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Cognitive biases and alcohol use in adolescence and young adulthood: The moderating role of gender, attentional control and inhibitory control

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ABSTRACT

The present study investigated the cross-sectional associations between cognitive biases (i.e., attentional bias and approach bias) and alcohol use and investigated the moderating role of gender, attentional control and inhibitory control. The sample consisted of 94 adolescents and young adults (52.1% boys) between 15.3 and 20.8 years old (M_{age} = 18.0, SD = 1.1) who reported drinking alcohol in the past three months. A stronger approach bias was related to higher alcohol use, albeit only among boys. Furthermore, the association between attentional bias and alcohol use was moderated by attentional control; the lowest alcohol use was found in adolescents with low attentional bias and high attentional control, suggesting protective effects of both variables. The present study replicates and extends the results of studies on cognitive biases and addiction in adolescence and young adulthood.

1. Introduction

In adolescence and young adulthood, it is normative to experiment with alcohol (Shedler & Block, 1990). However, some adolescents develop alcohol use problems; posing risks for their future development (Burrow-Sanchez, 2006). To improve prevention and intervention, it is important to gain insight into the processes that contribute to alcohol use problems.

According to the incentive sensitization theory (Robinson & Berridge, 1993), substance-related cues (e.g., beer glasses, a pub, etc.) in the environment acquire the ability to grab the user's attention, because they become associated with the effects of the substance through the process of classical conditioning (Schoenmakers, Wiers, & Field, 2008). Consistent with this theory, several studies have indicated an attentional bias for substance-related stimuli in substance users with the strength of the bias proportional to the frequency and quantity of use (e.g., Field & Cox, 2008).

Cognitive biases for disorder-relevant cues are, however, not limited to selective attention. In the domain of problematic substance use there is also evidence for the existence of biases in the evaluation of substance-related cues (e.g., Field, Eastwood, Bradley, & Mogg, 2006). Stimulus valence can be assessed either explicitly (e.g., by means of valence ratings) or implicitly (e.g., by means of a reaction time task, in which valence is derived from latencies to approach and avoid stimuli). There is growing evidence that individuals with substance use problems show greater preference for substance-related cues both on explicit and implicit indices of stimulus valence (e.g., Bradley, Field, Mogg, & De Houwer, 2004), which is consistent with incentive models of addiction (e.g., Robinson & Berridge, 2001), according to which drug addicted patients perceive drug-related cues as attractive.

Most research on these attentional and approach biases has been conducted in adult samples of addicted patients or heavy drinkers. Only a few studies have examined cognitive biases in preadult samples (e.g., Peeters et al., in press; Van Hemel-Ruiter, de Jong, & Wiers, 2011). Moreover, with the exception of the study of van Hemel-Ruiter et al. (2011) all other studies have been conducted in samples of adolescents recruited in schools with high prevalence of alcohol and drug use (e.g., Special Education schools). These samples are presumed to be at-risk samples for alcohol use problems (e.g., Peeters et al., in press). However, it is important to investigate whether automatic cognitive processes are also related to alcohol use in adolescents and young adults who are not assumed to be at-risk. Indeed, if cognitive biases are associated with drinking behavior, then youth with high cognitive biases can be identified as at risk youth and thus become candidates for prevention programs. The first aim of the present study was to examine whether attentional and/or approach bias are related to alcohol use in a community sample of adolescents and young adults.

Numerous studies have demonstrated gender differences in drinking patterns. In adolescence, boys report higher levels of alcohol use compared to girls (Schulte, Ramo, & Brown, 2009). However, to our knowledge, none of the studies on the associations

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of attentional and/or approach bias with alcohol use in adolescence and young adults have investigated gender differences in these associations. Given the sex differences in drinking behavior during adolescence and the lack of studies investigating gender differences in the relation between attentional and/or approach bias and alcohol use in this age group, the second aim of the present study was to test whether the associations between cognitive biases and alcohol use are moderated by gender.

Recently, dual-process models have been formulated (e.g., Stacy & Wiers, 2010) which view addictive behaviors as the joint outcome of automatic appetitive processes (such as cognitive biases) and controlled regulatory processes. From this view, problematic alcohol use may result from a fundamental imbalance between automatic appetitive processes and weakened ability and motivation to regulate these appetitive impulses (Stacy & Wiers, 2010). Previous studies both in young adults (e.g., Houben & Wiers, 2009) and adolescents (e.g., Thush et al., 2008) have shown that automatic cognitive processes are related to higher alcohol use especially when individuals have low regulatory capacities. Across studies regulatory capacities have been operationalized in different ways, with studies in adolescents mainly assessing executive control using working memory or response inhibition tasks (e.g., Thush et al., 2008). However, it would also be useful to investigate whether trait aspects of self-regulation, assessed by a questionnaire, influence cognitive biases. Indeed, self-reports of self-regulation are more easily collected, so, to the extent that they yield effects, they may offer a more feasible or efficient means of identifying 'at risk' youths. In addition, it would be useful to investigate whether different aspects of self-regulation are related to different cognitive processes. In this respect, the temperament trait effortful control as conceptualized by Rothbart (1989) is noteworthy. Effortful control is a self-regulatory capacity that emerges in childhood, allowing the child to gain active control over behavior and emotional responses. It includes inhibitory control, activation control and attentional control. In accordance with dual-process models of problematic substance use, the third aim of the present study was to investigate whether the associations of attentional bias and approach bias with alcohol use are moderated by effortful control. Given that attentional control reflects the ability to voluntarily focus or shift attention when needed, it seems reasonable to assume that the predictive value of attentional bias for alcohol use would especially be pronounced in adolescents with weak attentional control. In the same line, given that inhibitory control reflects the ability to inhibit behavior if necessary, it is reasonable to suppose that the predictive validity of approach bias would especially be pronounced in adolescents with low levels of inhibitory control.

2. Method

2.1. Participants

One-hundred twenty-two participants were recruited for the study. Adolescents and young adults who never drank alcohol (13.1%) or who had too many missing values on the AUDIT (0.8%) were excluded from the analyses. Eleven (10.5%) participants with an outlying score (i.e., 2 SD's above or below the mean) on one or more of the conditions of either cognitive bias task (i.e., congruent trials, incongruent trials, approach trials, avoid trials) were also excluded. This resulted in a sample of 94 participants (52.1% boys), between the ages of 15.3 and 20.8 years old (M_{age} = 18.0, SD = 1.1).

2.2. Instruments

Alcohol use was measured with the *Alcohol Use Disorder Identification Test* (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993), which consists of ten questions regarding alcohol consumption and alcohol-related consequences. In the current study, the questions were formulated related to the past 3 months. Because the distribution of the scores on the AUDIT deviated from normality, a log10 transformation was conducted. The AUDIT has proven to be appropriate for alcohol screening in adolescents (Reinert & Allen, 2007).

Attentional and inhibitory control were measured with the two corresponding subscales of the *Adult Temperament Questionnaire* (ATQ; Rothbart, Ahadi, & Evans, 2000), consisting of respectively five and seven items to be rated on a seven-point scale. The psychometric properties have been established both in college students (Rothbart et al., 2000) and in adolescents (Willem et al., 2011).

Attentional bias was assessed using a pictorial version of the visual dot-probe task (e.g., Bradley et al., 2004) with substance-related and neutral stimuli. As the present study was part of a larger research project also targeting drug use, the visual dot-probe task contained both alcohol-related and drug-related stimuli. For the purpose of this study, only the data from trials with alcohol-related cues were used. Twelve photographs of alcohol-related scenes (e.g., a man drinking a glass of beer; alcohol target pictures) were matched with 12 alcohol control pictures (e.g., a man drinking a glass of cola). Each picture pair was randomly presented four times, once for each possible combination of two variables: target picture location (top or bottom) and dot probe location (top or bottom). The complete task consisted of 16 practice trials and 124 test trials (48 critical alcohol trials, 40 critical drug trials and 36 filler trials). Each trial started with the presentation of a fixation cross in the centre of the screen for 500 ms, immediately followed by a pair of simultaneously presented pictures, centered to the top and bottom half of the screen, respectively, and presented for 750 ms. Upon offset of the picture pair a dot probe appeared in the position of one of the two pictures. Participants were instructed to press one of the two response keys as quickly as possible, to the top ('Y' key) or bottom ('B' key) of the keyboard, to indicate in which location the dot probe had appeared. In half of the trials of the practice block and half of the filler trials of the test block, no dot was presented. On those trials, the screen remained blank during 2750 ms upon offset of the picture pair. Reaction time was measured in milliseconds from the moment of dot probe presentation to the response. In case of an incorrect response, verbal error feedback was displayed on the screen for 500 ms. After an inter-trial interval of 1000 ms, the next trial started. The dependent variable in this task was latency in ms to respond to the dot probe. Attentional bias scores were calculated by subtracting the mean reaction time when the dot probe was in the same location as the alcohol cue (congruent trials) from the mean response time when the dot probe and the alcohol cue were in different locations (incongruent trials) with positive scores indicating an attentional bias for alcohol or drugs. Reaction times that fell more than two SD's below or above the mean RT of the congruent and/or incongruent trials were considered outliers and were deleted. Trials in which participants made an incorrect response were also discarded from further analysis.

Approach bias was assessed using a speeded approach/avoidance stimulus–response compatibility task (De Houwer, Crombez, Baeyens, & Hermans, 2001) with the same alcohol-related target (12 pictures) and neutral control stimuli (12 pictures) as used in the visual dot-probe task (this task did not include drug-related pictures). On each trial of the approach/avoidance task, a manikin appeared in the top or bottom half of the screen, accompanied after 750 ms by a single picture (either an alcohol-related or a matched control picture) displayed on the opposite half of the screen. Subjects were instructed to make the manikin move toward or away from the picture by pressing one of two keys as quickly as possible