

Impulsivity in cue-elicited craving and appetitive learning

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Summary

Harmful alcohol use is associated with a wide range of social and public health problems such as cardiovascular disease, cirrhosis of the liver, cancers, violence, fatal injuries, and road traffic accidents (WHO, 2004). Research on alcohol-drinking behaviour could offer some insight into the psychological mechanisms involved in the development and maintenance of this behaviour and this knowledge in turn could help us to develop useful interventions in order to decrease alcohol-induced mortality and morbidity.

Similar to eating and drinking, alcohol-drinking behaviour cannot be explained merely by its consequences, e.g., the appetitive effects of alcohol on the central nervous system (CNS). Cues that precede alcohol drinking and are repeatedly paired with alcohol administration may become pavlovian signals that elicit physiological and subjective responses that motivate alcohol drinking (Carter & Tiffany, 1999; Drummond, 2000; Jansen, 1998). Craving, defined as the desire for alcohol, is one type of cue-elicited response (Drummond, 2001; Kozlowski & Wilkinson, 1987; Sayette, Shiffman, Tiffany, Niaura, Martin, & Shadel, 2000). However, not everyone experiences cue-elicited craving in the same way and personality factors such as impulsivity could account for individual differences (Drummond et al., 2000; Litt, Cooney, & Morse, 2000; Rees & Heather, 1995).

In general, impulsivity is defined as the tendency to act rashly and without consideration of the consequences of one's own behaviour (Dawe & Loxton, 2004; Evenden, 1999; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2000). Nevertheless, impulsivity appears to be a multidimensional concept as the multitude of behavioural tasks and self-report impulsivity measures do not always correlate with each other. The involvement of impulsivity in cue reactivity could explain some of the variability in cue-elicited responses and enable us to identify individuals for whom cue-elicited craving is a high risk factor for relapse.

The main goal of the present thesis is to investigate the relationship between cue-elicited craving for alcohol and impulsivity in social and dependent alcohol drinkers. We expected that higher impulsivity levels would be associated with stronger craving for alcohol. In the first study (Chapter 2), we investigated this relationship in heavy and light social drinkers. Impulsivity was measured with the stop signal task (response inhibition), Card Arranging Reward Responsivity Objective Test (CARROT, sensitivity to reward), and Barratt Impulsiveness scale version 11 (BIS-11, trait impulsiveness). We found evidence supporting our main hypothesis in heavy but not in light social drinkers. Heavy social drinkers with a less effi-

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cient response inhibition experience higher cue-elicited craving for alcohol than heavy social drinkers with more effective response inhibition.

In the second study (Chapter 3), we took into account the perceived availability of alcohol as there is evidence that it may play a role in cue reactivity (Wertz & Sayette, 2001). First of all, it was hypothesized that cue-elicited craving for alcohol is higher when people perceive alcohol as being available than as being not available in the environment. Moreover, it was expected that social drinkers with less vs. more efficient response inhibition (stop signal task) experience higher cue-elicited craving for alcohol. Finally, it was hypothesized that the effects of perceived availability on cue-elicited craving for alcohol are stronger in social drinkers with less vs. more efficient response inhibition. Our results showed that response inhibition is not associated with cue-elicited craving for alcohol in moderate social drinkers, resembling the findings for the light drinkers in the first study. As expected, perceived availability of alcohol increases craving for alcohol during the cue exposure paradigm. Finally, confirming our last hypothesis, response inhibition modulates the relationship between perceived availability and cue-elicited craving in moderate social drinkers: participants with less effective response inhibition who expected alcohol experienced the highest craving during cue exposure.

In Chapter 4, we explored the mechanisms by which impulsivity modulates conditioned appetitive responses. One possibility is that impulsivity regulates appetitive learning processes. Thus, we examined the involvement of response inhibition (stop signal task), rash impulsiveness (short SSS), and reward sensitivity (BAS) in the acquisition and extinction of subjective appetitive responses for chocolate (craving/desire, expectancy, liking) and we successfully replicated Van Gucht, Vansteenwegen, Beckers, and Van den Bergh's (2008) main findings by demonstrating that not all appetitive responses are equally sensitive to extinction. Expectancy for chocolate in response to the CS+ extinguished successfully, while craving for chocolate in response to the CS+ and liking for the CS+ did not. However, our results do not support the involvement of impulsivity in the regulation of appetitive learning processes. We demonstrated that neither reward sensitivity nor response inhibition nor sensation seeking influence the speed or strength of acquisition and extinction of appetitive CRs (craving, expectancy, and liking).

In Chapter 5, we carry on our investigation in a clinical population. Participants were alcohol-dependent inpatients of the private clinic U-Center (Epen, the Netherlands) who took part in a cue reactivity study in which they were exposed to their favourite alcoholic drink in a real alcohol setting. Two impulsivity measures were taken in that study: response inhibition (stop signal task) and trait impulsiveness (BIS-11). It was hypothesized that i) alcohol-dependent people experience stronger craving for alcohol when exposed to alcohol than to water cues, ii) a higher trait impulsiveness score is associated with higher cue-elicited craving for alcohol, and iii) a less effective response inhibition is linked to stronger cue-elicited craving for alcohol. Our findings confirmed our hypotheses. Higher scores in trait impulsiveness are associated with a higher increase in craving for alcohol during the whole

cue-exposure paradigm (water: baseline vs. exposure; alcohol: baseline vs. exposure in the bar-restaurant) and a higher absolute craving score in the bar-restaurant. In addition, a less effective response inhibition predicts higher craving for alcohol only in the bar-restaurant (absolute score).

Finally, Chapter 6 consists of a small 3-month follow-up study in which we considered the role of impulsivity and cue-elicited craving in relapse. The participants in this study were former patients of the U-Center clinic who had been treated for alcohol use disorders and had an abstinence goal. All of them had participated in the cue-reactivity study described in Chapter 4. We tested the hypothesis that cue-elicited craving for alcohol and rash impulsiveness (BIS-11) predict relapse in former patients. It was found that higher cue-elicited craving during the cue exposure paradigm is associated with higher probability of relapse in former patients. An unexpected finding was the negative relationship between trait impulsiveness and relapse: higher scores in trait impulsiveness were associated with a lower probability to relapse.

Overall, the findings of the present thesis support the idea that higher impulsivity is associated with stronger cue-elicited craving for alcohol in both heavy and alcohol-dependent drinkers. Additionally, perceived availability of alcohol may serve as a component of the alcohol cue or context and could increase craving for alcohol. Furthermore, there is an interaction between impulsivity and perceived availability and as a result people who are more impulsive and perceive alcohol as being available in the environment may experience stronger craving. In turn, cue-elicited craving for alcohol could predict alcohol-drinking and relapse in problem drinkers but its predictive value may depend on the context in which the cues are presented. Moreover, higher impulsivity levels could be associated with a higher probability of relapse indirectly via higher levels of cue-elicited craving. Although our findings suggest a negative relationship between impulsivity and relapse, this relationship could be modulated by other factors such as age, comorbidity, severity of dependence, etc.

Our findings have also clinical implications. For example, manipulations of perceived availability of alcohol should be included in the design of the future (clinical) studies. For example, being exposed to the cue of perceived availability without drinking could help the patients to extinguish the learning to this cue hence enabling them to learn to ignore it. Our results indicate that this strategy might be especially important to those patients with more deficient response inhibition. Furthermore, craving for alcohol is often used as an index of the treatment progress of the patient and our results highlight the importance of cue-elicited craving in relapse in alcohol-dependence. Thus, we recommend that cue exposure with response prevention (CERP) interventions should be incorporated into clinical practice (Conklin & Tiffany, 2002). However, we suggest that special effort should be made to expose patients to the real-life alcohol setting, for example, at home or in their own favourite pub. Finally, if cue-elicited craving predicts relapse, it is important to differentiate between patients who respond to alcohol-related cues with

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higher craving from those who do not because the former group is more likely to relapse than the latter group. To achieve that, impulsivity measures should be incorporated into clinical practice as a way of identifying the most vulnerable patients.

Taken as a whole, the results of the present thesis display that higher impulsivity is associated with stronger cue-elicited craving for alcohol in heavy social and dependent alcohol drinkers and a stronger cue-elicited craving for alcohol predicts a higher probability of relapse in problem alcohol drinkers. Finally, perceived availability increases craving for alcohol and interacts with impulsivity so as impulsive people who perceive alcohol as being available in the environment experience higher craving than less impulsive people or people who perceive alcohol to be unavailable.

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