Cue-induced activation of implicit affective associations with heroin use in abstinent heroin abusers

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ABSTRACT

Background and objectives: While drug-related contexts have been shown to influence drug users' implicit and explicit drug-related cognitions, this has been minimally explored in heroin abusers. This study examined the effect of heroin-related cue exposure on implicit and explicit valence and arousal-sedation associations with heroin use for abstinent heroin abusers.
Methods: In Experiment 1, 39 male abstinent heroin abusers were exposed to heroin-related words and reported cravings before and after cue exposure. They subsequently performed two Extrinsic Affective Simon Tasks (EASTs), which were used to assess implicit valence and arousal-sedation associations with heroin use. Thirty-six male abstinent heroin abusers (controls) only performed the two EASTs. All participants completed measures of explicit expectancy regarding heroin use. In Experiment 2, twenty-eight newly recruited abstinent heroin abusers were exposed to heroin-related pictures, and completed the same implicit and explicit measures used in Experiment 1.
Results: A non-significant increase in craving after cue exposure was observed. While participants exposed to heroin-related words or pictures exhibited more positive implicit heroin use associations (relative to negative associations), and such trend was not observed in controls, this difference was not significant across groups. Participants still indicated negative explicit associations with heroin use after cue exposure. Exposure to cues significantly accelerated arousal and sedation responses.
Limitations: Whether cue exposure could change self-reported craving requires further study in abstinent heroin abusers. The exclusively male sample limits generalization of the results.
Conclusions: The present findings extend the evidence on whether implicit and explicit heroin-related cognitions are susceptible to context.

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1. Introduction

In the past decade, numerous indirect measures have been used to examine drug users' implicit (or automatic) memory associations with drugs (Roefs et al., 2011). Evidence suggests that these implicit associations with drug-related stimuli predict the unique variance in drug use behavior after controlling for cognitive processes assessed by explicit measures (Houben & Wiers, 2008; Ostafin & Palfai, 2006; Thush & Wiers, 2007; Thush et al., 2007; Wiers, Van Woerden, Smulders, & de Jong, 2002). Recently, various studies have explored the effect of context on drug users' implicit associations; specifically, it has been examined whether emotion (Birch et al., 2008; Ostafin & Brooks, 2011), certain drug-related stimuli (Sherman, Rose, Koch, Presson, & Chassin, 2003), or drug deprivation (Sherman et al., 2003; Waters et al., 2007) impact drug-related associations. These studies, mainly conducted in alcohol and nicotine users, generally indicated that drug users' implicit drug-related associations were sensitive to context. Moreover, it was demonstrated that context also affects explicit drug-related cognitions (Birch et al., 2004; Marhe, Waters, van de Wetering, & Franken, 2013; Waters et al., 2007). However, few studies have considered the role of context in implicit and explicit heroin-related cognitions of heroin abusers; hence, the present study addressed this issue.

Context comprises myriad social, cognitive, affective, and environmental components (Krank & Wall, 2006). In substance users, any such component could potentially be encoded as part of a

substance-use memory representation (Krank & Wall, 2006). Thus, the retrieval and accessibility of drug-related cognition may be facilitated when users return to a context previously associated with drug use. Various studies have examined whether context influences the implicit associations with drug-related stimuli in substance users. For example, Lindgren, Neighbors, Ostafin, Mullins, and George (2009) used the implicit association test (IAT; Greenwald, McGhee, & Schwartz, 1998) to assess whether context affected automatic alcohol approach—avoidance associations in student drinkers. The researchers asked participants to read a vignette depicting a dating scenario that took place in a bar or a coffee shop. It was found that alcohol-approach (vs. alcohol-avoidance) associations were strengthened when the scenario happened in the bar or when the ending was not romantically successful. More recently, Ostafin and Brooks (2011) used the IAT to examine whether negative affect increases the implicit associations between alcohol and approach (vs. implicit associations between alcohol and avoidance) in regular drinkers classified as having high or low coping motivation. Results showed that negative affect enhanced the strength of alcohol-approach (vs. alcohol-avoidance) associations only in participants with high coping motivation. Birch et al. (2008) investigated the impact of emotion and drinking motive on alcohol-reward (positive reinforcement motivation) and alcohol-relief (negative reinforcement motivation) associations measured by the Extrinsic Affective Simon Task (EAST; De Houwer, 2003). They found that positive mood increased implicit alcohol-reward (vs. alcohol-relief) associations in enhancement motivated (EM) drinkers, while negative mood did not influence alcohol-relief (vs. alcohol-reward) associations in coping motivated (CM) drinkers. While the results of these two studies may appear contrary regarding the effect of negative mood on CM drinkers' implicit alcohol-related associations, this inconsistency may have resulted from the use of different emotion-induction methods (i.e., personalized negative affect imagination vs. unified negative musical mood induction) or different implicit measures (i.e., IAT vs. EAST) to investigate the relationship between negative mood and different aspects of implicit alcohol-related associations (i.e., approach—avoidance associations vs. reward—relief associations).

Addiction studies have also focused on the role of context in the implicit attitudes of drug users toward drugs. Sherman et al. (2003) revealed that smokers' implicit attitudes toward smoking, when assessed via a priming task (but not by the IAT), varied according to the presented smoking-related stimuli and the extent of nicotine exposure. Waters et al. (2007) used the IAT to measure smokers' implicit attitudes toward smoking and found that they were moderated by smoking abstinence. In addition, results showed that the IAT effect was less negative (or more positive) following pre-session abstinence (i.e., smokers abstained from smoking for 12 h before the experimental sessions) or within-session abstinence (i.e., smokers did not smoke 40 min before completing the IAT). Use of different participants (i.e., undergraduate smokers with a mean age of 19.6 vs. adult smokers with a mean age of 43.6), deprivation duration (i.e., 4 h vs. 12 h), and stimuli of the contrast category used in the IAT (i.e., slightly positive vs. neutral pictures) may explain the different effect of deprivation on implicit smoking attitudes assessed by IAT between the two studies. More recently, Marhe et al. (2013) examined whether implicit attitudes toward drugs varied as a result of different levels of drug use motivation, and whether drug-craving and implicit attitudes were associated with relapse in heroin-dependent inpatients. Participants completed drug IATs at random times (random assessment; RA) and when they were experiencing a temptation to use drugs (temptation assessment; TA). Individuals who relapsed during the study week exhibited more positive implicit attitudes toward drugs compared to non-

relapsers at TAs (but not RAs). Compared to non-relapsers, relapsers reported higher levels of craving and more positive explicit attitudes toward drugs at TAs than at RAs. However, one study (Huijding, de Jong, Wiers, & Verkooijen, 2005) that examined whether implicit attitudes toward smoking were sensitive to context (i.e., smoking setting vs. nonsmoking setting) failed to find an effect. Huijding et al. stated that the smoking-associated context did not induce a strong desire to smoke, and that the focus on implicit smoking attitudes (i.e., the global evaluations of smoking), rather than specific associations between smoking and beliefs about the emotional effects of smoking (i.e., valence and arousal-sedation expectancies of smoking) (cf. Wiers et al., 2002) may have been the reason for the non-significant findings.

While previous studies indicate that context may influence implicit associations related to substance use, few studies have examined this issue in abstinent heroin abusers. Given the serious public health problem presented by heroin abuse, and the role of context in implicit drug associations, which predict drug use, it is critical to understand how context influences heroin abusers' implicit associations with heroin use. Moreover, a context that contains drug-related cues may trigger a desire to use drugs (Tiffany, 1990) and impact automatic drug-related cognitive processes in drug users (Cox, Yeates, & Regan, 1999). Further, in addition to influencing the aforementioned drug associations, context may impact the associations between drugs and beliefs about the emotional effects of drug use (i.e., valence and arousal-sedation expectancies of drug use), which are predictive of substance use among diverse drug use populations (Ames et al., 2007; Rather & Goldman, 1994; Rather, Goldman, Roehrich, & Brannick, 1992; Thush & Wiers, 2007; Wiers et al., 2002). Hence, exposing heroin abusers to heroin-related cues may affect their automatic associations between heroin and their beliefs about the emotional effect of heroin use. Specifically, exposure to heroin-related cues may lead to more positive automatic expectancies of heroin use, according to previous findings about context effects on implicit drug attitudes (Marhe et al., 2013; Sherman et al., 2003; Waters et al., 2007). Moreover, heroin abusers potentially expect a greater sedative effect of heroin use after exposure to heroin-related cues, as abusers report this effect being highly accessible (Seecof & Tennant, 1986). In addition, the urge to use drugs may be potently induced in drug users when drug cues are specifically associated with past drug use experience (Sinha, Catapano, & O'Malley, 1999). Therefore, our study examined whether exposing abstinent heroin abusers to heroin-related cues while guiding them to associate those cues with their experiences influenced their implicit valence and arousal-sedation associations with heroin use.

Many aforementioned studies (Huijding et al., 2005; Lindgren et al., 2009; Marhe et al., 2013; Ostafin & Brooks, 2011; Sherman et al., 2003; Waters et al., 2007) used the IAT to explore the effect of context on implicit drug-related associations. In the IAT, individuals' reaction times toward certain categories of words (e.g., alcohol related) are compared with those of an appropriate contrast category of words (e.g., soda related); however, it is relatively difficult to select an appropriate contrast category for the heroin-associated category. Hence, the EAST was used to assess abstinent heroin abusers' implicit associations with heroin-related stimuli in the present study. An important virtue of the EAST relative to the IAT is that it is a non-relative measure of implicit associations. Hence, it can assess individuals' associations toward a single object without requiring a contrast category. The EAST has been employed for measuring implicit associations with various objects and concepts, including vegetables and meat (De Houwer & De Bruycker, 2007a), ethnic prejudice (Degner & Wentura, 2008), self-esteem (De Houwer, 2003), spiders (Ellwart, Becker, & Rinck, 2005), anxiety-related symptoms (Lefaivre, Watt, Stewart, & Wright,