

## Reactivity to nicotine cues over repeated cue reactivity sessions

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### Abstract

The present study investigated whether reactivity to nicotine-related cues would attenuate across four experimental sessions held 1 week apart. Participants were nineteen non-treatment seeking, nicotine-dependent males. Cue reactivity sessions were performed in an outpatient research center using in vivo cues consisting of standardized smoking-related paraphernalia (e.g., cigarettes) and neutral comparison paraphernalia (e.g., pencils). Craving ratings were collected before and after both cue presentations while physiological measures (heart rate, skin conductance) were collected before and during the cue presentations. Although craving levels decreased across sessions, smoking-related cues consistently evoked significantly greater increases in craving relative to neutral cues over all four experimental sessions. Skin conductance was higher in response to smoking cues, though this effect was not as robust as that observed for craving. Results suggest that, under the described experimental parameters, craving can be reliably elicited over repeated cue reactivity sessions.

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### 1. Introduction

While craving occupies a central conceptual role in addictive behaviors research, no consensus has been reached regarding its definition (Pickens & Johanson, 1992). Despite the lack of consensus, one

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common feature of many definitions of craving is that it is a subjective state of desire with motivational properties that have an important role in the procurement and consumption of drugs (cf., Sayette et al., 2000) as well as relapse to drug use (Childress, McLellan, & O'Brien, 1988; Wise, 1988). The cue reactivity paradigm has been used to systematically study craving (Drobes, Saladin, & Tiffany, 2001; Drummond, Tiffany, Glautier, & Remington, 1995). In a typical cue reactivity study, cues such as drug-related pictures, movies, and/or paraphernalia are presented to participants in a controlled laboratory setting. While numerous response systems have been monitored during cue presentations, the most conceptually important of these responses is subjective craving. Generally, drug-dependent individuals report greater craving in response to cues associated with their drug of choice as compared to neutral cues (Drobes et al., 2001; Drummond et al., 1995). Measures of craving and cue reactivity have been used within the field of addictions research to predict relapse in drug-dependent individuals as well as assess the efficacy of novel pharmacological agents for the treatment of addictions (Carter & Tiffany, 1999; Modesto-Lowe & Kranzler, 1999).

Although numerous theoretical accounts of craving and cue reactivity have been posited, most models postulate a central role for associative learning mechanisms (Childress, Ehrman, Rohsenow, Robbins, & O'Brien, 1992). These models maintain that cues that have been reliably paired with previous drug administration or withdrawal will elicit Pavlovian conditioned reactions when the cues are subsequently encountered. While conditioning models have many similar features, they differ with regard to the nature and form of the conditioned reactions. Appetitively based models assume that the conditioned reactions are consistent with the rewarding or excitatory effects of the drugs (Stewart, DeWitt, & Eikelboom, 1984; Wise, 1988) whereas aversive or withdrawal-based accounts assume the reactions take the form of withdrawal-like responses (Poulos, Hinson, & Siegel, 1981; Siegel, 1983; Wikler, 1980). Other models suggest that cues may activate both appetitively based and withdrawal-based mechanisms that in turn contribute to the generation of cravings (Baker, Morse, & Sherman, 1987; Niaura et al., 1988). Despite the differences between these theoretical accounts, all of the models argue that cue-elicited craving and reactivity are important motivators of drug seeking and consummatory behaviors.

If cue-elicited craving and reactivity have a causal role in the maintenance of substance use (among non-treatment seeking individuals), then it should be expected that the response-eliciting properties of substance-paired cues should be maintained over time or across multiple cue reactivity assessments (i.e., if cues don't maintain their potency over time, they aren't likely to have an important role in addictive behavior). This expectation would also be consistent with the aforementioned learning models since active use should sustain the associative learning mechanisms that presumably underlie cue-elicited craving and reactivity. Despite decades of research, relatively few studies have examined cue reactivity over repeated laboratory sessions. A number of 2-session studies have been conducted to assess initial efficacy of various medications for the treatment of cocaine dependence. These studies have generally found evidence for a reduction in reactivity from the first to the second session (Hersh, Bauer, & Kranzler, 1995; Modesto-Lowe, Bursleson, Hersh, Bauer, & Kranzler, 1997; Reid, Mickalian, Delucchi, & Berger, 1999), regardless of whether the medication under study produced any significant effects. However, with only two sessions of cue reactivity, it is difficult to know whether the reduction was the product of acclimation to the novel experimental setting and assessment procedures, or rather a genuine reduction in craving and reactivity in response to the substance cues. Moreover, since these studies had treatment components (i.e. experimental medication), it is possible that the perceived demand characteristics of the study may have led to a reduction in self-reported cravings.

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