Smoking and the Five-Factor Model of personality

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ABSTRACT
Aims Investigating the association between personality traits and smoking status using a comprehensive model of personality, the Five-Factor Model (FFM).
Design Cross-sectional survey.
Setting Baltimore, MD, USA.
Participants Adult elderly Americans (n = 1638).
Measurements A self-administered survey on cigarette smoking and the Revised NEO Personality Inventory (NEO-PI-R).
Findings Current smokers scored higher than never smokers on neuroticism and lower on agreeableness and conscientiousness; former smokers scored intermediate on these higher-order dimensions. Neuroticism was related to smoking particularly among individuals with low conscientiousness, as indicated by an interaction effect between the two factors. There were no differences on extraversion and openness to experience. At the lower-order facet level, smokers were characterized by inability to resist cravings (high impulsiveness), search for stimulation (high excitement-seeking), lack of perseverance (low self-discipline) and lack of careful consideration of the consequences of their actions (low deliberation).
Conclusions At the higher-order factor level, this study replicates and extends previous studies using a comprehensive model of personality (FFM). The greater specificity provided by the facet-level analysis appears to explain some of the conflicting results in the literature, and the use of an older sample provides insight especially into the former smokers group. Personality research may lead to a deeper understanding of cigarette smoking and can potentially contribute to policies and programs of smoking prevention and cessation.

KEYWORDS Conscientiousness, five-factor model, health risk behavior, impulsivity, interaction effect, neuroticism, personality traits, smoking.

INTRODUCTION
The World Health Organization (WHO 2002) identifies tobacco smoking as a major preventable risk factor for disease, disability and death. Programs of smoking prevention and cessation are based on an understanding of the psychological, social, biological and pharmacological processes involved in smoking initiation and maintenance (Leventhal & Cleary 1980). Smoking cessation programs are increasingly concerned with matching interventions to individuals’ needs and their stage of change (Velicer et al. 1993; Prochaska et al. 2001). From this perspective, it is important to identify individual difference variables, particularly personality traits that increase the risk for cigarette smoking. Understanding the influence of personality on behavior may improve interventions through public policies and personalized treatment.

Personality traits are enduring dispositions (McCrae & Costa 2003) and major determinants of behavior (Paunonen 2003). In the last few decades, a growing consensus has supported the five-factor model (FFM, see Digman 1990; Goldberg 1990; John 1990; McCrae & John 1992; McCrae 2001a; but see Block 1995) as a
comprehensive yet manageable taxonomy of traits. Those traits have been shown to be heritable (e.g. Jang et al. 1998) and generalizable across cultures (McCrae & Costa 1997; Paunonen et al. 2000; McCrae 2001b; Terracciano 2003; see also Triandis & Suh 2002). The FFM is a hierarchical model that organizes personality traits into five broad or higher-order factors of neuroticism (N), extraversion (E), openness to experience (O), agreeableness (A) and conscientiousness (C). Each factor is defined by six more specific, lower-order traits, known as facets (see Table 1 for a listing of the 30 facet scales). In this study, the five broad factors as well as the specific facets were used as a framework to investigate the relationship between smoking and personality.

A large number of studies have examined the relationships between personality traits and cigarette smoking variables. Although the personality differences between smokers and non-smokers are usually small, they are important considering the large number of people who smoke (WHO 2002). Even a small contribution of personality research may enhance knowledge of smoking behavior and have a clinical impact through the improvement of smoking prevention and cessation programs.

In 1970, Smith reviewed the empirical literature, and—despite conflicting data—concluded that smokers were more extraverted, externally oriented, impulsive and showed more antisocial tendencies/disagreeableness and poorer mental health than non-smokers. Most of the later studies have been conducted on broad traits conceptually related to the stimulating and mood-regulating effects of cigarette smoking. Eysenck (1980) argued that individuals high in extraversion would smoke in search of stimulation, whereas individuals high in neuroticism would smoke to reduce tension and anxiety (see also Tate, Pomerleau & Pomerleau 1994; Berlin et al. 2003). Results across studies are mixed (e.g. McCrae, Costa & Bosse 1978; Eysenck 1980; Breslau, Kilbey & Andreski 1993; Arai et al. 1997; Kassel, Stroud & Paronis 2003), but when differences were found, smokers tended to score higher on neuroticism and extraversion compared with those who never smoked. Fewer studies have examined the association of smoking status with other major dimensions of personality. Some studies have found smokers to score higher than non-smokers on Eysenck’s psychoticism (e.g. Spielberger & Jacobs 1982; Arai et al. 1997; but see Parkes 1984; Breslau, Kilbey & Andreski 1994), a construct inversely related to agreeableness and conscientiousness (McCrae & Costa 1985; Goldberg & Rosolack 1994). Smoking is regarded as somewhat antisocial (Eysenck 1980), and, consistent with this view, Smith (1967) found that smokers were rated by their peers as being low on agreeableness. Vollrath, Knoch & Cassano (1999) found smoking to be inversely related to self-reported agreeableness. There is evidence that low conscientiousness is related to health risk behaviors (Booth-Kewley & Vickers 1994; Vollrath et al. 1999; Trobst et al. 2000; Vollrath & Torgersen 2002). A remarkable 24 year follow-up study (Kubicka et al. 2001) showed that low conscientiousness in children, but not neuroticism or extraversion, was a predictor of smoking in adulthood. Gilbert (1995) summarized studies subsequent to the review of Smith (1970). Despite some inconsistency, he concluded that smokers differed most reliably on psychoticism (especially impulsivity, antisocial behavior, sensation seeking and aggression) and neuroticism. He argued that recent studies found only a weak relationship between smoking and extraversion, and the role of openness has not been adequately assessed.

There are several possible explanations for the discrepancies in the literature. The studies conducted span large time periods and involve different countries. Cultural factors and public policy influence greatly the prevalence of smoking in the population and in turn the characteristics of smokers (Hughes et al. 1997). Knowledge of the adverse health consequences of smoking and stringent social policy has produced dramatic effects on some groups but not on others (Pomerleau 1997), and US smokers today are likely to be different from the US smokers of a few decades ago, or current smokers in non-Western countries. The inconsistency in the literature may also derive from comparisons of studies that have used different instruments, different methods of classification of smoking status or different sample populations. Another possible reason for inconsistency across studies is the broad and heterogeneous nature of the dimensions studied. For example, the FFM characterizes extraversion as being hierarchically related to six lower-order facets such as warmth, gregariousness, assertiveness, activity, excitement seeking and positive emotions. Among these, only excitement seeking is conceptually related to Eysenck’s hypothesis and neurochemical evidence that smoking produces central nervous system stimulation (see also Benowitz 1988: Carton, Jouvent & Widlocher 1994; Stein et al. 1998). Although the six facets tend to covary, each has unique variance and predictive value (Paunonen & Ashton 2001), and they are not equally represented in all global measures of extraversion. More consistent results might be obtained if the specific facets were assessed.

Analysis at the level of facets permits the examination of multifaceted constructs, which could be relevant to understanding smoking behavior. For example, Whiteside & Lynam (2001) point out that four facets from three factors or domains of the Revised NEO Personality Inventory (NEO-PI-R, Costa & McCrae 1992) define the multifaceted construct of impulsivity: impulsiveness, one of the
six facets of neuroticism, refers to the inability to resist cravings and urges; excitement-seeking, a facet of extraversion, refers to the tendency to seek excitement and stimulation; low self-discipline, a facet of conscientiousness, refers to the inability to begin and complete a task in the face of boredom and other distractions, and low deliberation, another facet of conscientiousness, refers to the tendency to act without considering the consequences (Costa & McCrae 1992). These facets probably play a role in smoking initiation, maintenance or cessation, and only analyses at the facet level offer the opportunity to assess their importance.

Even at the global factor level, new analyses might be revealing. Parkes (1984) performed discriminant analyses on Eysenck’s dimensions and found interactions between neuroticism and psychoticism and between neuroticism and extraversion to contribute significantly to the differentiation between smokers and non-smokers. Vollrath & Torgersen (2002) used a typological approach and found that individuals both high in neuroticism and low in conscientiousness were disproportionately likely to be smokers. The analysis of interaction effects and the use of a typological approach have the advantage of considering multiple dimensions simultaneously. Examining complex interactions is interesting because the effect of a single personality factor can be intensified, weakened or cancelled by the individual’s standing on other factors. In this study, the authors examined the interactive effects between the factors of the FFM to investigate whether combinations of traits have unique effects. The 10 possible pairs from the five factors are also known as personality styles: neuroticism × extraversion, style of well-being; neuroticism × openness, style of defense; neuroticism × agreeableness, style of anger control; neuroticism × conscientiousness, style of impulse control; extraversion × openness, style of interest; extraversion × agreeableness, style of interaction; extraversion × conscientiousness, style of activity; openness × agreeableness, style of attitude; openness × conscientiousness, style of learning; agreeableness × conscientiousness, style of character (Costa, McCrae & PAR Staff 2000).

Another notable feature of this study is the demographics of the sample studied: middle-aged and elderly adults. As a group, these men and women are at low risk of smoking initiation, but at higher (immediate) risk of the adverse effects of smoking on health. Older populations include a large proportion of former smokers, a group that cannot be well addressed with a younger sample. Finally, older populations are of interest because they have been studied less frequently.

To summarize, this study examined personality differences between never, former and current smokers on the five broad factors and 30 specific facets of the FFM. The analyses at the factor level have the potential to replicate and extend previous studies. The analyses at the level of facets can provide a more detailed profile of the smoker groups and potentially resolve inconsistencies in the literature. Finally, interactions between factors were examined to evaluate the effects of combinations of personality traits.

**METHOD**

**Sample**

Participants (n = 1,638; age range from 20 to 96, mean = 60.3, SD = 18) completed questionnaires as part of the Baltimore Longitudinal Study on Aging (BLSA, Shock et al. 1984). The BLSA is not a probability sample; participation is on a voluntary basis. However, prior studies did show that findings from this sample were consistent with the findings from representative samples (Costa et al. 1986). Most of the BLSA participants are highly educated, have high socioeconomic status and are relatively healthy. For the analyses of this study, participants were divided into three groups, according to smoking status. ‘Never smokers’ (n = 828, 50.5%) never smoked, or smoked fewer than 100 cigarettes over their entire lifetime. ‘Former smokers’ (n = 694, 42.4%) were those who have quit smoking. On average, former smokers started smoking at age 19 (SD = 5.3, range = 7–56), smoked for 19 years (SD = 13.5, range = 0–62 years) and quit 24 years ago (SD = 14.9, range = 1–70 years). ‘Current smokers’ (n = 116, 7.1%) were those who reported smoking at the time of the most recent visit. On average, current smokers started smoking at age 20 (SD = 6.5, range = 8–44) and have smoked for 29 years (SD = 17.6, range = 0–72 years).

Smoking and personality assessments were both collected during each 2 day visit to the Gerontology Research Center, Baltimore, MD, USA. The most recent visit was considered in the cases of multiple assessments. Most participants completed smoking and personality questionnaires on the same day or within 48 hours. About 2.4% of cases had no personality or smoking data collected during the most recent visit. In those cases, the data from the next most recent visit were used (there was on average a 2 year interval between visits). The data were collected from 1989 through 2002. The median date of visit was August 1996 for the never smokers, March 1997 for the former smokers and October 1993 for the current smokers. Those dates reflect the decline in the number of US smokers in the 1990s.

There were gender differences in the three groups [χ²(2) = 31, P < 0.001]. More women were never smokers (22.5% men versus 28.1% women), whereas more
men were former smokers (24.9% men versus 17.5% women). Gender differences among the current smokers were small (3.6% men versus 3.5% women). The groups differed in age \( F_{2,1634} = 36.7, P < 0.001 \). The former smokers (mean = 64.2, SD = 15.8) were older than the never smokers (mean = 58.3, SD = 19), who were older than the current smokers (mean = 51.5, SD = 17.7). There were also significant differences in years of education \( F_{2,1582} = 6.9, P = 0.001 \). Current smokers (mean = 15.4, SD = 2.7) were significantly less educated than former smokers (mean = 16.2, SD = 2.7) and never smokers (mean = 16.4, SD = 2.4). The low percentage of current smokers, the high percentage of former smokers and the pattern observed for gender, age and education are reasonably in line with the US population of older individuals with high education (Center for Disease Control 2002). According to the National Health Interview Survey, USA, 2000 (Center for Disease Control 2002), the prevalence of smoking was 9.7% among the population older than 65 years. The prevalence was also lower among those with high education (13.2% among older than 65 years. The prevalence was also lower among those with high education (13.2% among those with an undergraduate degree and 8.4% among those with a graduate degree) and who are above the poverty level.

**RESULTS**

Means (SD) for personality traits for the never, former and current smoker groups are reported in Table 1. Analysis of variance (see \( F \) values in Table 1) indicates that there were significant differences among groups on neuroticism, agreeableness and conscientiousness, but no significant differences on extraversion or openness factors. Post hoc tests indicate that current smokers scored significantly higher on neuroticism compared with non-smokers and significantly lower on agreeableness and conscientiousness, with the difference in conscientiousness larger than 0.5 SD, effect size \( d = 0.6 \). Former smokers showed intermediate scores on the above factors, with significant differences from the other groups on neuroticism and conscientiousness. Former smokers also scored significantly lower than never smokers in agreeableness. Additional analyses indicated that individuals who smoked fewer than 100 cigarettes in their lifetime scored intermediate between never and former smokers on neuroticism, agreeableness and conscientiousness, but they were not significantly different from never smokers.

Analyses at the facet level indicate that with the exception of self-consciousness, all facets of neuroticism showed significant differences among smoking status groups. Current smokers scored higher than the other groups on all facets of neuroticism, with the largest differences in impulsiveness. Among the facets of extraversion, there were significant differences only in excitement-seeking, with current smokers scoring higher than never smokers. There were significant differences on openness to values, with current smokers scoring the highest. There were also significant differences on straightforwardness, altruism and compliance, with current smokers scoring lower than never smokers. There were significant differences among groups on all facets of conscientiousness, with smokers scoring clearly lower than non-smokers. The \( \eta^2 \) values are between small and medium effect size (Cohen 1988), which is consistent with previous studies.

**Statistical analyses**

All analyses were performed using SPSS 11.0.1 (SPSS Inc, Chicago, IL, USA). The assumption of homogeneity of variance for the ANOVA was tested using the Levene statistic. No large violations were found and robust statistics produced consistent results. In the major analysis reported in Table 1, Bonferroni correction was performed to evaluate the statistical significance of mean differences among the three groups. Because 35 comparisons were performed, the 0.05 and 0.01 significance levels were divided by 35 (0.05/35 = 0.0014; 0.01/35 = 0.00029). The effect sizes were estimated with \( \eta^2 \). According to Cohen (1988), \( \eta^2 \) values of 0.0099, 0.0588 and 0.1379 correspond to small, medium and large effect sizes, respectively.

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smokers who were sex- and age-matched to the current smokers. To select never and former smokers from the large samples, a random procedure was used when multiple cases matched the characteristic of the current smokers. The resulting samples of never \((n = 116, \text{age mean } = 51.5, \text{range 21–89})\) and former smokers \((n = 116, \text{age mean } = 51.7, \text{range 21–89})\) matched almost perfectly the sample of current smokers \((n = 116, \text{age mean } = 51.5, \text{range 21–89})\). 

ANOVA indicated that differences among the sex- and age-matched groups were reasonably consistent with the results obtained with the full sample. In particular, there were significant differences on neuroticism \((P = 0.001)\), agreeableness \((P = 0.001)\) and conscientiousness \((P < 0.001)\), but not on extraversion and openness \((P > 0.05)\). The only notable difference was the non-significant differences on excitement-seeking in the sex- and age-matched sample.

Vollrath & Torgersen (2002) used a typological approach to examine configurations of personality traits in regard to health risk behaviors. They found that individuals both high in neuroticism and low in conscientiousness were disproportionately likely to be smokers. To replicate and extend their study, a stepwise hierarchical discriminant analysis was performed to identify factors and interactions between factors that provide the best discrimination among groups. A two-stage hierarchical analysis was adopted, entering first the five factors and then the 10 two-way interactions. The interaction terms were represented by the cross-products of the factors.

### Table 1  Means (SD) of personality traits for never, former and current smokers.

<table>
<thead>
<tr>
<th>NEO-PI-R scales</th>
<th>Never smokers ((n = 828))</th>
<th>Former smokers ((n = 694))</th>
<th>Current smokers ((n = 116))</th>
<th>(F (2, 1635))</th>
<th>(\eta^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>46.74a (9.6)</td>
<td>48.51a (9.2)</td>
<td>51.86c (9.9)</td>
<td>17.77**</td>
<td>0.021</td>
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<tr>
<td>Extraversion</td>
<td>50.44 (10.3)</td>
<td>50.25 (10)</td>
<td>50.92 (9.4)</td>
<td>0.24</td>
<td>0.000</td>
</tr>
<tr>
<td>Openness</td>
<td>52.05 (11.1)</td>
<td>51.99 (10.6)</td>
<td>53.68 (10.8)</td>
<td>1.26</td>
<td>0.002</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>51.04a (10.2)</td>
<td>49.42a (9.0)</td>
<td>47.81b (9.6)</td>
<td>8.94**</td>
<td>0.011</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>51.80a (10.1)</td>
<td>48.86d (9.7)</td>
<td>45.95 (10.3)</td>
<td>29.42**</td>
<td>0.035</td>
</tr>
<tr>
<td>N1: Anxiety</td>
<td>47.7a (9.7)</td>
<td>48.55a (9.6)</td>
<td>51.57c (10.2)</td>
<td>8.41**</td>
<td>0.010</td>
</tr>
<tr>
<td>N2: Angerous hostility</td>
<td>47.4a (9.4)</td>
<td>49.51a (9.0)</td>
<td>51.51a (9.4)</td>
<td>14.3**</td>
<td>0.017</td>
</tr>
<tr>
<td>N3: Depression</td>
<td>47.16a (9.4)</td>
<td>48.25a (9.3)</td>
<td>51.76b (10.6)</td>
<td>12.57**</td>
<td>0.015</td>
</tr>
<tr>
<td>N4: Self-consciousness</td>
<td>48.23 (9.8)</td>
<td>48.49 (9.2)</td>
<td>49.59 (10.2)</td>
<td>1.03</td>
<td>0.001</td>
</tr>
<tr>
<td>N5: Impulsiveness</td>
<td>47.83a (9.3)</td>
<td>49.56c (9.3)</td>
<td>53.01b (9.9)</td>
<td>18.32**</td>
<td>0.022</td>
</tr>
<tr>
<td>N6: Vulnerability</td>
<td>46.95a (9.8)</td>
<td>48.99a (9.6)</td>
<td>51.11a (9.3)</td>
<td>14.41**</td>
<td>0.017</td>
</tr>
<tr>
<td>E1: Warmth</td>
<td>50.31 (10.1)</td>
<td>49.67 (9.8)</td>
<td>49.7 (9.8)</td>
<td>0.83</td>
<td>0.001</td>
</tr>
<tr>
<td>E2: Gregariousness</td>
<td>50.17 (10.6)</td>
<td>50.94 (10)</td>
<td>50.84 (10)</td>
<td>1.11</td>
<td>0.001</td>
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<tr>
<td>E3: Assertiveness</td>
<td>52.79 (10)</td>
<td>52.12 (9.4)</td>
<td>50.84 (9.9)</td>
<td>2.46</td>
<td>0.003</td>
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<td>E4: Activity</td>
<td>51.33 (10.2)</td>
<td>50.42 (10.6)</td>
<td>50.17 (10.9)</td>
<td>1.71</td>
<td>0.002</td>
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<tr>
<td>E5: Excitement-seeking</td>
<td>47.14a (9.7)</td>
<td>48.03a (9.3)</td>
<td>50.95b (8.6)</td>
<td>8.87**</td>
<td>0.011</td>
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<td>E6: Positive emotions</td>
<td>50.17 (11)</td>
<td>49.62 (10.4)</td>
<td>50.86 (10.7)</td>
<td>0.91</td>
<td>0.001</td>
</tr>
<tr>
<td>O1: Fantasy</td>
<td>50.82 (10.7)</td>
<td>51 (10.5)</td>
<td>53.76 (10.5)</td>
<td>3.94</td>
<td>0.005</td>
</tr>
<tr>
<td>O2: Aesthetics</td>
<td>53.61 (10.1)</td>
<td>53.22 (10.1)</td>
<td>53.18 (9.3)</td>
<td>0.31</td>
<td>0.000</td>
</tr>
<tr>
<td>O3: Feelings</td>
<td>50.93 (10.2)</td>
<td>50.54 (9.9)</td>
<td>53.04 (9.4)</td>
<td>3.12</td>
<td>0.004</td>
</tr>
<tr>
<td>O4: Actions</td>
<td>50.73 (11.1)</td>
<td>50.57 (10.2)</td>
<td>49 (10.3)</td>
<td>1.35</td>
<td>0.002</td>
</tr>
<tr>
<td>O5: Ideas</td>
<td>51.39 (10.4)</td>
<td>51.28 (10.2)</td>
<td>51.28 (10.7)</td>
<td>0.03</td>
<td>0.000</td>
</tr>
<tr>
<td>O6: Values</td>
<td>49.85a (10.8)</td>
<td>50.59a (9.5)</td>
<td>53.57b (10.3)</td>
<td>6.93*</td>
<td>0.008</td>
</tr>
<tr>
<td>A1: Trust</td>
<td>52.09 (10)</td>
<td>52.01 (9)</td>
<td>49.85 (10.6)</td>
<td>3.72</td>
<td>0.005</td>
</tr>
<tr>
<td>A2: Straightforwardness</td>
<td>51.28a (9.9)</td>
<td>50.36a (9.5)</td>
<td>47.83b (8.8)</td>
<td>6.98*</td>
<td>0.008</td>
</tr>
<tr>
<td>A3: Altruism</td>
<td>51b (9.8)</td>
<td>49.05b (9.5)</td>
<td>48.58b (9.7)</td>
<td>9**</td>
<td>0.011</td>
</tr>
<tr>
<td>A4: Compliance</td>
<td>51.89a (10.8)</td>
<td>50.07a (10)</td>
<td>48.60a (9.8)</td>
<td>8.76**</td>
<td>0.011</td>
</tr>
<tr>
<td>A5: Modesty</td>
<td>47.53 (10.2)</td>
<td>46.74 (9.5)</td>
<td>46.87 (10.2)</td>
<td>1.25</td>
<td>0.002</td>
</tr>
<tr>
<td>A6: Tender-mindedness</td>
<td>50.41 (10.2)</td>
<td>49.58 (9.3)</td>
<td>50.32 (10.6)</td>
<td>1.35</td>
<td>0.002</td>
</tr>
<tr>
<td>C1: Competence</td>
<td>53.32a (10)</td>
<td>50.92a (10.4)</td>
<td>49.63b (10.7)</td>
<td>13.9**</td>
<td>0.017</td>
</tr>
<tr>
<td>C2: Order</td>
<td>49.21a (10.3)</td>
<td>47.24a (10.1)</td>
<td>46.78b (10.8)</td>
<td>8.12*</td>
<td>0.010</td>
</tr>
<tr>
<td>C3: Dutifulness</td>
<td>51.85a (9.3)</td>
<td>50.37d (8.8)</td>
<td>46.58b (9.6)</td>
<td>18.78**</td>
<td>0.022</td>
</tr>
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<td>C4: Achievement-striving</td>
<td>51.78a (10.7)</td>
<td>49.78a (10.2)</td>
<td>45.15b (10.3)</td>
<td>23.08**</td>
<td>0.027</td>
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<tr>
<td>C5: Self-discipline</td>
<td>49.23a (10.7)</td>
<td>47.02a (10.5)</td>
<td>44.43a (10.3)</td>
<td>15.2**</td>
<td>0.018</td>
</tr>
<tr>
<td>C6: Deliberation</td>
<td>52.89a (9.6)</td>
<td>50.02a (9.5)</td>
<td>48.08a (10.3)</td>
<td>24.08**</td>
<td>0.029</td>
</tr>
</tbody>
</table>

Means with the same superscript are not significantly different, \(P < 0.05\) after Bonferroni correction.

\*\(P < 0.05\), \**\(P < 0.01\) after Bonferroni correction for 35 comparisons and controlling for sex, age and education.
neuroticism × extraversion). As advocated by Cohen (1978), in the hierarchical approach the two-way interactions are corrected for the effects of the main factors; in other words, they explain variance beyond that explained by the main factors. Three of the five factors, conscientiousness \( [\lambda = 0.970, F(2, 1635) = 25.62, P < 0.001] \), agreeableness \( [\lambda = 0.958, F(4, 3268) = 17.67, P < 0.001] \) and neuroticism \( [\lambda = 0.950, F(6, 3266) = 14.02, P < 0.001] \) were found to contribute significantly to the discriminant function. Of all possible interaction terms, only neuroticism × conscientiousness contributed significantly to the discriminant function \( [\lambda = 0.946, F(8, 3264) = 11.59, P < 0.001, \eta^2 = 1 - \lambda = 0.054] \). Further analyses showed that the discriminant analysis results were robust across different multivariate methods (e.g. multinomial logistic regression, GLM on dichotomized factors). The interactive effect of neuroticism and conscientiousness is illustrated in Fig. 1, in which the proportions of never, former and current smokers are stratified by the style of impulse control (combination of scores on neuroticism and conscientiousness; Costa, McCrae & PAR Staff 2000). The group low in conscientiousness and high in neuroticism (under-controlled style) was about two times more likely to be current smokers than the group low in conscientiousness and low on neuroticism (relaxed), and was three times more likely to be current smokers than groups high on conscientiousness and high (over-controlled) or low (directed) on neuroticism. This suggests that neuroticism was related to smoking mostly among individuals low on conscientiousness.

**DISCUSSION**

There has been great progress in trait psychology in the past 20 years, with a general consensus on the FFM as a reasonably comprehensive taxonomy of personality traits. A major contribution of the present study is its use of the FFM to investigate the association between cigarette smoking and personality traits. Analyses at the facet level extend knowledge, allow direct tests of hypotheses and provide insight into the dynamics of cigarette smoking.

Current smokers were found to score significantly higher 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 other groups in neuroticism and conscientiousness, suggesting that neuroticism and conscientiousness may play a role in both smoking initiation and maintenance/cessation. No differences on overall extraversion or openness were observed among groups. These effects remained after controlling for age, education and sex with a statistical and a design control. At the facet level, all facets of neuroticism except self-consciousness showed significant differences among groups, with the largest differences in impulsiveness. The smokers’ higher scores on neuroticism facets are consistent with the susceptibility toward psychopathology found in nicotine-dependent smokers (e.g. Breslau et al. 1993). The high score on neuroticism is also consistent with the view that some individuals use

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**Figure 1** The four impulse control style groups were determined by scores on neuroticism (N) and conscientiousness (C). The sample was split at the mean normative value (mean = 50), and the sign + and – following N or C indicates scores above and below the mean, respectively. For example, the under-controlled (N + C–) group has high scores on neuroticism and low scores on conscientiousness.
cigarette smoking as self-medication (Khantzian 1997). There is striking evidence (Fowler et al. 1996) that smoking inhibits monoamine oxidase, which breaks down neurotransmitters such as serotonin and dopamine that are implicated in mood regulation. The Fowler et al. (1996) study highlights the importance of investigating biological and genetic factors underlying or moderating the association of personality traits and smoking. Possible genetic moderators, especially genes involved with serotonin and dopamine systems, are plausible candidates.

High scores on neuroticism could be a cause as well as an effect of smoking. Indeed, longitudinal data suggest that high neuroticism is a risk factor for smoking initiation (Cherry & Kiernan 1976). Other evidence indicates that nicotine depletion (i.e. time between cigarettes) produces high negative affective states (Costa & McCrae 1981; Parrott 1998; Picciotto, Brunzell & Caldaroni 2002) and over long periods of time, cigarette smoking may increase the risk of anxiety and depressive disorders (Choi et al. 1997; Wu & Anthony 1999; Johnson et al. 2000). Consistent with previous studies (Parrott 1998), former smokers scored lower on neuroticism compared with current smokers. It is possible that even before quitting, former smokers had a lower neuroticism score compared with individuals who continued to smoke, which may have facilitated quitting; the stress of nicotine withdrawal may be more tolerable to ‘better adjusted’ people (Hall et al. 1993; Covey, Glassman & Stetner 1997; Madden et al. 1997). Alternatively, quitting smoking may reduce stress and lower neuroticism, as some evidence suggests (Parrott 1995, 1998), providing an additional incentive for quitting smoking.

Among the facets of extraversion, only excitement-seeking differed among groups, with current smokers scoring higher than non-smokers. The role of excitement-seeking is particularly relevant in light of the stimulating effect of nicotine. However, global extraversion was unrelated to smoking status, because there were no differences among groups on the other facets. Prior findings suggesting that extraversion is related to smoking were often obtained using measures of extraversion that included impulsivity as a facet (Eysenck & Eysenck 1964). Different questionnaires assess extraversion through different facets, and this might explain the literature’s inconsistent results regarding the broad extraversion factor. Another intriguing, although speculative, possibility is that extraverts are more likely to be smokers within populations with a high prevalence of smokers, where smoking is less socially disapproved (Eysenck 1983). Indeed, the association of smoking with extraversion was found in the US population before 1970–80 (Smith 1970), but not in the last two decades, whereas the association is still found in countries with a high prevalence of smokers, such as Japan (Arai et al. 1997). An inverse pattern could be argued for neuroticism.

Considering the social pressure against starting and continuing smoking, the smokers’ lower scores on agreeableness facets are not surprising. Some studies suggest that rebelliousness, a trait closely related to low agreeableness, contributes to the etiology of cigarette smoking (Stewart & Livson 1966). Individuals with low scores on agreeableness are antagonistic, hostile and intolerant; they have lower needs for social approval and thus are more likely to start and continue smoking in spite of the deleterious effect of smoking upon other people (e.g. environmental tobacco smoke or second-hand smoking, negative role models). Among the facets of conscientiousness, smokers were particularly lower in self-discipline and deliberation, which are related to the impulsivity construct. Lack of persistence, restraint and dutifulness are likely to play a critical role in the individual’s susceptibility to smoking initiation. The same personality characteristics are also likely to undermine efforts in smoking cessation programs. Low conscientiousness has been associated with other health risk behaviors (see Trobst et al. 2000), and the present study supports the view that conscientiousness is the strongest personality predictor of health risk behaviors (Booth-Kewley & Vickers 1994). It is worth noting that the personality dimension of conscientiousness, which showed the largest association to smoking behavior in this study, has rarely been considered in previous studies. This finding supports the need for the use of a comprehensive model of personality to avoid the risk of neglecting important correlates of health risk behavior.

Combinations of personality traits (styles or types) have been related to smoking. Vollrath & Torgersen (2002) reported that the impulsive and insecure personality types, which are both characterized by low conscientiousness and high neuroticism, are more likely to be current smokers. Analyses on the present sample are highly consistent with their findings and are somewhat consistent with Parkes’s (1984) findings of an interaction between neuroticism and psychoticism but not with the finding of interaction between neuroticism and extraversion. The neuroticism x conscientiousness interaction effect illustrates that personality traits can influence behavior in a complex manner. The level of conscientiousness seems to be a moderator factor in the relationship between neuroticism and smoking. Neuroticism was related to smoking particularly among individuals with low conscientiousness, an effect that may have contributed to produce inconsistent results across studies. These data suggest that individuals high on conscientiousness may not adopt the same maladaptive strategy (i.e. smoking) to deal with high neuroticism. Of relevance, high neuroticism and low conscientiousness defines the
under-controlled style of impulse control. Under-controlled individuals are described as being:

... Often at the mercy of their own impulses. They find it difficult and distressing to resist any urge or desire, and they lack self-control to hold their urges in check. As a result, they may act in ways that they know are not in their long-term interests. They may be particularly susceptible to substance abuse and other health risk behaviors. (Costa et al. 2000)

The findings of the present study have implications for understanding smoking and smoking cessation programs. The high impulsivity of smokers—expressed in their inability to resist cravings, search for stimulation, lack of careful consideration of the consequences of their actions and their limited self-discipline—suggest that relying only on the individual’s resources could be a poor strategy for smoking prevention and cessation. Even with full knowledge of the harmful effects of smoking, individuals with this personality profile may be unable to control their smoking. Data from the WHO confirm that societal pressure in the form of high taxation, restriction in advertising and interdiction of smoking in public places are more cost-effective than programs that rely on the efforts of individual smokers. However, evidence that smokers not are a homogeneous group suggests that a diversity of treatment modalities is necessary. For example, smokers high on neuroticism might benefit from psychotherapy or antidepressant treatment. A combination of public policy and treatment strategies tailored to the needs of individual smokers is required to reduce the prevalence of cigarette smoking. Potentially important in this regard is the addition of personality trait profiles to expert-systems interventions for smoking cessation, as described by Velicer & Prochaska (1999). Their Pathways to Change system is based upon the transtheoretical model of change and provides assessments and feedback related to the individual’s needs and readiness to change. Efficacy is evidenced by cessation rates of 22–26% in a general population. An important and interesting aspect of future research is to consider how to integrate an individual smoker’s personality trait information into population-based intervention programs. Indeed, different treatment options are available, and all seem effective on some individuals but not on others. Personality traits may provide indications of which treatments are more likely to be effective. For example, individuals high on neuroticism may benefit from psychotherapy or medication or both. Such indications could be based on observational data from former smokers, assessing their personality traits and their successful and unsuccessful ways of quitting. More compelling data would come from assessing personality traits in individuals involved in ongoing cessation treatment programs. In both cases, it would be possible to test whether personality traits affect the success rate of each treatment program.

This study was conducted on an adult elderly US population, from 1989 to 2002. Although the findings are likely to generalize to the US adult population today, historical and cross-cultural differences may shape the association of smoking status with personality traits. As argued by Hughes et al. (1997), the prevalence of smoking is changing constantly, with different trends in different times and cultures. Continuous monitoring of the variables associated with smoking status is essential to addressing this major public health threat.

REFERENCES


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