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The Effect of Visual Alcohol Cues on Risk Taking Behavior Based on Memory Primes and Individual Drinking Habits

Madison McCue

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Professor Piercarlo Valdesolo

By:

Madison McCue

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Abstract

Given the strong presence of alcohol cues in the media, this study aimed to investigate whether exposure to a visual alcohol cue versus a neutral cue would elicit memories about alcohol and increase the likelihood to engage in risk taking behavior, particularly for individuals who consume higher levels of alcohol or who report positive memories associated with alcohol. Through an online Qualtrics survey, 110 college student participants watched either two video advertisements for alcohol brands (alcohol cue), or two advertisements for soda brands (neutral cue), and then completed a memory cue task to assess if positive, neutral or negative memories involving alcohol became salient. Participants then completed the Domain Specific Risk Taking Scale, and a demographic survey assessing typical weekly alcohol consumption. The results from this study did not support any of the hypotheses about the proposed relationship between alcohol cues and risk taking, however results did find that heavy drinking behavior was associated with a higher risk taking score. It is possible that the lack of support for the hypotheses was due to the cue word task priming alcohol for a majority of participants, limited sample size, or the use of a more stable measurement of risk. Further research on the possibility of a relationship between alcohol cues and risk taking behavior would be beneficial.

Keywords: alcohol, advertising, cues, priming, memory, risk

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The Effect of Visual Alcohol Cues on Risk Taking Behavior Based on Memory Primes and Individual Drinking Habits

Alcohol Use and Risk Taking

Alcohol is the most commonly used substance in the United States, with 36% of Americans reporting consumption of alcohol within the past 30 days, and 85% of Americans over the age of 18 reporting consumption of alcohol at some point in their life (Kacha-Ochana et al., 2022). 25% of people surveyed in the United States reported an instance of binge drinking within the past month, which involves consuming multiple drinks in one sitting and reaching a blood alcohol content above the legal limit of .08% (NIAAA, 2020). Alcohol use disorder (AUD) is the most prevalent substance use disorder, with around 10% of the American population having experienced the debilitating effects of AUD in the past year. Around 3% of adolescents between age 12 and 17 face an alcohol use disorder, and adolescent alcohol use has been found to affect brain development and increase the likelihood of developing AUD later on in life (NIAAA, n.d.). The organization Mental Health America attributes the prevalence of alcohol use disorder to "widespread legal access and social approval of moderate drinking" (MHA, n.d.). Alcohol use is currently the fourth-leading cause of preventable death in the United States, and alcohol contributes to around 19% of emergency department visits (NIAAA, n.d.). Driving under the influence of alcohol is a particularly dangerous issue; statistics have found that 32 people die every day from drunk driving related accidents, and 30% of car crash fatalities have a drunk driver involved (NHTSA, 2019). This data demonstrates the numerous harmful effects of alcohol on individuals and the greater community.

Consumption of alcohol has been shown to increase risk taking behavior, particularly risky behaviors that result in consequences to the self, such as increased instances of violence,

risky sexual activity, and drug use (Lane et al., 2004). The relationship between alcohol use and risk taking has been well established in naturalistic settings but has been more difficult to prove in lab settings. One naturalistic study conducted on over 900 bar patrons found that alcohol consumption was associated with increased intention to partake in unprotected sex. This study also found that those with a higher breath alcohol content were less likely to be carrying a condom, though more likely to report intentions to engage in sexual activity (Chaney et al., 2016). Another study found that in a naturalistic bar setting, participants under the influence were more likely to choose a risky option when given the opportunity to participate in a lottery to win free drinks. Participants were recruited at a restaurant bar, had their blood alcohol content measured, and then were told that they could choose between a lottery in which there was a 50% chance of a free drink ticket, or an ambiguous lottery in which the ratio of free drink tickets to blank tickets was unknown. Men in particular were more likely to choose the ambiguous option when their blood alcohol content was high, thus demonstrating both that risk taking increases with alcohol consumption, as does aversion to ambiguity (Tyszka et al., 2015). A self report study using a daily diary found that sensation seeking behavior was more frequently reported on days when alcohol consumption was reported, and risk taking behavior was linked with sensation seeking behavior (Lydon-Staley et al., 2020). These are some examples of naturalistic studies demonstrating the link between alcohol consumption and risk taking behavior.

Biologically, consuming alcohol impairs motor function, reaction times, and impacts judgment. Alcohol increases neurotransmitters in the brain that contribute to feelings of pleasure and relaxation, and decreases activity in the prefrontal cortex, the part of the brain responsible for rational thinking and decision making (American Addiction Centers Inc., 2022). Studies have shown that as blood alcohol levels increase, likelihood to engage in risk taking behavior also

increases. An fMRI study found that consuming alcohol and then playing a risk taking game that involved choosing between a safe or risky option resulted in increased risk taking behavior, as the region of the brain involved with reward became more activated. This study also found that risk taking behavior especially increased for individuals who experienced a more stimulating effect from alcohol, rather than a depressing effect (Gilman et al., 2012). A 2007 study found that individuals under the influence were more likely to engage in risk behavior while playing online blackjack. Players had faster and more impulsive response times, and were more likely to rely on an aid in the game, suggesting that intoxicated individuals had more trouble processing information (Philips & Ogeil, 2007). Alcohol has also been found to increase risk taking behavior in a simulated driving task. Men who were administered alcohol were more likely to take a narrower, risky path while driving in a controlled environment (Burian et al., 2002). Another study on alcohol use and driving found that alcohol consumption increased risky driving during a simulated driving task, and that those who estimated having a lower blood alcohol concentration were the riskiest drivers (Laude & Fillmore, 2016). A recent meta-analysis found that risky behavior increases for substance users in general even while not under the influence, which has greater implications for the lasting effects of alcohol on risk taking behavior. (Chen et al., 2020).

Measuring Risk Taking Behavior

There are numerous valid measures to assess risk taking behavior or propensity to engage in risk taking behavior. Much of the previous research regarding risk taking behavior and substance use has utilized the Balloon Analogue Risk Task to assess active risk taking behavior (Lejuez et al., 2002). This task involves a simulated computer experience of blowing up a balloon; each pump of the balloon adds money to a pool of earnings, but if the balloon pops, all

money is lost. Studies examining the effects of alcohol consumption or intoxication often use the BART to examine behavioral risk taking, as it is a gambling task, and assess whether participants are willing to risk the balloon popping in order to earn more money. One study utilizing the BART found that an alcohol dose that led to a blood alcohol concentration of .08% increased risk taking behavior for those who have a family history of alcohol abuse (Caneto et al., 2018). Another study utilizing the BART found that alcohol consumption increased desire to drink and subsequent risk taking on the task (Rose et al., 2014). Research also found that in sober participants, more frequent personal drinking habits resulted in increased risk taking on the BART (Weafer et al., 2011).

However, recent research has demonstrated that many of the commonly utilized behavioral measures of risk are not as reliable across contexts, including the BART (Frey et al., 2017). The research found that more stable measures of assessing risk proved to be more reliable, so for this reason, the present study will utilize the Domain Specific Risk Taking Scale (DOSPERT). This 30-item scale assesses potential risk taking behavior across five domains, including financial, health and safety, recreational, ethical, and social (Blais & Weber, 2006). Participants are asked a variety of questions and asked to rank on a 7-point Likert scale how likely they would be to engage in a variety of risky activities that fall within the five domains. Scores are averaged and can be calculated according to overall risk propensity or risk propensity within a specific domain. The DOSPERT has been used in a variety of behavioral research on risk taking, and although it is typically used as a more stable risk propensity score, studies have used the DOSPERT to predict risky behavior during travel, risk taking propensity during the coronavirus pandemic, and risk taking as a predictor of alcohol habits and impulsivity (Courtney et al., 2012; Farnham et al., 2018; Li et al., 2022). A meta-analysis found the DOSPERT to be

sufficiently reliable regardless of the particular study characteristics (Shou & Olney, 2020), and another study found that the DOSPERT can be used to predict general risk taking propensity (Highhouse et al., 2016).

Impact of Alcohol Advertising

Despite the known relationship between alcohol and risk taking, American media capitalizes on alcohol's popularity, and alcohol advertising is pervasive in television, radio, billboards, clothing, and numerous other contexts. A 1997 study found that the alcohol industry spent over $1 billion on advertising in the previous year, and television sports programming is the most common target, with an alcohol advertisement airing every 25 minutes during major sporting events (Besen, 1997). A 2019 study found that Americans on average are exposed to around 576 alcohol advertisements every year (Niederdeppe et al., 2021). This study used two databases that independently tracked television advertisements for alcohol. One comprehensive database included local networks, national networks, and cable television, and sorted alcohol advertisements according to the type of alcohol being advertised (e.g. beer, wine, spirits). The other database was from a mail survey that included questions about TV habits and alcohol use. The information from both databases was used to calculate an approximate average number of alcohol advertisements viewed per year. This data revealed that beer in particular is the most frequent type of alcohol advertised, and men report being exposed to nearly twice as many beer advertisements, while women tend to be exposed to more wine advertisements (Niederdeppe et al., 2021). This study found that African Americans are disproportionately exposed to more alcohol advertisements, around 100 more each year than the average White American. This research also noted a slight positive association between increased exposure to alcohol advertising and increased drinking behavior. (Niederdeppe et al., 2021)

There have been many concerns raised about the impact of alcohol advertising, particularly on children and young adults, with some advocacy groups around the globe urging for a full ban on alcohol advertising. A study found that American children between the ages of 11 and 14 see an average of three alcohol advertisements every day, with a majority of advertisements seen by children coming from outdoor billboards (Collins et al., 2006). Children are more vulnerable when it comes to the harmful effects of consuming alcohol, which is a cause for concern when children are being exposed to messaging that paints alcohol in a very positive, exciting light (NIAAA, n.d.). A meta-analysis found that exposure to alcohol advertising has a positive predictive effect on young people's drinking behavior (Anderson, 2009). Concerningly, some studies have found that the onset of drinking significantly increased for previously non-drinking adolescents, after being exposed to alcohol advertising and other forms of media that include alcohol (Smith & Foxcroft, 2009). One study on non-drinking seventh graders found that exposure to beer displays in stores and magazine advertisements for alcohol predicted frequency of drinking in the ninth grade (Elickson et al., 2005). Another study on 10 to 14 year old non-drinkers found that exposure to alcohol use through movies predicted alcohol use, and each additional hour of alcohol use in movies increased the risk of initiating alcohol use by 15% (Sargent et al., 2006). These studies demonstrate how alcohol use in media and advertising predict later alcohol use for adolescents.

Effect of Alcohol Cues on Behavior

The strong presence of alcohol advertising in the media thus raises questions about the impact of alcohol cues on behavior. It has already been discussed that viewing alcohol advertisements leads to an increased likelihood to consume alcohol, which is particularly concerning for still-developing adolescents. But exposure to alcohol cues, including

advertisements, has been found to influence behavior in a number of ways; for example, exposure to an olfactory alcohol cue has been found to increase physiological arousal and cravings for alcohol (Jones et al., 2013). Many studies have compared alcohol cue exposure for heavy drinkers/alcoholics versus those who drink less or don't drink at all. A study on men with alcoholism found that exposure to alcohol related imagery increased physiological arousal, measured by skin conductance response. This study also found that photos of hard liquor elicited more of an arousal response than photos of beer (Laberg et al., 1992). Other studies found that for those with alcoholism, heart rate and salivation increased after being exposed to the smell of alcohol (Kaplan et al., 1985; Pomerleau et al., 1983). One study in particular compared alcoholics and nonalcoholics and found that only those in the alcoholic group salivated when cued with the sight and smell of their preferred alcohol brand, thus demonstrating that cues have a greater effect on those who are heavier drinkers (Monti et al., 1987).

There has also been a link between alcohol cues and aggression, with one study finding that exposure to alcohol related imagery increased accessibility of aggressive thoughts (Bartholow & Heinz, 2006). This study consisted of two experiments to demonstrate the link between alcohol cues and aggressive thoughts. In the first experiment, participants were primed with either images related to alcohol (like beer bottles and martini glasses), images of weapons, or neutral images of plants. Then, participants were presented with a series of target words, some related to aggression, some neutral, and some were non-words. The objective was to indicate whether the word presented was an English word or not, and the results revealed that both participants primed with weapon images and alcohol images reacted quicker to words related to aggression, thus demonstrating that alcohol cues can make aggressive thoughts more accessible (Bartholow & Heinz, 2006). The second study in this project had participants view either alcohol

advertisements or neutral advertisements, none of which contained any aggressive content. They then read a story about a character engaging in a series of ambiguously hostile acts, and ranked the character on various characteristics, including hostility. Those who were exposed to the alcohol advertisements ranked the ambiguous character as more hostile when compared to those who viewed the neutral advertisements (Bartholow & Heinz, 2006). This research demonstrates how alcohol cues, and advertisements specifically, can impact behavior through priming the concept of alcohol, even when alcohol is not explicitly consumed.

Cues, Memory Priming, and Behavior

There is a gap in the research regarding whether exposure to alcohol cues can influence risk taking behavior, and whether alcohol cues can influence behavior due to conceptual priming. Since it is well established that actually consuming alcohol increases risk taking behavior, and alcohol cues influence behavior in a variety of ways, it is worth exploring whether alcohol cues have any impact on risk taking tendencies. Alcohol cues can influence behavior due to the priming of memories involving alcohol. Research has found that for those with alcohol use disorder, relapse of alcohol use can occur due to memories involving alcohol being retrieved after exposure to environmental alcohol cues (Visser et al., 2020). This relationship can be examined more broadly when examining how general cue exposure can influence behavior due to the conceptual priming of memories. Cues can be presented in a number of different modes, which can result in different quality of memory recall, and visual cues are one mode that can serve as a trigger for autobiographical memories (Goddard et al., 2005). Studies have shown that exposure to visual cues can lead to specific memory recall (Thompson & Paivio, 1994). One study found that in children, visual cues aid in recall of specific autobiographical memories (Mateo et al., 2020). More specifically, when comparing visual word cues regarding specific

events versus specific locations, participants described more detailed autobiographical memories after an event based cue (Sheldon & Chu, 2017). Another study found that semantic memory primes autobiographical memory; when participants were primed with a specific semantic word like ‘garden,’ it activated autobiographical memories about the semantic word when compared to participants who weren’t primed with the same words (Mace et al., 2019). Advertisements play a role in memory formation and recall, as those exposed to advertisements are more likely to remember information about the particular product being advertised, or advertisements can result in the cueing of memories surrounding past experiences with the product being advertised (Keller, 1987; Yoo, 2007). Some advertisers even use a specific marketing tactic called ‘nostalgia marketing,’ which attempts to target positive experiences in the past to increase desire to engage with the product being advertised (Muehling & Sprott, 2004).

When autobiographical memories are primed, such as through visual cues or advertisements, it can have an influence on behavior. Priming is a psychological effect in which exposure to a certain stimulus elicits a response to a second stimulus. Priming can be a fairly autonomous process, and can affect behavior without much awareness. Being primed with a task like thinking of a memory can subconsciously influence behavior based on a desire to either repeat the experience of a positive memory or reduce the chances of repeating a negative memory. The concept of the “episodic buffer” in memory research states that when an episodic memory comes to mind, the past is brought into the present consciousness, and so information from memories in the past is used to guide future decisions (Baddeley, 2000; Gershman, 2017). Research has shown that negative memories around a particular event tend to be more durable in memory, and decrease the likelihood of engaging in the particular behavior that resulted in the unfavorable memory. Positive memories tend to result in increased likelihood to engage in the

behavior that resulted in the positive experience (Williams et al., 2022). Remembering positive events in the past can also invoke pleasant emotions tied to the memory, and recalling positive memories as compared to neutral memories has also been found to buffer stress response by dampening the rise of cortisol (Speer & Delgado, 2017). An fMRI study found that participants were willing to give up a small monetary payoff in order to have the opportunity to recall a positive memory from their past, demonstrating the value that positive memories hold (Speer at al., 2014). More specifically, positive memories that involve a social context are valued more than positive memories that do not involve socializing with others (Speer & Delgado, 2020). These studies demonstrate the powerful impact of positive and negative memories, and the possible effect on behavior when such memories are primed.

Present Study

The current study aims to investigate whether there is a relationship between visual alcohol cues and propensity to engage in risk taking behavior. The previous literature demonstrates that alcohol cues, specifically alcohol advertisements, can have various impacts on behavior. Consumption of alcohol has been found to increase risk taking behavior due to impaired judgment and inhibition. Exposure to a visual cue can in turn trigger memories about a particular event and experience, and the priming of autobiographical memories can influence behavior based on the past experience. This study aims to investigate whether watching alcohol advertisements versus soda advertisements elicits a greater chance to report an autobiographical memory involving alcohol, based on a neutral cue word. The study also will seek to investigate whether exposure to the alcohol cue increases participants' likelihood to engage in risk taking behavior as measured with the Domain Specific Risk Taking Scale. Based on the proven reliability of the Domain Specific Risk Taking Scale, and the aforementioned unreliability of

other behavioral measures of risk, the DOSPERT is the preferred measure to assess risk propensity for this current study.

The memory cue task for this study is based on a valid measure from previous memory research. This task involves cuing participants with a particular word meant to invoke an autobiographical memory about the subject of the cue word (Crovitz & Schiffman, 1974). This technique is frequently used in episodic and autobiographical memory research, and has been found to produce distinct and detailed memories (Rubin & Schulkind, 1997). For this particular study, the cue word '*party'* was chosen because it is an event based cue, and as previously discussed, event based cues tend to result in more vivid memories when compared to location based cues (Sheldon & Chu, 2017).

Based on this previous research, the following hypotheses can be made. First, it is hypothesized that exposure to visual cues about alcohol in the form of advertisements will make autobiographical memories about alcohol more salient. Second, it is hypothesized that exposure to an alcohol advertisement will increase risk taking behavior because of the memories about alcohol being primed. Specifically, the proposed effect will be stronger for those who regularly consume alcohol, because those who consume alcohol more frequently will have more memories pertaining to alcohol and more experiences potentially engaging in risky behavior after consuming alcohol. Also, this effect will be stronger for those who report positive or neutral autobiographical memories around alcohol, and weaker for those who report negative memories around alcohol.

Method

Sample

The participants in this study were 110 willing participants from a consortium of undergraduate liberal arts colleges in southern California.. The sample consisted of 25 men, 79 women, and 6 non-binary/genderfluid individuals. 40 identified as White, 31 identified as Asian, 17 identified as Hispanic/Latino, 4 identified as Native Hawaiian/Pacific Islander, 4 identified as Black, and 14 identified as another racial identity. All participants identified as undergraduate students. Age ranged from 18 years old to 23 years old (M=19).

Procedure and Design

This study was a between subjects factorial design with one manipulated variable with two levels, three measured variables, and one dependent variable. The manipulated variable was whether participants were exposed to an alcohol cue or a neutral cue. The measured variables include the participants own alcohol consumption habits, whether they reported a memory involving alcohol during the cue-word task, and the valence of the memory they reported. The dependent variable was the participants' self reported likelihood to engage in risk taking behavior. Recruitment for the study occurred through the SONA system for research subject recruitment, and through personal outreach from the researcher. Participants were told that the study aimed to look at the effects of advertising on memory and behavior. Once participants provided consent to participate in the study, they gained access to the Qualtrics survey that contained the study material.

Participants were randomly assigned to either the control or cue group within Qualtrics. The control group watched two commercials advertising soda brands, one for Coke Zero and one for Pepsi. The cue group watched two commercials advertising alcohol brands, one for White Claw hard seltzer and one for Corona beer. All of the commercials were similar in nature, and

showed people hanging out with friends, relaxing at the beach, dancing, and drinking the specified beverage. After viewing the commercials, participants completed a memory task in which they were prompted to think of a specific memory that came to mind when they saw the word *"party."* They were asked to write down the memory in detail, and then asked a series of questions that determined whether the memory included alcohol, and how positive or negative the memory was. After the memory task, participants completed the Domain-Specific Risk Taking Scale (DOSPERT). Finally, participants completed the Big Five Inventory to serve as a distraction from the DOSPERT. Demographics questions were interspersed throughout the survey, also to serve as a distractor. Half of the demographics questions were completed before the DOSPERT and half were completed after. The demographics sections contained questions about alcohol consumption habits, including free-response questions for the average number of standard drinks consumed per week, and the average number of days per week in which alcohol is consumed.

Attention checks were included throughout the survey to ensure participants were staying focused on the task. Two attention checks were included after the advertisements in each cue condition, asking about details from the videos to confirm participants watched them all the way through. An example of an attention check from the alcohol cue condition was "What sport was being played on the beach in the first advertisement," and three options were provided, with the correct answer being 'Volleyball.' Researchers later determined that each cue condition had one attention check that was slightly too specific, so it was decided that as long as participants got one of the two video attention checks correct, they would not be omitted from the data. There were also two simple attention checks throughout the survey, asking participants to select the

number ‘3’ and then later the number ‘8’ from a list of numbers, and if participants answered incorrectly for either of the simple attention checks, they were omitted from the data.

Materials

Videos. There were four advertisements total, two for the alcohol cue group and two for the neutral cue group. Participants were randomly assigned to either group, so each participant watched only the two alcohol cue advertisements, or the two neutral advertisements. The alcohol cue advertisements were for White Claw hard seltzer, and Corona Beer (Daniel Catterson, 2017; White Claw, 2021). The White Claw advertisement was released in 2021, and the Corona advertisement was released in 2017. Each advertisement is roughly 30 seconds long, and both depict people enjoying the beverage of choice with friends at the beach. White Claw and Corona are brands that are popular among college students, particularly at college parties. The neutral advertisements were for Pepsi soda and Coke Zero soda (Coca-Cola Great Britain and Ireland, 2017; Sebastian Has, 2022). The Pepsi advertisement was released in 2022, and the Coke Zero advertisement was released in 2017. The objective was to find neutral advertisements that were similar to the advertisements for alcohol, just depicting a non-alcoholic drink. The soda advertisements were also roughly 30 seconds, and depicted people drinking the beverage at the beach with friends.

Memory Task. The autobiographical memory task was based on the cue-word method that is popular in autobiographical memory research (Rubin & Schulkind, 1997). Participants were asked to think of a specific memory that came to mind when seeing the word *“party.”* The word *‘party’* was chosen because it can have associations with alcohol, particularly for college students, but it could just as easily be associated with a party that doesn’t involve alcohol, like a children's birthday party. Participants wrote out the memory and included as much detail as they

could remember. They were then asked a series of questions to gather more concrete information about the memory. The main purpose of the set of questions was to see if the described memory included alcohol and the valence of the memory, and the rest of the questions served as filler questions so participants didn't figure out that the focus of the study was alcohol (See Appendix A). Participants were asked whether the reported memory included alcohol, and answered with either 'yes,' 'no,' or 'don't remember.' The final question asked participants to rate how positive or negative the memory was, on a 7-point scale from extremely negative (1) to extremely positive (7).

DOSPERT. The Domain Specific Risk Taking Scale (DOSPERT) was originally created in 2002 as a 40 item scale, and was revised to a 30 item scale in 2006 (Blais & Weber 2006). The scale measures five domains of risk taking (financial, health/safety, recreation, social, ethical). Participants are asked about their likelihood to engage in a variety of risky activities on a 7-point scale from extremely unlikely (1), to extremely likely (7). Examples include "Betting a day's income at a high stakes poker game," "Riding a motorcycle without a helmet," "Walking home alone at night in an unsafe area," (See Appendix B). This scale has established validity in previous studies assessing risk taking.

Demographics. Participants completed demographic questions that were dispersed throughout the survey (See Appendix C). The demographics survey asked about factors like age, gender identity, racial identity, and personal alcohol habits. Specifically, participants answered free response questions about the average number of drinks they consume in a week, and the average number of days in a week in which they consume alcohol.

Big Five Inventory. The Big Five Inventory (BFI) is a well established 44-item self report inventory used to measure the Big Five dimensions of personality (extraversion,

agreeableness, conscientiousness, neuroticism, openness) (John et al., 1991). Participants are prompted with the phrase “I see myself as someone who…” and then rank a number of statements on a 5 point likert scale according to whether they agree or disagree. Examples of statements include “Is reserved,” “Worries a lot,” “Is generally trusting.” (See Appendix D).

Results

Data was transferred from Qualtrics to an SPSS file for coding. Participants who failed one of the numeric attention checks or both of the advertisement attention checks were omitted from the data pool, along with any incomplete responses, and 25 participants were omitted for these reasons. Data was coded according to which cue participants were exposed to (alcohol or neutral) and by alcohol consumption according to categories of no drinking, moderate drinking and heavy drinking. Alcohol categories were coded according to the National Institute on Alcohol Abuse and Alcoholism, which define heavy alcohol use as more than 14 drinks a week or more than 4 drinks a day for men, and more than 7 drinks a week or more than 3 drinks a day for women (NIAAA, 2017). Since both number of drinks per week, and number of days in a week in which alcohol is consumed were both questions on the survey, if a participant fell into the high drinking condition for either category (drinks per week or drinks per day), they were coded as a heavy drinker. If participants did not meet the requirements to be classified as a heavy drinker but still reported any amount of alcohol consumption, they were coded as a moderate drinker. Any participant who reported zero drinks in a week and zero days in which alcohol was consumed was coded as no drinking. If participants provided a range for any question, the highest end of the range was used, but this never resulted in a change in coding. If an answer was provided in words (e.g. “none”) it was converted to a numeric value (e.g. “0”). For participants who identified as non-binary/gender nonconforming, if their alcohol consumption fell within the moderate category for both men and women, or their alcohol consumption was zero, they were still included in data coding. Overall, 39 participants were non-drinkers (36%), 57 were moderate drinkers (52%), and 14 were heavy drinkers (13%) after coding (M=2.9 drinks per week, SD =

3.83). The scores on the DOSPERT scale were averaged into one complete risk taking score (α=.842), and then averages for each domain were calculated as well.

A chi-square test of independence revealed that exposure to the alcohol cue did not result in more memories about alcohol being reported, $X^2(2, n=110) = 1.7, p=0.423$). In fact, the number of reported memories involving alcohol ended up being exactly the same for both cue conditions (See Table 1 & Figure 1). A factorial analysis of variance found that exposure to the alcohol cue compared to the neutral cue did not yield any significant difference in risk taking score, F(1,104)=.514, *p*=.475, and there was also no significance in risk taking based on cue condition and personal drinking habits, F(2,104)= .449, *p*=0.640. However, this analysis did find that alcohol consumption habits yielded significant results with regards to risk taking behavior, F(2,104)=11.65, *p*=<.001 (See Figure 2). Another factorial analysis of variance found in the post hoc tests that there was a significant difference in self reported risk taking behavior between those who do not drink and those who drink heavily (None-Heavy=-1.03, *p*<.001), and a significant difference in risk taking between those who drink moderately and those who drink heavily (Moderate-Heavy=-.795, *p*<.001). There was no significant difference in risk taking between those who do not drink and those who drink moderately (None-Moderate=-.236, *p*=.223). Because there was no significance found regarding alcohol cue and memory subject, further analysis on whether cued memory subject influences risk taking, was not deemed necessary. Finally, regarding valence of memory, a majority of participants who reported a memory including alcohol reported the memory as positive (82.5%). The distribution of memory valence was very similar regardless of cue condition and memory subject, with a majority of participants reporting positive memories across the board.

Because significance was found regarding drinking habits and risk taking behavior, exploratory correlations were run on drinking behavior and the more specific domains within the DOSPERT. Pearson correlations were run using the continuous variable of number of drinks per week, and the averages of the five risk taking domains within the DOSPERT. The results found significant positive correlations for four out of the five risk domains, financial risk $r(108)=.419$, $p>.001$, health/safety risk $r(108)=.591$, $p>.001$, recreational risk $r(108)=.258$, $p=.007$, and ethical risk $r(108)=.434$, $p>.001$ (See Table 2). Social risk was the only domain that did not yield a significant correlation $r(108)=.091$, $p=.342$. The positive correlations within these domains demonstrate that as the number of drinks consumed per week increased, self-reported risk taking behavior in those particular domains increased as well (See Figure 3).

General Discussion

This study aimed to investigate whether exposure to an alcohol cue in the form of a video advertisement could influence risk taking behavior, on the basis of memory priming. It was hypothesized that viewing the alcohol advertisements compared to the neutral advertisements would make memories including alcohol more salient. It was also hypothesized that those exposed to the alcohol cue would have higher risk taking scores on the Domain Specific Risk Taking Scale, and that this effect would occur more strongly for those who are heavier drinkers and who report positive memories about alcohol. The results from this study found that none of the proposed hypotheses were supported, however exploratory results found that participants who reported heavier drinking also had higher risk taking scores. The following discussion will elaborate on these results.

The findings from this research did not support the hypothesis that viewing a series of alcohol advertisements compared to neutral soda advertisements would influence whether memories involving alcohol became more salient. Participants in either cue condition were roughly equal in terms of the frequency of reporting a memory in which alcohol was involved. One potential reason for the rejection of this hypothesis is a combination of factors, including the participant population and the cue word that was used to invoke an autobiographical memory. The cue word in this research was *"party"* and participants were asked to think of a memory that came to mind based on the word. Considering the fact that all participants in this study were undergraduates in college, it is likely that a majority of parties attended by college undergraduates include alcohol in some form. One study on college party characteristics found that 50% of students reported drinking to intoxication the last time they attended a college party, suggesting a strong relationship between college parties and alcohol (Marzell et al., 2015). From

the current study, 75% of participants in the cue condition reported a memory involving alcohol, and 70% of those in the neutral condition reported a memory involving alcohol. Based on the free response memory descriptions, a majority described a party they attended in college, with a few reporting memories of a party in high school or an early childhood birthday party. Even individuals who report no consumption of alcohol often cited memories that involved alcohol, due to others drinking around them. Thus, it is likely that the word *"party"* wasn't a neutral enough cue word due to the prevalence of alcohol at the types of parties attended by college undergraduates. It is possible that if a different cue word was used, like '*event,'* or if there was a larger population that extended beyond college students, there might have been a significant effect regarding whether alcohol cues lead to increased likelihood of a memory involving alcohol. It is also possible that the use of a soda advertisement as a neutral cue was not neutral enough. Soda is also a beverage commonly served at parties alongside alcohol, and is sometimes mixed with alcohol, so it is possible that the soda cue produced a similar result to the alcohol cue in terms of cuing memories about parties and the experience of drinking alcohol.

There was no relationship found between the alcohol cue and risk taking behavior, even when the moderating factors of memory subject and personal alcohol habits were analyzed. Those in the alcohol cue condition who reported being heavier drinkers or those who reported a more positive memory including alcohol did not have significantly higher risk taking scores than those in the neutral cue condition. The rejection of this hypothesis does not align with previous research that demonstrates the numerous effects of alcohol cues on behavior. Alcohol cues are known to cause physiological arousal, increased cravings, and even greater accessibility of aggressive thoughts (Bartholow & Heinz, 2006; Kaplan et al., 1985; Pomerleau et al., 1983). The

current research did not support the hypothesis that exposure to an alcohol cue would result in increased propensity to engage in risk taking behavior.

There are a number of possible reasons to account for the rejection of the hypothesis involving alcohol cues and the predicted effect on risk taking. As mentioned, a majority of participants reported a memory involving alcohol based on the cue word *"party,"* likely due to the fact that a majority of parties for college undergraduates include alcohol. Thus, it is possible that the memory cue task acted as its own alcohol cue, and those in the neutral cue condition were equally primed with the concept of alcohol by means of reporting a memory that included alcohol. However, the average DOSPERT score for the present study is exactly the same as the average DOSPERT score when the scale was first created and validated (M=3.2), and the averages within the domains are similar as well, thus suggesting that even if a majority of participants were primed with the concept of alcohol, it did not increase risk taking behavior on the DOSPERT (Bartholow & Heinz, 2006).

Once again, a different cue word might have been more effective in differentiating whether the alcohol advertisements made the concept of alcohol more salient. It is also possible that the memories that were being cued were not emotional enough to have an influence on behavior. Much of the research on the effect of memories on behavior suggest that memories with strong ties to an emotion tend to have the greatest influence on behavior (Williams et al., 2022). It is important to note that alcohol can dampen emotions, and because a majority of participants reported memories that included alcohol, it is possible that these memories were not highly emotional memories, and thus did not result in the replication of risk taking behavior (Euser & Franken, 2012). In fact, alcohol is known to impair memories in general, so perhaps the use of a memory cue task in which memories involving alcohol were primed resulted in weak

memories being produced (White, 2003). Most of the descriptions of memories reported were simple and not very detailed, focusing mainly on the location, type of music, availability of drinks, and who else attended the party. Although a majority reported very positive memories, it appears as though participants were remembering more trivial details, and thus the memories might not have been emotional enough to influence behavior.

The population size was also fairly limited, and a larger sample might have yielded more significance regarding cue condition and the effect on risk taking. There was a noticeable difference between the mean DOSPERT score for heavy drinkers exposed to the alcohol cue condition (M=4.173) compared to heavy drinkers in the neutral cue condition (M=3.859), but this effect was not statistically significant, thus a larger sample size might have created a statistically significant result (See Figure 2). The smallest drinking category in this sample was the heavy drinking category, so it is possible that there weren't enough participants in the heavy drinking category to produce a significant result, especially considering that prior research demonstrates that risk taking behavior tends to increase for those who drink more.

There is also a possibility that the results would have differed with different methods of cueing and assessing risk. Some research on the effects of alcohol cues utilize what could be described as "stronger" alcohol cues, such as placing participants in a fake bar scenario, or having participants smell or taste a small amount of alcohol (Jones et al., 2013; Tyszka et al., 2015). Memory research has found that olfactory cues can be more effective than visual cues at triggering autobiographical memories (de Bruijn & Bender, 2018). The Proust Phenomenon refers to the ability of odors to spontaneously evoke strong, vivid memories from the past (de Bruijn & Bender, 2018). Thus, if this research had utilized an olfactory alcohol cue rather than

the visual cue of advertisements, participants may have had more vivid memories of alcohol primed without even needing a cue word.

The use of the DOSPERT as the measure of assessing risk taking could have also contributed to the lack of significance in the results. The DOSPERT was chosen because research has demonstrated that behavioral measures of assessing risk taking tend to be less reliable depending on the context (Frey et al., 2017). However, the DOSPERT is a fairly stable measure of risk taking propensity, and is often used in research that aims to assess a participants general apparent risk taking behavior (Blais & Weber, 2006). It is possible that DOSPERT was too stable of a measure of risk to be affected by the alcohol cue, and this is why there was no significance found between the cue condition and risk taking behavior. However, a study found that participants exposed to alcohol images were not significantly riskier on the Balloon Analogue Risk Task, a behavioral measure of risk, so it is possible that regardless of which measure of risk is being used, visual alcohol cues simply do not have an effect on risk taking behavior (Logan, 2019).

Thus, there is the possibility that regardless of what methodology was used, there is simply no relationship between these variables. Alcohol cues simply may not impact memory subject or influence risk taking behavior no matter what measurement is used. A very similar study was conducted in 2019 for a dissertation; in this study, participants were primed with alcohol related images and words, and then completed the Balloon Analogue Risk Task (BART) (Logan, 2019). Participants also answered a fill in the blank prompt of "Alcohol makes me ____", which could be considered similar to the free response memory task in the present study in which a majority reported a memory including alcohol. This study also failed to support the hypothesis that alcohol cues would lead to riskier behavior, thus demonstrating that a behavioral

measure of risk did not yield any difference in result than the present study that utilized the DOSPERT (Logan, 2019). A 2014 study using the BART found that individuals with a higher symptom count for alcohol use disorder actually displayed less risk taking, thus there is evidence to suggest that personal drinking habits don't have an effect on risk taking at all (Ashenhurst et al., 2011).

There has also been debate within priming literature regarding the effectiveness of priming. Some research has questioned the priming effect, particularly with studies that sought to replicate a previous study that demonstrated the priming effect. A 2019 study attempted to replicate a widely cited priming study from 2006, which demonstrated that being primed with the concept of money led to changes in behavior across seven experiments. The behaviors in the money primed group included unscrambling words to create a phrase related to money, working longer on a puzzle before quitting, and choosing to work alone more frequently than the control group (Vohs et al., 2006). The attempted replication of one of the seven experiments done in 2019 did not support the money priming effect that was originally observed, thus raising questions about the legitimacy of priming (Rohrer et al., 2019). One article that cites this study is claiming that the field of social priming is close to being entirely discredited due to the number of studies that failed to replicate findings from prior priming research (Chivers, 2019). Because the hypothesis for the present study was based on the efficacy of the priming effect, if the priming effect is in fact proving to be less effective, it would explain why no significant relationship was found between the alcohol prime and risk taking behavior.

Exploratory Discussion

Exploratory analysis found that risk taking behavior increased as drinking behavior increased. Those who were heavy drinkers had significantly higher risk taking scores than

moderate drinkers or people who don't drink at all. This finding does align with prior research demonstrating that those who drink more tend to have higher propensity to engage in risky behavior. A 2015 study on college students found that students with higher scores on the Alcohol Use Disorder Identification Test (AUDIT) were significantly more likely to experience consequences as a result of risky behavior, such as physical injury, arguments, and unplanned sexual activity (O'Neill et al., 2015). The AUDIT was developed by the World Health Organization and stands as a valid measure for assessing excessive drinking behavior (Babor et al., 2001). Higher scores on the AUDIT were also correlated with other risky forms of substance use such as smoking and drug use. A study on adolescents found that those who engage in riskier driving behaviors also tend to misuse alcohol and smoke (Twisk & Senserrick, 2021). Thus, the current finding that heavier drinking behavior was associated with a higher overall score on the DOSPERT is consistent with prior research on the known relationship between alcohol habits and general risk taking behavior.

A further set of exploratory analyses found significance when looking at the specific domains of risk taking and personal drinking habits. Positive correlations were found between drinking behavior and four of the risk taking domains; ethical, financial, health/safety and recreational risk. The ethical risk domain of the DOSPERT entails situations like revealing a friend's important secret, or passing off someone else's work as your own. The financial risk domain mainly entails gambling situations, like betting at a sporting event or investing in risky stocks. The health and safety domain describes situations like heavy drinking, engaging in unprotected sex, and unsafe driving. The recreational risk domain entails situations like skydiving and skiing. Social risk was the only domain in which there was no correlation. These findings also align with prior research on the relationship between alcohol use and risk. Many of

the DOSPERT questions asked within these domains align with risky behaviors that are associated with alcohol use, such as engaging in unprotected sex, gambling, dangerous driving, lying, etc… (Chaney et al., 2016; Philips & Ogeil, 2007). The social domain, which was the only domain that did not yield significant results, asked about more long term career behaviors such as moving away from home or starting a new job. Although there is research on how alcohol use impacts the workplace, such as impacting job performance, there is no research to suggest alcohol use influences the behaviors in the social domain of the DOSPERT, like starting a new job (French et al., 2011).

Future Directions

For future research, it might be worthwhile to recreate this study with a valid behavioral measure of risk to get a greater understanding of how behavioral risk taking behavior changes based on alcohol advertisements, rather than propensity to engage in risk taking. It also could be beneficial to replicate this study with different alcohol cues, such as the smell or taste of alcohol rather than just viewing media content where alcohol is present. Stronger cues that require active participation, such as smelling alcohol, could have had a greater effect on the DOSPERT. A future direction could also involve redoing this study without the memory cue or with a different cue word, because it is likely that the word '*party'* is too closely correlated with alcohol and thus the memory cue task served as its own alcohol cue. Finally, more research is necessary to investigate the priming effect and its effectiveness.

Limitations

It is important to recognize that this study has numerous limitations. The population size was relatively small, with only 110 participants. Ideally, there would have been at least 100 participants in each cue condition to produce the most reliable results. This study was also

conducted on a fairly narrow population of college undergraduates at a small liberal arts college. The study was conducted entirely online, so the conditions in which participants took the survey could not be controlled. Finally, the participant population for this study ended up being majority female identified, and some of the research on alcohol use and risk found a stronger effect for men, therefore the lack of male participants in this study was another limitation.

Conclusion

The data from this research did not support the hypothesis that alcohol cues make memories about alcohol more salient, or that alcohol cues influence risk taking behavior on the Domain Specific Risk Taking Scale. The data also failed to support the hypothesis that reporting a positive memory that included alcohol would have an effect on risk taking behavior, as a majority of participants ended up reporting a positive memory that included alcohol. This study did support what previous research has already demonstrated, that individuals with heavier drinking habits have a higher propensity to engage in risky behavior, particularly when it comes to ethical, financial, health, and recreational behavior.

References

Alcohol-Related Emergencies and Deaths in the United States. (n.d.). National Institute on Alcohol Abuse and Alcoholism (NIAAA). https://www.niaaa.nih.gov/alcohols-effects-health/alcohol-topics/alcohol-facts-and-statistics/alcohol-related-emergencies-and-deaths-united-states

Alcohol Use Disorder (AUD) in the United States. (n.d.). National Institute on Alcohol Abuse and Alcoholism (NIAAA). https://www.niaaa.nih.gov/alcohols-effects-health/alcohol-topics/alcohol-facts-and-statistics/alcohol-use-disorder-aud-united-states

American Addiction Centers Inc. (2022, August 31). *Why alcohol lowers inhibitions and leads to bad decisions.* Alcohol.org. https://alcohol.org/effects/inhibitions/

Anderson P. (2009). Is it time to ban alcohol advertising?. *Clinical medicine (London, England)*, *9*(2), 121–124. https://doi.org/10.7861/clinmedicine.9-2-121

Ashenhurst, J. R., Jentsch, J. D., & Ray, L. A. (2011). Risk-taking and alcohol use disorders symptomatology in a sample of problem drinkers. *Experimental and clinical psychopharmacology*, *19*(5), 361–370. https://doi.org/10.1037/a0024412

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B. & Monteiro, M. G. (2001). AUDIT: the alcohol use disorders identification test : guidelines for use in primary health care, 2nd ed. World Health Organization. https://apps.who.int/iris/handle/10665/67205

Baddeley, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences, 4*(11), 417–423. https://doi.org/10.1016/S1364-6613(00)01538-2

Bartholow, B. D., & Heinz, A. (2006). Alcohol and Aggression Without Consumption: Alcohol Cues, Aggressive Thoughts, and Hostile Perception Bias. *Psychological Science, 17*(1), 30–37. https://doi-org.ccl.idm.oclc.org/10.1111/j.1467-9280.2005.01661.x

Blais, A.-R., & Weber, E. U. (2006). A Domain-Specific Risk-Taking (DOSPERT) scale for adult populations. *Judgment and Decision Making, 1*(1), 33–47. https://doi.org/10.1017/S1930297500000334

Burian, S. E., Liguori, A., & Robinson, J. H. (2002). Effects of alcohol on risk-taking during simulated driving. *Human psychopharmacology, 17*(3), 141–150. https://doi.org/10.1002/hup.384

Caneto, F., Pautassi, R. M., & Pilatti, A. (2018). Ethanol-induced autonomic responses and risk taking increase in young adults with a positive family history of alcohol problems. *Addictive Behaviors*, *76*, 174–181. https://doi-org.ccl.idm.oclc.org/10.1016/j.addbeh.2017.08.008

Chaney, B. H., Vail-Smith, K., Martin, R. J., & Cremeens-Matthews, J. (2016). Alcohol use, risky sexual behavior, and condom possession among bar patrons. *Addictive behaviors*, *60*, 32–36. https://doi.org/10.1016/j.addbeh.2016.03.035

Chen, S., Yang, P., Chen, T., Su, H., Jiang, H., & Zhao, M. (2020). Risky decision-making in individuals with substance use disorder: A meta-analysis and meta-regression review. *Psychopharmacology*, *237*(7), 1893–1908. https://doi.org/10.1007/s00213-020-05506-y

Chivers T. (2019). What's next for psychology's embattled field of social priming. *Nature*, *576*(7786), 200–202. https://doi.org/10.1038/d41586-019-03755-2

Coca-Cola Great Britain and Ireland (2017, Aug 11). *Coca-Cola Zero Sugar: Taste The Feeling.* [Video]. YouTube. https://www.youtube.com/watch?v=EHQVWbdYaYY

Collins, R. L., Ellickson, P.L., McCaffrey, D.F., & Hambarsoomian, K. (2006) *Forging the Link Between Alcohol Advertising and Underage Drinking*, RAND Corporation. https://www.rand.org/pubs/research_briefs/RB9073.html

Courtney, K. E., Arellano, R., Barkley-Levenson, E., Gálvan, A., Poldrack, R. A., Mackillop, J., Jentsch, J. D., & Ray, L. A. (2012). The relationship between measures of impulsivity and alcohol misuse: an integrative structural equation modeling approach. *Alcoholism, clinical and experimental research, 36*(6), 923–931. https://doi.org/10.1111/j.1530-0277.2011.01635.x

Crovitz, H. F., & Schiffman, H. (1974). Frequency of episodic memories as a function of their age. *Bulletin of the Psychonomic Society, 4*(5-B), 517–518. https://doi.org/10.3758/BF03334277

Daniel Catterson. (2017, October 18). *Corona Extra - A Corona Gets Its Lime Again.* [Video]. YouTube. https://www.youtube.com/watch?v=uhadJKYPqGw

de Bruijn, M. J., & Bender, M. (2018). Olfactory cues are more effective than visual cues in experimentally triggering autobiographical memories. *Memory (Hove, England)*, *26*(4), 547–558. https://doi.org/10.1080/09658211.2017.1381744

Euser, A. S., & Franken, I. H. (2012). Alcohol affects the emotional modulation of cognitive control: an event-related brain potential study. *Psychopharmacology*, *222*(3), 459–476. https://doi.org/10.1007/s00213-012-2664-6

Ellickson, P. L., Collins, R. L., Hambarsoomians, K., & McCaffrey, D. F. (2005). Does alcohol advertising promote adolescent drinking? Results from a longitudinal assessment. *Addiction (Abingdon, England)*, *100*(2), 235–246. https://doi.org/10.1111/j.1360-0443.2005.00974.x

Farnham, A., Ziegler, S., Blanke, U., Stone, E., Hatz, C., & Puhan, M. A. (2018). Does the DOSPERT scale predict risk-taking behaviour during travel? A study using smartphones. *Journal of travel medicine, 25*(1), 10.1093/jtm/tay064. https://doi.org/10.1093/jtm/tay064

French, M. T., Maclean, J. C., Sindelar, J. L., & Fang, H. (2011). The morning after: alcohol misuse and employment problems. *Applied economics*, *43*(21), 2705–2720. https://doi.org/10.1080/00036840903357421

Frey, R., Pedroni, A., Mata, R., Rieskamp, J., & Hertwig, R. (2017). Risk preference shares the psychometric structure of major psychological traits. *Science advances, 3*(10), [e1701381]. https://www-science-org.ccl.idm.oclc.org/doi/10.1126/sciadv.1701381

Gershman, S. J. (2017). Predicting the past, remembering the future. *Current Opinion in Behavioral Sciences, 17*, 7–13. https://doi.org/10.1016/j.cobeha.2017.05.025

Gilman, J. M., Smith, A. R., Ramchandani, V. A., Momenan, R., & Hommer, D. W. (2012). The effect of intravenous alcohol on the neural correlates of risky decision making in healthy social drinkers. *Addiction biology*, *17*(2), 465–478. https://doi.org/10.1111/j.1369-1600.2011.00383.x

Goddard, L., Pring, L., & Felmingham, N. (2005). The effects of cue modality on the quality of personal memories retrieved. *Memory (Hove, England)*, *13*(1), 79–86. https://doi.org/10.1080/09658210344000594

Highhouse, S., Nye, C. D., Zhang, D. C., & Rada, T. B. (2017). Structure of the dospert: Is there evidence for a general risk factor? *Journal of Behavioral Decision Making, 30*(2), 400–406. https://doi.org/10.1002/bdm.1953

John, O. P., Donahue, E. M., & Kentle, R. L. (1991). The Big Five Inventory--Versions 4a and 54. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.

Jones, A., Rose, A. K., Cole, J., & Field, M. (2013). Effects of alcohol cues on craving and ad libitum alcohol consumption in social drinkers: The role of disinhibition. *Journal of Experimental Psychopathology, 4*(3), 239–249.

Kacha-Ochana, A., Jones, C. M., Green, J. L., Dunphy, C., Govoni, T. D., Robbins, R. S., & Guy, G. P. (2022). Characteristics of Adults Aged ≥18 Years Evaluated for Substance Use and Treatment Planning — United States, 2019. *MMWR. Morbidity and Mortality Weekly Report*, *71*(23), 749–756. https://doi.org/10.15585/mmwr.mm7123a1

Kaplan, R. F., Cooney, N. L., Baker, L. H., Gillespie, R. A., Meyer, R. E., & Pomerleau, O. F. (1985). Reactivity to alcohol-related cues: physiological and subjective responses in alcoholics and nonproblem drinkers. *Journal of studies on alcohol, 46*(4), 267–272. https://doi.org/10.15288/jsa.1985.46.267

Keller, K. L. (1987). Memory Factors in Advertising: The Effect of Advertising Retrieval Cues on Brand Evaluations. *Journal of Consumer Research, 14*(3), 316–333. http://www.jstor.org/stable/2489494

Laberg, J. C., Hugdahl, K., Stormark, K. M., Nordby, H., & Aas, H. (1992). Effects of visual alcohol cues on alcoholics' autonomic arousal. *Psychology of Addictive Behaviors, 6*(3), 181–187. https://doi-org.ccl.idm.oclc.org/10.1037/h0080628

Lane, S. D., Cherek, D. R., Pietras, C. J., & Tcheremissine, O. V. (2004). Alcohol effects on human risk taking. *Psychopharmacology*, *172*(1), 68–77. https://doi.org/10.1007/s00213-003-1628-2

Laude, J. R., & Fillmore, M. T. (2015). Alcohol cues impair learning inhibitory signals in beer drinkers. *Alcoholism, clinical and experimental research, 39*(5), 880–886. https://doi.org/10.1111/acer.12690

Laude, J. R., & Fillmore, M. T. (2016). Drivers who self-estimate lower blood alcohol concentrations are riskier drivers after drinking. *Psychopharmacology*, *233*(8), 1387–1394. https://doi-org.ccl.idm.oclc.org/10.1007/s00213-016-4233-x

Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., Strong, D. R., & Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: the Balloon Analogue Risk Task (BART). *Journal of experimental psychology. Applied*, *8*(2), 75–84. https://doi.org/10.1037//1076-898x.8.2.75

Li, D., Wu, M., Chao, B., & Zhang, L. (2022). Coping efficacy is associated with the domain specificity in risk-taking behaviors during the COVID-19 pandemic. *International journal of disaster risk reduction : IJDRR, 82, 103321*. https://doi.org/10.1016/j.ijdrr.2022.103321

Logan, P. M. (2019). Linking Trait-Based Influences with Proximal, Contextually Driven Processes to Understand the Relationship Between Alcohol Use and Risk Behavior [Doctoral dissertation, University of South Florida]. USF Tampa Graduate Theses and Dissertations.

Lydon-Staley, D. M., Falk, E. B., & Bassett, D. S. (2020). Within-person variability in sensation-seeking during daily life: Positive associations with alcohol use and self-defined risky behaviors. *Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors, 34*(2), 257–268. https://doi.org/10.1037/adb0000535

Mace, J. H., McQueen, M. L., Hayslett, K. E., Staley, B. J. A., & Welch, T. J. (2019). Semantic memories prime autobiographical memories: General implications and implications for

everyday autobiographical remembering. *Memory & cognition, 47*(2), 299–312. https://doi.org/10.3758/s13421-018-0866-9

Marzell, M., Bavarian, N., Paschall, M. J., Mair, C., & Saltz, R. F. (2015). Party Characteristics, Drinking Settings, and College Students' Risk of Intoxication: A Multi-Campus Study. *The journal of primary prevention*, *36*(4), 247–258. https://doi.org/10.1007/s10935-015-0393-4

Mateo, A., Ros, L., Ricarte, J. J., Fernandez, D., & Latorre, J. M. (2020). Effects of visual and verbal cues in facilitating the remembering of an autobiographical event in preschoolers. *Early Child Development and Care, 190*(7), 1093–1108. https://doi-org.ccl.idm.oclc.org/10.1080/03004430.2018.1516649

Monti, P. M., Binkoff, J. A., Abrams, D. B., Zwick, W. R., Nirenberg, T. D., & Liepman, M. R. (1987). Reactivity of alcoholics and nonalcoholics to drinking cues. *Journal of Abnormal Psychology*, *96*(2), 122–126. https://doi-org.ccl.idm.oclc.org/10.1037/0021-843X.96.2.122

Muehling, D. D., & Sprott, D. E. (2004). The Power of Reflection: An Empirical Examination of Nostalgia Advertising Effects. *Journal of Advertising, 33*(3), 25–35. http://www.jstor.org/stable/4189264

National Highway Traffic Safety Administration. (2019, January 11). *Drunk Driving*. NHTSA; United States Department of Transportation. https://www.nhtsa.gov/risky-driving/drunk-driving

National Institute on Alcohol Abuse and Alcoholism. (2020, August 12). *Binge Drinking*. National Institute on Alcohol Abuse and Alcoholism (NIAAA). https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/binge-drinking

National Institute on Alcohol Abuse and Alcoholism. (2017). *Drinking Levels Defined.* Nih.gov. https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking

Niederdeppe, J., Avery, R. J., Tabor, E., Lee, N. W., Welch, B., & Skurka, C. (2021). Estimated televised alcohol advertising exposure in the past year and associations with past 30-day drinking behavior among American adults: results from a secondary analysis of large-scale advertising and survey data. *Addiction (Abingdon, England)*, *116*(2), 280–289. https://doi.org/10.1111/add.15088

O'Neill, G., Martin, N., Birch, J., Oldam, A., & Newbury-Birch, D. (2015). The Drinkers Degree: Risk Taking Behaviours amongst Undergraduate Student Drinkers. *Journal of addiction*, *2015*, 965438. https://doi.org/10.1155/2015/965438

Phillips, J. G., & Ogeil, R. P. (2007). Alcohol consumption and computer blackjack. *The Journal of general psychology*, *134*(3), 333–353. https://doi.org/10.3200/GENP.134.3.333-354

Pomerleau, O. F., Fertig, J. B., Baker, L., & Cooney, N. (1983). Reactivity to alcohol cues in alcoholics and non-alcoholics: Implications for a stimulus control analysis of drinking. *Addictive Behaviors, 8*(1), 1–10. https://doi.org/10.1016/0306-4603(83)90048-5

Position Statement 33: Substance Use Disorders. (n.d.). Mental Health America. https://mhanational.org/issues/position-statement-33-substance-use-disorders#:~:text=Alcohol%20use%20disorder%20is%20still

Rohrer, D., Pashler, H., & Harris, C. R. (2019). Discrepant data and improbable results: An examination of Vohs, Mead, and Goode (2006). *Basic and Applied Social Psychology, 41*(4), 263–271. https://doi.org/10.1080/01973533.2019.1624965

Rose, A. K., Jones, A., Clarke, N., & Christiansen, P. (2014). Alcohol-induced risk taking on the BART mediates alcohol priming. *Psychopharmacology*, *231*(11), 2273–2280. https://doi.org/10.1007/s00213-013-3377-1

Rubin, D. C., & Schulkind, M. D. (1997). Properties of word cues for autobiographical memory. *Psychological reports, 81*(1), 47–50. https://doi.org/10.2466/pr0.1997.81.1.47

Sargent, J. D., Wills, T. A., Stoolmiller, M., Gibson, J., & Gibbons, F. X. (2006). Alcohol use in motion pictures and its relation with early-onset teen drinking. *Journal of studies on alcohol*, *67*(1), 54–65. https://doi.org/10.15288/jsa.2006.67.54

Sebastian Has. (2022, July 28). *Pepsi Taste Challenge commercial (summer 2022)*. [Video]. YouTube. https://www.youtube.com/watch?v=8eCpxl3iU88

Sheldon, S., & Chu, S. (2017). What versus Where: Investigating how Autobiographical Memory Retrieval Differs when Accessed with Thematic versus Spatial Information. *Quarterly Journal of Experimental Psychology, 70*(9), 1909–1921. https://doi.org/10.1080/17470218.2016.1215478

Shou, Y., & Olney, J. (2020). Assessing a domain-specific risk-taking construct: A meta-analysis of reliability of the DOSPERT scale. *Judgment and Decision Making, 15*(1), 112–134. https://doi.org/10.1017/S193029750000694X

Smith, L. A., & Foxcroft, D. R. (2009). The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: systematic review of prospective cohort studies. *BMC public health*, *9*, 51. https://doi.org/10.1186/1471-2458-9-51

Speer, M. E., Bhanji, J. P., & Delgado, M. R. (2014). Savoring the past: Positive memories evoke value representations in the striatum. *Neuron, 84*(4), 847–856. https://doi.org/10.1016/j.neuron.2014.09.028

Speer, M. E., & Delgado, M. R. (2020). The social value of positive autobiographical memory retrieval. *Journal of Experimental Psychology: General, 149*(4), 790–799. https://doi.org/10.1037/xge0000671

Thompson, V. A., & Paivio, A. (1994). Memory for pictures and sounds: Independence of auditory and visual codes. *Canadian Journal of Experimental Psychology / Revue canadienne de psychologie expérimentale, 48*(3), 380–398. https://doi.org/10.1037/1196-1961.48.3.380

Twisk, Divera & Senserrick, Teresa. (2021). Risky road behaviours cluster and share predictor variables with smoking and drinking, and anti-social behaviours during early adolescence. *Journal of Transport & Health.* 20. 101024. 10.1016/j.jth.2021.101024.

Tyszka, T., Macko, A., & Stańczak, M. (2015). Alcohol reduces aversion to ambiguity. *Frontiers in psychology*, *5*, 1578. https://doi.org/10.3389/fpsyg.2014.01578

Visser, E., Matos, M. R., van der Loo, R. J., Marchant, N. J., de Vries, T. J., Smit, A. B., & van den Oever, M. C. (2020). A persistent alcohol cue memory trace drives relapse to alcohol seeking after prolonged abstinence. *Science advances*, *6*(19), [eaax7060]. https://doi.org/10.1126/sciadv.aax7060

Vohs, K. D., Mead, N. L., & Goode, M. R. (2006). The Psychological Consequences of Money. *Science, 314*(5802), 1154–1156. https://doi.org/10.1126/science.1132491

Weafer, J., Milich, R., & Fillmore, M. T. (2011). Behavioral components of impulsivity predict alcohol consumption in adults with ADHD and healthy controls. *Drug and alcohol dependence*, *113*(2-3), 139-146.

White A. M. (2003). What happened? Alcohol, memory blackouts, and the brain. *Alcohol research & health : the journal of the National Institute on Alcohol Abuse and Alcoholism*, *27*(2), 186–196.

White Claw. (2021, June 9). *Let's White Claw®: Roller Girl.* [Video].YouTube. https://www.youtube.com/watch?v=QG-ELRoJ2pA

Williams, S.E., Ford, J.H. & Kensinger, E.A. (2022).The power of negative and positive episodic memories. *Cognitive, Affective, & Behavioral Neuroscience*, 22, 869–903 https://doi.org/10.3758/s13415-022-01013-z

Yoo, C. Y. (2007). Implicit Memory Measures for Web Advertising Effectiveness. *Journalism & Mass Communication Quarterly, 84*(1), 7–23. https://doi.org/10.1177/107769900708400102

Table 1

	Participants Reporting Alcohol Memory	DOSPERT Overall Risk Score	DOSPERT Ethical Risk Score	DOSPERT Financial Risk Score	DOSPERT Health/Safety Risk Score	DOSPERT Recreational Risk Score	DOSPERT Social Risk Score
Alcohol Cue	N=40 53 Total	M = 3.191 SD = 0.856	M = 2.170 SD = 0.846	M = 2.491 SD = 1.105	M = 2.893 SD = 1.185	M = 3.667 SD = 1.153	M = 4.733 SD = 1.174
Neutral Cue	N=40 57 Total	M = 3.120 SD = 0.639	M = 2.316 SD = 0.846	M = 2.421 SD = 1.049	M = 2.832 SD = 1.071	M = 3.637 SD = 1.415	M = 4.781 SD = 0.866

Table 2

		Alcohol Consumption	DOSPERT Overall Risk Score	DOSPERT Ethical Risk Score	DOSPERT Financial Risk Score	DOSPERT Health/Safety Risk Score	DOSPERT Recreational Risk Score	DOSPERT Social Risk Score
Alcohol Consumption	Pearson Correlation	1						
	Sig. (2-Tailed)							
DOSPERT Overall Risk Score	Pearson Correlation	.520**	1					
	Sig. (2-Tailed)	<.001						
DOSPERT Ethical Risk Score	Pearson Correlation	.434**	.608**	1				
	Sig. (2-Tailed)	<.001	<.001					
DOSPERT Financial Risk Score	Pearson Correlation	.419**	.646**	.356**	1			
	Sig. (2-Tailed)	<.001	<.001	<.001				
DOSPERT Health/Safety Risk Score	Pearson Correlation	.591**	.740**	.561**	.348**	1		
	Sig. (2-Tailed)	<.001	<.001	<.001	<.001			
DOSPERT Recreational Risk Score	Pearson Correlation	.258**	.748**	.142	.357**	.359**	1	
	Sig. (2-Tailed)	.007	<.001	.138	<.001	<.001		
DOSPERT Social Risk Score	Pearson Correlation	.091	.607**	.206*	.133	.272**	.431**	1
	Sig. (2-Tailed)	.342	<.001	.031	.165	.004	<.001	

*=significant at the .05 level

**=Significant at the .01 level

Figure 1

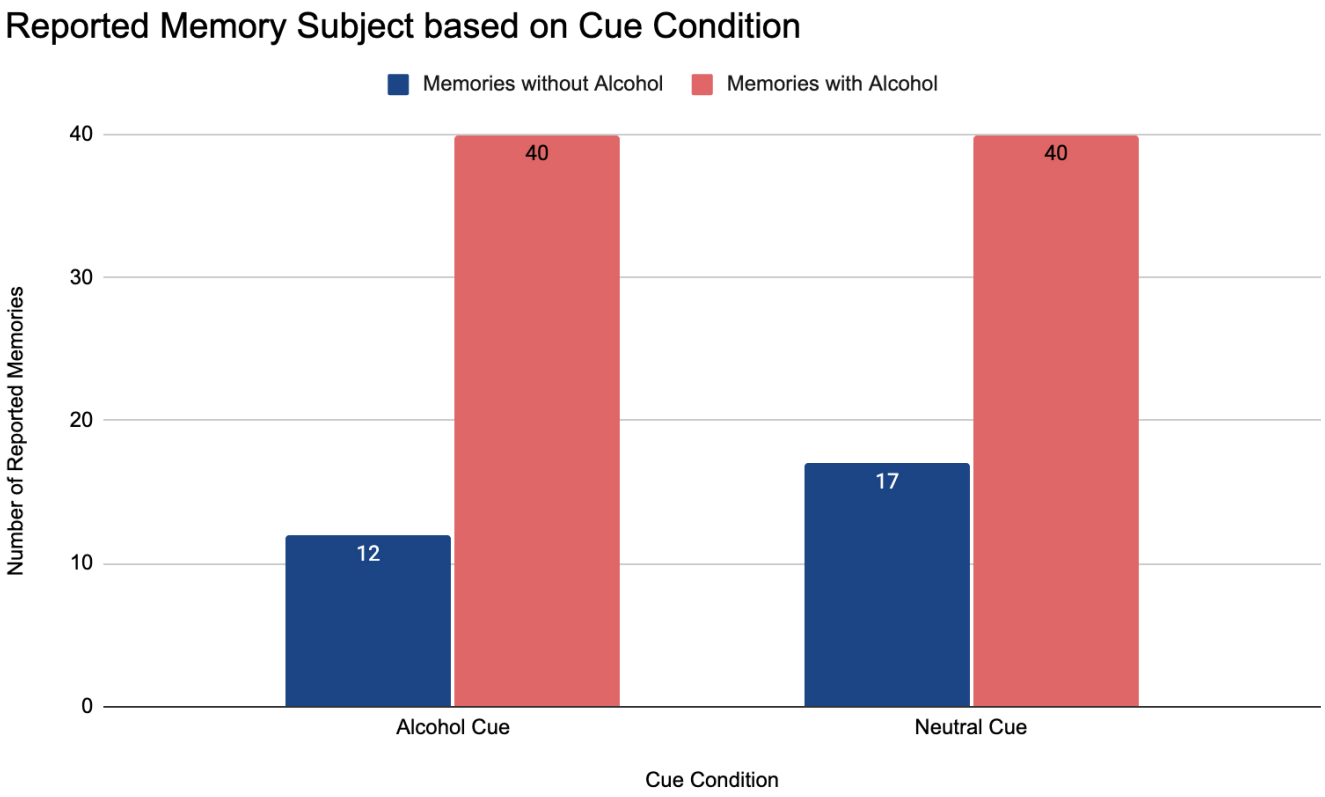

Reported Memory Subject based on Cue Condition
Memories without Alcohol
Memories with Alcohol
Number of Reported Memories
40
30
20
10
0
40
40
12
17
Alcohol Cue
Neutral Cue
Cue Condition

Figure 2

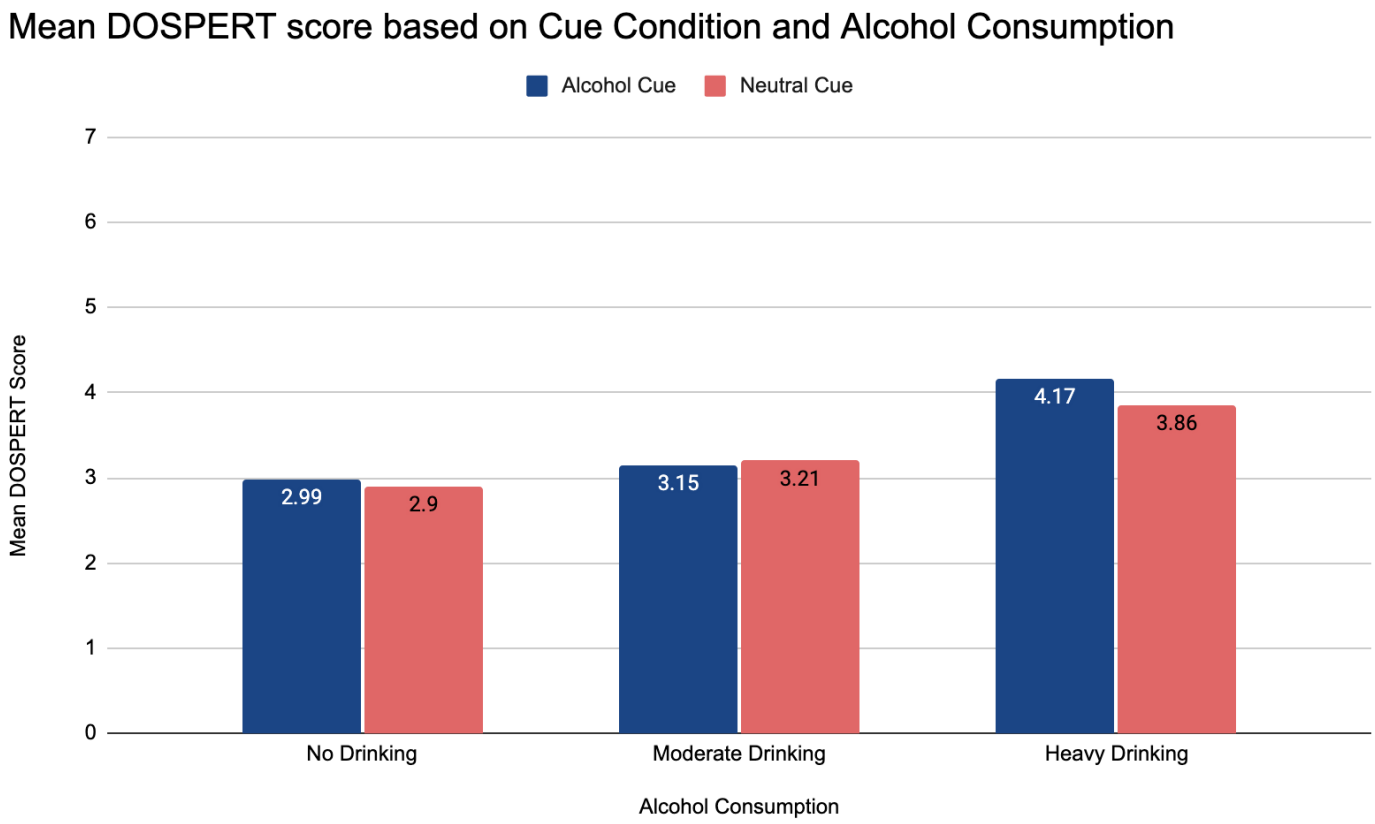
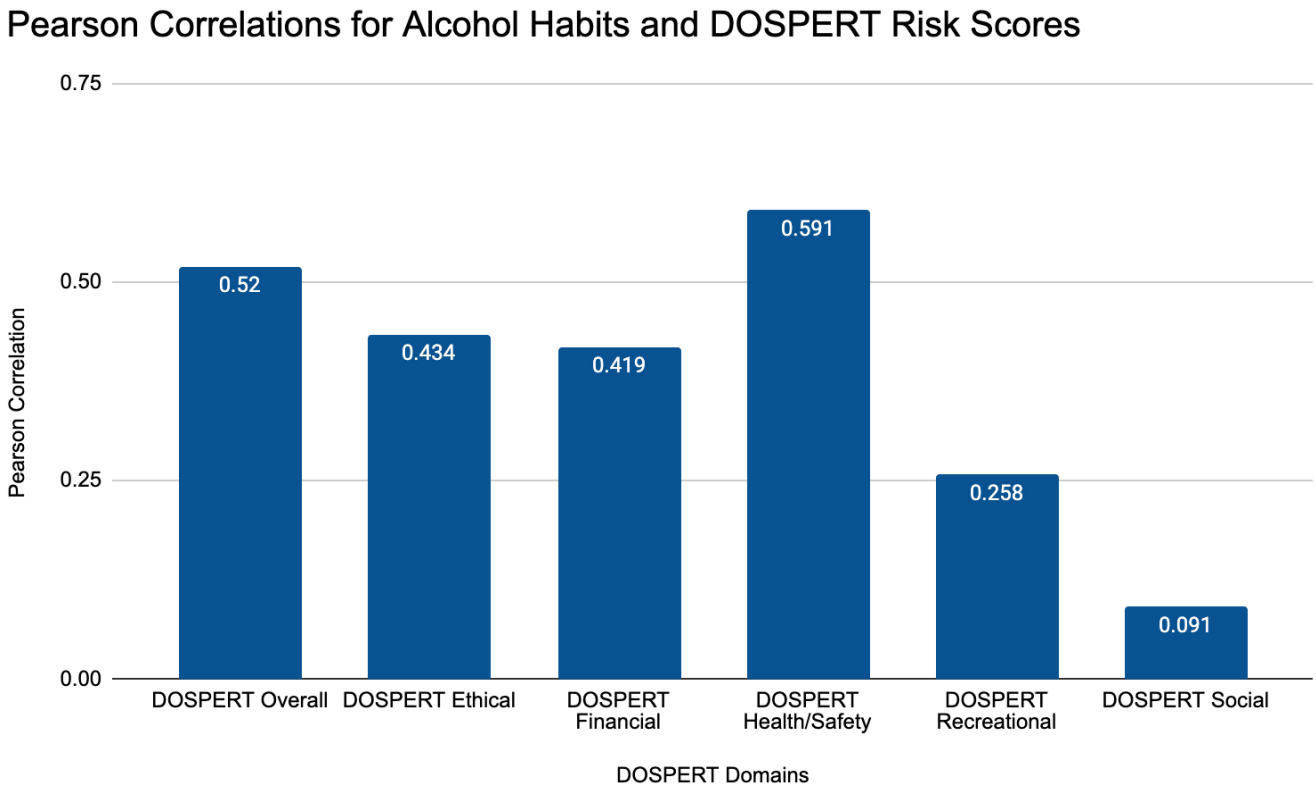

Mean DOSPERT score based on Cue Condition and Alcohol Consumption
Alcohol Cue
Neutral Cue
Mean DOSPERT Score
7
6
5
4
3
2
1
0
2.99
2.9
3.15
3.21
4.17
3.86
No Drinking
Moderate Drinking
Heavy Drinking
Alcohol Consumption

Figure 3


Pearson Correlations for Alcohol Habits and DOSPERT Risk Scores
0.75
0.50
0.25
0.00
Pearson Correlation
0.52
0.434
0.419
0.591
0.258
0.091
DOSPERT Overall
DOSPERT Ethical
DOSPERT Financial
DOSPERT Health/Safety
DOSPERT Recreational
DOSPERT Social
DOSPERT Domains

APPENDIX A.

You will be asked some more specific questions about the memory you just described. Please respond truthfully to each question. If you cannot remember a detail, select "I don't remember."

Did this memory take place within the past 10 years?
Yes No I don’t remember

Did this memory take place in college?
Yes No I don’t remember

Does this memory include family?
Yes No I don’t remember

Does this memory involve a birthday?
Yes No I don’t remember

Does this memory include alcohol?
Yes No I don’t remember

Does this memory include cake?
Yes No I don’t remember

Did this memory take place at night?
Yes No I don’t remember

Does this memory include soda?
Yes No I don’t remember

When thinking about this memory, how positive or negative was it?
Extremely negative, Moderately negative, Slightly negative, Neither positive nor negative, Slightly positive, Moderately positive, Extremely Positive

How vivid and detailed is this memory?
Not very vivid, many details are lost, Somewhat vivid, some details are lost, Very vivid, can remember lots of detail

APPENDIX B.

For each of the following statements, please indicate the likelihood that you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from *Extremely Unlikely* to *Extremely Likely*, using the following scale:

Extremely Unlikely	Moderately Unlikely	Somewhat Unlikely	Not Sure	Somewhat Likely	Moderately Likely	Extremely Likely

1. Admitting that your tastes are different from those of a friend.
2. Going camping in the wilderness.
3. Betting a day's income at the horse races.
4. Investing 10% of your annual income in a moderate growth diversified fund.
5. Drinking heavily at a social function.
6. Taking some questionable deductions on your income tax return.
7. Disagreeing with an authority figure on a major issue.
8. Betting a day's income at a high-stake poker game.
9. Having an affair with a married man/woman.
10. Passing off somebody else's work as your own.
11. Going down a ski run that is beyond your ability.
12. Investing 5% of your annual income in a very speculative stock.
13. Going whitewater rafting at high water in the spring.
14. Betting a day's income on the outcome of a sporting event.
15. Engaging in unprotected sex.
16. Revealing a friend's secret to someone else.
17. Driving a car without wearing a seatbelt.
18. Investing 10% of your annual income in a new business venture.
19. Taking a skydiving class.
20. Riding a motorcycle without a helmet.
21. Choosing a career that you truly enjoy over a more secure one.
22. Speaking your mind about an unpopular issue in a meeting at work.
23. Sunbathing without sunscreen.
24. Bungee jumping off a tall bridge.
25. Piloting a small plane.
26. Walking home alone at night in an unsafe area of town.
27. Moving to a city far away from your extended family.
28. Starting a new career in your mid-thirties.
29. Leaving your young children alone at home while running an errand.
30. Not returning a wallet you found that contains $200.

APPENDIX C.

What is your age?
17 18 19 20 21 22 23 24

What is your undergraduate field of study?

_____

What is your gender identity?
Male Female Nonbinary/Genderfluid Other

What is your racial identity?
White Hispanic/Latino American Indian/Alaska Native Asian Black/African American Native Hawaiian/Pacific Islander Other

How would you describe your general health?
Terrible Poor Average Good Excellent

On average, how many standard drinks of alcohol do you consume in a week?

_____

How many days in a typical week do you consume an alcoholic beverage?

_____

Was English your first language?
Yes No

APPENDIX D.

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please select an answer to indicate the extent to which you agree or disagree with that statement.

Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree Strongly
1	2	3	4	5

I see Myself as Someone Who:

1. Is talkative
2. Tends to find fault with others
3. Does a thorough job
4. Is depressed, blue
5. Is original, comes up with new ideas
6. Is reserved
7. Is helpful and unselfish with others
8. Can be somewhat careless
9. Is relaxed, handles stress well
10. Is curious about many different things
11. Is full of energy
12. Starts quarrels with others
13. Is a reliable worker
14. Can be tense
15. Is ingenious, a deep thinker
16. Generates a lot of enthusiasm
17. Has a forgiving nature
18. Tends to be disorganized
19. Worries a lot
20. Has an active imagination
21. Tends to be quiet
22. Is generally trusting
23. Tends to be lazy
24. Is emotionally stable, not easily upset
25. Is inventive
26. Has an assertive personality
27. Can be cold and aloof
28. Perseveres until the task is finished
29. Can be moody
30. Values artistic, aesthetic experiences
31. Is sometimes shy, inhibited
32. Is considerate and kind to almost everyone
33. Does things efficiently
34. Remains calm in tense situations
35. Prefers work that is routine
36. Is outgoing, sociable
37. Is sometimes rude to others
38. Makes plans and follows through with them
39. Gets nervous easily
40. Likes to reflect, play with ideas
41. Has few artistic interests
42. Likes to cooperate with others
43. Is easily distracted
44. Is sophisticated in art, music, or literature