



Effect of tobacco craving cues on memory encoding and retrieval in smokers

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Abstract

Previous studies have shown that cue-elicited tobacco craving disrupted performance on cognitive tasks; however, no study has examined directly the effect of cue-elicited craving on memory encoding and retrieval. A distinction between encoding and retrieval has been reported such that memory is more impaired when attention is divided at encoding than at retrieval. This study tested the hypothesis that active imagery of smoking situations would impair encoding processes, but have little effect on retrieval. Imagery scripts (cigarette craving and neutral content) were presented either before presentation of a word list (encoding trials) or before word recall (retrieval trials). A working memory task at encoding and free recall of words were assessed. Results indicated that active imagery disrupted working memory on encoding trials, but not on retrieval trials. There was a trend toward impaired working memory following craving scripts compared with neutral scripts. These data support the hypothesis that the cognitive underpinnings of encoding and retrieval processes are distinct.

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1. Introduction

Because craving for cigarettes is commonly reported by individuals who are trying to quit smoking (U.S. Department of Health and Human Services [USDHHS], 1988), tobacco craving is generally

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considered to play a critical role in treatment outcome (i.e., relapse) and in the maintenance of nicotine addiction (Killen and Fortmann, 1997; USDHHS, 1988). However, tobacco craving can also be elicited reliably by environmental cues in smokers not attempting abstinence (Carter & Tiffany, 1999).

Results from several studies suggest that exposure to smoking cues disrupts performance on cognitive tasks. In two studies using dual-task procedures, subjects either imagined smoking-related and neutral sentences (Cepeda-Benito & Tiffany, 1996) or were exposed to smoking and neutral cues (Sayette & Hufford, 1994) and simultaneously responded to auditory stimuli. During smoking-cue exposure, both studies reported slower response time to auditory stimuli compared to neutral-cue conditions. Madden and Zwann (2001) Zwann, Stanfield, and Madden (2000) have also reported that elevated tobacco craving was associated with impaired sentence comprehension and arithmetic skills. However, no study has examined the effect of smoking cues on memory encoding and retrieval.

The purpose of the present study was to examine the effect of imagery-induced tobacco craving on memory encoding and retrieval. Because encoding processes appear more susceptible than retrieval to disruption from competing cognitive demands (Craik, Govoni, Naveh-Benjamin, & Anderson, 1996; Naveh-Benjamin, Craik, Gavrilescu, & Anderson, 2000) and because effortful, cognitive processes are proposed to underlie craving (Tiffany, 1990), we hypothesized that imagery of craving scripts at encoding would disrupt working memory and subsequent recall compared with neutral scripts, whereas imagery of craving scripts at retrieval would not impair working memory or free recall relative to neutral scripts.

2. Method

2.1. Participants

Forty-eight cigarette smokers (24 men, 24 women) ranging in age from 18 to 58 years old ($M=33.6$, $SD=9.4$) were recruited from newspaper advertisements. The sample consisted of 26 African-Americans (14 men, 12 women) and 22 Caucasians (10 men, 12 women). Inclusionary criteria were having smoked a minimum of 10 cigarettes a day for the past 6 months. Participants smoked an average of 20.7 ($SD=9.0$) cigarettes per day, had smoked for an average of 18.7 ($SD=9.5$) years, and had no current interest in quitting smoking. Participants reported current use of alcohol (54% of participants), marijuana (44%), cocaine (31%), and heroin (17%). Participants gave written informed consent according to guidelines for the protection of research volunteers of the USDHHS and were paid for their participation. The study was approved by the NIDA Institutional Review Board.

2.2. Procedure

Drug use (except nicotine) was prohibited within 24 h of test sessions, and participants were screened for intoxication before sessions with a breathalyzer and a behavioral drug evaluation (Heishman, Singleton, & Crouch, 1996). Test sessions lasted 2 h and began with participants smoking one preferred-brand cigarette to standardize the time since last tobacco exposure. Participants completed baseline measures, including a memory test, 17-item version of the Tobacco Craving Questionnaire (TCQ, Heishman, Singleton, & Moolchan, 2003), and Visual Analog Scale (VAS) questions. Each participant then received four imagery-memory trials with a 5-min break between each. Imagery scripts were presented auditorially and described situations that either depicted a person experiencing a desire to

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