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A comparison of daily and occasional smokers' implicit affective responses to smoking cues

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ABSTRACT

Previous research has not compared implicit affective responses to smoking-related stimuli in occasional (i.e., those who smoke less than one cigarette per day) and daily smokers (i.e., those who smoke at least once per day). In addition to assessing their motivations for smoking, implicit affective responses were measured using the Affect Misattribution Procedure (AMP) in occasional ($n = 19$) and daily smokers ($n = 34$) to smoking-related and neutral cues. Half of the cues depicted a human interacting with an object (i.e., active), whereas the remaining cues depicted objects alone (i.e., inactive). Results indicated that for the active cues, daily smokers responded more positively to smoking-related than to neutral cues, whereas occasional smokers showed no difference in their implicit responses. In addition to smoking frequency, relative differences in implicit responses to active cues were related to cognitive enhancement motivation. For inactive cues, implicit responses were related to cognitive enhancement as well as reinforcement. Because daily smokers have more positive implicit responses to active smoking-related cues than occasional smokers, these cues may play an important role in maintaining smoking behavior in daily smokers.

1. Introduction

Tobacco addictions are prevalent in our society and represent a serious risk to the health of smokers and those around them. According to the American Cancer Society (2009), smoking is currently the leading preventable cause of death within the United States, with over 440,000 deaths per year. Although most age groups in the United States have shown a decline in smoking behavior in the last few decades, current smoking prevalence has remained stable among those aged 18–24 years (Centers for Disease Control & Prevention (CDC), 2009). Although many individuals begin smoking in adolescence, a sizable proportion of individuals begin smoking or show increases in smoking behavior after age 18 (*e.g.*, Chassin, Presson, Pitts, & Sherman, 2000; Chassin, Presson, Sherman, & Edwards, 1991).

Although several studies have found that many college students explicitly report negative attitudes towards smoking regardless of their own smoking behavior (Elders, Perry, Eriksen, & Giovino, 1994; Goddard, 1992; Johnston, O'Malley, & Bachman, 1996; Stern, Prochaska, Velicer, & Elder, 1987), social desirability may diminish the reporting of positive emotions in self-reports of attitudes towards smoking (*e.g.*, Swanson, Rudman, & Greenwald, 2001). Because of the limitations of explicit measures, researchers use implicit measures to examine smokers' affective reactions to smoking by focusing on their responses to smoking-related cues, such as pictures of cigarettes or other smoking-related objects, using a range of paradigms such as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). Although implicit affective responses to smoking-related cues provide important insights for understanding how environmental cues maintain smoking behavior, studies examining implicit responses to smoking cues have produced inconsistent results, with some experiments showing that smokers have positive implicit associations (*e.g.*, Sherman, Rose, Koch, Presson, & Chassin, 2003), and others showing that smokers have negative implicit associations with smoking cues (*e.g.*, Swanson et al., 2001).

One reason for inconsistencies in this research may be that these studies have not distinguished between smoking styles. This may be particularly important to consider for college-age smokers who demonstrate considerable individual variability in their smoking frequency (Colder et al., 2006). Of the more than 40% of college students who report that they smoke (Stromberg, Nichter, & Nichter, 2007), approximately 40–50% are daily smokers who smoke at least one cigarette every day and exhibit physiological and psychological withdrawal symptoms when deprived of cigarettes for a prolonged period of time; the remaining are occasional smokers (Moran, Wechsler, & Rigotti, 2004; Oksuz, Mutlu, & Malhan, 2007), who do not smoke every day and generally smoke in social situations (Leatherdale & McDonald, 2005; Stromberg et al., 2007). Differences between occasional and daily smokers have been shown in regards to their internal and external motivations for smoking. For example, daily smokers often report that their smoking behavior is motivated by internal cues such as negative boredom, stress sensory satisfaction, and for appetite or weight control. In contrast, occasional smokers are

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motivated by environmental cues, which include social situations, such as interactions with peers who smoke (Otsuki, Tinsley, Chao, & Unger, 2008; Stromberg et al., 2007). Given these motivational differences, it seems wise to analyze these groups separately when investigating their affective responses to smoking-related cues (Fagerström, 1978; Tiffany & Drobes, 1990; Wetter et al., 2004). To our knowledge, there have been no studies that examine differences in implicit affective responses to smoking-related cues between occasional and daily smokers.

A second reason for the inconsistencies in college smokers' implicit affective responses to smoking-related cues may be the variation in the types of stimulus pictures employed in previous studies (Stritzke, Breiner, Curtin, & Lang, 2004). Many studies use pictures depicting humans interacting with drug-related objects as well as the objects alone (*e.g.*, Payne, Cheng, Govorun, & Stewart, 2005; Sherman et al., 2003). However, to our knowledge, none of these studies has investigated whether participants respond differently to these two types of stimuli. This could produce unwanted variability in participants' responses because psychophysiological evidence shows that stimuli containing people are processed differently from stimuli containing objects (*e.g.*, Haaga & Allison, 1994; Bentin, Allison, Puce, Perez, & McCarthy, 1996; Bobes, Valdés-Sosa, & Olivares, 1994; VanRullen & Thorpe, 2001). In fact, a recent study by Forestell, Dickter, Wright, and Young (2011) demonstrated that non-smoking college students with a history of family smoking attend differently to smoking-related pictures with human content compared to those with only smoking-related objects presented alone.

Finally, methodological issues that undermine the reliability and validity of implicit measures may have also produced inconsistencies in the literature. To address this concern, Payne et al. (2005) developed the Affect Misattribution Procedure (AMP) as an implicit measure of affective responses to cues. In this paradigm, participants are shown a prime picture followed by a Chinese pictograph and are asked to rate whether the pictograph is pleasant or unpleasant. Because the pictographs are ambiguous to participants and do not independently initiate emotional responses, participants' evaluation of the pictographs is implicitly related to their evaluation of the preceding prime. Discriminant validity has been shown to exist between various explicit measures, such as self-reported attitudes, and the AMP (Payne et al., 2005). Moreover, AMP responses to alcoholic-related cues correlated with participants' reported weekly consumption of alcohol (Payne, Govorun, & Arbuckle, 2007). These psychometric properties suggest that the AMP may be an effective procedure for measuring implicit affective responses to drug-related cues.

In a recent study using the AMP procedure, Payne, McClernon, and Dobbins (2007) found that smokers' responses to smoking-related and non-smoking-related neutral pictures did not differ. These results are in contrast to previous findings in which smokers were placed in groups based on their smoking behavior, suggesting that affective responses to smoking-related pictures may vary as a function of smoking status. For example, Sherman et al. (2003, Study 2) used the IAT to examine the implicit responses of college smokers and found that light smokers (i.e., those who smoked less than 15 cigarettes a day) responded more negatively to smoking-related pictures than heavy smokers (i.e., those who smoked more than 15 cigarettes a day), Thus, implicit reactions to smoking cues may vary as a function of smoking frequency. Because participants reported smoking 1–20 cigarettes per day in the Payne, McClernon, and Dobbins' (2007) study, it is possible that the more positive emotional responses to smoking-related cues in heavy smokers was counteracted by lighter smokers' negative emotional responses to smoking-related cues. To address this issue, in the current study, we divided smokers into two groups based on their smoking frequency. That is, the affective reactions of daily smokers who report smoking every day and exhibit physiological and psychological withdrawal symptoms when deprived of cigarettes for a prolonged period of time were compared to those of occasional smokers (Moran et al., 2004; Oksuz et al., 2007).

The current study was designed to address three questions. First, implicit affective responses to smoking-related and non-smoking-related control cues were compared across occasional and daily smokers. Based on differences in implicit affective responses found between light and heavy smokers (Sherman et al., 2003), it was hypothesized that daily smokers would show more positive implicit affective reactions to smoking-related cues than non-smoking-related cues, but that occasional smokers would show no difference between the smoking and non-smoking stimuli. The AMP was used as the implicit affective paradigm in the current study based on evidence of its enhanced reliability and validity over other implicit measures (Payne et al., 2005). Second, the content of the pictures was manipulated to determine whether those that depicted an individual interacting with a smoking-related object were judged differently from those that depict smoking-related objects by themselves (Forestell et al., 2011; Dickter & Forestell, 2011). Because college student smokers tend to be social smokers (Moran et al., 2004), we expected that differences in implicit affective responses between the smoking-related and the neutral cues would be greater for the active than for the inactive cues. Finally, motivations for smoking were measured to determine whether they were related to implicit affective responses towards active and inactive smoking-related stimuli. Previous research has found that the more college student smokers indicate smoking for positive reinforcement, negative reinforcement, and cognitive enhancement, the more positive their implicit affective response towards smoking-related cues (Payne et al., 2007).

2. Method

2.1. Participants

Fifty eight (15 females) undergraduates at a medium-sized liberal arts college who reported smoking on an occasional to daily basis ($M = 3.59$ cigarettes per day, $SD = 3.73$ cigarettes per day) were recruited either through an online database and provided with credit in their introductory psychology course or through flyers and paid $10 for their participation. The mean age of participants was 19.75 years ($SE = 0.20$, Range = 18–24 years). All procedures were approved by the school's Protection of Human Subjects Committee, and written informed consent was obtained from each participant.

2.2. Materials

2.2.1. Stimuli

Prime pictures consisting of 40 color photographs were presented, which consisted of 20 smoking-related and 20 non-smoking-related neutral pictures which were matched on various visual properties such as color, brightness, and object to the smoking-related pictures (Forestell et al., 2011). Half of the pictures were active in that they depicted a person interacting with the stimulus, whereas the remaining pictures were inactive, in that they consisted of the stimulus alone. All images were successfully pilot-tested with 10 non-smoking undergraduates to ensure that participants could identify their contents and judge whether or not they were smoking-related. The average accuracy rate for smoking and non-smoking-related stimuli was 98% ± 0.08 (Range: 90%–100%). The target picture stimuli for the computer task were 40 Chinese pictographs which were selected because of their neutral content, and have been used in previous studies as targets (*e.g.*, Payne et al., 2005; Payne et al., 2007).

2.2.2. Reaction time task

The Affect Misattribution Procedure (AMP) was developed to measure participants' implicit affective responses to presented primes (Payne et al., 2005) and was previously used to examine