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Which dimensions of impulsivity are related to cigarette craving?

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Abstract

Cigarette smoking is a very important health problem and represents the largest preventable risk factor for premature death in developed countries. A considerable body of research indicates that impulsivity is a central etiological concept in many theoretical models of tobacco addiction. The aim of this study is to analyse which dimensions of impulsivity are related to cigarette craving. To this end, 40 undergraduate psychology students were screened using the revised Questionnaire on Smoking Urges (QSU-12) and the French adaptation of the UPPS Impulsive Behavior Scale (UPPS). This scale identifies four distinct components associated with impulsive behaviour: urgency, lack of premeditation, lack of perseverance, and sensation seeking. The results showed that urgency is a significant predictor of tobacco cravings, while depression and anxiety are not.

Keywords: Cigarette; Smoking; Craving; Impulsivity; UPPS; QSU; Urgency; Inhibition

1. Introduction

Cigarette smoking is a very important health problem and represents the largest preventable risk factor for premature death in the developed countries (Bergen & Caporaso, 1999; Peto, Lopez, Boreham, Thun, & Heath, 1992). Cigarette smoking is extremely prevalent worldwide: several studies (e.g., Centers for Disease Control and Prevention, 1999) have revealed that about a quarter of all American adults smoke cigarettes, and smoking rates are higher in many other countries. In Switzerland, the country in which the current study was done, 31% of the population (26% of females and 36% of males) were smokers in 2002 (Office Fédéral de la Santé Publique, 2003). Moreover, since the diagnosis of nicotine dependence

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appeared in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1987), it has become the single most common psychiatric diagnosis in the United States (Bergen & Caporaso, 1999). Tobacco, as a major cause of cardiac disease, vascular disease, pulmonary disease, and a variety of cancers, was responsible for 1 out of 10 deaths in the entire world in 2000 (Burnand & Cornuz, 2005).Through his research, Lopez (1997) estimated that about eight million people will die from smoking-related illnesses by 2020, compared to three million people in 1996. It is therefore obvious that cigarette smoking is a plague resulting in growing human and economic costs and is one of the most important public health problems we will have to deal with in the years to come.

Cigarette smoking is now viewed as a complex bio-psycho-social problem (e.g., Baker, Brandon, & Chassin, 2004; Bergen & Caporaso, 1999). With regard to the biological aspects, evidence of genetic determinants affecting the smoking phenotype has been demonstrated (e.g., Straub et al., 1999) and addiction to nicotine has been established as the psychopharmacological cause that maintains smoking behaviours (e.g., United States Department of Health and Human Services, 1988). As for the social aspects, it has been proven that certain demographic factors such as male gender, young age, low socioeconomic status and low educational level are positively related to cigarette smoking (e.g., Bergen & Caporaso, 1999; Escobedo, Anda, Smith, Remington, & Mast, 1990; Zhu, Giovino, Mowery, & Eriksen, 1996). In addition, certain social and/or contextual influences play a role (e.g., peer smoking: Conrad, Flay, & Hill, 1992; Derzon & Lipsey, 1999).

With regard to the psychological correlates of cigarette smoking, tobacco dependence must be considered as a prototypical addictive disorder which manifests classic characteristics such as tolerance, withdrawal, and use despite high personal costs (Baker et al., 2004). Extracting potential predictors from the literature, it appears that impulsivity (reflecting sensation seeking, behavioural under-control, and disorders of impulse control) has traditionally been a central etiological concept in many theoretical models of substance abuse (e.g., Acton, 2003; Finn, Bobova, Wehner, Fargo, & Rickert, 2005; Johnson, Malow, Corrigan, & West, 1993; Miller, Flory, Lynam, & Leukefeld, 2003; Moeller et al., 2001b; Tcheremissine, Lane, Cherek, & Pietras, 2003; Whiteside & Lynam, 2003; Zuckerman, Ball, & Black, 1990). More specifically, it has frequently been associated with cigarette smoking (e.g., Dinn, Aycicegi, & Harris, 2004; Doran, Spring, McChargue, Pergadia, & Richmond, 2004; Granö, Virtanen, Vahtera, Elovainio, & Kivimäki, 2004; Johnson et al., 1993; Mitchell, 1999; Reuter & Netter, 2001; Whiteside & Lynam, 2003). In addition, several studies show that attention-deficit/hyperactivity disorder (ADHD) symptoms, which have been associated with increased impulsivity (e.g., Halperin et al., 1988; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001a), are related to tobacco use in adolescents (Aytaclar, Tarter, Kirisci, & Lu, 1999) and young adults (Kollins, McClernon, & Fuemmeler, 2005). To sum up, the data as a whole make it clear that smokers have more difficulties controlling impulses than non-smokers, and that sensation seeking may increase the probability of starting to smoke, rather than dependence on cigarette smoking.

However, the concept of impulsivity comprises a heterogeneous cluster of lower-order components (Depue & Collins, 1999), which must be distinguished. Recently, Whiteside and Lynam (2001) revealed impulsivity to be a multi-faceted concept by identifying four separate components associated with impulsive behaviours; these served as the basis for the creation of a scale called the UPPS Impulsive Behavior Scale (UPPS). The four facets of impulsivity measured by the UPPS are: (1) urgency, defined as 'the tendency to experience strong impulses, frequently under conditions of negative affect'; (2) premeditation, defined as 'the tendency to think and reflect on the consequences of an act before engaging in the act'; (3) perseverance, defined as 'the ability to remain focused on a task that may be boring or difficult'; (4) sensation seeking, defined as 'a tendency to enjoy and pursue

activities that are exciting, and openness for new experiences'. Several studies, based on Whiteside and Lynam's works on impulsivity, have established a relationship between certain facets of impulsivity and some psychopathological states. A recent study of bulimia nervosa (Claes, Vandereycken, & Vertommen, 2005) revealed that bulimic symptoms (such as vomiting) are positively related more to urgency and less to premeditation and perseverance. Another study (Lynam & Miller, 2004) showed that lack of premeditation and sensation seeking are related to self-reports of deviance (conduct problems, heavy alcohol consumption, use of marijuana, and harder drugs) in an undergraduate student sample. Along the same lines, Whiteside and Lynam (2003) suggested that urgency and sensation seeking are the impulsive-behaviour-related traits most strongly associated with alcohol abuse. A further example is a study done by Miller et al. (2003), which demonstrated that lack of premeditation is the most consistent dimension of impulsivity associated with externalising behaviours (antisocial personality disorder, psychopathy, and a variety of delinquent acts), and that sensation seeking is a significant predictor of involvement in delinquent acts, drug and alcohol use, and risky sexual behaviour.

This research will explore the relationship between the components of impulsivity and a key concept of cigarette dependence: the construct of craving. According to Tiffany (1990), drug cravings are subjective motivational states thought to encourage compulsive drug self-administration, hinder efforts to achieve abstinence and cause a relapse following sustained drug abstinence. Some authors restrict the concept of craving as meaning a strong desire for a specific substance (e.g., Brandon, Wetter, & Baker, 1996; Kozlowski, Phillitteri, Sweeney, Whitfield, & Graham, 1996), but an alternative conception leans towards a broader definition, which considers the anticipation of the consequences of drug use, intentions to use drugs, and drug-related cognitions and affects as dimensions characterising craving states (Cepeda-Benito, Gleaves, Williams, & Erath, 2000; Cepeda-Benito, Henry, Gleaves, & Fernandez, 2004; Tiffany & Drobes, 1991). From this perspective, Tiffany and Drobes (1991) developed the Questionnaire of Smoking Urges (QSU-32), which assesses two different dimensions of cigarette craving. The first factor primarily reflects intention and desire to smoke and anticipation of pleasure from smoking. The second factor comprises anticipation of relief from negative affect and nicotine withdrawal, and an urgent and overwhelming desire to smoke. However, a recent study (Toll, McKee, Krishnan-Sarin, & O'Malley, 2004) showed that a two-factor model composed of 12 of the original items fit the data better than the original 32-item questionnaire, while reflecting the same dimensions highlighted by Tiffany and Drobes (1991). Moreover, the original QSU-32 and other shorter versions of the questionnaire have successfully reported craving changes in a wide variety of studies (e.g., Burton & Tiffany, 1997; Conklin, Tiffany, & Vrana, 2000; Robinson, Houstmuller, Moolchan, & Pickworth, 2000; Teneggi et al., 2002).

Considering the findings of previous research, the aim of the present study is to determine which facets of impulsivity are associated with cigarette craving. In our opinion, the desire to smoke scale of the QSU could possibly be associated with sensation seeking, given that the desire to smoke may be influenced by the anticipation of pleasure and agreeable sensations resulting from tobacco use. In addition, it could be supposed that lack of perseverance, which may result in more difficulties inhibiting irrelevant thoughts or memories (Bechara & Van der Linden, 2005), may increase potential occasions to experience thoughts concerning cigarette smoking, resulting in an increasing urge to smoke. We also hypothesised a relationship between urgency, which could be related to the inability to suppress dominant or automatic responses (Bechara & Van der Linden, 2005), and the negative affect scale of the QSU (including anticipation of relief from nicotine withdrawal). Finally, we did not expect to find a relation between craving and lack of premeditation. Indeed, we postulated that lack of premeditation, which here reflects

the tendency to ignore the negative long-term consequences of cigarette smoking, should be connected to cigarette use rather than directly to tobacco craving.

2. Methods

2.1. Participants

A total of 134 undergraduate psychology students at the University of Geneva (117 females and 17 males) took part in the study (the gender imbalance is due to the small number of male students in the psychology department at the University of Geneva). All participants filled out some questionnaires to get a course credit. Not all of the questionnaires fit into the framework of this study. However, data related to other questionnaires will be presented in other studies (e.g., Billieux, Van der Linden, d'Acremont, Ceschi, & Zermatten, in press).

2.2. Procedure

All participants were screened using the French version of the UPPS Impulsive Behavior Scale (Van der Linden et al., 2006), a French adaptation of the revised Questionnaire on Smoking Urges (QSU-12: Toll et al., 2004), Beck's Depression Inventory (BDI-2: Beck, Steer, & Brown, 1998), and the State Anxiety Inventory (STAI-S: Spielberger, 1993).

The proportion of smokers at the time of testing was 29.85% (33 females and 7 males) of the entire sample. Consequently, our final sample is composed of 40 students, aged from 19 to 48 years (M=25.08, S.D.=7.3). In addition, all participants in the study were asked how many cigarettes they smoked per week before they completed the QSU-12. In our final sample of 40 smokers, 17.5% of them smoke fewer than five cigarettes per week, 25% smoke between 5 and 20 cigarettes per week, and 57.5% smoke more than 20 cigarettes per week. Consequently, it is important to bear in mind that this study was done on light to moderate smokers. Nevertheless, several studies have highlighted tobacco dependence symptoms in light smokers (e.g., Soresi, Catalano, Spatafora, Bonsignore, & Bellia, 2005), implying that our sample is appropriate to study craving correlates.

2.3. Questionnaires

2.3.1. UPPS Impulsive Behavior Scale (UPPS)

The French version of the UPPS Impulsive Behavior Scale (Van der Linden et al., 2006), translated from Whiteside and Lynam (2001), consists of 45 items that evaluate four different facets of impulsivity, labelled urgency (12 items), (lack of) premeditation (11 items), (lack of) perseverance (10 items), and sensation seeking (12 items). Items of the scale are scored from 1 to 4, with 1='I agree strongly', 2='I agree somewhat', 3='I disagree somewhat', and 4='I disagree strongly'. Some items are reversed such that a high score reveals an impulsive personality trait.

2.3.2. The revised Questionnaire on Smoking Urges (QSU-12)

The revised version of the Questionnaire on Smoking Urges (Toll et al., 2004), which consists of 12 items evaluating urges for cigarettes, covers two distinct factors: the first factor reflects the intention and

desire to smoke ('desire to smoke scale': 5 items) and the second factor reflects the relief from withdrawal or negative affect ('negative affect scale': 7 items). In order to use the QSU-12 in French, we selected the corresponding 12 items of the French validation of the original 32-item Questionnaire on Smoking Urges (Guillin, Krebs, Bourdel, Olie, & Poirier, 2000). An exploratory factor analysis of the 12 items retained, conducted on the 40 participants in the current study, suggested a two-factor structure, which accounted for 71.43% of the variance, and the maximum loading was found on the correct factor for each item of the French validation of the QSU-32 (Guillin et al., 2000). Items of the scale are scored from 1 'I disagree strongly' to 7 'I agree strongly'. Some items are reversed such that a high score reveals high smoking urges.

2.3.3. The Beck's Depression Inventory (BDI-2)

The French version of Beck's Depression Inventory (Beck et al., 1998) consists of 21 items to assess the intensity of depression in clinical and normal individuals. Each item is a list of four statements about a particular symptom of depression arranged in order of increasing severity; high scores suggest intense depression.

2.3.4. The State Anxiety Inventory (STAI-S)

The French version of the State Anxiety Inventory (Spielberger, 1993) consists of 20 items that ask how a person feels at the time of testing and reflects situational factors that may influence anxiety levels. Items on the scale are scored from 1 = 'not at all' to 4 = 'very much so', with high scores representing high anxiety. Some items are reversed such that a high score reveals high anxiety.

The reliability coefficients (Cronbach's α) of the questionnaires used were high, for the impulsivity scale (UPPS-urgency: 0.89, UPPS-lack of premeditation: 0.82, UPPS-lack of perseverance: 0.80, UPPS-sensation seeking: 0.85), the smoking urges scale (QSU-12-desire to smoke: 0.90, QSU-12-negative affect: 0.87), the depression scale (BDI-2: 0.87), and the anxiety scale (STAI-S: 0.96), which confirms the questionnaires' good internal validity.

3. Results

The scores for the UPPS, the QSU-12, the BDI-2, and the STAI-S are summarised in Table 1.

Table 1
Means and S.D.s for the sample of smokers

	M	S.D.
BDI-2	12.68	8.01
STAI-S	47.05	13.85
UPPS-urgency	30.25	6.78
UPPS-lack of premeditation	23.38	5.05
UPPS-lack of perseverance	20.78	4.44
UPPS-sensation seeking	29.55	6.72
QSU-12-total	32.38	14.77
QSU-12-intention and desire to smoke	18.83	9.10
QSU-12-relief from negative affect	13.55	7.23

Table 2
Pearson correlations between questionnaires (within their 95% CI)

	URG	PREM	PERS	SS	QSU-I	QSU-R
URG						
PREM	.36[a] (.05, .60)					
PERS	.27 (−.05, .54)	.27 (−.05, .54)				
SS	.06 (−.26, .36)	.30 (−.01, .56)	.22 (−.10, .50)			
QSU-I	.28 (−.03, .54)	−.15 (−.44, .17)	.16 (−.16, .45)	−.02 (−.33, .29)		
QSU-R	.41[a] (.11, .64)	.06 (−.26, .36)	.25 (−.07, .52)	.18 (−.14, .47)	.63[a] (.40, .79)	
BDI-2	.41[a] (.11, .64)	.05 (−.27, .36)	.19 (−.13, .47)	−.19 (−.47, .13)	−.09 (−.39, .23)	−.04 (−.35, .27)
STAI-S	.55[a] (.29, .74)	.05 (−.27, .36)	.18 (−.14, .47)	−.05 (−.36, .27)	.10 (−.22, .40)	.22 (−.10, .50)

URG = UPPS-urgency, PREM = UPPS-lack of premeditation, PERS = UPPS-lack of perseverance, SS = UPPS-sensation seeking, QSU-I = QSU-12-intention and desire to smoke, QSU-R = QSU-12-relief from negative affect, BDI-2 = total score on the BDI-2, STAI-S = total score on the STAI-S.
[a] 0 not included in the 95% confidence interval.

As can be seen in Table 2, correlations were done between the four components of impulsivity (UPPS) and the questionnaires on smoking urges (QSU-12), depression (BDI-2), and anxiety (STAI-S). However, confirming or rejecting hypotheses based on *p*-value has been shown to be problematic because *p*-value depends on both effect size and sample size. Thus, following suggestions by several authors (e.g., Schmidt, 1996), effect sizes were reported within their 95% confidence interval (CI) and used to interpret results. Firstly, a correlation appeared between the urgency component and the relief from withdrawal or negative affect, $r = .41^*$, CI = (.11, .64), which could be considered as a moderate effect (Cohen, 1988). However, there is no relation between the QSU-12 and the other facets of the UPPS (see Table 2). A significant correlation was also observed between urgency and the total score on the BDI-2, $r = .41^*$, CI = (.11, .64), and with the total score on the STAI-S, $r = .55^*$, CI = (.29, .74).

A regression analysis was then performed in order to find out which dimension of impulsivity best predicts tobacco craving. A regression analysis allows one to highlight the relative importance of each predictor and determine the specific effect of each one because it takes into account the relations between the various predictors entered in the regression. We therefore computed a linear regression using as dependent variable the only factor of the QSU-12 which correlates with impulsivity: the relief from

Table 3
Relief from negative affect regressed on the UPPS scale, the STAI-S and the BDI-2

Scale	*B*	S.E.	*t*	P-values	*β*	Part
(Intercept)	−6.51	7.60	−0.86	.40	–	
UPPS-urgency	0.45	0.20	2.19	.04	.42*	.32
STAI-S	0.17	0.13	1.32	.19	.33	.19
UPPS-lack of perseverance	0.30	0.26	1.18	.25	.19	.17
UPPS-sensation seeking	0.10	0.17	0.56	.58	.09	.08
UPPS-lack of premeditation	−0.23	0.24	−0.95	.35	−.16	−.14
BDI-2	−0.43	0.21	−2.03	.05	−.48	−.29

Predictors are listed in decreasing order of importance (based on absolute *t*-value).
Part = semi-partial correlations.
* $p < .05$.

withdrawal or negative affect (factor 2 of the QSU-12). Depression and anxiety were also entered in order to control for the possibility that craving can be attributed to impulsive attitudes rather than to a depressive or anxious state. Exploration of the residuals suggested that they were normally distributed. Absolute t-values were used to determine the relative importance of each variable (Howell, 1998). Starting with the most important predictor, the regression revealed the following order: urgency, $t(33)=2.191$, $p=.04$; anxiety, $t(33)=1.32$, $p=.19$; lack of perseverance, $t(33)=1.18$, $p=.25$; sensation seeking, $t(33)=0.56$, $p=.58$; lack of premeditation, $t(33)=-0.95$, $p=.35$; and depression, $t(33)=-2.03$, $p=.05$. Thus, urgency is the only component of impulsivity that significantly predicts an increase in the relief from withdrawal or negative affect. The regression analysis is reported in Table 3.

4. Discussion

The aim of this study was to identify which facets of impulsivity are associated with cigarette craving. The main result of the study may be summarised as follows: correlation analysis revealed that urgency is positively correlated with relief from withdrawal or negative affect (negative affect scale of the QSU-12). Moreover, a regression analysis showed that urgency is the only significant predictor of tobacco craving. However, there is no significant correlation between the intention and desire to smoke (desire to smoke scale of the QSU-12) and the various components of impulsivity.

According to Whiteside and Lynam (2001), urgency refers to the tendency to feel strong impulses, usually in a context of negative affect. Bechara and Van der Linden (2005), who wanted to examine the cognitive mechanisms underlying urgency, tentatively suggested that this component of impulsivity may be related to the ability to deliberately suppress dominant, automatic, or prepotent responses. Thus, it could be supposed that poor response inhibition capacities may be related to a high urgency level. From this perspective, urgency, as defined by Whiteside and Lynam, has also been associated with alcohol abuse (Whiteside & Lynam, 2003). In Whiteside and Lynam's view, alcoholics find it more difficult to resist strong impulses, which results in harmful behaviours that relieve negative affect in the short-term but have detrimental long-term consequences. Therefore, inhibition difficulties are supposed to be related to alcoholics' inability to prevent themselves from drinking. In addition, recent studies have directly emphasised both the inhibition difficulties of cigarette smokers (Spinnella, 2002), and the predictive value of impaired executive functioning in childhood (including impaired ability to inhibit responses) for tobacco use in early adolescence (Aytaclar et al., 1999).

Thus, it may be hypothesised that smokers with a high level of urgency and the related inhibition difficulties will have problems not smoking, especially in conditions of negative affect. Indeed, keeping in mind that negative affect for smokers is related to nicotine withdrawal (Tiffany & Drobes, 1991), we made the assumption that urgency is associated for smokers, as for alcoholics, with an overwhelming desire to smoke to provide for their need for relief from negative affect as soon as possible.

It is now important to analyse the absence of the hypothesised relations between intention and desire to smoke (desire to smoke scale of the QSU-12) and two components of impulsivity: sensation seeking and lack of perseverance. According to the literature, sensation seeking is more likely to play a role in initiating smoking rather than in tobacco dependence (e.g., Bergen & Caporaso, 1999). Thus, it may be hypothesised that sensation seeking-related aspects of cigarette smoking are rapidly replaced by addiction symptoms such as tolerance and withdrawal, which are responsible for craving. In other words, regular smokers experience craving states because of withdrawal symptoms rather than pleasure and tobacco-

related sensations, which may explain the absence of any relation between craving and sensation seeking. Concerning lack of perseverance, the postulated relationship between intention and desire to smoke and the occurrence of smoking-related irrelevant thoughts was not found. We tentatively suggest that in craving states, physiological, and psychological correlates of nicotine withdrawal (e.g., strong impulses to reduce negative affect) are much greater than the potential influence of smoking-related thoughts. However, it could be supposed that lack of perseverance may play a role in the early stages of cigarette smoking in certain cases (when withdrawal symptoms are weak), by increasing the frequency of smoking-related intrusive thoughts likely to lead to tobacco use.

We also have to discuss the absence of any correlation between cigarette craving and the premeditation component of impulsivity. It is well known that cigarette smoking is very dangerous for one's health; in fact, it can be considered as a prototypical behaviour involving negative long-term consequences. From this perspective, Miller et al. (2003) recently showed that lack of premeditation, defined as the tendency to reflect on the consequences of an action before engaging in it, is an important predictor of cigarette smoking. However, we suppose that a scale focusing specifically on cigarette craving at the present time (such as the QSU) cannot pay much attention to the possible long-term consequences of tobacco use, which may explain why lack of premeditation is not related to cigarette craving in this study.

Finally, even though it is not the focus of our study, we think it is important to discuss whether impulsivity distinguishes smokers from non-smokers. More specifically, several studies have shown that high sensation seeking and low premeditation are related to cigarette use (e.g., Miller et al., 2003; Zuckerman et al., 1990). However, using logistic regression suitable for dichotomic dependent variables (in our case, the fact of smoking or of not smoking), we did not find any predictive relation between the various facets of impulsivity and tobacco use.[1] Nevertheless, this result could be due to the fact that, on one hand, our sample is relatively small and, on the other hand, the participants are light to moderate smokers. Indeed, 17.5% of the sample smokes fewer than five cigarettes per week, which could make it problematic to consider them either as smokers or as non-smokers.

Further studies are required to explore more systematically the assumptions arising from the results obtained here. More specifically, it is very important to explore the cognitive mechanisms underlying the urgency component of impulsivity, bearing in mind the fact that craving is the first cause of relapses with cigarette smoking (Baker, Sherman, & Morse, 1987; Niaura, Abrams, Demuth, Pinto, & Monti, 1989; Niaura et al., 1988; Shiffman & Jarvik, 1976). Thus, it remains to explore the influence of urgency on inhibition capacities by administering prepotent response inhibition tasks (e.g., antisaccade, Go/No Go). In addition, taking into account the fact that the urgency component of impulsivity may imply strong impulses in general, as well as in a context of negative affect,[2] analysing prepotent response inhibition capacities in both neutral and negative affect contexts could be a relevant way to explore the relations between inhibition capacities and emotional states.

To conclude, this research must be considered as a contribution to the body of studies aiming at an understanding of the psychological factors leading to tobacco dependence. It is important to remember that influences on smoking are diverse and involve biological, cognitive, and social aspects. This

[1] The logistic regression was done on the entire sample (N=134).

[2] About 50% of Urgency items of the UPPS impulsive scale represent feeling strong impulses in general and the other 50% represent strong impulses in the context of negative affect.

complexity supports a multidisciplinary approach, so that we will be able to better target prevention actions and policies.

References

Acton, G. S. (2003). Measurement of impulsivity in a hierarchical model of personality traits: Implications for substance use. *Substance Use and Misuse*, *38*(1), 67−83.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders III-R.* Washington, DC: American Psychiatric Association.

Aytaclar, S., Tarter, R. E., Kirisci, L., & Lu, S. (1999). Association between hyperactivity and executive functioning in childhood and substance use in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 172−178.

Baker, T. B., Sherman, J. E., & Morse, E. (1987). The motivation to use drugs: A psychobiological analysis of urges. In C. Rivers (Ed.), *The Nebraska symposium on motivation: Alcohol use and abuse* (pp. 257−323). Lincoln, NE: University of Nebraska Press.

Baker, T. B., Brandon, T. H., & Chassin, L. (2004). Motivational influences on cigarette smoking. *Annual Review of Psychology*, *55*, 463−491.

Bechara, A., & Van der Linden, M. (2005). Decision-making and impulse control after frontal lobe injuries. *Current Opinion in Neurology*, *18*, 734−739.

Beck, A. T., Steer, R. A., & Brown, G. K. (1998). *Inventaire de dépression de Beck-2ème édition (BDI-2).* Paris: Editions du Centre de Psychologie Appliquée (ECPA).

Bergen, A. W., & Caporaso, N. (1999). Cigarette smoking. *Journal of the National Cancer Institute*, *91*(16), 1365−1375.

Billieux, J., Van der Linden, M., d'Acremont, M., Ceschi, G., & Zermatten, A. (in press). Does impulsivity relate to perceived dependence on and actual use of the mobile phone? *Applied Cognitive Psychology.*

Brandon, T. H., Wetter, D. W., & Baker, T. B. (1996). Affect, expectancies, urges, and smoking: Do they conform to models of drug motivation and relapse? *Experimental and Clinical Psychopharmacology*, *4*, 29−36.

Burnand, B., & Cornuz, J. (2005). *Tabac: Causalité, survie, interprétation de données.* Cours de médecine sociale et préventive 4ème année. Retrieved on October 28, 2005, from the Institut universitaire de Médecine sociale et préventive (IUMSP) website: http://www.Iumsp.Ch/enseignement/pregradue/doc6/msp4tabac.Pdf

Burton, S. M., & Tiffany, S. T. (1997). The effect of alcohol consumption on craving to smoke. *Addiction*, *92*, 15−26.

Centers for Disease Control and Prevention (CDC) (1999). Cigarette smoking among adults. *The Journal of the American Medical Association*, *286*(22), 2802−2804.

Cepeda-Benito, A., Gleaves, D. H., Williams, T. L., & Erath, S. T. (2000). The development and validation of the state and trait food cravings questionnaires. *Behavior Therapy*, *31*, 151−173.

Cepeda-Benito, A., Henry, K., Gleaves, D. H., & Fernandez, M. C. (2004). Cross-cultural investigation of the Questionnaire of Smoking Urges in American and Spanish smokers. *Assessment*, *11*(2), 152−159.

Claes, L., Vandereycken, W., & Vertommen, H. (2005). Impulsivity-related traits in eating disorder patients. *Personality and Individual Differences*, *39*(4), 739−749.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Hillsdale, NJ: Erlbaum.

Conklin, C. A., Tiffany, S. T., & Vrana, S. R. (2000). The impact of imagining completed versus interrupted smoking on cigarette craving. *Experimental and Clinical Psychopharmacology*, *8*, 68−74.

Conrad, K., Flay, B., & Hill, D. (1992). Why children start smoking cigarettes: Predictors of onset. *British Journal of Addiction*, *87*, 1711−1724.

Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality: Dopamine, facilitation of incentive motivation, and extraversion. *Behavioral and Brain Science*, *22*, 491−569.

Derzon, J., & Lipsey, M. (1999). Predicting tobacco use to age 18: A synthesis of longitudinal research. *Addiction*, *94*, 995−1006.

Dinn, W. M., Aycicegi, A., & Harris, C. L. (2004). Cigarette smoking in a student sample: Neurocognitive and clinical correlates. *Addictive Behaviors*, *29*, 107−126.

Doran, N., Spring, B., McChargue, D., Pergadia, M., & Richmond, M. (2004). Impulsivity and smoking relapse. *Nicotine and Tobacco Research*, *6*(4), 641−647.

Escobedo, L. G., Anda, R. F., Smith, P. F., Remington, P. L., & Mast, E. E. (1990). Sociodemographic characteristics of cigarette smoking initiation in the United States. Implications for smoking prevention policy. *The Journal of the American Medical Association*, *264*, 1550−1555.

Finn, P. R., Bobova, L., Wehner, E., Fargo, S., & Rickert, M. E. (2005). Alcohol expectancies, conduct disorder and early-onset alcoholism: Negative alcohol expectancies are associated with less drinking in non-impulsive versus impulsive subjects. *Addiction*, *100*, 953−962.

Granö, N., Virtanen, M., Vahtera, J., Elovainio, M., & Kivimäki, M. (2004). Impulsivity as a predictor of smoking and alcohol consumption. *Personality and Individual Differences*, *37*, 1693−1700.

Guillin, O., Krebs, M. O., Bourdel, J. P., Olie, J. P., & Poirier, M. F. (2000). Validation de la traduction française et de la structure factorielle du questionnaire sur l'urgence à fumer de Tiffany et Drobes (QSU). *L'Encéphale*, *26*, 27−31.

Halperin, J. M., Wolf, L. E., Pascualvaca, D. M., Newcorn, J. H., Healey, J. M., O'Brien, J. D., et al. (1988). Differential assessment of attention and impulsivity in children. *Journal of the American Academy of Child and Adolescent Psychiatry*, *27*, 326−329.

Howell, D. (1998). *Méthodes statistiques en sciences humaines.* Paris: De Boeck Université.

Johnson, W. L., Malow, R. M., Corrigan, S. A., & West, J. A. (1993). Impulsive behavior and substance abuse. In W. G. McCown, J. L. Johnson, & M. B. Shure (Eds.), *The impulsive client: Theory, research and treatment* (pp. 225−246). Washington, DC: American Psychological Association.

Kollins, S. H., McClernon, F. J., & Fuemmeler, B. F. (2005). Association between smoking and attention-deficit/hyperactivity disorder symptoms in a population-based sample of young adults. *Archive of General Psychiatry*, *62*, 1142−1147.

Kozlowski, L. T., Phillitteri, J. L., Sweeney, C. T., Whitfield, K. E., & Graham, J. W. (1996). Asking questions about urges or cravings for cigarettes. *Psychology of Addictive Behaviors*, *10*(4), 248−260.

Lopez, A.D. (1997). *Tobacco is unique in its killing ability.* Paper presented at the Smokefree Europe: Conference on Tobacco or Health, Helsinki.

Lynam, D. R., & Miller, J. D. (2004). Personality pathways to impulsive behavior and their relations to deviance: Results from three samples. *Journal of Quantitative Criminology*, *20*(4), 319−341.

Miller, J., Flory, K., Lynam, D. R., & Leukefeld, C. (2003). A test of the four-factor model of impulsivity-related traits. *Personality and Individual Differences*, *34*, 1403−1418.

Mitchell, S. H. (1999). Measures of impulsivity in cigarette smokers and non-smokers. *Psychopharmacology*, *146*, 455−464.

Moeller, F. G., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. *American Journal of Psychiatry*, *158*(11), 1783−1793.

Moeller, F. G., Dougherty, D. M., Barratt, E. S., Schmitz, J. M., Swann, A. C., & Grabowski, J. (2001). The impact of impulsivity on cocaine use and retention in treatment. *Journal of Substance Abuse Treatment*, *21*(4), 193−198.

Niaura, R. S., Rohsenow, D. J., Binkoff, J. A., Monti, P. M., Pedraza, M., & Abrams, D. B. (1988). Relevance of cue reactivity to understanding alcohol and smoking relapse. *Journal of Abnormal Psychology*, *97*(2), 133−152.

Niaura, R., Abrams, D., Demuth, B., Pinto, R., & Monti, P. (1989). Responses to smoking-related stimuli and early relapse to smoking. *Addictive Behaviors*, *14*(4), 419−428.

Office Fédéral de la Santé Publique (2003). Enquête suisse sur le tabagisme. Retrieved on October 28, 2005, from Office Fédéral de la Santé Publique (OFSP) website: http://www.Suchtundaids.Bag.Admin.Ch/themen/sucht/tabak/zahlen_fakten/index.Html

Peto, R., Lopez, A. D., Boreham, J., Thun, M., & Heath, C. J. (1992). Mortality from tobacco in developed countries: Indirect estimation from national vital statistics. *The Lancet*, *339*(8804), 1268−1278.

Reuter, M., & Netter, P. (2001). The influence of personality on nicotine craving: A hierarchical multivariate statistical prediction model. *Neuropsychobiology*, *44*, 47−53.

Robinson, M. L., Houstmuller, E. J., Moolchan, E. T., & Pickworth, W. B. (2000). Placebo cigarettes in smoking research. *Experimental and Clinical Psychopharmacology*, *8*, 326−332.

Schmidt, F. L. (1996). Statistical significance testing and cumulative knowledge in psychology: Implications for training of researchers. *Psychological Methods*, *1*, 115−129.

Shiffman, S., & Jarvik, M. E. (1976). Smoking withdrawal symptoms in two weeks of abstinence. *Psychopharmacology*, *50*, 35−39.

Soresi, S., Catalano, F., Spatafora, M., Bonsignore, M. R., & Bellia, V. (2005). Light smoking and dependence symptoms in high-school students. *Respiratory Medicine*, *99*(8), 996−1003.

Spielberger, C. D. (1993). *Manuel de l'inventaire d'anxiété état-trait. Forme Y.* Paris: Editions du Centre de Psychologie Appliquée (ECPA).

Spinnella, M. (2002). Correlations between orbitofrontal dysfunction and tobacco smoking. *Addiction Biology*, *7*, 381−384.

Straub, R. E., Sullivan, P. F., Ma, Y., Myakishev, M. V., Harris-Kerr, C., Wormley, B., et al. (1999). Susceptibility genes for nicotine dependence: A genome scan and followup in an independent sample suggest that regions on chromosomes 2, 4, 10, 16, 17 and 18 merit further study. *Molecular Psychiatry*, *4*, 129−144.

Tcheremissine, O. V., Lane, S. D., Cherek, D. R., & Pietras, C. J. (2003). Impulsiveness and other personality dimensions in substance use disorders and conduct disorders. *Addictive Disorders and their Treatment*, *2*(1), 1−7.

Teneggi, V., Tiffany, S. T., Squassante, L., Milleri, S., Ziviani, L., & Bye, A. (2002). Smokers deprived of cigarettes for 72 h: Effect of nicotine patches on craving and withdrawal. *Psychopharmacology*, *164*, 177−187.

Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behavior: Role of automatic and nonautomatic processes. *Psychological Review*, *97*, 147−168.

Tiffany, S. T., & Drobes, D. J. (1991). The development and initial validation of a questionnaire on smoking urges. *British Journal of Addiction*, *86*(11), 1467−1476.

Toll, B. A., McKee, S. A., Krishnan-Sarin, S., & O'Malley, S. S. (2004). Revisiting the factor structure of the questionnaire on smoking urges. *Psychological Assessment*, *16*(4), 391−395.

United States Department of Health and Human Services (USDHHS). (1988). *Health consequences of smoking: Nicotine addiction.* Washington, DC: United States Department of Health and Human Services.

Van der Linden, M., d'Acremont, M., Zermatten, A., Jermann, F., Laroi, F., Willems, S., et al. (2006). A French adaptation of the UPPS Impulsive Behavior Scale: Confirmatory factor analysis in a sample of undergraduates. *European Journal of Psychological Assessment*, *22*(1), 38−42.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences*, *30*, 669−689.

Whiteside, S. P., & Lynam, D. R. (2003). Understanding the role of impulsivity and externalizing psychopathology in alcohol abuse: Application of the UPPS Impulsive Behavior Scale. *Experimental and Clinical Psychopharmacology*, *11*(3), 210−217.

Zhu, B. P., Giovino, G. A., Mowery, P. D., & Eriksen, M. P. (1996). The relationship between cigarette smoking and education revisited: Implications for categorizing a person's educational status. *American Journal of Public Health*, *86*, 1582−1589.

Zuckerman, M., Ball, S., & Black, J. (1990). Influences of sensation seeking, gender, risk appraisal, and situational motivation on smoking. *Addictive Behaviors*, *15*, 209−220.