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## Personality Dimensions and Nicotine Dependence and Withdrawal Symptoms: the Mediating Role of Self-Directness

*We analyzed the relationship between personality traits and smoking status and nicotine withdrawal symptoms using two comprehensive models of personality: the Five-Factor Model and the Cloninger's Temperament and Character Inventory. In total 295 people were examined, 149 smokers and 146 who have never smoked. To measure the severity of the nicotine dependence we used the Fagerstroem Tolerance Questionnaire and the DSM-IV criteria of nicotine dependence and to measure the nicotine withdrawal symptoms the Nicotine Dependence History. The results showed significant differences between the groups in particular dimensions: Neuroticism, Agreeableness and Conscientiousness. The analyse of the TCI demonstrate, that smokers are higher in Novelty Seeking and lower in Reward Dependence than never smokers and show less Self-Directness and Cooperativeness. The mediation analyses showed that Self-Directness is the significant mediator between Extra-Introversion and nicotine withdrawal symptoms measured by NDHIS and between Neuroticism and DSM-IV criteria of nicotine dependence.*

**Keywords:** *personality dimensions, Extra- Introversion, nicotine dependence, withdrawal symptoms, NEO-FFI, TCI*

### Introduction

An estimated 46 million adults in the United States (20.6% of the population) report having smoked cigarettes and every day another 1,000 young people become new smokers. Annually in America smoking results in 440,000 deaths and approximately one of every five preventable deaths is a consequence of tobacco smoking. Tobacco use contributes to 1.5 million cancer-related deaths per year across the world (MMWR, 2009) and the World Health Organization identifies cigarette smoking as a major preventable cause of disease and death (Terracciano, 2004; Breslau, 2001). Despite the well established associated health risks, worldwide smoking prevalence is still increasing. As well as discouraging people from initiating the habit, efforts to stop these trends must focus on improving cessation rates among smokers (Munafo, 2007). Contemporary smoking cessation programs are increasingly concerned with matching interventions to individuals' needs and abilities to quit (Terracciano, 2004). From this perspective it is necessary for clinical and health psychologists to identify individual difference variables,

particularly personality traits that increase the risk of habit persistence. The focus of analyses of the specific differences between smokers and other groups (compared to people using other drugs) should be identifying the underlying personality traits that control smoking, in order to develop appropriate forms of treatment and therapies.

Of interest, in this context, are the differences between nicotine addiction and other forms of addiction, which imply the need for differences in treatment. Smokers feel stronger primarily psychological withdrawal symptoms and have hardly any physical symptoms (as opposed those addicted to alcohol or drugs). Smokers do not see direct negative consequences of smoking or they are insensitive to them. Referring to these differences, we pose the question: what makes the cigarette smokers insensitive to negative consequences of smoking (eg. health warnings on all tobacco advertisements and cigarette packs like "Smoking is harmful to your health"). Moreover, with the lack of physical withdrawal symptoms, why do smokers struggle hard to quit and suffer psychological withdrawal symptoms?

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Certain personality dimensions taken from personality trait theories have been linked to cigarette smoking behaviours. Many theories regarding the role of underlying trait factors specific to nicotine use have been developed in from numerous studies of the relationships between personality and smoking. The most widely and consistently reported associations relate to Extraversion, Neuroticism, Novelty Seeking, Impulsivity and Harm Avoidance (Munafò, 2007). Review of the empirical literature carried out by Matthew Smith in 1970 showed that despite conflicting data smokers were generally more extraverted, impulsive, manifested more anti-social tendencies and poorer mental health than non smokers. Results across studies were mixed but where differences were found, smokers tended to score higher on Neuroticism and Extraversion scales than those members of the study groups that never smoked (Terracciano, 2004).

Nicola Cherry and Kathy Kiernan (1976) in longitudinal studies sampled 2753 members explored the relationship between personality scores (from Eysenck's Maudsley Personality Inventory - MPI) and cigarette smoking behaviour in their young adult years. Personality measures were collected at the age of 16 years and information on cigarette smoking at ages 20 years and 25 years. Survey members who reached high Neuroticism scores were found to be more likely to smoke than those with low scores and extraverts were more likely to smoke than introverts. The personality scores were also found to have some power in predicting changes in smoking behaviour - low neurotic extraverts among the men were most likely to give up smoking.

Hans Eysenck, after achieving in his studies the same results in levels of Neuroticism and Extraversion among smokers, concluded that individuals high in Extraversion would smoke in search of stimulation, whereas individuals high in Neuroticism would smoke to reduce tension and anxiety (Joseph, 2003; Terracciano, 2004). Evdokia Papakyriazi and Stephen Joseph (1998) drew similar conclusions after their study investigated the association between personality and smoking tendencies. Because of the small sample used in this study, Joseph (Joseph et al., 2003) replicated it in order to provide further evidence that personality is associated with smoking behaviours. He found again, that more introverted smokers primarily use cigarettes to help them feel more confident in social situations, and that more neurotic smokers primarily use cigarettes as a way of controlling negative affect.

Andrew Terracciano and Paul Costa (2004) use the Five-Factor Model of Personality to investigate the association between smoking and personality measured by NEO-PI-R self-report questionnaire by Paul Costa and Robert McCrae. Results of their study on 1638 adult Americans (never-, former- and current-smokers) showed that current-smokers reached significantly higher scores than never-smokers on

Neuroticism and significantly lower on Agreeableness and Conscientiousness. Former-smokers showed intermediate scores on these factors, with significant differences from the others groups in Neuroticism and Conscientiousness. Neuroticism was related to smoking particularly among individuals with low Conscientiousness, as indicated by an interaction effect between the two factors. No differences on overall Extraversion or Openness were observed within these three study groups.

Marcus Munafò et al. (2007) used meta-analytic techniques to clarify the strength and direction of the association between smoking status and personality. The review included 25 cross-sectional studies published between 1972 and 2001 that reported personality data for adult smokers and non smokers using measures of personality traits from Eysenck's tripartite taxonomy of personality. Data from this cross-sectional observational studies confirmed significant difference between smokers and no smokers on both Extraversion and Neuroticism traits and indicate that both increased traits are associated with an increased susceptibility of being a smoker, although in both cases the effect sizes indicated by the meta-analysis were small (Munafò, 2007).

Robert Cloninger (1994) examining the relationship between temperament and character traits measured by the Temperament and Character Inventory and cigarette smoking has indicated that high Novelty Seeking is predicted to be the major determinant of initiation of smoking regardless of subjects' gender. High score in Harm Avoidance was mostly associated with difficulty in giving up the habit maintained by positive reinforcement. In addition female smokers were higher in Harm Avoidance than female no smokers and male smokers were lower in Reward Dependence than the male group of no smokers. Taking into account his and previous researches on smoking and the characteristics of temperament traits Cloninger concluded that only Novelty Seeking as an indicator of behaviour is associated with measures of nicotine dependence and difficulties in stopping the habit.

Knowing that Neuroticism, Extraversion, Novelty Seeking, Reward Dependence or Harm Avoidance are correlated with nicotine addiction does not make it easier to develop appropriate therapies because these features are slightly influenced by changes in social interactions (including therapy) or even pharmacology. These are the qualities of temperament which have specific biological substrate. The question emerging from the above studies is: whether character traits such as Self-Directness, Cooperativeness and Self-Transcendence, which are under the influence of conscious mental processes and consequently - susceptible to social interactions and changes, have a relationship with nicotine addiction.

The aim of our research was to detect personality qualities which differentiate smokers and nonsmokers and

also those which are linked with the degree of nicotine dependence and withdrawal symptoms. Following research questions were posed:

Which personality variables (temperament and character variables) differentiate smokers from never smokers?

Are the temperament variables predictors of the degree of nicotine dependence and withdrawal symptoms?

Do the character variables mediate between temperament variables and the degree of nicotine dependence and withdrawal symptoms?

## Method

### Participants and Measures

The examined groups comprised persons without nicotine dependence and persons who fulfilled the criteria of nicotine dependence according to DSM-IV. To qualify for the clinical group, participants had to smoke at least 10 cigarettes per day, had to fulfil at least 3 DSM-IV criteria for nicotine dependence and had to make at least one serious quit attempt. In total 295 participants were examined from the Mainz City regions of Germany. Study participant were recruited by public advertisement. The persons were divided into the two groups: control group with never-smokers and group with nicotine dependence. In the smokers group (Age  $42.1 \pm 9,7$ ), 85 of the 149 Participants were male, 64 were female. In the control group without nicotine dependence (Age  $43,6 \pm 10,8$ ) were 146 individuals (78 male and 68 female). The persons from the control group were matched according to their age and education with persons from the smokers group, so that the mentioned variables could be strictly controlled. Concerning the severity of the nicotine dependence we showed no significant difference in the number of fulfilled DSM-IV criteria of a nicotine dependence of male and female smokers. The number of smoked cigarettes per day was by woman less (22) as by men (25). The smokers and the never-smokers had no current or previous history of relevant physical illness, no current or past psychiatric or substance abuse disorders and no regular use of medication.

In addition to the DSM-IV-criteria of nicotine dependence, smokers also filled individual the 6-items *Fagerstroem Tolerance Questionnaire* (Fagerstroem et al, 1978, Heatherton et al, 1991 a revision) to measure the severity of the nicotine dependence and the *Nicotine Dependence History* scale (NDHIS; Fehr & Wirth, 2006) to measure the nicotine withdrawal symptoms, as well as to investigate the relation between those indices and the personality variables. Smokers and never-smokers were given two personality inventories: The *Temperament and Character Inventory* (Cloninger, Przybeck, Svrakic and Wetzel, 1994) and the *NEO-Five-Factor Inventory* (Costa & McCrae, 1989) to investigate the relation between these

variables and the nicotine dependence in the smokers group.

*NEO-Five-Factor Inventory* (Costa & McCrae, 1989) is a personality inventory, whose first two dimensions measure temperament traits manifested in affect sensitivity which plays an important role in the context of regulation of these affects in people addicted to nicotine. Dimension Extraversion/Introversion investigates high vs. low sensitivity to positive affect. Neuroticism dimension examines the sensitivity to negative affect. The other three dimensions (Openness, Agreeableness and Conscientiousness) examine psychosocial characteristics.

The *Temperament and Character Inventory* (Cloninger, Przybeck, Svrakic and Wetzel, 1994) examines two specific and distinct from each other dimensions - traits of temperament (Novelty Seeking, Harm Avoidance, Reward Dependence and Persistence) with the biological substrate (dopaminergic, serotonic and noradrenalin systems) and character traits (Self-Directness, Cooperativeness and Self-Transcendence) based on the autobiographical memory background, acting under the influence of conscious mental processes. Character traits are susceptible to the influence of treatment, and studying their relationship with temperamental traits among smokers gives the opportunity to measure the potential effectiveness of therapy.

To the measurement of nicotine dependence one approach is reflected in the *Diagnostic and statistical Manual of Mental Disorders 4<sup>th</sup> Ed.* (DSM-IV, American Psychiatric Association [APA], 1994). According to the DSM-IV the essential features of nicotine dependence incorporate a combination of cognitive, behavioural and physiological symptoms, they play in an individual's continued use of the substance despite significant substance related problems. Specifically nicotine dependence comprises (1) diminishes responsiveness or the development of tolerance to nicotine effects, (2) nicotine withdrawal symptoms, (3) nicotine being used in larger amounts or over a longer period of time, (4) desire to quit or unsuccessful efforts to quit smoking, (5) a great deal of time spent in smoking-related activities, (6) giving up or reducing social, occupational or recreational activities and (7) continued nicotine use despite harmful effects. Two competent evaluators experienced in DSM-IV scoring, scored the participants according to the frequency of such criteria of nicotine dependence.

The 6-items *Fagerstroem Tolerance Questionnaire* to measure the severity of the nicotine dependence is the revision of the 8-item *Fagerstroem Tolerance Questionnaire*. Four of the six are dichotomous questions, whereby the answer "yes" counts 1 point, "no" 0 point ("Which cigarette would you hate most to give up?", "Do you find it difficult to refrain from smoking in places where it is forbidden?", "Do you smoke more frequently during the first hours after awakening than during the rest of the day?", "Do you smoke even if you are so ill that you are

**Table 1**  
**Statistical Differences between the TCI and NEO-FFI-Scores for the two Groups: Never Smokers and Smokers (t-Test Scores).**

Variables	Group		Group		T(1.171)	p	Cohen's d
	Never Smokers	Smokers	Never Smokers	Smokers			
Neuroticism	19.62	7.3	21.80	7.3	2.28	0.023	-0.30
Extraversion	27.12	6.3	27.12	6.0	0.01	0.997	0.00
Openess	28.66	5.9	28.67	5.3	0.01	0.990	-0.002
Agreeableness	32.56	5.2	29.38	5.4	-4.90	0.000	0.60
Conscientiousness	32.92	6.1	31.35	6.1	-2.12	0.035	0.26
Novelty Seeking	18.36	5.2	20.96	5.2	4.28	0.000	-0.50
Harm Avoidance	14.54	5.8	14.28	6.7	-0.36	0.718	0.04
Reward Dependence	15.81	3.6	14.90	4.1	-2.00	0.046	0.24
Persistance	4.15	2.0	4.14	1.8	0.02	0.983	0.005
Self-Directness	34.48	6.4	30.64	7.5	-4.65	0.000	0.55
Cooperativeness	33.08	5.3	30.86	5.7	-3.40	0.001	0.40
Selftranscendence	13.43	7.8	14.14	6.3	0.84	0.401	-0.10

in bed most of the day?”). The two remaining questions have four answer possibilities, scores between zero and three points (“How many cigarettes per day do you smoke?”, “How soon after waking up do you smoke your first cigarette?”). The total score of the 6 items Fagerstroem test between 0-2 correspondent to very low dependence, 3-4 low dependence, 5 to medium dependence, 6-7 to high dependence and 8-10 very high dependence. The 6-items scale reached a high reliability score: Cronbach Alpha = 0.76.

At last the *Nicotine Dependence History* scale included 19 dichotomous questions has been used in our study to measure the nicotine withdrawal symptoms. According to NDHIS questions we explore following withdrawal symptoms: anxiety (i.e. “Did you experience any fear of specific situations?”), emotional irritability/arousal (i.e. “Did you become very nervous because of little things?”), restlessness (i.e. “Did you feel depressed or powerless?”), depression and sadness (i.e. “Did your mood deteriorate in recent times?”), insomnia (i.e. “Did you have troubles falling asleep?”), concentration problems (i.e. “Did you have troubles concentrating during a conversation with someone or for example when watching TV?”) and appetite and weight gain (i.e. “Did you notice an increased appetite?”). The 19-items scale reached a high reliability score: Cronbach Alpha = 0.83.

In the first phase of the statistical analyses the personality variables were subjected to the t-test statistic to obtain significant differences in the two groups of the study. In the next phase we calculated correlations to answer the following question: Is there a relation between the personality variables and the indicators of nicotine dependence and/or withdrawal symptoms? Finally, a causal path analyses, based on multi factor regression analysis, was to determine if any personality dimensions (variables) or

another indicator function as a statistical mediator between the personality variables and the nicotine dependence or withdrawal symptoms.

## Results

To calculate the statistical differences between the smokers and never smokers groups were the personality variables subjected to the t-test statistic. The results showed significant differences between the groups in particular personality dimensions: Neuroticism, Agreeableness and Conscientiousness (see Table 1). The statistical analyse of the TCI demonstrate more differences between the groups. The smokers are higher in Novelty Seeking than never smokers and low in Reward Dependence. According to Cloninger’s theory of personality traits associated with basic stimulus-response-characteristics, the smokers belong to the cluster opportunistic vs. scrupulous and are more opportunistic and less scrupulous than never smokers. Female smokers showed more Harm Avoidance ( $t(144) = -2.77, p < 0,01$ ) and Reward Dependence ( $t(143) = -3.00, p < 0,001$ ) than male smokers. According to Cloninger’s theory the female smokers are more passive-avoidant and less oppositional than the males smokers. In the character indicators the smokers showed less Self-Directness. The smokers are lower in the subscales Responsibility (5,4 vs. 6,5), Resourcefulness (3,6 vs. 4,1), Self-Acceptance (7,5 vs. 8,5) and Self-Congruence (8,3 vs. 9,4), than never smokers, but not differ from norms. They smokers are also lower in the Cooperativeness; they showed less Helpfulness and Compassion than controls.

The analysis of the calculated correlations showed a significant relationship between the personality variables on the indicators of nicotine dependence or withdrawal symptoms was similarly statistically significant. The

**Table 2**  
**Bivariate Correlations of Variables between the TCI, NEO-FFI, NDHIS, Fagerstroem Test und DSM-IV Scores (N = 149).**

Variable	NEURO.	EXTRA.	OPPEN.	AGREE.	CONSC.	FAGER.	NDHIS	DSM-IV
NS	-0.01	0.07	0.08	0.01	0.06	0.16	0.08	0.03
HA	0.64***	-0.56***	0.07	0.11	-0.46***	0.36**	0.23**	0.02
RD	0.20*	0.26*	0.33*	0.44**	0.13	0.05	-0.02	0.05
Pe	-0.18	0.33**	-0.04	-0.01	0.67***	0.09	-0.08	-0.05
SD	-0.56***	0.40***	-0.13	0.09	0.42**	-0.15	-0.32**	-0.23*
Co	0.10	0.07	0.20*	0.17	0.04	-0.24*	-0.10	-0.01
ST	0.07	0.20*	0.19	-0.11	0.04	0.08	0.04	-0.01
FAGER.	0.14	-0.36***	0.10	0.02	0.03	1.00	0.21*	0.23*
NDHIS	0.31**	-0.28**	0.06	-0.12	-0.11	0.21*	1.00	0.33**
DSM-IV	0.20*	-0.15	0.03	-0.03	-0.12	0.23*	0.33**	1.00

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Note. NA = Novelty Seeking; HA = Harm Avoidance; RD = Reward Dependence; PE = Persistence; SD = Self-Directness; CO = Cooperativeness; ST = Selftranscendence; FAGER.=Total Score of Fagerstroem Test; NDHIS = Total Score of Nicotine Dependence History Scale; DSM-IV = Total Score of Nicotine Dependence Criteria.

personality dimension Extraversion correlated negatively with the general score in Fagerstroem test and with general score in NDHIS scale for withdrawal symptoms. The higher the score in Extraversion, the lower the nicotine dependence measured by Fagerstroem test and less nicotine withdrawal symptoms experience by the participants. Positive relationship was obtained in the correlation between the Neuroticism and NDHIS and the DSM-IV total score of nicotine dependence criteria whereas the correlation with the Fagerstroem general score was statistically insignificant (Table 2). The higher the score in Neuroticism, the higher nicotine dependence and more withdrawal symptoms.

In the group of smokers Neuroticism (high sensitivity to punishment) correlates positively with the Reward Dependence (high sensitivity to rewards), ( $r = 0.20$ ,  $p < 0.05$ ). Thus a significant correlation between Neuroticism and Reward Dependence did not occur in the group of never smokers ( $r = 0.09$ ,  $p < 0.5$ ). This result means that among smokers in our sample: the higher Neuroticism and greater activation of negative affect and punishment system (,eg. health warning inscriptions on cigarette packs) the higher Reward Dependence and reward system activation (probably associated with the rewarding effect of smoking). Positive and statistically significant connection with Fagerstroem and NDHIS variables was shown by Harm Avoidance. Among personality variables examined by TCI only Self-Directness correlated negatively with NDHIS and the DSM-IV, total score of nicotine dependence criteria whereas the correlation with the Fagerstroem test was statistically insignificant. The negatively significant connection with Fagerstroem general score was shown by the variable Cooperativeness. The higher Self-Directness the lower the nicotine dependence measured by the criteria of DSM-IV and less withdrawal symptoms experience by participants measured according to NDHIS scale, whereas high

Cooperativeness is associated with a reduction in nicotine dependence symptoms.

In the final stage we tried to examine whether the relationship between the personality dimensions associated with negative and positive affect sensitivity (Neuroticism and Extra- vs. Introversion) and nicotine dependence indicators (DSM-IV and NDHIS) is mediated by other personality variables. In the context of the degree of nicotine dependence (measured by the criteria of DSM-IV), there was a predictive role of Neuroticism  $\beta = -0.20$ ,  $t(144) = -1.96$ ,  $p < 0.05$ . Regression analysis has demonstrated predictive role of Neuroticism and Extra- vs. Introversion in the context of withdrawal symptoms (measured by NDHIS). Neuroticism has a relationship with the severity of withdrawal symptoms with  $\beta = 0.31$ ,  $t(144) = 3.60$ ,  $p < 0.01$ , Extra-introversion dimension is related to the reduction of withdrawal symptoms,  $\beta = -0.28$ ,  $t(144) = -2.60$ ,  $p < 0.01$ . In the context of therapeutic interactions, negative affect is associated with the depth of dependence and positive affect has a relationship with the reduction of withdrawal symptoms. In the context of nicotine dependence (as measured by the criteria of DSM-IV) mediators for Neuroticism were searched, while in the context of coping with withdrawal symptoms mediators for Extra- vs. Introversion were searched. The relationship between Extra-Introversion and withdrawal symptoms measure with the NDHIS interview and the relationship between Neuroticism and DSM-IV criteria for nicotine dependence was mediated by only one personality variables: Self-Directness. The strong relationship between Neuroticism and nicotine dependence and between Extra- and Introversion and nicotine withdrawal symptoms is not mediated by another personality variables (measure by TCI and NEO-FFI). The regression analysis with all personality variables (TCI and NEO-FFI variables) as predictors (dependent variables) and the general score in the DSM-

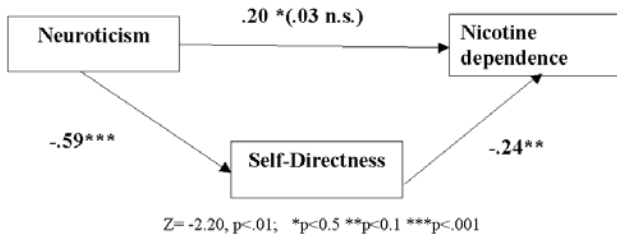


Figure 1. Path analyses depicting the mediating role of Self-Directness between Neuroticism and the Total Score of DSM-IV for nicotine dependence. The direct path is significant: .20 ( $p < .05$ ) whereas the indirect path taking into account Self-Directness as mediator (shown in parenthesis), is eliminate: .03 (*n.s.*), indicating complete mediation. All coefficients are standardized Betas;  $Z$  = modified Sobel test of significance of mediation.

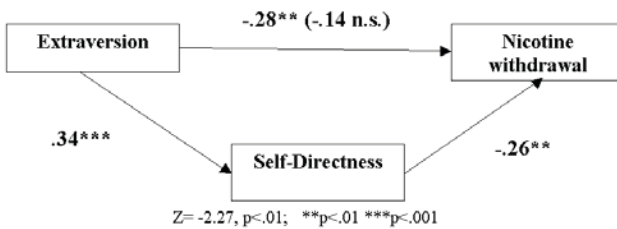


Figure 2. Path analyses depicting the mediating role of Self-Directness between Extraversion and the Total Score of NDHIS for nicotine withdrawal. The direct path is highly significant:  $-.28$  ( $p < .01$ ) whereas the indirect path taking into account Self-Directness as mediator (shown in parenthesis), is eliminate:  $-.14$  (*n.s.*), indicating complete mediation. All coefficients are standardized Betas;  $Z$  = modified Sobel test of significance of mediation.

IV and NDHIS as a criterion variable did not produce any statistically significant scores.

To examine, that the relationship between the Neuroticism and nicotine dependence symptoms measured by DSM-IV was mediated through (absence of) Self-Directness we carried out a series of separate path analyses. First of all, all of those variables should correlate significantly with each other, which is in the table (see Table 1). To qualify as a potential mediator Self-Directness should not only bear a significant relationship to general score of DSM-IV, it must also significantly reduce or eliminate the effect of Neuroticism on nicotine dependence measure by DSM-IV criteria (see Kenny, Keshy & Bolger, 1998, pp. 258-261). First, the Neuroticism scale was positively related to the general score in DSM-IV  $\beta = 0.20$ ,  $t(144) = 1.96$ ,  $p < 0.05$ . Second, the DSM-IV score was inversely related to Self-Directness  $\beta = -0.23$ ,  $t(144) = -2.85$ ,  $p < 0.05$ . Third, when Self-Directness and Neuroticism were entered into the equation simultaneously, (high) Self-Directness was predictive of the DSM-IV score for nicotine dependence symptoms  $\beta = -0.24$ ,  $t(144) = -2.24$ ,  $p < 0.01$ , but the direct relationship between Neuroticism and general score of DSM-IV was practically disappeared  $\beta = 0.03$ ,  $t(144) = 0.40$ , *n.s.* This highly reduced relationship was statistically significant according to the modified version of the  $Z$ -test (Sobel, 1982) proposed by Reuben Baron and David Kenny (1986):  $z = -2.20$   $p < 0.05$ , which supports the mediation status of Self-Directness between Neuroticism and DSM-IV to measure the nicotine dependence symptoms by our participants. This path analysis demonstrated, that the

people high in Self-Directness are prone to show less Neuroticism. This Self-Directness was associated with less symptoms of nicotine dependence (Figure 1).

Apart from Neuroticism, only Self-Directness, which shows strong negative correlation, was a second candidate to mediate the relation between Extra- Introversion and NDHIS. To examine this hypothesis we carried out again a series of separate path analyses. The regression analyses showed an inverse relationship between Extraversion and general score in NDHIS. Similar the NDHIS score was inversely related to Self-Directness  $\beta = -0.32$ ,  $t(144) = -4.00$ ,  $p < 0.00$ . When both Extraversion and Self-Directness were entered into the equation simultaneously, (high) Self-Directness was predictive of the withdrawal symptoms measure by NDHIS  $\beta = -0.26$ ,  $t(144) = -2.85$ ,  $p < 0.05$ , but the direct relationship between Extraversion and NDHIS score disappeared  $\beta = -0.14$ ,  $t(144) = -1.50$ , *n.s.* This relationship was statistically significant according to the Sobel test:  $z = -2.27$ ,  $p < 0.01$ . These result supports the mediation status of Self-Directness between Extraversion and NDHIS total score (Figure 2). Findings are consistent with the assumption, that individuals high in Extraversion are prone to show high Self-Directness. This Self-Directness is associated by extraverted persons with less withdrawal symptoms measure according to NDHIS scale.

## Discussion

Smokers in our study were more neurotic, more emotionally instable and more sensitive to negative affect than never smokers. There are less agreeable, cooperative and responsive than never smokers and less conscientious, precise and orderly. The significant differences between smokers and never smokers in the NEO-FFI from the present study are consistent with the results from the study of Terraccino and Costa (2004), and showed again, that smokers reached higher scores than never smokers on Neuroticism and lower on Agreeableness and Conscientiousness. Munafo (2007) showed the relationships between personality and smoking and reported associations relate to Extraversion, Neuroticism, Novelty Seeking and Harm Avoidance. The statistical analysis of the TCI and NEO-FFI showed any interesting differences between the groups. Smoking women in our study showed in TCI more Harm Avoidance and Reward Dependence than smoking men. These results demonstrate according to Cloninger's theory differences in temperament across the two groups. Smoking men are positional, directly confrontational, self-willed and energetic because they are insensitive social disapproval (i.e. low Reward Dependence) and insensitive to threat of punishment (i.e. low Harm Avoidance). In contrast smoking women are sympathetic and warm, sentimental and indirectly manipulative, they are expected to be submissive and passively avoidant, because they cannot tolerate the

threat of punishment, pain, or social disapproval. These expected interactions have been confirmed by objective results of sensitivity to pain (Freedland et al., 1991) and social disapproval.

The path analyses demonstrate that Self-Directness shows stronger effect on the nicotine dependence than the NEO-FFI dimensions Neuroticism and stronger effect on the withdrawal symptoms of nicotine dependence (measure with NDHIS) than the NEO-FFI dimensions Extra- and Introversion. The characteristic of self directed individuals is that they are self sufficient, responsible and well integrated individuals, they have good self-esteem and they are effective, i.e., able to adapt their behaviour in accord with individually chosen and voluntary goals (Cloninger et al., 1994). People high in Extraversion are prone to show high Self-Directness and this self-regulatory ability is associated with less withdrawal symptoms.

Experimental analyses of the Five-Factor Model with Extra- and Introversion have demonstrated systematic relationships with reward and punishment system (Gray 1987). Extraversion is related to the reward system and strong experience of positive affect (Nichols & Newman, 1986; Diner et al., 1992). Neuroticism is related to the punishment system with behavioural inhibition and negative emotionality (Elliot & Trash, 2002). These central personality dimensions can be conceived of as sensitivity to positive and negative affect and assess how quickly a person enters a positive or negative affective state. The relationship between affect sensitivity dimensions and personality functioning has been well documented (Costa & Widinger, 1994; McCrae & Costa, 1991). The Self-Directness is assessed by self regulatory abilities and affect regulation. The ability to self regulate one's feelings and thoughts assesses the degree to which a person is able to leave a particular affective state once it is aroused. The mediating role of Self-Directness is an important factor for the self-regulation of negative affects and thoughts in experience of psychological symptoms of nicotine dependence and for the self regulation and activity of positive affects to stay abstinent and to reduce withdrawal symptoms: emotional irritability, discomfort, restlessness, anxiety, depression and sadness and other cognitive and somatic symptoms. Several studies demonstrated that affect regulation is especially important when sensitivity to positive affect (Introversion) is low (Baumann, Kaschel & Kuhl, 2007; Cordero, 2005). Joseph et al. (2003) found again that introverted smokers (low in positive affect) use cigarettes to feel more confident in social situation, and that neurotic smokers (higher in negative affect) use cigarettes for controlling negative affect. Self-Directness competences are also necessary for regulation of negative affect by neurotic smokers in contexts of nicotine dependence and generation of positive affect by introverted smokers to help them functioning

in social relations and coping with the withdrawal symptoms.

Regression analysis confirmed that Neuroticism is a predictor of nicotine dependence symptoms. Neuroticism affiliated with sensitivity to punishment shows a positive correlation with the Reward Dependence or sensitivity to reward in the group of smokers. This result suggests a paradox in smokers' behavior, which was not found in the control group. Activation of negative affect (i.e., as a result of losses caused by smoking) is positively associated with addiction reward or activation of positive affect, associated with smoking behavior, and thus increases the intensity of dependence (Neuroticism is associated with Reward Dependence and the DSM-IV criteria for nicotine dependence). This coupling between negative and positive affect may indicate smoking-related dysfunctional behavior involving an activation of the reward system when negative emotion is aroused, thus further strengthening addictive smoking behavior. As a result smoking would be associated with a difficulty to terminate habits maintained by positive reinforcement.

The main aim in the treatment of nicotine is not only to reduce the negative affect of dependence but also to activate positive affect by motivating behaviors to maintain abstinence. As follows from the analysis of mediation only Self-Directness mechanisms (regulation of affect) weaken the Neurotic relationship with symptoms of addiction. Moreover Self-Directness mediates between Extra- vs. Introversion and the reduction of withdrawal symptoms (Self-Directness do not mediate between Neuroticism and symptoms of withdrawal): Extraverted individuals are able to reduce withdrawal symptoms only when they have learned how to downregulate negative affect by self-confrontation rather than defensive mechanisms such as denial or embellishment. Introduction of motivational therapy techniques (Miller & Rollnick, 2002) and showing positive effects of non-smoking behavior, activating and maintaining a positive affect in the context of health promotion, better physical condition or attractiveness (Self-Directness activation in combination with Extraversion) may appear more effective than traditional confrontational techniques associated with a display of harmful and negative consequences of smoking.

These differences may suggest that somatically healthy smokers do not see and do not show sensitivity to the negative consequences of smoking. It seems that among smokers activating system of punishment and recall losses (i.e., criticism or punish for a failure) is rather non-adaptive and maintains the smoking habit reward system (high Neuroticism positively correlates with Reward Dependence) which do not activate the self-system (low self-regulation and Self-Directness) needed to the intrinsic motivation to quit and maintain the abstinence. This hypothetical effect may be consistent with others, already empirically proven

effect (Fuhrmann & Kuhl, 1998) among people who are willing to engage in restrictive diets. In these subjects with high self-control (and low self-regulation) rapid activation of positive affect and the reward system (i.e., reward for a small success) do not activate the self-system and only placing in the treatment of punishment and reward system (method of three phases of in treating eating disorders) leads to activation of self-system and intrinsic motivation to healthy behaviors. In this context, not only system of punishment, but reward system as well should be the subject of therapy.

The present results open a door to special therapeutic intervention. Self-regulation abilities are not innate but more dependent from the influence of environment than the dimensions of Extra- and Introversion and therefore are suited for the therapy. During the therapy with the people it is also important to work up the Self-Directness competences: self-acceptance, self-efficiency, responsibility to attitudes and behaviour and self-congruence with their long term goals and values. We consider the results from present study to be significantly important for the formulation of future treatment programs for people addicted to nicotine to help them to give up and cope with the withdrawal symptoms. What can be effective in treating nicotine addiction? In such a strong psychological dependence, important seems to be the combination of medication and psychotherapy. In psychotherapy, the most significant activating mechanism is Self-Directness associated with strong internal motivation and desire to be abstinent, a well-planned system of self-control (emotional self-regulation and self-efficacy) and support from the environment. To compare and examine the effectiveness of various forms of addictions treatment, it would be useful to activate the mechanism of Self-Directness (regulation of emotions, self-congruence and self-efficacy) among smokers in their withdrawal phase and compare the results with results coming from traditional techniques of treating addictions (confrontational methods, showing losses, regret the loss) and results of treating who combine both the techniques.

The conclusions resulting from our research require further empirical verification. First of all comparative studies should be done with TCI and NEO-FFI tests in other groups of addictions in order to verify whether there are differences in the characteristics of personalities, what is significant for therapy programs for various forms of addictions. Also comparative research among people somatically healthy smokers and smokers with somatic disease, among whom smoking is an important risk factor, should be done. Showing losses and sensitivity to punishment system probably will not be in a positive relationship with addiction reward and thus may explain the more effective smoking cessation in people with somatic disease.

The present study has several limitations. First, the study used only self-reported measures as opposed to more objective measures of nicotine withdrawal, affect sensitivity and affect regulation. Second the participants were smokers but not in the condition of abstinence and presented no withdrawal symptoms. Future study may investigate the symptoms during the abstinence from consume of nicotine. It would be interesting to test the self regulatory abilities and Self-Directness during the abstinence and their efficiency to decrease of withdrawal symptoms in the therapy of nicotine dependence.

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