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Short Communication

Quit interest influences smoking cue-reactivity

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HIGHLIGHTS

- We examined the role of quit interest as influencing cue-reactivity.
- Participants completed cue exposure followed by self-control tasks.
- Those with quit interests had riskier behavior after cigarette cue exposure.
- Quit interest also predicted lower tolerance on a cold pressor task.

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ABSTRACT

Interest in quitting smoking is important to model in cue-reactivity studies, because the craving elicited by cue exposure likely requires different self-regulation efforts for smokers who are interested in quitting compared to those without any quit interest. The objective of the current study was to evaluate the role of quit interest in how cigarette cue exposure influences self-control efforts. Smokers interested in quitting ($n = 37$) and smokers with no interest in quitting ($n = 53$) were randomly assigned to a cigarette or neutral cue exposure task. Following the cue exposure, all participants completed two self-control tasks, a measure of risky gambling (the Iowa Gambling Task) and a cold pressor tolerance task. Results indicated that smokers interested in quitting had worse performance on the gambling task when exposed to a cigarette cue compared to neutral cue exposure. We also found that people interested in quitting tolerated the cold pressor task for a shorter amount of time than people not interested in quitting. Finally, we found that for people interested in quitting, exposure to a cigarette cue was associated with increased motivation to take steps toward decreasing use. Overall these results suggest that including quit interest in studies of cue reactivity is valuable, as quit interest influenced smoking cue-reactivity responses.

1. Introduction

Decades of research has demonstrated that exposure to cigarette cues results in increased craving for smokers (Carter & Tiffany, 1999; Drummond, 2001), and recent work suggests that cigarette cue exposure also influences smoking-related behavior (Veilleux & Skinner, 2015). However, craving processes seem to operate differently for smokers who are interested in quitting or reducing smoking (Sayette & Dimoff, 2016), such that smokers in treatment exhibit lower craving (Wertz & Sayette, 2001) and different neural responses to cues (Wilson, Sayette, & Fiez, 2012) compared to continuing smokers. Unfortunately, smoking quit interest is rarely included as a study factor in cigarette cue-reactivity studies (see Conklin, Parzynski, Salkeld, Perkins, & Fonte (2012); Sayette & Dimoff (2016); Wilson et al. (2012) for exceptions).

Modeling quit interest is particularly important when examining cue-reactivity from a self-regulation framework (Köpetz, Lejuez, Wiers, & Kruglanski, 2013), because increased craving should only require self-regulation in the context of a conflicting goal indicative of a temptation situation. Temptation occurs when desire or craving for an immediate hedonic experience (either to experience pleasure or avoid pain) clashes with a long term goal (Hofmann & Kotabe, 2012; Tice & Bratslavsky, 2000). Thus, cues should only elicit *temptation* for people who hold a long term goal inconsistent with smoking, such as people who want to quit. Managing temptation often involves significant regulation effort, which may in turn reduce energy toward subsequent tasks requiring self-control (Muraven & Baumeister, 2000).

The current study was developed to extend prior work examining the effects of cigarette cue exposure on self-control (Hagger et al., 2013; Veilleux & Skinner, 2016) by recruiting participants both interested and not interested in reducing smoking. Because those motivated to reduce smoking would experience temptation when exposed to cigarette cues, and thus need to work harder to combat the craving associated with cue exposure, we would paradoxically expect to see lower

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self-control in individuals trying to quit compared to those not interested in quitting.

2. Method

2.1. Participants

All study procedures were approved by the Institutional Review Board. Current smokers (>10 cigarettes/day) were recruited via flyers and screened via phone. At the phone screening, we classified people as "quit interested" if they reported an intention to quit or reduce smoking within 3 months, and "non-quit interested" if they reported no intention to quit or reduce smoking in the next year (Perkins et al., 2008). People currently participating in cessation services were excluded. Eligible participants were instructed to smoke 1 h before the start of the study to control for nicotine deprivation. In total, 90 participants completed the laboratory session (45.6% female, 75.6% White, average age 33.00, $SD = 10.25$). Participants smoked 17.17 cigarettes per day ($SD = 7.57$) and had been smoking for about 12 years, with an average Fagerstrom Tolerance of Nicotine Dependence (FTND) score of 4.99 ($SD = 2.37$). There were no differences between people in the quit interest group ($n = 37$) and the non-quit interest group ($n = 53$) on any demographic or smoking variables (all *ts* and $\chi^2 < 1$, $ps > 0.30$).

2.2. Procedure

After providing informed consent, participants confirmed smoking status via carbon monoxide detection (CO Vita). Participants then completed what they were told was a "product rating" task that served as the cue exposure manipulation (Hagger et al., 2013), where they were randomly assigned to rate either cigarettes or drinking straws. All participants were shown three brands of either cigarettes or straws and asked to rate each on feel, smell, appearance, shape, general liking, likelihood of purchasing, and likelihood of using. In addition, participants were asked "How interested are you in smoking the cigarette (using this straw) right now?" which was used as a proxy for craving. All items were given on 1 (*not at all*) to 5 (*very much*) Likert-type scales.

Participants then completed two self-control tasks in counterbalanced order. The cold pressor task involved participants keeping their non-dominant hand in a bucket of ice water (between 1 °C and 3 °C) for as long as possible. Participants were asked to report when they started to feel pain, and that they could withdraw their hand whenever it was too uncomfortable to continue. Time between acknowledgment of pain and hand removal was calculated as an index of distress tolerance. Any participant still engaged in the task at 5 min was asked to remove their hand to avoid any aversive effects of the cold water (Hirsch & Liebert, 1998).

The other self-control task was the computerized version of the Iowa Gambling Task (IGT; Bechara, 2007). Participants viewed 4 decks of cards and were asked to choose one card from any deck. They were told that some decks are worse than others and the goal of the game was to win as much money as possible. The task is constructed such that selecting cards from two of the decks results in gain over time, whereas the other two are "disadvantageous" and result in a loss over time. Our outcome measure was the number of total advantageous decks chosen minus the disadvantageous decks chosen across the 100 trials (Buelow & Suhr, 2009), where scores above zero suggest a net choice of advantageous decks (e.g., better performance) and scores below zero suggest riskier decision making.

Finally, participants were asked to self-report their craving, resistance to smoking, positive affect and negative affect on 0 to 100 visual analogue scales. We also assessed demographic information and individual differences[1] including nicotine dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) and stage of change regarding quitting (SOCRATES; Miller & Tonigan, 1996) before participants were paid ($30) and allowed to leave.

3. Results

To confirm the effectiveness of the cue exposure manipulation, we evaluated the mean response to the craving proxy item for the three rated "brands" across smoking and control cue conditions. As expected, the cigarette condition participants had higher craving ratings ($M = 2.77$; $SD = 1.13$) compared to the straw condition ($M = 1.98$; $SD = 0.87$), $t(88) = 3.65$, $p < 0.001$.

3.1. Self-control outcomes

We evaluated the effect of quit interest and cue condition on self-control outcomes using three-way ANOVAs, where the third factor was order of self-control tasks. Due to skewness and kurtosis of the cold pressor variables, the distress tolerance cold pressor variable was log transformed prior to analysis. A main effect of quit group on cold pressor tolerance (e.g., time from acknowledging pain until hand removal) revealed that people interested in quitting tolerated their distress for less time ($M = 0.96$, $SD = 0.66$) than people not interested in quitting, ($M = 1.29$, $SD = 0.61$), $F(1, 81) = 5.27$, $p = 0.02$, $\eta_p^2 = 0.06$. No other main effects or interactions were significant.

On the IGT, there was a significant cue condition by order interaction, $F(1, 75) = 8.89$, $p < 0.01$, $\eta_p^2 = 0.11$. Specifically, order did not matter for the people in the control straw condition. But, for people in the cigarette cue condition, those who had the IGT immediately after the cue condition had significantly riskier (i.e., lower) scores ($M = -14.64$, $SD = 20.63$) than those who had the IGT after the cold pressor ($M = 15.09$, $SD = 26.60$). We also found a significant cue condition by quit group interaction, $F(1, 75) = 4.89$, $p = 0.03$, $\eta_p^2 = 0.06$. Specifically, there was no cue effect for people not interested in quitting, but for people interested in quitting, exposure to a cigarette cue was associated with risker decision making via lower IGT scores (see Fig. 1). No other effects were significant.

3.2. State outcomes

A series of 2 (cue condition) × 2 (quit group) ANOVAs were conducted on state affect, craving and resistance to smoking measured after the self-control outcomes. A significant main effect of quit group on resistance scores, $F(1, 86) = 4.00$, $p = 0.049$, $\eta_p^2 = 0.04$, revealed that quit interested participants had greater resistance ($M = 46.89$, $SD = 25.45$) compared to non-quit interested participants ($M = 34.02$, $SD = 30.17$). None other effects were significant, notably including any effect of cue condition on craving.

Finally, and primarily as validation for the recruitment strategy, we assessed differences in quit interest groups on the three subscales

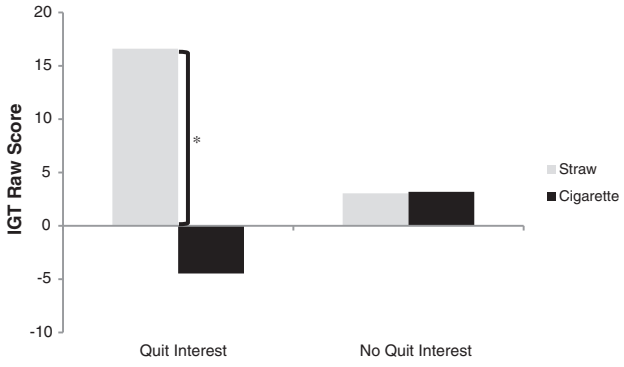

Fig. 1. Quit group by cue condition interaction for Iowa Gambling Task scores.

[1] Full list of individual difference measures administered is available from the authors.