

## RESEARCH REPORT

# The development and initial validation of a questionnaire on smoking urges

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### Abstract

*A 32-item questionnaire on smoking urges was administered to 230 daily cigarette smokers assigned to one of three levels of cigarette deprivation (0, 1 or 6 hours). Factor analyses showed that a two-factor solution best described the item structure for each of the three deprivation levels and for the entire sample. Factor scales of 15 and 11 items derived from rotation to simple structure were highly reliable, 0.95 and 0.93, respectively, and moderately correlated ( $r=0.71$ ). Average scores on both scales increased significantly with level of deprivation, and the Factor 1 scale was significantly higher than the Factor 2 scale at all levels. Factor 1 scale items reflected primarily intention and desire to smoke, and anticipation of pleasure from smoking. Factor 2 scale items were comprised primarily of anticipation of relief from negative affect and nicotine withdrawal, and urgent and overwhelming desire to smoke.*

### Introduction

Smokers attempting to quit often complain of urges and cravings to smoke. Indeed, urges and cravings have been identified as prominent features of the tobacco withdrawal syndrome<sup>1-3</sup> and are frequently posited to be major contributors to the high rate of relapse encountered in many treatment programs for smoking cessation.<sup>4-7</sup>

Theories of smoking urges are consistent with general models of drug urges, which tend to assume that urges and cravings represent subjectively experienced, motivational states that are responsible for on-going drug use in drug-dependent individuals, and precede and precipitate relapse episodes in addicts attempting abstinence.<sup>4-9</sup> Models of urges and cravings generally posit that urges arise from drug withdrawal,<sup>7-10</sup> from the positively reinforcing effects of drugs<sup>5-11</sup> or from both of these sources.<sup>8</sup>

In an approach distinctly different from current models of drug urges, Tiffany<sup>12</sup> has applied the

cognitive concepts of automatic and non-automatic processing<sup>13-15</sup> to addictive behavior. He has suggested that drug-use behavior in the addict represents skilled activity controlled largely by automatized processes, organized in unitized memory structures in the form of action schemata. In this model, urges and cravings are conceptualized as constellations of verbal, somatovisceral and behavioral responses supported by non-automatic cognitive processes. It is hypothesized that these processes are activated in parallel with drug-use action schemata either in support of the schema, as would occur when the drug-use behavior of an addict not attempting abstinence was blocked or impeded, or in an effort to prevent the execution of the automatized action schema, as would occur when the addict was attempting abstinence. A notable feature of this theory is that, in contrast to most other conceptualizations, urges and cravings are not assumed to be direct manifestations of the motivational processes

central to drug use or drug relapse. One implication of this characterization of drug urges that is relevant to the present study is that urges should have multi-dimensional manifestations, and that a prominent component of self-reported urges in drugs users not attempting abstinence should be a stated intention to engage in drug-use behavior that is strongly associated with desire to use drug.<sup>5</sup>

In spite of the theoretical and clinical importance attached to the concept of smoking urges and cravings, research in this area has been impeded by an absence of a questionnaire devoted to an assessment of self-reported smoking urges and cravings with demonstrated high reliability and content sufficiently broad to address the various conceptualizations of extant urge theories. Most researchers rely on only one of two face-valid items of unknown reliability when asking subjects about smoking urges.<sup>8,16-22</sup> Although longer questionnaires of smoking urges (i.e. five or six items) have been developed,<sup>3,23</sup> their utility is limited by their small validation samples (35 subjects in one case and 29 in the other), absence of information on their psychometric properties (e.g. reliability), and their content-limiting assumption that urges are a manifestation of a unidimensional motivational state.

In this study we describe the development and initial validation of a questionnaire of smoking urges and cravings designed to overcome major limitations of previous urge assessments. Items for the questionnaire were generated to represent four theoretically and clinically distinct conceptualizations of smoking urges:

- (1) desire to smoke;
- (2) anticipation of positive outcomes from smoking;
- (3) anticipation of relief from nicotine withdrawal or from withdrawal-associated negative affect;
- (4) intention to smoke.

The urge questionnaire was administered to 230 smokers instructed to abstain from smoking for 0, 1 or 6 hours prior to completing the assessment. (The manipulation of length of abstinence was intended to produce a wider range of responses on the urge questionnaire.) Data from the questionnaire were analysed with exploratory factor analyses in an attempt to help identify the basic structure of the verbal report of smoking urges. Assessments of variables that might be related to various components of reported smoking urges (e.g. smoking history, reported reasons for smoking, mood and

smoking withdrawal) were included in the study in order to aid in the interpretation of factors that emerged from the analysis.

## Methods and materials

### Subjects

The subjects, 230 cigarette smokers (141 men and 89 women) recruited through posters and newspaper advertisements, had to meet the following screening criteria: age 17 or older, currently smoking daily, and smoking daily for at least the past year. The average subject was 21.4 years old (range 17-64 years), smoked 22.3 cigarettes per day (range 3-50), had begun smoking at the age of 16 (range 10-25 years old), had been smoking regularly for 4.81 years (range 12 months to 42 years), and had made 1.33 attempts to quit smoking (range 0-5 attempts).

### Questionnaire development

An initial pool of 70 items was prepared by the two authors and two advanced graduate students working in the senior author's laboratory. The items were generated to represent four distinct conceptualizations of drug urges:

- (1) desire to smoke;
- (2) anticipation of immediate positive outcome from smoking;
- (3) anticipation of immediate relief from nicotine withdrawal or relief from negative affect;
- (4) intention to smoke.

Eight items from each of these four categories were selected from the initial item pool for the formation of the Questionnaire of Smoking Urges (QSU). Several criteria were used in the selection of the final items, including readability and clear association with only one of the four content categories. Fourteen of the 32 items were reverse keyed in order to reduce variance due to acquiescence.<sup>24</sup> In a preliminary evaluation of item characteristics, the QSU was included in a post-session assessment battery administered to 60 cigarette smokers participating in another study being conducted in our laboratory.<sup>25</sup> Based on results from this administration, one of the reverse-keyed items was rewritten to be keyed in the positive direction. When completing the QSU, subjects were asked to indicate on a Likert-type scale how strongly they agreed or disagreed with each statement on the questionnaire. Each item was scored on a scale of 1

Table 1. QSU items, grouped by content categories and associated factor loadings

| Item  | Loadings <sup>a</sup> |                    |
|---|-----------------------|--------------------|
|   | Factor 1              | Factor 2           |
| <i>Desire to smoke</i>  |                       |                    |
| 4. <sup>b</sup> I am not missing smoking right now <sup>c</sup>                   | 0.437 <sup>d</sup>    | 0.100              |
| 6. I don't want to smoke now <sup>c</sup>   | 0.546 <sup>d</sup>    | 0.072              |
| 13. All I want right now is a cigarette   | 0.139                 | 0.530 <sup>e</sup> |
| 17. I have no desire for a cigarette right now <sup>c</sup>                       | 0.663 <sup>d</sup>    | -0.040             |
| 18. My desire to smoke seems overpowering   | 0.145                 | 0.495 <sup>e</sup> |
| 20. I crave a cigarette right now   | 0.464 <sup>d</sup>    | 0.241              |
| 23. I have an urge for a cigarette  | 0.573 <sup>d</sup>    | 0.127              |
| 31. I need to smoke now   | 0.267                 | 0.408              |
| <i>Anticipation of positive outcome</i>   |                       |                    |
| 1. Smoking would make me feel very good right now                                 | 0.418                 | 0.240              |
| 3. Nothing would be better than smoking a cigarette right now                     | 0.068                 | 0.553 <sup>e</sup> |
| 11. Smoking a cigarette would not be pleasant <sup>c</sup>                        | 0.566 <sup>d</sup>    | -0.034             |
| 15. Smoking would make me happier now   | 0.283                 | 0.382              |
| 19. Smoking now would make things seem just perfect                               | 0.083                 | 0.526 <sup>e</sup> |
| 21. I would not enjoy a cigarette right now <sup>c</sup>                          | 0.477 <sup>d</sup>    | 0.031              |
| 22. A cigarette would not taste good right now <sup>c</sup>                       | 0.587 <sup>d</sup>    | -0.071             |
| 27. A cigarette would not be very satisfying now <sup>c</sup>                     | 0.542 <sup>d</sup>    | -0.008             |
| <i>Relief of withdrawal or negative affect</i>                                    |                       |                    |
| 2. I would be less irritable now if I could smoke                                 | 0.096                 | 0.511 <sup>e</sup> |
| 7. Smoking would make me less depressed   | -0.124                | 0.571 <sup>e</sup> |
| 8. Smoking would not help me calm down now <sup>c</sup>                           | 0.203                 | 0.127              |
| 12. If I were smoking this minute, I would feel less bored                        | -0.049                | 0.417 <sup>e</sup> |
| 14. Smoking right now would make me feel less tired                               | -0.064                | 0.516 <sup>e</sup> |
| 24. I could control things better right now if I could smoke                      | -0.028                | 0.649 <sup>e</sup> |
| 26. I would not feel better physically if I were smoking <sup>c</sup>             | 0.075                 | 0.145              |
| 29. If I were smoking now I could think more clearly                              | 0.057                 | 0.478 <sup>e</sup> |
| <i>Intention to smoke</i>   |                       |                    |
| 5. I will smoke as soon as I get the chance                                       | 0.533 <sup>d</sup>    | 0.097              |
| 9. If I were offered a cigarette, I would smoke it immediately                    | 0.486 <sup>d</sup>    | 0.127              |
| 10. Starting now, I could go without smoking for a long time <sup>c</sup>         | 0.299                 | 0.099              |
| 16. Even if it were possible, I probably wouldn't smoke now <sup>c</sup>          | 0.646 <sup>d</sup>    | -0.052             |
| 25. I am going to smoke as soon as possible                                       | 0.557 <sup>d</sup>    | 0.120              |
| 28. If I had a lit cigarette in my hand I probably wouldn't smoke it <sup>c</sup> | 0.457 <sup>d</sup>    | -0.081             |
| 30. I would do almost anything for a cigarette now                                | 0.064                 | 0.542 <sup>e</sup> |
| 32. Right now, I am not making plans to smoke <sup>c</sup>                        | 0.451 <sup>d</sup>    | 0.063              |

<sup>a</sup>Reference vector correlations; <sup>b</sup>item position on QSU; <sup>c</sup>reverse-keyed items; <sup>d</sup>items assigned to Factor 1 scale; <sup>e</sup>items assigned to Factor 2 scale.

(strongly disagree) to 7 (strongly agree). The 32 items of the QSU, grouped according to the four content categories, are shown in Table 1, column 1.

### *Procedure*

Subjects were screened initially through a brief telephone interview and those meeting the inclusion criteria were assigned to one of three abstinence conditions in which they were asked to refrain from smoking for 0 ( $n=80$ ), 1 ( $n=75$ ), or 6 hours ( $n=75$ ) prior to completing the QSU. Subjects in the 0-hour abstinence condition attended one session, and subjects in the 1- and 6-hour abstinence conditions attended two sessions with an interval of 1 or 6 hours, respectively, between sessions. At the beginning of session 1, an expired air carbon monoxide (CO) level was collected<sup>26</sup> using an Ecolyzer CO Analyzer. Subjects were then asked to smoke one cigarette of their own brand while they completed a Smoking History Form, which elicited demographic and smoking history information, and Reasons for Smoking Questionnaire (RFS).<sup>27</sup>

Fifteen minutes after the completion of their cigarettes, subjects in the 0-hour abstinence condition were administered a second set of questionnaires including the QSU, a Mood Form,<sup>28</sup> and the Withdrawal Symptoms Checklist (WSC).<sup>3</sup> (The Mood Form contains nine unipolar rating scales designed to assess the current intensity of positive and negative moods.) Subjects in the 0-hour abstinence condition were then paid \$7.00 for their participation.

Subjects assigned to the two abstinence conditions had their second session scheduled either 1 or 6 hours after they completed the first set of questionnaires. They were instructed to remain completely abstinent from cigarettes or any tobacco product over the intersession level and were told that any smoking would be detectable through CO analysis. When these subjects returned for their second session, a CO level was obtained and subjects were asked if they had smoked any cigarettes or used any form of tobacco over the intersession interval. No subject in either group reported any tobacco use. These reports were supported by an examination of the CO levels. Subjects then completed the QSU, the Mood Form, and the WSC. At the completion of the session these subjects were paid for their participation (\$10.00 for the 1-hour condition and \$13.00 for the 6-hour condition).

### *Data analyses*

The responses to the QSU items (with reverse-keyed items inverted) were subjected to exploratory factor analyses using principle axis extraction for factor determination<sup>29</sup> with squared multiple correlations as communality estimates. All variables exceeded the value of 0.90 on Kaiser's<sup>30</sup> measure of sampling adequacy, indicating the data were highly appropriate for the common factor model. Decisions regarding the number of factors to extract were based primarily on two considerations: eigen-values greater than one, and results of scree tests.<sup>31</sup> Retained factors were rotated obliquely to simple structure using the promax procedure.<sup>32</sup> Four separate analyses were conducted, one on each of the three abstinence conditions and one on the entire data set. Scores for factors extracted from the entire sample were estimated from the assignment of unit weights (0 or 1) to items based on loadings determined from the reference vector structure matrix. As an aid in the interpretation of factors, stepwise multiple regression<sup>33</sup> was used to relate the factor scores to other data collected in the study. Changes in factor scores and other relevant variables across the three abstinence conditions were evaluated with mixed-design analyses of variance (ANOVA).<sup>34</sup>

## **Results**

### *Subject characteristics*

Table 2 summarizes demographic characteristics, smoking history information and relevant questionnaire data for subjects in each of the three abstinence conditions. One-way ANOVA's on each variable revealed no significant differences across conditions,  $F$ 's (2,227)  $\leq 2.85$ ,  $p$ 's  $> 0.05$ .

### *QSU factor analyses*

Results of separate factor analyses on the three abstinence conditions indicated that a two-factor extraction represented the most adequate solution for each condition. Examinations of item loadings following rotation to simple structure revealed that the two factors in each condition were best defined by essentially the same two item sets, the major difference across the conditions being the order in which the two factors were extracted (i.e. what had been Factor 2 in the 0-hour and 1-hour conditions emerged as the first factor in the 6-hour condition). Moreover, the correlations between the rotated factors were highly similar across the three condi-

Table 2. Subject characteristics as a function of abstinence condition

|                                   | Abstinence condition |                  |                  |
|-----------------------------------|----------------------|------------------|------------------|
|                                   | 0-hour<br>(n=80)     | 1-hour<br>(n=75) | 6-hour<br>(n=75) |
| Age                               | 20.91                | 20.64            | 22.73            |
| Male/female                       | 50/30                | 44/31            | 47/28            |
| Cigarettes/day                    | 23.3                 | 21.28            | 22.36            |
| Months regular smoking            | 55.23                | 51.37            | 66.61            |
| Age began smoking                 | 15.96                | 15.65            | 16.28            |
| Minutes since last cigarette      | 66.19                | 55.53            | 76.30            |
| CO level <sup>a</sup> (session 1) | 12.10                | 15.69            | 13.45            |
| Quit attempts                     | 1.18                 | 1.49             | 1.32             |
| Quit confidence <sup>b</sup>      | 2.38                 | 2.74             | 2.48             |

<sup>a</sup>In ppm; <sup>b</sup>How confident are you that you could go the next year without smoking?, rated on a 5-point scale with 1=no confidence and 5=extremely confident.

tions. In light of the comparability of the three separate factor solutions, our description will focus on the results of the factor analysis conducted on the entire data set.

Analysis of the QSU data from the combined abstinence conditions indicated the presence of two non-trivial factors with eigen-values of 15.50 and 1.97 accounting for 78 and 10% of the item variance, respectively. Promax rotation of the extracted factors (with power=3) produced an excellent simple structure. Following rotation, the two factors displayed a sizable interfactor correlation of 0.66, indicating the presence of a second-order urge factor. Higher order analysis showed that the two primary factors loaded 0.81 on the second-order factor.

The item loadings for each primary factor, as indexed by the reference vector structure matrix, are shown in Table 1, columns 2 and 3. QSU subscales were formed for the factors by assigning each item to a scale if it loaded 0.40 or greater on a given factor and less than 0.25 on the other factor, and if the item's loadings for the two factors differed by at least 0.20. Using these criteria, a 15-item Factor 1 scale and an 11-item Factor 2 scale were identified. The reliabilities of these two subscales, as estimated by internal consistency, were exceptionally high: Factor 1=0.95, Factor 2=0.93. The intercorrelation of the two factor scales was 0.71.

The Factor 1 subscale was comprised of five items from the 'desire to smoke' category, 6 items from the 'intention to smoke' category, and 4 items from the 'anticipation of positive outcome' category. Thus, the semantic content of this scale seems to reflect a clear intention and desire to engage in

smoking behavior that is anticipated as pleasant, enjoyable and satisfying. The majority of the items for the Factor 2 subscale came from the 'relief of withdrawal or negative affect' category (6 items). The remaining items on this subscale came from the 'desire to smoke' and 'anticipation of positive outcome' categories (two items from each), and from the 'intention to smoke' category (one item). In contrast to Factor 1, Factor 2 seems to be oriented toward an anticipation of relief from negative affect through smoking. Furthermore, the urge condition described by Factor 2 items seems to be more urgent and overwhelming than the condition suggested by Factor 1 items. For example, the two 'desire to smoke' items associated with Factor 2 ('All I want right now is a cigarette' and 'My desire to smoke seems overpowering') and the single 'intention' category item assigned to this factor ('I would do almost anything for a cigarette now') convey a greater sense of exigency and imperative than do the items from these categories associated with Factor 1.

#### *Changes across abstinence*

The mean QSU factor scores for each of the three abstinence conditions are shown in Table 3. On average, Factor 1 scores were higher than Factor 2 scores across the three conditions. QSU scores for both factors tended to increase over the abstinence intervals with a somewhat greater increase in Factor 1 scores, relative to Factor 2 scores, in the abstinence interval from 0 to 1 hour. An ANOVA on these data showed significant main effects for abstinence condition  $F(2,227)=26.33, p<0.0001$ ,

**Table 3.** Mean QSU, WSC and mood form scores (and SEMs) for each abstinence condition

|                          | Abstinence condition |              |              |
|--------------------------|----------------------|--------------|--------------|
|                          | 0-hour               | 1-hour       | 6-hour       |
| QSU                      |                      |              |              |
| Factor 1                 | 4.17 (0.156)         | 5.37 (0.141) | 5.88 (0.117) |
| Factor 2                 | 2.99 (0.136)         | 3.40 (0.142) | 3.96 (0.167) |
| WSC <sup>a</sup>         |                      |              |              |
| Craving                  | 3.49 (0.133)         | 2.48 (0.134) | 2.10 (0.122) |
| Psychological discomfort | 3.95 (0.094)         | 3.45 (0.100) | 3.15 (0.110) |
| Physical symptoms        | 4.43 (0.130)         | 4.55 (0.146) | 4.70 (0.145) |
| Stimulation/sedation     | 3.10 (0.134)         | 3.07 (0.145) | 3.37 (0.174) |
| Appetite                 | 4.0 (0.137)          | 3.99 (0.130) | 3.74 (0.141) |
| Mood form <sup>b</sup>   |                      |              |              |
| Positive mood            | 2.89 (0.144)         | 2.88 (0.133) | 2.38 (0.156) |
| Negative mood            | 1.38 (0.133)         | 1.46 (0.142) | 1.66 (0.151) |

<sup>a</sup>Scored on a 7-point scale with lower scores indicating more intense symptoms with the exception of stimulation/sedation on which higher scores indicate greater sleepiness;

<sup>b</sup>scored on a 5-point scale with higher scores indicating more intense mood.

and QSU factors,  $F(1,227)=651.62$ ,  $p<0.0001$ , and a significant Abstinence Condition X QSU Factors interaction,  $F(2,227)=15.14$ ,  $p<0.0001$ . Newman-Keuls tests ( $p<0.05$ ) showed that each factor score displayed a significant increase with each increment in abstinence.

Table 3 also depicts the average withdrawal subscale scores for the WSC, and the average positive and negative mood scores from the Mood Form for each of the abstinence conditions. A multivariate analysis of variance on WSC scores revealed that only the Craving score and the Psychological Discomfort score showed significant differences as a function of abstinence,  $p's<0.0001$ . Subsequent Newman-Keuls tests showed that these scores decreased significantly with each increase in abstinence interval. Analyses of the mood scores showed no effect for abstinence interval on negative mood,  $F(2,227)=1.01$ ,  $p>0.30$ , but revealed a significant abstinence interval effect on positive mood,  $F(2,227)=4.05$ ,  $p<0.05$ , with subjects reporting significantly less positive mood in the 6-hour condition than in either the 0- or 1-hour condition (significant with Newman-Keuls tests at  $p<0.05$ ).

### Correlational analyses

The QSU Factor 1 subscale was correlated  $-0.90$  with the Craving subscale of Shiffman and Jarvik's<sup>3</sup> WSC. (More intense 'craving' on the WSC is indicated by a lower score). The extremely strong association between these two measures, almost to

the limit of their reliable variance [1], indicates that these scales are nearly isomorphic. The QSU Factor 2 subscale had a significantly lower correlation of  $-0.70$  with the Craving subscale, the  $F(1,227)$  for the difference  $=9.57$ ,  $p<0.0001$ , suggesting that the Factor 2 scale captures an aspect of smoking urges not clearly represented by the Craving scale of the WSC.

The two subscale scores of the QSU were averaged to form an approximation of the second-order QSU factor, and stepwise multiple regression analysis was used to regress this score on all non-urge measures collected in this study [2]. Abstinence-condition assignment was forced first into the model as a covariate so that results would not be redundant with the previous analyses of changes across abstinence conditions. Variables were then entered into the regression equation, with an entry criterion of  $p<0.01$ , in descending order of their partial correlation with the general urge score. This

[1] The reliability of the WSC craving subscale in this sample, as estimated by internal consistency, was 0.90.

[2] These variables included all demographic and smoking history measures, and scores from the Mood Form, WSC (excluding the Craving scale), and RFS. A factor analysis of the RFS in this sample (using the same factor-analytic strategy described for the QSU) replicated 6 of the 7 factors identified by Leventhal and Avis.<sup>27</sup> These were addiction, negative affect, social reward, fiddle, pleasure/taste and stimulation. Five additional, interpretable factors were identified in the 72 items of the RFS. Examinations of item loadings suggested that these might be labeled: social cue smoking, stereotyped pattern of smoking, hunger, boredom smoking and brand (i.e. smoking affected by brand available). Scales were derived for all 11 factors and these scale scores were used in all subsequent analyses with the RFS reported in this paper.

analysis showed that the Addiction score from the RFS  $sR^2=0.247$ ,  $F(1,227)=98.88$ ,  $p<0.0001$ , the Physical Symptoms scale from the WSC,  $sR^2=0.042$ ,  $F(1,226)=18.24$ ,  $p<0.0001$ , and the Boredom score from the RFS,  $sR^2=0.026$ ,  $F(1,225)=11.65$ ,  $p<0.001$ , were significant predictors of the QSU general score. Descriptively, this analysis suggested that higher general urge scores on the QSU were associated with a greater self-described tendency to feel uncomfortable or experience desires to smoke when cigarettes were unavailable, more palpitations and reported hand shakiness, and a greater self-reported tendency to smoke when bored.

In an effort to determine unique predictors of each QSU primary factor scale with the effects of the other factor scale and abstinence condition covaried out, regression analyses were conducted on each factor scale with these two variables forced first into the model. These analyses revealed that covariate-adjusted QSU Factor 1 scores were associated positively with a stereotyped smoking pattern as reported on the RFS,  $sR^2=0.031$ ,  $F(1,226)=18.50$ ,  $p<0.0001$ , and a report of being less sleepy on the Stimulation/Sedation scale of the WSC,  $sR^2=0.019$ ,  $F(1,225)=11.80$ ,  $p<0.001$ . The covariate-adjusted QSU Factor 2 scores were associated positively with a self-reported tendency on the RFS to smoke when experiencing negative affect,  $sR^2=0.062$ ,  $F(1,226)=32.77$ ,  $p<0.0001$ , greater sleepiness reported on the WSC,  $sR^2=0.037$ ,  $F(1,225)=21.51$ ,  $p<0.0001$ , and a self-reported tendency on the RFS to feel uncomfortable or experience desires to smoke when cigarettes were unavailable,  $sR^2=0.012$ ,  $F(1,224)=7.04$ ,  $p<0.01$ .

## Discussion

The analyses of the QSU items revealed two distinct, yet related, manifestations of verbal report of smoking urges that displayed a consistent structure across 0, 1 or 6 hours of cigarette deprivation. It was possible to identify discrete and highly reliable sets of items representative of each urge factor. The factor scales derived from these item sets indicated that urges of both types increased monotonically with cigarette deprivation, although Factor 1 urge report was consistently stronger than Factor 2 urge report [3].

The two manifestations of smoking urges could be discriminated on the basis of item content and scale correlates. An examination of the item categories contributing to the Factor 1 scale suggested that this manifestation of urges could be characterized by a desire to smoke; an anticipation that a cigarette would taste good and that smoking would be pleasant, enjoyable and satisfying; and intentions and plans to engage in smoking. Variables predictive of this scale, independent of the influence of the Factor 2 scale and level of smoke deprivation, indicated that stronger Factor 1 urges were associated with a self-described pattern of stereotyped smoking and lower levels of sleepiness during the session. Factor 2 urge items seemed to be characterized by an anticipation that smoking would relieve negative affect and fatigue, and allow for greater clarity of thinking and for an increased feeling of control. Items loading on the Factor 2 scale also conveyed a greater sense of urgency and single-minded devotion to smoking a cigarette than implied by Factor 1 items. Predictors of Factor 2 urges, with the influence of Type 1 urges and level of smoke deprivation covaried out, included a reported general tendency to smoke when experiencing negative affect, high levels of intrasession sleepiness, a self-described tendency to avoid situations where cigarettes were unavailable, and to experience urges and feel uncomfortable should such a situation arise.

One explanation for the QSU factor structure obtained in the present study is that it does not represent a substantive difference in urge report across the two factors, but instead, results from negative keying of certain of the items. Ten of the 15 items on the Factor 1 scale are negatively keyed, whereas all of the Factor 2 scale items are positively keyed. The interpretation of Factor 1 as a negatively-keyed artefact is questionable for several reasons. First, five of the Factor 1 scale items are positively keyed; if this factor were solely a consequence of negative keying, positively-keyed items should not have loaded on it. Secondly, the average loadings of these five positively-keyed items (0.527) was clearly not different from the average loadings of the ten negatively-keyed items on that factor (0.537), further suggesting that negative keying cannot be considered the predominant determinant of Factor 1. Thirdly, since the average loading of the five positively-keyed items of the Factor 1 scale is the same as the average loading of the positively-keyed items of the second factor scale (0.526), it would be possible to construct a Factor 1

[3] Rather than assigning descriptive labels to each Factor scale, we have opted to designate the urge states represented by each factor as Factor 1 and Factor 2. At this stage of research, descriptive labels may convey an overly simplistic understanding of the meaning of these manifestations of smoking urges.

scale, distinct from the Factor 2 scale, with the use of only positively-keyed items. Finally, the differential relationships of the QSU factor scales to other measures supports the argument that these two scales represent dimensions of urge report and are not merely a consequence of item keying. For example, Factor 1 seems to identify essentially the same dimension of urges represented by the Craving subscale of the WSC, whereas Factor 2 had a significantly lower association with the Craving subscale. It is noteworthy that four of the six items on the Craving subscale of the WSC are positively worded.

Although the two manifestations of smoking urges identified in this sample exhibit features of several conceptualizations of urges, the entire pattern of data is not wholly consistent with any single, conventional theory of drug urges and cravings. The semantic content and correlates of the Factor 2 scale appear to be concordant with general precepts of withdrawal-based models of urges and cravings, which posit that urges are closely associated with drug withdrawal and negative affect.<sup>7,9,10</sup> Urge theories that emphasize the appetitive or positively-reinforcing aspects of drugs of abuse in the genesis of urges and cravings<sup>5,11</sup> would seem to be compatible with the manifestation of smoking urges represented by the Factor 1 urge scale. The fact that both Factor 1 and Factor 2 urge manifestations co-exist in this sample suggests that conceptualizations that emphasize only drug appetitive effects or drug withdrawal and negative affect as critical in the generation of smoking urges may be incomplete.

An urge theory that does incorporate drug withdrawal and drug appetitive effects into a comprehensive model is the recent proposal of Baker *et al.*<sup>8</sup> that urges represent the operation of two distinct affective systems, one associated intimately with negative affect and withdrawal (negative affect urges) and one linked to the appetitive, positively-reinforcing effects of drugs (positive affect urges). Although the Factor 1 and Factor 2 scales might be identified as examples of, respectively, positive affect and negative affect smoking urges, one aspect of the present results provides a serious challenge to an application of the Baker *et al.*<sup>8</sup> model to our data. That model asserts that a fundamental feature of the two hypothesized urge systems is that they are mutually inhibitory, thus precluding the possibility that at a particular time an urge or craving would be a blend of both processes.<sup>8,35</sup> This proposal is incompatible with the

strong positive correlation between the two smoking urge factors identified in this study.

Another recent theory that describes drug urges as potentially having two distinct manifestations is Kozlowski and Wilkinson's<sup>4</sup> hypothesis that cravings and urges represent quantitatively and, perhaps, qualitatively different constructs. They have proposed that the term 'urge' be used to refer to the entire continuum of desire to use drugs, whereas 'craving', in line with dictionary definitions of the term, should be restricted to mean a separate state of particularly intense and urgent desire. Within this study, the semantic content of the Factor 2 urge scale seems closer to Kozlowski and Wilkinson's<sup>4</sup> concept of craving than the content of the Factor 1 scale, yet there is little evidence that the smokers distinguished between the terms urge and craving or reserved the term craving to designate a particularly intense desire to smoke. QSU items specific to urge and craving (i.e. items 23 and 20) were highly correlated ( $r=0.84$ ), and both loaded on the Factor 1, not the Factor 2, urge scale.

As anticipated by Tiffany,<sup>12</sup> the present results show that an urge questionnaire of diverse content permits the multi-dimensional aspects of the verbal report of urges to emerge. Furthermore, the data are consistent with the hypothesis proposed by Tiffany<sup>12</sup> that intention to smoke should be a major constituent of urge report, and that intention should be linked closely with descriptions of desire to smoke. It is important to note that this model does not predict that the QSU factor structure identified in this study will be invariant across all situations. In particular, the theory hypothesizes that, during attempts at abstinence, smokers will be more ambivalent about their intentions to smoke. Consequently, under those circumstances, intention items should be less clearly aligned with desire to smoke.

Over and above the theoretical implications of the present data, the QSU may be of value in investigations of the efficiency of nicotine replacement therapies for the treatment of cigarette smoking. Although several studies have shown that nicotine chewing gum may have some modest benefits in improving rates of abstinence and moderating many of the affective symptoms and physiological signs associated with nicotine withdrawal<sup>36,37</sup> there is very little evidence that this treatment has much consistent impact on self-reported urges and cravings to smoke.<sup>16,27,23,38,39</sup> Previous failures to find such evidence may be due, in part, to the use of urge assessments that have limited reliability and that address, predominantly, what we have identified as



Factor 1 urge manifestations. The QSU, by virtue of its high reliabilities and inclusion of a scale more closely linked to negative affect and nicotine withdrawal, offers a sensitive instrument for the detection of potential changes in urge report brought about by nicotine replacement therapies. Of course, as suggested above, the QSU factor structure may differ as a function of whether or not the smoker is attempting to quit. Consequently, QSU factor scales for smokers attempting to quit should be derived from such a sample.

The QSU may also be a useful instrument for examining the relationship between urge report and actual smoking behavior. In general, the associations typically found between self-reported urges and drug use have been substantially less than predicted by most models of drug urges and cravings.<sup>12</sup> This low association might be accounted for, in part, by the use of unreliable measures of urges, or the use of measures that do not capture all major components of urge report. The QSU, which overcomes these limitations of previous urge assessments, might provide a more accurate estimate of the relationship between facets of self-reported urges and smoking behavior.

Conclusions regarding the generality of the present QSU data must be tempered by the possibility that the factor structure of this item set or the relative strength of factor scales may differ as a function of both subject and situational variables. For example, subjects in this study were, on average, relatively young, light smokers. Older subjects smoking at higher rates for longer periods of time might configure their urge report differently or have stronger Factor 2 urge report. Actually, recent results from our laboratory using a sample ( $n=207$ ) of older, heavier smokers not attempting abstinence<sup>40</sup> indicate that the two-factor QSU structure is remarkably consistent. Although the order of factor extraction was reversed in this new sample, the pattern of item loadings was highly similar to that obtained in the present study, and Factor 1 urges remained stronger than Factor 2 urges.

In summary, the present results indicate that self-reported smoking urges in subjects not attempting to quit smoking can be characterized as having two different, yet related manifestations. These results are in contrast to most theoretical conceptualizations, which assume that, at any point in time, smoking urges are unidimensional states. In light of these findings, the typical practice of using only one or two items, or brief scales of homogeneous content, to assess smoking urges may be inadequate.

An evaluation of the generality of this urge structure across different populations of smokers or during periods of attempted abstinence, as well as an examination of the relationship between QSU factor scales and smoking behavior, will be an important focus for further research. The QSU offers a valuable new instrument for the comprehensive evaluation of the structure and function of smoking urges, and provides a model for the development of similar instruments for other types of drug urges.

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