict greater decreases in drinking relative to any other condition. As stated previously with respect to hypothesis four, results demonstrated that in comparison with the NI, the WI provided a means by which to closer approximate each individual's readiness to reduce drinking in the form of a weighted DBP. Given these findings, in conjunction with previous research (Collins et al., 2009), it was expected that this weighted DBP would in turn predict decreased alcohol consumption. When the weighted and non-weighted intervention were compared simultaneously, the weighted intervention was marginally associated with reduced drinks per week and problems (Table 12). One implication of these findings is that although assigning weights to items might result in increased DBP (Table 10), this may not necessarily translate to a greater decrease in actual drinking compared to not assigning weights. Alternatively, it is possible that this effect might emerge significantly with greater power. Simply put, either the WI did not work, or there was insufficient power to detect an effect. To further elucidate whether drinking outcomes are indeed a function of weighting items during the DB procedure, sufficiently powered replications of this study are needed.

The seventh hypothesis predicted that DBP would moderate the effect of the WI and drinking. Consistent with expectations, there were significant main effects for DBP when predicting peak drinks and drinking frequency, a significant main effect for the WI when predicting alcohol-related problems, and a marginal effect of WI on drinks per week (Table 13). It is worth noting that the model that was tested with respect to the seventh hypothesis yielded significant results when predicting drinking from the WI, however, the model that was tested with respect to the sixth hypothesis did not yield significant effects when WI was used to predict drinking (Table 12). The difference between these models lies with the fact that initial DBP was included as a predictor in the former (hypothesis seven), but was not in the latter (hypothesis six). Because DBP was part of the intervention, it was not included as a covariate when testing hypothesis six. However, as the seventh hypothesis evaluates two-way product terms between initial DBP and WI at Step 2, DBP was included at Step 1. Thus, findings associated with hypothesis seven suggest that when initial DBP is included in the model, WI significantly predicted follow-up alcohol-related problems, and initial DBP predicted follow-up drinking outcomes (Table 13). This implies that when initial DBP is taken into account, participants who received the WI (that is, participants who were asked to list pros and cons of drinking and reducing drinking, and asked to assign weights of relative importance to each item), drank less compared to participants who either received a non-weighted alcohol intervention or no intervention (control). As such, main effects at Step 1 provide some support for hypothesis six.

Although main effects were significant, it is important to note that no significant interactions emerged at Step 2. It was expected that the WI would be most effective for participants with higher motivation to reduce drinking at baseline, as individuals already motivated to drink less will consume less alcohol following the intervention compared to

individuals not motivated to make a change in their drinking. Contrary to these predictions, results demonstrated that initial DBP did not moderate the effect of WI on drinking (Table 13). This suggests that efficacy of the WI did not depend on whether the individual receiving the intervention was motivated to reduce their drinking or not. This further implies that regardless of an individual's DBP, an intervention that includes weighting of items is expected to encourage reduced drinking.

In sum, these findings can be considered in light of three main questions; 1) *did the intervention work?*; 2) *does weighting matter?*; and 3) *why were there differences in results for different drinking outcomes?* Overall, with respect to the question of whether the intervention worked, findings from the present study are mixed. The DB procedure appears to be partly effective in reducing alcohol use. Thus, intervention efficacy for the present research depends on the specific outcome. For these data, the DB procedure was effective in reducing drinks per week but no other drinking variables. Additionally, intervention efficacy depended on whether the DBP was weighted or not weighted. Furthermore, the method by which the weighted DBP was calculated (summed versus multiplied or averaged) seemed to have differential result in terms of predicting follow-up drinking variables, and it is not yet clear which of the three DBP weights is best. Therefore, it appears that the DB intervention was effective for specific outcomes, and only when weighted a certain way.

With respect to the question of whether weighting matters, it appears that, yes, weighting items during the DB procedure does indeed matter. As such, there are two considerations regarding weighting in alcohol intervention. The first is whether the intervention incorporates weighting at all, and the second relates to how the weights are scored. As stated above, the present study scored weights three different ways and sought to determine which of these best

predicted follow-up drinking. However, there was no clear winner among the three weighted DBP measures. A follow-up question to whether weighting matters is the question of why the weighted intervention worked. To this end, it seems that it is the *process* of weighting that is of importance and less so the *actual* weights of items. It is likely that the assignment of weights might cognitively reinforce the significance or extremity of each reason to reduce drinking. This might in turn tip the balance towards making a change by enhancing the resolution of ambivalence regarding drinking. It is possible that assigning weights to items encourages individuals to explore ambivalence. Considering weighted items might enhance the exploration of ambivalence and may provide an internal search for inspiration to change. This might be a significant process in the resolution of ambivalence, and the resulting increase in motivation to change behavior might be greater than had the individual not undergone the process of assigning weights.

Regarding the question of why there were differential results for drinking outcomes, it is worth noting that the weighted intervention predicted reductions in drinks per week, but not other drinking indices. Weekly drinking has been shown to account for the most variance in the prediction of alcohol problems (Borsari, et al., 2001), and thus, relative to other drinking indices, weekly drinking is a reliable index of problems related to alcohol among college students. Indices of quantity of alcohol consumption, such as peak drinks, are not sensitive to episodic drinking which is commonly encountered in the college environment. Indices of frequency of alcohol consumption, such as drinking frequency, are not sensitive to differences between heavy versus light drinking. Weekly drinking is more reliable relative to frequency and peak consumption because it is an index of drinking over time, and it is within reason that findings

from the present study show that drinks per week was predicted by the weighted intervention, whereas peak drinks and drinking frequency were not.

Although initial DBP was not found to moderate intervention efficacy, additional research is needed to elucidate whether other moderators might be identified. Individual differences to be considered might include factors related to motivation such as intrinsic versus extrinsic elements or incentives that might influence an individual's motivation to engage in or reduce drinking. One potential avenue for future research is to build on one of the strategies already presented in this paper. This strategy, coded DBP (see 5.2.2. *Coding participant-generated DBP*), may provide some insight regarding intrinsic and extrinsic factors that most influence undergraduates to drink or reduce drinking. In addition to identifying most *common* reasons why undergraduates drink, a coded DBP may help alcohol researchers to better understand specifically what common intrinsic and common extrinsic factors related to drinking or not drinking are most important to take into account. For example, it is possible that participants high in intrinsic motivation might be motivated to reduce drinking based on internal reasons such as feeling healthier, whereas participants high in extrinsic motivation might be motivated to drink less based on external reasons such as parental expectations. Moreover, intrinsic and extrinsic motivation might be evaluated as moderators of intervention efficacy. In other words, it may be worth considering whether the weighted DBP intervention is more effective for participants who are high in intrinsic versus extrinsic motivation, or vice versa. It is possible that individuals high in intrinsic motivation might benefit more from the intervention compared to those high in extrinsic motivation as the DB process encourages an internal search for reasons to reduce drinking. However, it is also possible that individuals high in extrinsic motivation might benefit more from the intervention compared to those high in intrinsic

motivation as listing pros and cons during the DB procedure may highlight external reasons for drinking less.

Along these same lines, personalized DBP feedback (discussed in section 5.2.3.) might be a second potential avenue for future research. This strategy may provide further insight with respect to intrinsic versus extrinsic motivation and may represent a method by which to evaluate moderators of intervention efficacy. The basis for using personalized feedback in intervention stem from theoretical predictions involving dissonance by presenting individuals with discrepant information. Future research might consider whether personalized DBP feedback is more effective for participants who are high in intrinsic versus extrinsic motivation, or high in extrinsic versus intrinsic motivation. It is possible that those high in intrinsic motivation may be more sensitive to the experience of self-discrepancy related dissonance following the viewing of personalized DBP feedback compared to those high in extrinsic motivation, and this may trigger behavioral changes to reduce that discrepancy, such as drinking less. In this case, the intervention would be more effective among those high in intrinsic motivation compared to those high in extrinsic motivation. However, it is also possible that for those high in external motivation, the personalized DBP feedback may itself serve as an external force that motivates the extrinsically motivated individual to reduce drinking. Here, the intervention would be more effective for those high in extrinsic motivation relative to those high in intrinsic motivation. It is clear that further research is needed to better understand the relationship between DBP and drinking. Considering intrinsic and extrinsic motivation as moderators of intervention efficacy may further elucidate this relationship and facilitate the tailoring of future alcohol interventions.

10. Limitations

The strengths of the study must be considered in light of the limitations. First, it is important to note that to an extent, the DBP (weighted or non-weighted) is a relative measure that assesses the proportion of one behavioral alternative (current drinking) relative to the other (reducing drinking). Thus, if a participant's DBP score changes over time it would not be possible to determine which preference of behavior option had changed relative to the other option (other strategies must be used for this, such as evaluating the number of pros listed at baseline compared to the number listed at follow-up). Additionally, as the DBP can only be interpreted as motivation to engage in a behavior relative to other, however should an individual weigh three or more alternatives (e.g., current drinking, reducing drinking, and abstinence), results may be confounded. Furthermore, related to the weighted DBP, there is an implicit assumption that weight anchors of items are evenly spread between "*not at all important*" and "*extremely important*." However, it is likely that the scale anchors are not in fact uniformly distributed. In fact, the difference between the lowest anchor "*not at all important*" (which translates to a weight of zero), and the next, "*somewhat important*" (which translates to a weight of one), might represent a significant "jump" compared to the difference between "*somewhat important*" and the adjacent anchor, "*very important*" (which translates to a weight of two). Moreover, theoretical predictions involving the DB procedure suggest that it is designed to facilitate the exploration and resolution of ambivalence. It is possible that this procedure may not be beneficial for individuals whose ambivalence is low compared to individuals whose ambivalence is high.

Additional limitations relate to the sample, which was comprised of University of Houston (UH) students. Although this might be considered a sample of convenience, this sample

is taken from a population at risk for problems associated with alcohol use and is representative of UH demographics.

11. Conclusion

This paper provided a review of DB theory, history, and research, and proposed strategies for improving DB with respect to alcohol brief interventions for college students. The present study replicates and extends previous research by providing an examination of weighted and non-weighted DBP as a measure of MTC among a sample of heavy drinking undergraduate students. Findings provided mixed support for hypotheses in that the weighted DBP intervention resulted in increased RTC and decreased drinks per week but not peak drinks, drinking frequency, or alcohol-related problems; however, initial DBP was not found to moderate the intervention. Results of this research can readily be disseminated to help investigators and health professionals with stronger methods than have previously been applied. Furthermore, this research lays the groundwork for enhancing future interventions by increasing empirical knowledge of the role motivation plays in heavy alcohol use and factors in predicting drinking.

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Table 1
Stages of change in which specific processes of change are emphasized

Stages of Change	Precontemplation	Contemplation	Preparation	Action	Maintenance
Processes of Change	Consciousness Raising Environmental Reevaluation Dramatic Relief	Self-Reevaluation	Self-Liberation	Reinforcement Management Counterconditioning Helping Relationships Stimulus Control	

Table 2

MTC strategies, MI principles, and MI strategies

MTC Strategies	MI Principles	MI Strategies
Giving Advice	Develop Discrepancy	Ask Open-Ended Questions
Removing Barriers	Avoid Argumentation	Listen Reflectively
Providing Choice	Roll with Resistance	Affirm
Decreasing Desirability	Supports Self-Efficacy	Summarize
Practicing Empathy	Express Empathy	Elicit Self-Motivational Statements
Providing Feedback		
Clarifying Goals		
Active Helping		

Table 3
Four-field decisional balance worksheet and DBP calculation in accordance with Collins (2009)

	Pros	Cons
Drinking	<ol style="list-style-type: none"> 1. Drinking helps me fit in 2. Alcohol helps me have fun 3. Drinking relieves my stress <p>$\text{pros}_{\text{cur}} = 3$</p>	<ol style="list-style-type: none"> 1. Drinking is bad for my health 2. Hangovers <p>$\text{cons}_{\text{cur}} = 2$</p>
Reducing Drinking	<ol style="list-style-type: none"> 1. My health will improve 2. Save money <p>$\text{pros}_{\text{red}} = 2$</p>	<ol style="list-style-type: none"> 1. I won't be cool 2. Won't have fun <p>$\text{cons}_{\text{red}} = 2$</p>
$\frac{(\text{pros}_{\text{red}} + \text{cons}_{\text{cur}})}{(\text{pros}_{\text{red}} + \text{cons}_{\text{cur}} + \text{pros}_{\text{cur}} + \text{cons}_{\text{red}})}$		
$\text{DBP} = (2 + 2) / (2 + 2 + 3 + 2) = 4 / 9 = \mathbf{0.44}$		

Table 4

Four-field decisional balance worksheet reflecting the same participant-generated items from Table 3. Here, the weighted DBP is calculated.

	Pros	Rating	Cons	Rating
Drinking	1. <i>Drinking helps me fit in</i> 2. <i>Alcohol helps me have fun</i> 3. <i>Drinking relieves my stress</i> $\text{pros}_{\text{cur}} = 3$	5 4 1 $\text{W}_{\text{proscur}} = 10$	1. <i>Drinking is bad for my health</i> 2. <i>Hangovers</i> $\text{cons}_{\text{cur}} = 2$	7 5 $\text{W}_{\text{conscur}} = 12$
Reducing Drinking	1. <i>My health will improve</i> 2. <i>Save money</i> $\text{pros}_{\text{red}} = 2$	3 6 $\text{W}_{\text{prored}} = 9$	1. <i>I won't be cool</i> 2. <i>Won't have fun</i> $\text{cons}_{\text{red}} = 2$	3 4 $\text{W}_{\text{consred}} = 7$

$$[(\text{pro}_{\text{red}} + \text{W}_{\text{prored}}) + (\text{con}_{\text{cur}} + \text{W}_{\text{conscur}})]$$

$$[(\text{pro}_{\text{red}} + \text{W}_{\text{prored}}) + (\text{con}_{\text{cur}} + \text{W}_{\text{conscur}}) + (\text{pro}_{\text{cur}} + \text{W}_{\text{proscur}}) + (\text{con}_{\text{red}} + \text{W}_{\text{consred}})]$$

$$\text{Weighted DBP} = [(2 + 9) + (2 + 12)] / [(2 + 9) + (2 + 12) + (3 + 10) + (2 + 7)] = 25 / 47 = \mathbf{0.53}$$

Table 5
Evidence and characteristics of alcohol-related studies using decisional balance

Citation	Sample Size	Sample description	Study	DB Measure Type	Findings	Limitations
Babbin, 2011	3565	Sixth grade students from 20 schools	Data were from baseline of an intervention	Decisional Balance Inventory for the Prevention of Alcohol Use (“pros/cons” but really pros of drinking & pros of not drinking)	The DBIPA demonstrates high factorial invariance	Homogeneous racial sample
Carey, 2010	677	College students (mandated)	Data were from baseline of an intervention	Decisional Balance for Immoderate Drinking (pros/cons of current drinking)	Gender differences emerged on motivational variables. Family history was related to drinking pattern and DB	Mandated sample restricts generalizability
Carey, 2006	509	College students (heavy drinkers)	RCT, 6 conditions, assessments at 1, 6, & 12 mo	Four-field open-ended worksheet	TLFB interview reduced drinking at 1mo, basic BMI improved drinking outcomes beyond TLFB at 1mo, enhanced BMI did not	Retrospective self-reports (recall bias), homogeneous sample (lack of diversity)
Collins, 2005	131	College students (heavy drinkers)	RCT, 3 conditions, assessments at baseline, 2wk, & 6mo	Four-field open-ended worksheet (in-person or written DB)	In-person DB generated more cons of current drinking than written DB, but no support for DB as a stand-alone intervention	Generalizability Sample characteristics may have limited sensitivity of design
Collins, 2009	143	College students (heavy drinkers)	Intervention, assessments at baseline, 1, 6, & 12mo	Four-field open-ended worksheet, calculated DBP	DBP predicted changes in drinking up to 6mo, supporting DB as stand-alone intervention	Nonrandom sample Generalizability (homogeneous racial & ethnic sample)

(table continues)

Table 5 (continued)

Citation	Sample Size	Sample description	Study	DB Measure Type	Findings	Limitations
Collins, 2010	191	Treatment seeking smokers	Secondary analysis of data from a smoking cessation intervention (2 conditions)	Four-field open-ended worksheet, calculated DBP	DBP change scores predicted smoking frequency and relapse, supporting use of DB as stand-alone intervention	Nonrandom sample
Cunningham, 1997	218	Clients in an outpatient treatment facility	Single assessment	Alcohol and Drug Consequences Questionnaire (pros/cons of changing alcohol/drug use)	Scale development. Measure appears to be a useful indicator of DB	Generalizability to non-clinical population
Grothues, 2005	408	Clinical patients meeting alcohol abuse criteria	Cross-sectional	Alcohol Decisional Balance Scale (adapted & translated to German)	Comorbidity was related to higher use of processes of change and more pros and cons of drinking compared to non-comorbid individuals	Procedure bias (some in-person, some via mail to save time) Generalizability to non-clinical population
Johnson, 2006	1240	Students in USA, England, and Israel	Cluster analyses on 4 independent samples	Decisional Balance Inventory (DB for not using substances for elementary & middle schools, and pros/cons for using for highschool samples)	4 prevention profiles emerged (most protected, least positive, most tempted, most negative)	Age generalizability Cross-sectional data prohibits causal inferences
LaBrie, 2011	230	College students (sanctioned males)	Intervention, assessments at baseline, and weekly for 3mo	Facilitator-led DB (*weighted DB for items that most resonated with participants)	Intervention reduced drinking	Generalizability, lack of RCT (no true control group)

(table continues)

Table 5 (continued)

Citation	Sample Size	Sample description	Study	DB Measure Type	Findings	Limitations
LaBrie, 2006	167	College students (adjudicated)	Single session MI-style group intervention	Group dialogue DB	Significant reductions in drinking, significantly more so in males	No control group
LaBrie, 2006	47	College males	Intervention, assessments at baseline & 1mo	Facilitator-led DB	Decreased intention to drink, drinking levels, and increased MTC at 1mo follow-up. DB as a unique intervention is supported.	Women excluded
LaBrie, 2007	115	Adjudicated college females	Group intervention, 3mo follow-up	Group dialogue DB	Significant reductions in drinking and related consequences across 3mo follow-up	Multicomponent intervention (can't evaluate DB as stand-alone intervention)
Migneault, 1997	853	10th & 11th graders attending vocational training	Single assessment	Decisional Balance Inventory	Scale development (immoderate drinking)	Generalizability
Migneault, 1999	629	College students	Single assessment	Decisional Balance Questionnaire	Scale development (immoderate drinking)	Generalizability
Morgen, 2008	462	College students	Single assessment	Alcohol Decisional Balance Scale (pros/cons of alcohol use)	Students meeting alcohol disorder criteria perceived their drinking as normal and reported highest pros. Pros were linked with problem drinking.	External validity, sampling error
Noar, 2003	406	College students	Single assessment	Alcohol Decisional Balance Scale (pros/cons of alcohol use)	DB has equal or better predictive validity to expectancies. Positive expectancies & pros were positively related to each other and both predicted drinking, but DB was just as good a predictor and sometimes better than expectancies.	Didn't measure subjective evaluations

(table continues)

Table 5 (continued)

Citation	Sample Size	Sample description	Study	DB Measure Type	Findings	Limitations
Nye, 1999	72	College students (heavy drinkers)	Experimental 2x2 design, assessments at screening & 3mo	Modified Decisional Balance Measure (with bar mounted on horizontal axis, DB based on acute/obtuse angles)	Intervention conditions increased cons of drinking	posttest-only design
Semaan, 2003	1938	Sexually active women	Data were from baseline of an intervention	Decisional Balance Measure (standardized)	Identified characteristics of women with low pros and high cons. Binge drinking associated with decreased pros. Income associated with increased DB scores. Most women had negative DB scores regarding condom use.	Cross-sectional data prohibits causal inferences
Share, 2004	119	Alcohol-dependent, treatment-seeking women	Single session prior to treatment	Alcohol & Drug Consequences Questionnaire (pros/cons of drinking)	Salience of pros and cons of changing behavior was associated with a decision to take action. DB is linked with MTC.	Cross-sectional data prohibits causal inferences
Talpade, 2008	407	Adolescent students	Data were from a curriculum-based program	Four-field open-ended worksheet, calculated DBP	The majority of the participants (94%) made significantly more healthy decisions	No control group
Thyrian, 2004	137	Alcohol and tobacco users in Germany	Single assessment	Decisional Balance Measure	Little correspondence between stages of change for alcohol versus smoking	Generalizability
Velasquez, 1999	132	Alcohol dependent outpatients in a public mental health clinic	Data were collected prior to treatment	Alcohol Decisional Balance Scale (pros/cons of drinking)	DB considerations were related to psychiatric severity	Generalizability to nonclinical population
Walton, 2010	3338	Adolescent patients seeking treatment at an emergency department	3 conditions, assessments at baseline, 3mo, & 6mo	DB exercises via computer or therapist (multi-component) – DB for potential benefit of staying away from drinking/fighting	Participants in the intervention conditions showed reduced aggression compared to controls at 3 and 6mo follow-ups	Generalizability

Table 6
Aims and hypotheses

Aims	Hypotheses
1. Evaluate cross-sectional associations between the DBP (non-weighted) and drinking	1. Initial DBP are expected to positively correlate with baseline drinking 2. Initial DBP scores are expected to positively correlate with baseline RTC
2. Evaluate an alcohol DB intervention in comparison to control.	3. WI and NI will be associated with increased RTC compared to control 4. WI will be associated with increased RTC (evidenced by increases in DBP and RTC) in comparison to any other condition 5. WI and NI will be associated with greater reductions in drinking compared to control. 6. WI will be associated with greater reductions in drinking compared to any other condition.
3. Evaluate DBP as a moderator of intervention efficacy such that individuals with higher motivation to reduce drinking will consume less alcohol following the DBP relative to individuals with lower motivation to reduce drinking	7. DBP will moderate the effect of the intervention on drinking such that higher initial DBP will be associated with greater reductions in drinking. Given that the WI DBP scores are expected to be most closely associated with drinking reduction, this moderating hypothesis is expected to emerge especially for the WI condition.

Table 7
Assessment summary of data collection procedures

Measure	Brief Description	Before Manipulation	Manipulation	After Manipulation	One Month Follow-Up
Demographics	Participants will provide information such as gender, weight, racial background, student status, and age.	X			
Quantity Frequency Scale	Assesses the number of drinks and the number of hours spent drinking on a peak drinking event within the last month	X			X
Daily Drinking Questionnaire	Measures the number of standard drinks that are consumed on every day of a normal week (Monday-Sunday) within the last three months.	X			X
Rutgers Alcohol Problem Index	Assess alcohol related negative consequences in the last month	X			X
Decisional Balance Sheet	This is a free recall task that evaluates the accessibility of alcohol expectancies. Participants are asked to record each advantage and disadvantage of “continuing to drink as you are now” and “drinking less than you do now.” Participants in weighted conditions will be asked to assign weights of relative importance to each pro and con listed, ranging from not at all important to extremely important on a 7-point Likert scale.		X		X
Readiness to Change Questionnaire	The Readiness to Change Questionnaire will be used to rate level of agreement with statements about how participants feel about their drinking right now.	X		X	X
Physical Activity Scale	A Physical Activity scale will be used to rate level and frequency of physical activity with six items containing questions about how many days per week participants engage in moderate or vigorous activities.	X			X

Table 8
Means, Standard Deviations, and Correlations among Variables

			Baseline/Intervention													Follow-Up								
			1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	
Baseline / Intervention	1.	Peak Drinks	-																					
	2.	Drinking Frequency	0.19*	-																				
	3.	Drinks per Week	0.46***	0.52***	-																			
	4.	Alc-Related Problems	0.26***	0.19*	0.51***	-																		
	5.	DBP (Not Weighted)	-0.08	-0.06	-0.08	-0.14†	-																	
	6.	DBP (Summed)	-0.09	-0.04	-0.13	-0.21*	0.96***	-																
	7.	DBP (Multiplied)	-0.09	-0.05	-0.11	-0.20*	0.90***	0.95***	-															
	8.	DBP (Averaged)	-0.05	-0.002	-0.02	-0.17*	0.81***	0.85***	0.68***	-														
	9.	RTC (Pre)	0.14†	0.17*	0.22**	0.31***	0.13†	0.10	0.11	0.09	-													
	10.	RTC (Post)	0.06	0.16*	0.17*	0.27***	0.11	0.09	0.09	0.08	0.85***	-												
Follow-Up	11.	Peak Drinks	0.42***	0.25**	0.44***	0.27***	-0.18*	-0.25**	-0.22*	-0.24**	0.10	0.06	-											
	12.	Drinking Frequency	0.12	0.67***	0.45***	0.22**	-0.16*	-0.16†	-0.13	-0.17†	0.17*	0.14†	0.43***	-										
	13.	Drinks per Week	0.25***	0.40***	0.57***	0.31***	-0.13†	-0.19*	-0.16†	-0.20*	0.11	0.10	0.61***	0.63***	-									
	14.	Alc-Related Problems	0.21**	0.24**	0.45***	0.69***	-0.13	-0.14	-0.12	-0.11	0.27***	0.25**	0.21**	0.29***	0.37***	-								
	15.	DBP(Not Weighted)	-0.05	-0.08	-0.17*	-0.06	0.13	0.15†	0.12	0.15†	0.08	0.07	-0.01	-0.06	-0.10	-0.06	-							
	16.	DBP (Summed)	-0.19*	-0.16†	-0.19*	-0.06	0.23**	0.24**	0.26**	0.15†	0.09	0.07	-0.05	-0.14	-0.16†	-0.093	0.94***	-						
	17.	DBP (Multiplied)	-0.16†	-0.18*	-0.16†	-0.05	0.20*	0.24**	0.33***	0.05	0.08	0.03	-0.04	-0.14	-0.15†	-0.10	0.85***	0.95***	-					
	18.	DBP (Averaged)	-0.16†	-0.06	-0.16†	-0.07	0.20*	0.20*	0.12	0.31***	0.09	0.12	-0.06	-0.11	-0.14	-0.04	0.80***	0.84***	0.64***	-				
	19.	RTC	0.15†	0.13†	0.24**	0.26***	0.05	0.10	0.11	0.08	0.66***	0.63***	0.62	0.11	0.06	0.28***	0.19*	0.15†	0.19*	0.07	-			
	20.	Alc Cond (AC)	0.05	-0.07	-0.002	0.05	-0.13†	-0.24**	-0.30***	-0.11	-0.003	0.05	-0.003	-0.10	-0.14†	-0.04	-0.12	-0.21*	-0.24**	-0.11	0.04	-		
	21.	Weighted AC	0.007	-0.010	-0.02	0.09	-0.01	-0.22*	-0.15†	-0.27**	0.05	0.08	-0.06	-0.02	-0.12	-0.04	-0.02	-0.08	0.03	-0.19*	0.02	0.53***	-	
Mean			7.13	5.59	8.61	31.55	0.69	0.67	0.70	0.63	0.42	0.43	4.91	4.81	7.31	29.99	0.66	0.66	0.70	0.62	0.56	0.46	0.20	
Standard Deviation			3.50	1.20	6.55	8.68	0.17	0.16	0.18	0.17	1.24	1.25	3.69	2.54	6.62	7.16	0.17	0.14	0.17	0.38	1.27	0.50	0.40	

Note. N=180 *** $p < .001$. ** $p < .01$. * $p < .05$. † $p < .10$

Table 9

Regression analysis for variables predicting RTC and DBP from the intervention condition, with baseline RTC included as a covariate.

	Predictor	B	SE B	β
Post-Intervention RTC	Baseline RTC	0.91	0.05	0.87***
	Intervention	0.13	0.11	0.05
Follow-up RTC	Baseline RTC	0.69	0.06	0.68***
	Intervention	0.20	0.16	0.08
Follow-up DBP (Non-Weighted)	Baseline RTC	0.006	0.01	0.05
	Intervention	-0.05	0.02	-0.17†
Follow-up Weighted DBP (Weights Summed)	Baseline RTC	0.009	0.01	0.08†
	Intervention	-0.06	0.03	-0.20*
Follow-up Weighted DBP (Weights Multiplied)	Baseline RTC	0.01	0.01	0.07
	Intervention	-0.08	0.03	-0.23**
Follow-up Weighted DBP (Weights Averaged)	Baseline RTC	0.008	0.01	0.08
	Intervention	-0.03	0.02	-0.10

Note. N=180 *** $p < .001$ ** $p < .01$ * $p < .05$. † $p < .10$

Table 10

Regression analysis for variables predicting RTC and follow-up DBP from the weighted intervention condition, with baseline RTC included as a covariate.

	Predictor	B	SE B	β
Post-Intervention RTC	Baseline RTC	0.91	0.05	0.88***
	Weighted Intervention	-0.16	0.17	-0.04
Follow-up RTC	Baseline RTC	0.69	0.07	0.68***
	Weighted Intervention	0.14	0.25	0.04
Follow-up DBP (Non-Weighted)	Baseline RTC	0.01	0.01	0.06
	Weighted Intervention	-0.06	0.04	-0.13
Follow-up Weighted DBP (Weights Summed)	Baseline RTC	0.01	0.01	0.08
	Weighted Intervention	-0.04	0.04	-0.09
Follow-up Weighted DBP (Weights Multiplied)	Baseline RTC	0.01	0.01	0.07
	Weighted Intervention	0.01	0.05	0.02
Follow-up Weighted DBP (Weights Averaged)	Baseline RTC	0.01	0.01	0.09
	Weighted Intervention	-0.09	0.04	-0.21*

Note. N=180 *** $p < .001$ ** $p < .01$ * $p < .05$. † $p < .10$

Table 11

Regression analysis for variables predicting drinking from the intervention condition with baseline drinking controlled.

	Predictor	B	SE B	β
Follow-up Peak Drinks	Baseline Peak Drinks	0.45	0.07	0.42***
	Intervention	-0.19	0.52	-0.03
Follow-up Drinking Frequency	Baseline Drinking Frequency	0.85	0.08	0.66***
	Intervention	-0.31	0.30	-0.06
Follow-up Drinks per Week	Baseline Drinks per Week	0.57	0.06	0.57***
	Intervention	-1.82	0.84	-0.14*
Follow-up Alcohol-Related Problems	Baseline Alcohol-Related Problems	0.57	0.05	0.70***
	Intervention	-1.10	0.80	-0.08

Note. N=180 *** $p < .001$ ** $p < .01$ * $p < .05$. † $p < .10$

Table 12
Regression analysis for variables predicting drinking from the intervention condition with baseline drinking controlled.

	Predictor	B	SE B	β
Follow-up Peak Drinks	Baseline Peak Drinks	0.45	0.07	0.42***
	Weighted Intervention	-0.57	0.68	-0.06
	Non-Weighted Intervention	0.08	0.61	0.01
Follow-up Drinking Frequency	Baseline Drinking Frequency	0.85	0.08	-0.06***
	Weighted Intervention	-0.40	0.40	-0.06
	Non-Weighted Intervention	-0.25	0.35	-0.04
Follow-up Drinks per Week	Baseline Drinks per Week	0.57	0.06	0.56***
	Weighted Intervention	-2.24	1.10	-0.14†
	Non-Weighted Intervention	-1.44	0.99	-0.10
Follow-up Alcohol-Related Problems	Baseline Alcohol-Related Problems	0.58	0.05	0.70***
	Weighted Intervention	-1.94	1.05	-0.11†
	Non-Weighted Intervention	-0.48	0.95	-0.03

Note. N=180 *** $p < .001$ ** $p < .01$ * $p < .05$. † $p < .10$

Table 13
Hierarchical regression analysis for variables predicting DBP from the intervention condition, with baseline drinking included as covariates.

		Predictor	B	SE B	β
Follow-up Peak Drinks	Step 1	Baseline Peak Drinks	0.43	0.07	0.41***
		Initial DBP	-3.20	1.54	-0.15*
		Weighted Intervention	-0.46	0.66	-0.05
	Step 2	Initial DBP * Weighted Intervention	1.60	3.61	0.12
Follow-up Drinking Frequency	Step 1	Baseline Drinking Frequency	0.84	0.07	0.66***
		Initial DBP	-1.74	0.87	-0.12*
		Weighted Intervention	-0.25	0.38	-0.04
	Step 2	Initial DBP * Weighted Intervention	-0.63	2.09	-0.07
Follow-up Drinks per Week	Step 1	Baseline Drinks per Week	0.55	0.07	0.55
		Initial DBP	-3.49	2.51	-0.09
		Weighted Intervention	-1.85	1.07	-0.11†
	Step 2	Initial DBP * Weighted Intervention	4.25	5.87	0.18
Follow-up Alcohol-Related Problems	Step 1	Baseline Alcohol-Related Problems	0.57	0.05	0.70***
		Initial DBP	-1.16	2.46	-0.03
		Weighted Intervention	-2.07	1.02	-0.11*
	Step 2	Initial DBP * Weighted Intervention	3.16	5.62	0.13

Note. N=180 *** $p < .001$ ** $p < .01$ * $p < .05$. † $p < .10$

Figure Captions

Figure 1. The three proposed strategies (weighted DBP, coded DBP, and personalized DBP feedback) can be used separately or in conjunction in alcohol intervention.

Figure 2. Study design/conditions

Figure 3. Recruitment flyer

Figure 4. Consort table showing study flow

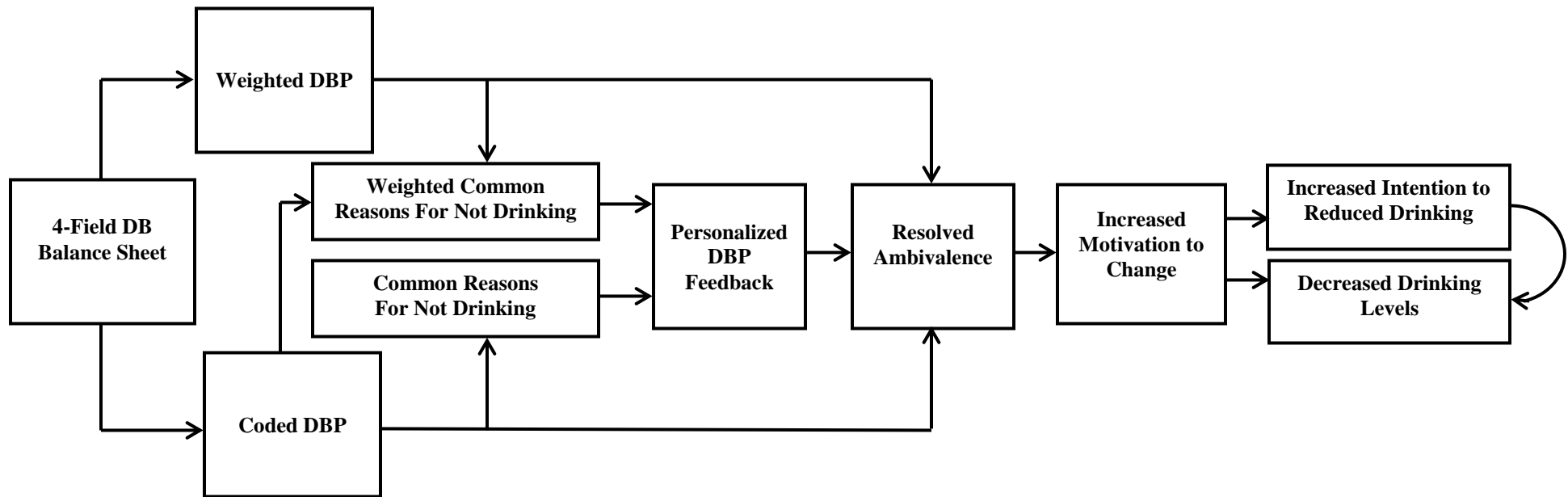


Figure 1. The three proposed strategies (weighted DBP, coded DBP, and personalized DBP feedback) can be used separately or in conjunction in alcohol intervention.

	<i>Intervention</i> Alcohol DBP	<i>Control</i> Physical Activity DBP
Weighted	Weighted Intervention (WI)	Weighted Control (WC)
Not Weighted	Non-Weighted Intervention (NI)	Non-Weighted Control (NC)

Figure 2. Study design/conditions (N = 60 in each cell)

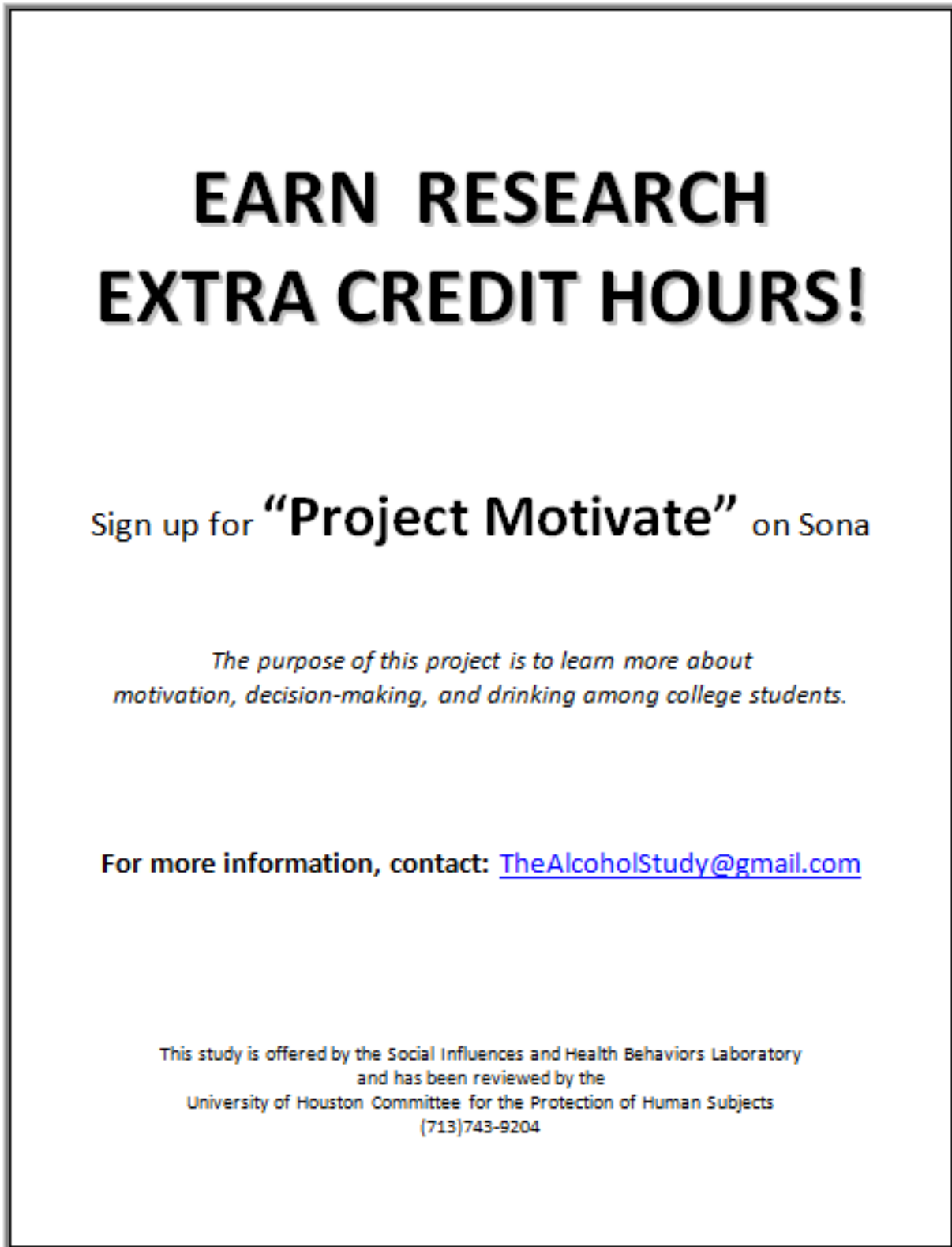


Figure 3. Recruitment flyer

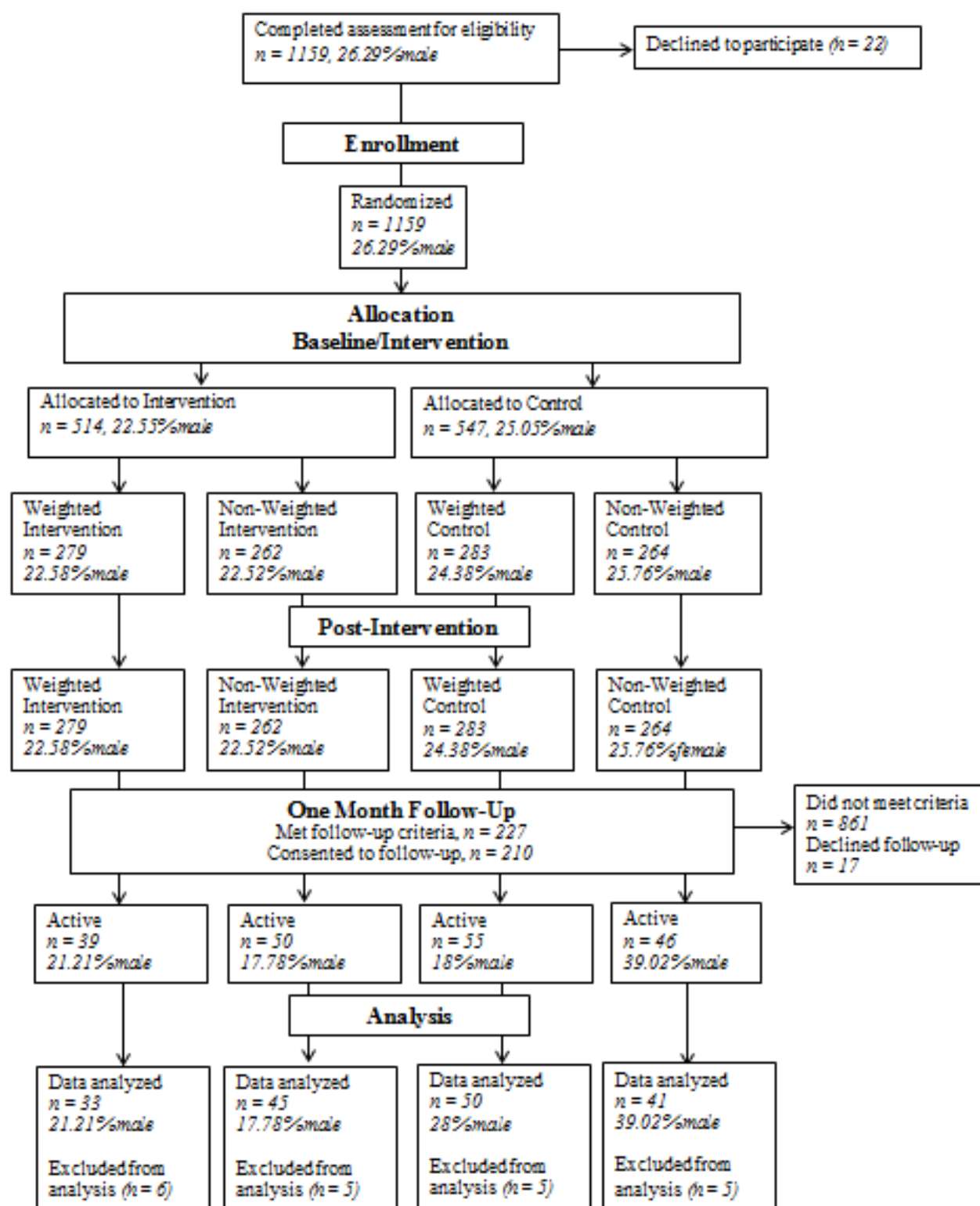


Figure 4. Consort table showing study flow

Appendix

Demographics

Instructions: Please read each question carefully and select the most accurate response.

1. Are you at least 18 years of age?

- ☐ Yes
☐ No (If participant marks "No," they will be sent out of the survey as they do not meet participation requirements)

2. Age: _____ years

3. Height: _____ ft. _____ in

4. Sex: ☐ Male ☐ Female

5. Weight: (for Blood Alcohol Content):

_____ lbs.

6. Ethnic Background:

- ☐ Hispanic/Latino ☐ Nonhispanic

7. Racial Background:

- ☐ White/Caucasian
☐ Native American/American Indian
☐ Black/African American
☐ Asian
☐ Native Hawaiian/ Pacific Islander
☐ Multi-Ethnic
☐ Other

8. What is your year in school?

- ☐ 1st year ☐ 2nd year ☐ 3rd year
☐ 4th year ☐ 5th year ☐ 6th year
☐ 7th year ☐ more

9. Class Standing:

- ☐ Freshman
☐ Sophomore
☐ Junior
☐ Senior

10. Student Status:

- ☐ Part-time (1-11 credits)
☐ Full-time (12+ credits)

11. Most recent Semester's GPA (Write N/A if this does not apply to you): _____

12. Where you are living this semester:

- ☐ Residence Halls/Dorm Room
☐ Fraternity/Sorority House
☐ Off-Campus Housing/Apartment/House
☐ With Parents

13. Are you currently a Fraternity or Sorority Member? ☐ Yes ☐ No

14. Work Status:

- ☐ I do not work
☐ Working part-time
☐ Working full-time

15. Religious Affiliation?

- ☐ Christian
☐ Jewish
☐ Hindu
☐ Buddhist
☐ Muslim/Islam
☐ Agnostic
☐ Atheist
☐ Non-religious/secular
☐ Other (specify) _____

16. Christian Denomination?

- ☐ Catholic
☐ Baptist
☐ Methodist
☐ Lutheran
☐ Presbyterian
☐ Episcopal
☐ Other (specify) _____
☐ Not applicable

17. Relationship Status?

- ☐ Single, not dating
☐ Single, casual dating
☐ Single, exclusively dating
☐ Engaged
☐ Married/Life partner

18. If you are currently in a relationship, do you live with your partner?

- ☐ Yes ☐ No ☐ Not applicable

Daily Drinking Questionnaire (DDQ)

This section asks you to report on **your** drinking over the **past three months**.

For all questions, **one drink equals:**

- 5oz. wine
- 12oz. wine cooler
- 12oz. beer (10oz. of Microbrew; 8-9 oz. Malt Liquor, Canadian beer or Ice beer)
- 6oz. Ice Malt Liquor
- 1 Cocktail with 1 oz. of 100 proof liquor or 1 ½ oz. (single jigger) of 80 proof liquor.

1. Consider a typical week during the **last three months**. How much alcohol, on average (measured in number of drinks), do **you** drink on each day of a typical week?

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

2. Consider a typical week during the **last three months**. Over how many **hours** do **you** drink the above number of drinks?

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

3. On average, during **the last three months**, **how often** have **you** consumed alcohol?

- | | | |
|---|--|--|
| <input type="checkbox"/> Never | <input type="checkbox"/> Three times a month | <input type="checkbox"/> Four times a week |
| <input type="checkbox"/> Less than once per month | <input type="checkbox"/> Once a week | <input type="checkbox"/> Five times a week |
| <input type="checkbox"/> Once a month | <input type="checkbox"/> Twice a week | <input type="checkbox"/> Six times a week |
| <input type="checkbox"/> Two times a month | <input type="checkbox"/> Three times a week | <input type="checkbox"/> Every day |

4. During **the last three months**, when you have consumed alcohol, how many drinks on average did you typically consume on a given occasion?

- | | | |
|-----------------------------------|------------------------------------|--|
| <input type="checkbox"/> 0 drinks | <input type="checkbox"/> 9 drinks | <input type="checkbox"/> 18 drinks |
| <input type="checkbox"/> 1 drink | <input type="checkbox"/> 10 drinks | <input type="checkbox"/> 19 drinks |
| <input type="checkbox"/> 2 drinks | <input type="checkbox"/> 11 drinks | <input type="checkbox"/> 20 drinks |
| <input type="checkbox"/> 3 drinks | <input type="checkbox"/> 12 drinks | <input type="checkbox"/> 21 drinks |
| <input type="checkbox"/> 4 drinks | <input type="checkbox"/> 13 drinks | <input type="checkbox"/> 22 drinks |
| <input type="checkbox"/> 5 drinks | <input type="checkbox"/> 14 drinks | <input type="checkbox"/> 23 drinks |
| <input type="checkbox"/> 6 drinks | <input type="checkbox"/> 15 drinks | <input type="checkbox"/> 24 drinks |
| <input type="checkbox"/> 7 drinks | <input type="checkbox"/> 16 drinks | <input type="checkbox"/> 25 or more drinks |
| <input type="checkbox"/> 8 drinks | <input type="checkbox"/> 17 drinks | |

Quantity/Frequency/Peak Alcohol Use Index

For all questions, **one drink equals:**

- 5oz. wine
- 12oz. wine cooler
- 12oz. beer (10oz. of Microbrew; 8-9 oz. Malt Liquor, Canadian beer or Ice beer)
- 6oz. Ice Malt Liquor
- 1 Cocktail with 1 oz. of 100 proof liquor or 1 ½ oz. (single jigger) of 80 proof liquor.

1. Think of the **occasion you drank the most** this **past month**. How **much** did you drink?

- | | | | | |
|-----------------------------------|-----------------------------------|------------------------------------|------------------------------------|-------------------------------------|
| <input type="checkbox"/> 0 drinks | <input type="checkbox"/> 6 drinks | <input type="checkbox"/> 11 drinks | <input type="checkbox"/> 16 drinks | <input type="checkbox"/> 21 drinks |
| <input type="checkbox"/> 1 drink | <input type="checkbox"/> 7 drinks | <input type="checkbox"/> 12 drinks | <input type="checkbox"/> 17 drinks | <input type="checkbox"/> 22 drinks |
| <input type="checkbox"/> 2 drinks | <input type="checkbox"/> 8 drinks | <input type="checkbox"/> 13 drinks | <input type="checkbox"/> 18 drinks | <input type="checkbox"/> 23 drinks |
| <input type="checkbox"/> 3 drinks | <input type="checkbox"/> 9 drinks | <input type="checkbox"/> 14 drinks | <input type="checkbox"/> 19 drinks | <input type="checkbox"/> 24 drinks |
| <input type="checkbox"/> 4 drinks | | | | <input type="checkbox"/> 25+ drinks |

- | | | | |
|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <input type="checkbox"/> 5 drinks | <input type="checkbox"/> 10 drinks | <input type="checkbox"/> 15 drinks | <input type="checkbox"/> 20 drinks |
|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|

2. Think of the **occasion you drank the most** this **past month**. How **many HOURS** did you spend drinking on that occasion?

- | | | | |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| <input type="checkbox"/> 0-1 | <input type="checkbox"/> 3-4 | <input type="checkbox"/> 6-7 | <input type="checkbox"/> 9-10 |
| <input type="checkbox"/> 1-2 | <input type="checkbox"/> 4-5 | <input type="checkbox"/> 7-8 | <input type="checkbox"/> 10+ |
| <input type="checkbox"/> 2-3 | <input type="checkbox"/> 5-6 | <input type="checkbox"/> 8-9 | |

3. On a given **weekend evening** during the **past month**, how **much** alcohol did you typically drink? Estimate for the past month.

- | | | | | |
|-----------------------------------|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <input type="checkbox"/> 0 drinks | <input type="checkbox"/> 6 drinks | <input type="checkbox"/> 11 drinks | <input type="checkbox"/> 16 drinks | <input type="checkbox"/> 21 drinks |
| <input type="checkbox"/> 1 drink | <input type="checkbox"/> 7 drinks | <input type="checkbox"/> 12 drinks | <input type="checkbox"/> 17 drinks | <input type="checkbox"/> 22 drinks |
| <input type="checkbox"/> 2 drinks | <input type="checkbox"/> 8 drinks | <input type="checkbox"/> 13 drinks | <input type="checkbox"/> 18 drinks | <input type="checkbox"/> 23 drinks |
| <input type="checkbox"/> 3 drinks | <input type="checkbox"/> 9 drinks | <input type="checkbox"/> 14 drinks | <input type="checkbox"/> 19 drinks | <input type="checkbox"/> 24 drinks |
| <input type="checkbox"/> 4 drinks | | | | <input type="checkbox"/> 25+ drink |

- | | | | |
|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <input type="checkbox"/> 5 drinks | <input type="checkbox"/> 10 drinks | <input type="checkbox"/> 15 drinks | <input type="checkbox"/> 20 drinks |
|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|

4. On a given **weekend evening** during the **past month**, how **many HOURS** did you spend drinking? Estimate for the past month.

- | | | | |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| <input type="checkbox"/> 0-1 | <input type="checkbox"/> 3-4 | <input type="checkbox"/> 6-7 | <input type="checkbox"/> 9-10 |
| <input type="checkbox"/> 1-2 | <input type="checkbox"/> 4-5 | <input type="checkbox"/> 7-8 | <input type="checkbox"/> 10+ |
| <input type="checkbox"/> 2-3 | <input type="checkbox"/> 5-6 | <input type="checkbox"/> 8-9 | |

5. How many days of the week did you drink alcohol during the **past month**?

- ☐ I do not drink at all
- ☐ About once a month
- ☐ Once a month
- ☐ Two times a month
- ☐ Three times a month
- ☐ Once a week
- ☐ Twice a week
- ☐ Three times a week
- ☐ Four times a week
- ☐ Five times a week
- ☐ Six times a week
- ☐ Every day

<div> <div> <input type="checkbox"/> NEVER 1 </div> <div> <input type="checkbox"/> 1 TO 2 TIMES 2 </div> <div> <input type="checkbox"/> 3 TO 5 TIMES 3 </div> <div> <input type="checkbox"/> 6 TO 10 TIMES 4 </div> <div> <input type="checkbox"/> MORE THAN 10 5 </div> </div>						<div> Rutgers Alcohol Problem Index <u>Directions:</u> How many times did the following things happen to you <u>while</u> you were drinking or <u>because of</u> your alcohol use during the last 3 months? Circle the number corresponding to your answer. </div>
1	2	3	4	5	1. Not able to do your homework or study for a test?	
1	2	3	4	5	2. Got into fights, acted bad, or did mean things?	
1	2	3	4	5	3. Missed out on other things because you spent too much money on alcohol?	
1	2	3	4	5	4. Went to work or school high or drunk?	
1	2	3	4	5	5. Caused shame or embarrassment to someone?	
1	2	3	4	5	6. Neglected your responsibilities?	
1	2	3	4	5	7. Relative avoided you?	
1	2	3	4	5	8. Felt that you needed more alcohol than you used to use in order to get the same effect?	
1	2	3	4	5	9. Tried to control your drinking by trying to drink only at certain times of the day or in certain places?	
1	2	3	4	5	10. Had withdrawal symptoms, that is, felt sick because you stopped or cut down on drinking?	
1	2	3	4	5	11. Noticed a change in your personality?	
1	2	3	4	5	12. Felt that you had a problem with alcohol?	
1	2	3	4	5	13. Missed a day (or part of a day) of school or work?	
1	2	3	4	5	14. Tried to cut down or quit drinking?	
1	2	3	4	5	15. Suddenly found yourself in a place that you could not remember getting to?	
1	2	3	4	5	16. Passed out or fainted suddenly?	
1	2	3	4	5	17. Had a fight, argument or bad feelings with a friend?	
1	2	3	4	5	18. Had a fight, argument or bad feelings with a family member?	
1	2	3	4	5	19. Kept drinking when you promised yourself not to?	
1	2	3	4	5	20. Felt you were going crazy?	
1	2	3	4	5	21. Had a bad time?	
1	2	3	4	5	22. Felt physically or psychologically dependent?	
1	2	3	4	5	23. Was told by a friend or neighbor to stop or cut down drinking?	
1	2	3	4	5	24. Drove shortly after having more than two drinks?	
1	2	3	4	5	25. Drove shortly after having more than four drinks?	

Decisional Balance Questionnaire

This questionnaire is designed to help us understand how people think about changing their drinking [physical activity]. We realize that you may not be thinking about making a change in your drinking [physical activity]. We would like you to imagine that you are considering reducing your drinking [increasing your physical activity]. Think about the pros and cons of reducing drinkin [increasing physical activity] and the pros and cons of not reducing drinking [not increasing physical activity]. Please list as many pros and cons that you can think of in the space provided. If you cannot think of 10 items, that is all right.

Benefits /Pros

Costs/Cons

Making a Change
Drinking)

(Reducing

Not Changing
(Not Reducing

Drinking)

Below is a list of items that you just listed regarding the **benefits/pros of reducing drinking [increasing physical activity]**. Please rate each item using the scale provided, in terms of its importance in your consideration of reducing your drinking.

	Not at all important		Somewhat important		Very important		Extremely important

Below is a list of items that you just listed regarding the **costs/cons of reducing drinking [increasing physical activity]**. Please rate each item using the scale provided, in terms of its importance in your consideration of reducing your drinking

	Not at all important		Somewhat important		Very important		Extremely important

Below is a list of items that you just listed regarding the **benefits/pros of not reducing drinking [not increasing physical activity]**. Please rate each item using the scale provided, in terms of its importance in your consideration of reducing your drinking

	Not at all important		Somewhat important		Very important		Extremely important

Below is a list of items that you just listed regarding the **costs/cons of not reducing drinking [not increasing physical activity]**. Please rate each item using the scale provided, in terms of its importance in your consideration of reducing your drinking.

	Not at all important		Somewhat important		Very important		Extremely important

Readiness to Change Questionnaire (RTCQ)

Please read the sentence below carefully. For each one please select the answer that best describes how you feel. Your answers will be private and confidential.

Strongly disagree

disagree

unsure

agree

strongly agree

1. My drinking is okay as it is
2. I am trying to drink less than I used to
3. I enjoy my drinking but sometimes I drink too much
4. I should cut down on my drinking
5. It's a waste of time thinking about my drinking
6. I have just recently changed my drinking habits
7. Anyone can talk about wanting to do something about drinking, but I am actually doing something about it
8. I am at the stage where I should think about drinking less alcohol
9. My drinking is a problem
10. It's alright for me to keep drinking as I do now
11. I am actually changing my drinking habits right now
12. My life would still be the same, even if I drank less