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Alcohol cue reactivity task development

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ABSTRACT

Background: The physiological and cognitive reactions provoked by alcohol cues, as compared to non-alcohol cues, can predict future drinking. Alcohol cue reactivity tasks have been developed; however, most were created for use with alcohol use disordered individuals and utilize limited or only partially standardized stimuli. This project systematically created an alcohol cue reactivity task for studies with non-drinkers, using well-characterized stimuli.
Objectives: We comprehensively standardized 60 alcohol and 60 non-alcohol beverage pictures using ratings from young non-drinkers ($N=82$) on affective and perceptual features.
Results: A statistical matching approach yielded 26 matched alcohol–non-alcohol picture pairs matched on valence, arousal, image complexity, brightness, and hue. The task was piloted and further refined to 22 picture pairs. An 8-minute, 32-second event-related task was created using a random stimulus function for optimized condition timing and systematic presentation of the images.
Conclusions: The long-term objectives of this project are to utilize this task with non-drinking youth to investigate how reactivity to alcohol stimuli may predict alcohol use initiation and escalation, to help identify the role of exposure to alcohol stimuli on the subsequent development of alcohol-related problems.

1. Introduction

Subjective alcohol craving and responses to alcohol-specific cues (e.g., pictures of alcoholic beverages) have been shown to produce different physiological and cognitive interference responses in contrast with exposure to non-alcohol cues (e.g., delayed reaction times on attentional tasks) (Bruce & Jones, 2004). Specifically, prior investigations have shown that alcoholics report higher subjective reactions (e.g., craving) to alcohol stimuli (e.g., pictures) when compared to non-alcoholic stimuli (Drobes, 2002) and social drinkers (George et al., 2001). Similarly, adults (Monti et al., 1987) and adolescents (Thomas & Deas, 2005; Thomas, Drobes, & Deas, 2005) with alcohol dependence have demonstrated differential physiological responses, such as increased salivation, to the sight and smell of alcoholic beverages as compared to non-alcoholic beverages. This population has also evidenced cognitive interference (e.g., delayed reaction times) when presented with alcohol cues (e.g., alcoholic beverages or alcohol-related words) (Bauer & Cox, 1998; Sayette et al., 1994). Social drinkers also show delayed reaction times (Bruce & Jones, 2004) or alcohol bias (Townshend & Duka, 2001) when presented with alcohol stimuli, which often correlated with the level of alcohol involvement. Cue reactivity paradigms have been used for tailoring alcohol interventions (Drummond & Glautier, 1994; Rohsenow et al., 2001), evaluating the efficacy of alcohol treatment programs (Hutchison et al., 2006; Schneider et al., 2001), and examining degree of reactivity in relation to duration of abstinence (Monti et al., 1993).

In brief, from the concentration of studies with alcohol using individuals, alcohol cue reactivity appears to develop through personal alcohol use. Only a few studies have examined alcohol cue reactivity among individuals *at risk* for alcohol use disorders (AUD) (Tapert et al., 2003). In the present study, an alcohol cue reactivity task was developed using stimuli ratings of non-drinkers, who have previously been shown to have different subjective affective responses to alcohol beverage images as compared to drinkers (Pulido, Mok, Brown, & Tapert, 2009). This alcohol cue reactivity task was developed for future use with non-drinkers at risk for AUD, to help determine whether attentional bias is developed only through personal alcohol use experiences, or if it can also be learned through modeling, and whether cue reactivity can predict subsequent drinking behavior. Ultimately, these findings can help in the development of effective AUD prevention programming.

1.1. Alcohol cue reactivity studies and limitations

Prior to assessing alcohol cue reactivity, a task for such purpose needs to be developed. Stimuli standardization and implementation

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into a task is time consuming, and several research groups have substantially advanced our understanding of stimulus characteristics important to consider when creating an alcohol cue reactivity task (Braus et al., 2001; Grusser, Heinz, & Flor, 2000; Grusser et al., 2004; Wrase et al., 2002, 2007).

First, stimulus affective and perceptual characteristics are important to consider. Fortunately, some investigators have highlighted the importance of stimulus standardization and reported efforts to standardize task materials prior to task creation (e.g., Grusser et al., 2000; Wrase et al., 2002). However, standardization procedures have typically explored only one dimension such as valence (e.g., Bauer & Cox, 1998) or the visual complexity of the stimuli (e.g., Bruce & Jones, 2004). A task simultaneously considering multiple task-relevant stimulus parameters is yet to be developed. Second, the standardization of a limited quantity of stimuli (e.g., Grusser et al., 2000) restricts its utility for creating an alcohol cue reactivity task since stimuli repetition can reduce statistical power or even confound results (Schwartz et al., 2003). For instance, a modest quantity of items has been managed in some studies by supplementing the task with stimuli standardized with divergent procedures (e.g., George et al., 2001; Hermann et al., 2006; Myrick et al., 2004). Third, in cases where alcohol visual stimuli standardization has been undertaken with small (Grusser et al., 2000; Lang, Bradley, & Cuthbert, 1999) and large (Stritzke, Breiner, Curtin, & Lang, 2004; Wrase et al., 2002) item pools, participants' alcohol use characteristics are often unknown, despite this being an important correlate of alcohol stimulus ratings (Pulido, Mok et al., 2009). Finally, although various tasks are currently available to assess alcohol cue reactivity among AUD individuals, no task has been developed to specifically examine alcohol cue reactivity among non-drinking individuals at risk for AUD.

This study utilized a database of affective (i.e., valence and arousal) and perceptual (i.e., familiarity and image complexity) ratings from 82 non-drinking individuals and objective brightness and color measures to statistically match 120 alcohol and non-alcohol beverage pictures for an alcohol cue reactivity task. The task developed here will improve upon existing alcohol cue reactivity paradigms in that it was developed by means of a novel and stringent procedure, simultaneously taking into consideration multiple recommended task development procedures. These included using a large item pool, collecting ratings from non-drinkers and covering relevant parameters, using an objective matching approach, optimizing task design for fMRI, including an active control condition, and conducting a pilot study. The careful creation of the task will allow for more accurate neural assessment of alcohol cue reactivity and comparison of results across samples.

2. Methods

This study had two objectives: a) to statistically match a set of alcohol and non-alcohol picture pairs on affective and perceptual features, and b) to systematically present these cues with a time course conducive to evaluating behavioral reactions as well as blood oxygen level dependent response during functional magnetic resonance imaging studies.

2.1. Methods for stimuli matching

The first objective was to generate a set of alcohol and non-alcohol beverage pictures that would be recognizable to non-drinkers, then to match alcohol to non-alcohol pictures on valence, arousal, and perceptual complexity ratings, and on objective measures of brightness level and net color. These aims were accomplished by (1) collecting ratings on familiarity, valence, arousal, and complexity ratings for 120 alcohol and non-alcohol beverage pictures from a sample of 245 adolescents and young adults, including 82 non-drinkers; and (2) obtaining objective measurement of pictures' brightness and color using the GNU Image Manipulation Program (GIMP; Berkeley, CA), a photo editing software program. Test construction theory was used to ensure the proper development of the task.

2.1.1. Participants

Participants ($N = 82$) were ages 13 to 23 ($M = 18.1$, SD = 2.2), 52% female, 41% Caucasian, 10% with paternal AUD (all denied maternal AUD), and reportedly minimal depressive symptomatology (BDI-II score $M = 5.9$, SD = 7.1). Participants ages 18 and older ($n = 67$) were college students recruited from local universities (Pulido, Mok et al., 2009). Participants under age 18 ($n = 15$) were recruited from local middle schools through an ongoing adolescent brain imaging study (Pulido, Anderson, Armstead, Brown, & Tapert, 2009; Spadoni, Norman, Schweinsburg, & Tapert, 2008). The inclusionary criterion for the present study was having had 10 or less lifetime alcohol drinking experiences, as determined by the Customary Drinking and Drug Use Record (see below, Brown et al., 1998); those reporting drinking more were excluded. An alcohol drinking experience was defined as a 24-hour period when one or more standardized alcoholic beverages (i.e., 12 oz. beer, 8 oz. malt liquor, 4 oz. wine, or 1.25 oz. of hard liquor) were consumed. This criterion was based on the future objective of using this task with non-drinkers, and our previous findings of differences in affective responses to alcohol pictures between individuals above and below this threshold (Pulido, Mok et al., 2009).

2.1.2. Measures

2.1.2.1. General interview (Brown, Vik, & Creamer, 1989). A general interview was administered to gather demographic information.

2.1.2.2. Customary drinking and substance use record (Brown et al., 1998). An abbreviated form of the CDDR gathered frequency, quantity, and recency of personal alcohol and other drug use.

2.1.2.3. The Short Michigan Alcoholism Screening Test versions M and F (Sher & Descutner, 1986). These forms were administered to participants to report on their Mothers (SMAST-M) and Fathers (SMAST-F) history of AUD. The SMAST-M and SMAST-F have shown good reliability and validity (Crews & Sher, 1992).

2.1.2.4. The Beck Depression Inventory—Second Edition (Beck, Steer, & Brown, 1996) and Beck Depression Inventory (Beck, 1978). The BDI-II and BDI were used to assess college student's and adolescents' current level of depression (respectively).

2.1.2.5. The beverage pictures. The beverage pictures stimuli consisted of 120 color pictures: 60 of alcoholic beverages and 60 of non-alcoholic beverages. Pictures were obtained from popular magazine advertisements, amateur photographs, the Normative Appetitive Picture System (Stritzke et al., 2004), the International Affective Picture System ([CSEA-NIMH], 1999), and the internet, then scanned at a similar resolution and image size. The pictures were displayed via an E-Prime (Pittsburgh, PA) program for systematic presentation (see sample picture in Fig. 1). Each subject rated 60 pictures instead of all 120 to minimize fatigue. Thus, four picture presentation programs were created with 30 alcohol and 30 non-alcohol pictures in each. Within each program, pictures were randomized to control for order effects.

2.1.2.6. The Self-Assessment Manikin (SAM) picture rating system (Lang et al., 1999). The SAM picture rating system includes two nine-point scales for rating valence (i.e., pleasure/displeasure) and arousal (i.e., excitement/calm) perceived while viewing each picture.