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An Examination of Reactivity to Craving Assessment: Craving to Smoke Does Not Change over the Course of a Multi-Item Craving Questionnaire

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Abstract

Self-report measures are typically used to assess drug craving, but researchers have questioned whether completing these assessments can elicit or enhance craving. Previous studies have examined cigarette craving reactivity and found null craving reactivity effects. Several methodological limitations of those studies, however, preclude definitive conclusions. The current study addresses limitations of previous studies and extends this area of research by using a large sample size to examine: (1) item-by-item changes in craving level *during* questionnaire completion, (2) craving reactivity as a function of craving intensity reflected in item content, (3) craving reactivity differences between nicotine dependent and nondependent smokers, and (4) potential reactivity across multiple sessions. This study also used a more comprehensive craving assessment (the 32-item Questionnaire on Smoking Urges; QSU) than employed in previous studies. Nicotine dependent and nondependent smokers ($n = 270$; nicotine dependence determined by the Nicotine Addiction Taxon Scale) completed the QSU on six separate occasions across 12 weeks. Craving level was observed at the item level and across various subsets of items. Analyses indicated that there was no significant effect of item/subset position on craving ratings, nor were there any significant interactions between item/subset position and session or level of nicotine dependence. These findings indicate that, even with relatively sensitive procedures for detecting potential reactivity, there was no evidence that completing a craving questionnaire induces craving.

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Contributors

Author S.T.T. designed the study and wrote the protocol. Author L.J.G. conducted the statistical analysis and wrote the first draft of the manuscript. Author S.T.T. provided oversight of analyses. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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Keywords

craving; reactivity; nicotine dependence

1. Introduction

Drug craving, a core feature of substance use disorders (American Psychiatric Association, 2014), is typically assessed with self-report measures (Rosenberg, 2009; Sayette et al., 2000). Researchers have questioned whether completing craving ratings can elicit or enhance craving (Juliano & Brandon, 1998; Niaura et al., 1998; Sayette et al., 2000; Sayette, Martin, Wertz, Shiffman, & Perrott, 2001). Similar to cue-reactivity procedures in which stimuli are presented to evoke craving (e.g., Carter & Tiffany, 1999), craving items used to assess craving levels may serve as cue-inducing stimuli and heighten the craving response. That is, craving assessment, like measurement of other self-reported constructs (e.g., negative affect; Mark, Sinclair, & Wellens, 1991), might be subject to reactivity.

Eliciting craving via a craving questionnaire may be undesirable for several reasons. For example, a craving questionnaire may be administered to obtain baseline assessments of craving; if the questionnaire enhances or elicits craving, then it would be difficult to gather accurate estimates of baseline craving via self-report. Moreover, unintentionally inducing or increasing craving may introduce measurement error and influence the detection of relationships between craving and other measures of interest such as smoking behavior and relapse (e.g., Wray, Gass, & Tiffany, 2013) and drug use (e.g., Gass, Motschman, & Tiffany, 2014). Finally, craving generated via craving assessments could obscure estimates of the full impact of other manipulations intended to induce craving (Sayette & Tiffany, 2013).

Concerns about craving reactivity have prompted investigations of the extent to which completing craving questionnaires induces desire to smoke (De Jong, Gongora, Engelhardt, & Breteler, 2006; Heishman, Saha, & Singleton, 2004; Shadel, Niaura, & Abrams, 2001), with that research finding no evidence of craving reactivity. These studies had several major limitations that precluded unambiguous conclusions regarding the potential reactivity of craving questionnaires. For example, Shadel and colleagues (2001) examined the influence of completing the 10-item Questionnaire on Smoking Urges (QSU-Brief; Cox, Tiffany, & Christen, 2001) on cigarette craving. Results indicated that completing the QSU did not increase craving. The sample size in the critical condition ($n = 13$ in the QSU completion group) was so small that it is unlikely the research was sufficiently powered to detect reactivity effects. Craving differences were also measured with a one-item visual analog scale (VAS) administered before and after QSU administration, rather than with an examination of craving differences that may have emerged *during* QSU completion (on an item-by-item basis). It is possible that craving might increase over the course of completing multiple items but that those effects may dissipate rapidly over time, or any increase may be restricted to the initial items in a series of items but disappear with repeated administrations. A simple pre-post design could not capture these effects. Additionally, participants were nicotine-deprived prior to completing the one-item VAS and the QSU (M length of abstinence = 3.7 hrs). This abstinence almost certainly elevated craving prior to

questionnaire completion and potentially created ceiling effects that may have obscured detection of reactivity.

Heishman and colleagues (2004) also examined reactivity in smokers' self-reported craving using the 12-item version of the Tobacco Craving Questionnaire (TCQ; Heishman, Singleton, & Moolchan, 2003). In that study, the TCQ was administered over a 15-minute time frame either two times (once at Minute 1 and once 15 minutes later) or 15 times (one TCQ administration per minute). Results indicated that craving ratings were not affected by repeated administrations of the TCQ. Again, however, the sample was limited in size, restricted to examining reactivity effects in two of the subgroups of the study ($n = 20$ total between the two groups), and craving reactivity was not assessed in an item-by-item manner. Additionally, the TCQ does not explicitly assess desire to smoke. Given that craving is typically defined as the desire for a drug, it is questionable whether the TCQ adequately assesses tobacco craving (Tiffany & Wray, 2012). Null reactivity effects of state and general heroin and drug craving have also been observed among patients treated for opioid dependence (De Jong et al., 2006). Similar to Shadel et al.'s study (2001), however, a one-item VAS was used to determine differences in craving pre- to post-craving questionnaire administration and the sample size for examining reactivity effects was restricted to two small groups ($n = 26$ total between the two groups).

The current study was designed to overcome the limitations of the previous investigations of the potential reactivity of craving assessment. This study used a much larger sample size ($n = 270$) of non-deprived smokers more suitable for detecting potential reactivity effects. A majority of previous studies also assessed reactivity before and after the craving questionnaire relative to *during* questionnaire completion. Item-by-item changes in craving levels over the course of a multi-item questionnaire may reflect position effects (i.e., reactivity) or systematic differences in craving levels as a function of specific item content. In order to avoid content differences in the current study, craving items were randomized across presentation positions.

Previous craving reactivity studies have also utilized craving questionnaires ranging from 10 to 14 items, despite concerns about craving reactivity emerging with the use of even longer craving assessments (e.g., Rosenberg, 2009; Sayette et al., 2001). Administering a longer craving measure would allow for a more thorough exploration of craving trends; thus, the current study utilized the 32-item QSU (Tiffany & Drobes, 1991). The variety of craving relevant items in this measure also allowed for the examination of craving reactivity as a function of item content that captured different levels of craving intensity. In addition, craving reactivity studies have not examined the influence of nicotine dependence on craving reactivity. Dependent and nondependent smokers exhibit different craving levels in response to smoking stimuli during cue-reactivity procedures (e.g., Sayette et al., 2001). Thus, dependent and nondependent smokers may show differential craving reactivity during craving questionnaire completion and, therefore, the current study examined nicotine dependence as a potential moderator of craving reactivity. Finally, previous studies have examined potential craving reactivity effects using data from only one occasion. Craving reactivity effects might be apparent at an initial session of craving assessment, but those effects may disappear over repeated sessions. Thus, participants were tested over six

sessions distributed across 12 weeks to determine whether craving reactivity was affected by session of testing.

2. Methods

2.1 Participants

Two hundred and seventy adult smokers were recruited based on eligibility determined through phone screening. Individuals were eligible if they were between 18 and 45 years old, proficient in reading English, not trying to quit over the past month nor intending to try to quit over the next two months, had not used nicotine or tobacco in any form other than cigarettes in the past 12 months, and had not been diagnosed with drug dependence (other than nicotine) in the past 12 months. Low-level smokers were over-recruited to ensure a wide range of smoking levels in the sample. Study participation occurred across six sessions. Participants were compensated with \$30 at the end of Sessions 1, 2, 3, and 4, \$70 after Session 5, and up to \$110 after Session 6. Participants were recruited as part of a larger study evaluating the validity of various biomarkers and self-report assessments of smoking (Wray et al., 2014).

2.2 Assessments

2.2.1 Cigarette craving—Craving was assessed at each of the six sessions using the 32-item Questionnaire on Smoking Urges (QSU; Tiffany & Drobes, 1991). In general, the QSU has exhibited high reliability (Tiffany & Drobes, 1991), consistent with the reliability of the total score derived from the QSU in the current study ($\alpha = .96$; reliability calculated at each session and averaged across sessions). Instructions specified that participants answer each item for how they were “thinking or feeling” during the time they completed the questionnaire (“right now”), using a 7-point Likert scale, from 1 (strongly disagree) to 7 (strongly agree). Participants viewed craving items on a computer monitor one item at a time, and answers were selected using a mouse-controlled cursor. After participants responded, the screen advanced to the next item. In order to eliminate item-position effects, the presentation order of the QSU items was randomized for each participant at each session.

2.2.2 Nicotine dependence—Participants completed the 12-item Nicotine Addiction Taxon Scale (NATS; Goedeker & Tiffany, 2008), an empirically validated instrument that has identified an explicit categorization of dependence. The NATS parameters were established from two large sample replications generated from a national data set (The National Survey of Drug Use and Health; Goedeker & Tiffany, 2008). Based on a taxometric analysis of scores derived from this nationally representative sample, scores greater than or equal to 14.33 were considered within the nicotine addiction taxon and indicated nicotine dependence, whereas scores below 14.33 indicated nondependence (Goedeker & Tiffany, 2008). The NATS was highly reliable in the current study ($\alpha = .88$) and research has indicated that the NATS has good concurrent validity (Goedeker & Tiffany, 2008).

2.2.3 Smoking history and current use—Participants completed a questionnaire about their smoking history; current cigarette consumption (average number of cigarettes smoked

per day over the past 28 days) was assessed at Session 1 using a 28-day timeline followback (TLFB modified for cigarette smoking; Sobell & Sobell, 1996). The 28-day TLFB has shown good test-retest reliability and strong validity (Brown et al., 1998).

2.3 Procedures

Participants attended six laboratory sessions over the course of three months. Sessions occurred at the same time each week for five weeks (Sessions 1–5) and participants returned for the final session (Session 6) 12 weeks after Session 1. When participants arrived to Session 1, they provided written consent, in accordance with the guidelines of the Institutional Review Board at the State University of New York at Buffalo. Participants then completed questionnaires assessing demographic factors (e.g., age, sex, race) and previous history of smoking behavior. The NATS was also administered at this time. The QSU was then administered on a computer. The TLFB was assessed later in Session 1 after QSU completion. During Sessions 2–6, participants completed the QSU at the beginning of the session prior to the administration of additional measures (these measures are not relevant to the current study and, therefore, will not be discussed).

2.4 Data Reduction and Analyses

2.4.1 Cigarette craving—QSU individual items were reverse-scored where appropriate. Four equally-sized QSU item subsets were created to allow for examination of craving trends across sections of the QSU administration; items were averaged within each subset with the four subsets comprised of craving ratings from items in positions 1–8, 9–16, 17–24, and 25–32. Additional subsets were created representing the average of craving ratings from items in positions 1–16 (the first half of items administered) and the average of craving ratings from items in positions 17–32 (the second half of items administered).

2.4.2 Item intensity—We hypothesized that the craving intensity reflected in items might affect craving rating trends during QSU completion. An item reflecting intense states of craving would likely generate lower average ratings than item content depicting milder forms of craving (Agrawal, Heath, & Lynskey, 2011; Germeroth, Wray, Gass, & Tiffany, 2013). For example, the item worded “I would do almost anything for a cigarette now” (item 30) represents an extreme level of craving and would be strongly endorsed by only those experiencing the most intense levels of craving. However, a craving item reflecting lower intensity would be endorsed by smokers at all levels of craving experience. In the current study, item 30 had the lowest mean craving rating (depicted as reflecting the most intense craving; M score of 1.99, $SD = 1.11$), whereas item 28 (“If I had a lit cigarette in my hand I probably wouldn’t smoke it”) had the highest mean craving rating (conceptualized as reflecting the least intense craving; M score of 5.35, $SD = 1.33$). We were interested in examining differences in craving means of the items following items 28 and 30 to determine if craving ratings were driven by the intensity of craving reflected in the immediately preceding items.

2.4.3 Analyses—Repeated measures ANOVAs were performed and omnibus F tests were observed to determine overall main effects of item/subset position, and two-way interactions of position X session and position X nicotine dependence on craving ratings. Repeated

measures ANOVAs were conducted using the following position variables for craving ratings across: (1) All 32 item positions, (2) The first eight item positions (to more closely examine the beginning portion of the QSU in which craving reactivity may occur), (3) The four consecutive subsets of 8-item blocks (item positions 1–8, 9–16, 17–24, and 25–32), (4) The first half of items averaged (items 1–16) relative to the second half of items averaged (items 17–32), and (5) Items following the least intense craving item (item 28) and the most intense craving item (item 30). Statistical significance was defined as $p < .05$.

3. Results

3.1 Participant Characteristics

All 270 (135 male/135 female) participants were included in the analyses, with 220 participants attending all six sessions, and 16, 5, 10, 8, and 11 participants attending five, four, three, two, and one session, respectively. Participants averaged 25.85 years of age ($SD = 6.74$) and 33.70% were of minority status (1 Native Hawaiian or other Pacific Islander, 5 American Indian or Alaskan Native, 32 Black/African American, 53 Asian, and 179 Caucasian). On average, participants had been smoking 10.11 years ($SD = 7.85$) and smoked 5.45 cigarettes per day over the past 28 days ($SD = 7.93$). Approximately 53.70% had made quit attempts with an average of 4.27 quit attempts ($SD = 9.93$). On the NATS, 73 participants were categorized as dependent (M score of 18.45, $SD = 2.96$) and 197 participants were categorized as nondependent (M score of 9.71, $SD = 2.34$).

3.2 Craving Trends

All omnibus F tests indicated nonsignificant main effects of item/subset position on craving ratings (all ps between .07 and .97; Figure 1 depicts mean craving ratings and error estimates across item positions at each session), and nonsignificant two-way interactions between item/subset position and session (all ps between .29 and .99) and between item/subset position and nicotine dependence (all ps between .67 and .93). Because nicotine dependence was not a significant moderator in the omnibus F tests, data and analyses were collapsed to include both dependent and nondependent smokers.

Due to the potential for reactivity being restricted to the first session, Session 1 was analyzed more closely with regard to the different item/subset variables and their impact on craving level during QSU completion. Repeated measures ANOVAs indicated that at Session 1, item position did not significantly influence craving ratings across the administration of all 32 items ($p = .14$) or across the administration of the first eight items ($p = .70$), craving ratings did not significantly change across the four 8-item subsets ($p = .25$) or from the first half of items to the second half ($p = .76$), and that craving ratings after the most and least intense items did not differ significantly from one another ($p = .16$).

4. Discussion

The current results suggest that completing a comprehensive multi-item craving assessment does not enhance craving among smokers. This finding was consistent across several sessions and emerged when examining item-by-item craving ratings, as well as various subsets of item positions. The study also suggests that craving intensity reflected in item

content did not influence craving reactivity, and that both nicotine dependent and nondependent smokers displayed lack of craving reactivity. With such consistent lack of reactivity effects across multiple administrations, researchers can be more certain about the ability to obtain reactivity-free baseline craving levels via self-report assessment, and, more broadly, craving reactivity may not be a major factor in studies involving craving manipulations.

Though previous studies of reactivity to craving assessments indicated null reactivity effects (De Jong et al., 2006; Heishman et al., 2004; Shadel et al., 2001), that research had several limitations not present in the current study. First, previous studies used sample sizes that were likely too small to detect potential reactivity effects. Additionally, one of these studies used a nicotine deprivation manipulation which potentially washed-out reactivity effects (e.g., Shadel et al., 2001). Previous research has also focused on craving differences before and after questionnaire administration but has not examined potential craving changes at the item level. Additionally, those studies used short craving assessments despite suggestions that longer craving questionnaires have an increased likelihood of inducing craving (Rosenberg, 2009; Sayette et al., 2000), and in some studies, used craving assessments that did not assess desire (e.g., the TCQ in Heishman et al., 2004). Thus, the current study assessed craving in a large sample of non-deprived smokers ($n = 270$) using a multi-item craving measure that provided a more comprehensive assessment of craving and greater opportunity for craving reactivity given its length and content.

The potential for reactivity during craving assessment has been one rationale for using brief measures of craving (e.g., Rosenberg, 2009; Sayette et al., 2000; Shadel et al., 2001). This argument is undercut in light of the evidence that craving assessments do not induce craving, and, depending on the aims of the research, researchers may consider using multi-item assessments of craving. Though it is not always feasible to administer lengthy assessments, more comprehensive craving assessments have the potential to increase reliability and also aid in a more thorough evaluation of the multi-dimensional craving construct (Sayette et al., 2000). The current study also supports the use of multi-item craving assessments for obtaining reactivity-free baseline measures of craving and using these measures to predict smoking-related outcomes.

Though the current study found no reactivity effects, future research should examine reactivity when craving assessments are administered prior to other smoking-related assessments. Sayette and Tiffany (2013) hypothesized that asking people about their smoking behavior and being in the context of a smoking study may provide sufficient cues to trigger craving. In the present research, the QSU was administered to participants who were aware that they were in a smoking study and after collecting other smoking-related measures (e.g., self-reported smoking history, NATS). Those procedures may have primed craving prior to the start of QSU administration rather than during QSU completion. If craving was already primed via these incidental cues, it may have been difficult to generate additional craving through the presentation of craving-specific items. It should be noted, however, that the smoking history form and NATS were administered prior to the QSU at Session 1 only.

The current study speaks to craving reactivity in terms of self-reported craving levels. However, it is unclear to what extent other craving-related factors may be influenced by craving assessments. For example, future studies might consider assessing physiological (craving-related) reactivity when completing a craving questionnaire (De Jong et al., 2006). Additionally, craving reactivity during questionnaire completion among nicotine-deprived smokers has been only minimally studied (use of a pre-post craving difference measure in a small sample; Shadel et al., 2001). Nicotine-deprived smokers, particularly heavier smokers, who are abstinent for long periods of time, may be more prone to reactivity during multi-item craving assessments. These questions notwithstanding, this study indicates that researchers and clinicians can administer multi-item craving assessments with confidence that those questionnaires generate no craving reactivity. Thus, it is suggested that, when possible, multi-item craving assessments be provided to improve reliability and more fully assess the multi-dimensional construct of craving.

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Highlights

- We examine reactivity when completing a 32-item cigarette craving assessment.
- Reactivity does not occur as a function of item position or item intensity.
- Reactivity does not differ between nicotine dependent and nondependent smokers.

Figure 1. Mean craving ratings and error estimates (standard error of the mean; shaded in gray) across the 32 QSU item positions at each session