Assessment of the Psychometric Properties of the Facets of Conscientiousness

Poomimna Madhavan

University of Illinois at Urbana-Champaign

The purpose of the following study was to examine the psychometric properties of the nine lower order facets of Conscientiousness derived from the IPIP (International Personality Item Pool) Conscientiousness scale by running a standard data analyses procedure involved in scale development or psychometric evaluation of a measure. The nine Conscientiousness scales were first tested for internal consistency, and were then correlated with preexisting personality scales (IPIP Big Five measures of personality, health behavior checklists) and demographic data to test for concurrent, discriminant, and convergent validities. The Conscientiousness scales were then factor analyzed to add supplementary information about the factorial stability of the scales. Results revealed that the nine Conscientiousness scales are a valid and reliable measure of personality. The scales were found to be internally consistent. Furthermore, analyses also revealed a stable factorial structure for the scale, in addition to high concurrent, discriminant and convergent validity.

The wealth of existing personality research and attempts at measuring and quantifying personality constructs over the last few decades has raised the need for the development of integrative taxonomic frameworks that organize the variety of individual differences in personality. One such attempt at effectively classifying the dimensions of personality has resulted in the development of the Big Five Factor Structure that offers a broad suggestion of five primary factors that are basic to human personality. In trait factor theory, the Five-Factor Structure reflects five major categories of emotionality, activity, and sociability factors.

The Big-Five Structure was originally developed by Tupes and Christal (1961) on the basis of reanalysis of various data sets using bipolar variables earlier constructed by Cattell (1957). Over the last decade, supporters of the Five-Factor Model (cf. Benet-Martínez & John, 1998; Block, 1995; Digman, 1990; Goldberg, 1990; Hendriks, 1997; John, 1990; Revelle, 1995; Saucier, 1994; Wiggins, 1996) have implied that personality can be understood in terms of five broad traits, namely: I Surgency (or Extraversion); II Agreeableness; III Conscientiousness (or Dependability); IV Emotional Stability (vs. Neuroticism); and V Culture.

Author info: Correspondence should be sent to Poomimna Madhavan, U. of Illinois, Aviation Human Factors Division, 1 Airport Road, Savoy, IL 61874, USA; or madhavan@uiuc.edu, phone # (217) 244-8904, fax # (217) 244-8647

© NAJP
Intellect or Openness (a combination of intelligence, imagination, and curiosity). The primary support for this Five-Factor Model comes from three main areas: the factor analysis of trait terms in language, the relation of trait questionnaires to other questionnaires and ratings, and the analysis of genetic (inherited) contributions to personality (Pervin, 1993).

Research has demonstrated that the analysis of any reasonably large sample of English trait adjectives in either self- or peer-descriptions will elicit a variant of the Big-Five Factor Structure (Goldberg, 1990). From a global perspective, such trait adjectives can be viewed as blends of five major features, features that relate in a gross way to Power, Love, Work, Affect, and Intellect (Peabody & Goldberg, 1989). Briefly, Extraversion summarizes traits related to activity, energy, dominance, sociability, and positive emotions. Agreeableness includes traits such as altruism, tenderness, trust and modesty. Conscientiousness describes socially prescribed impulse control that facilitates task- and goal-directed behavior (Benet-Martinez & John, 1998). Neuroticism (contrasted with Emotional Stability) includes a broad range of negative affects such as anxiety, irritability and nervous tension. Openness describes the breadth, depth, and complexity of an individual's mental and experiential life (Benet-Martinez & John, 1998).

While there exists emerging consensus about the validity of the Big Five Structure, Cattell contends that there are far more than five factors while Eysenck is certain that five is too many. Specifically, Eysenck (1991, 1992) has argued that Factor II (Agreeableness) and Factor III (Conscientiousness) in the Big-Five representation are merely facets of the higher-level construct of Psychoticism in his three-factor P-E-N (Psychoticism, Extraversion, Neuroticism) model (Goldberg, 1993). A major alternative set of Big-Five markers developed in recent times is the NEO Personality Inventory (NEO-PI) developed by Costa and Mc Crae (1985). The inventory provides scales measuring five domains, labeled Neuroticism (Factor IV), Extraversion (Factor I), Openness to Experience (Factor V), Agreeableness (Factor II), and Conscientiousness (Factor III), as well as measures of six facets each of the Neuroticism, Extraversion, and Openness domains. Thus, though the NEO-PI comprises the same original big five dimensions, it is different in that the focus rests heavily on the first three dimensions – Neuroticism, Extraversion, and Openness, while focusing on additional factors such as Conscientiousness in recent times.

One other interesting model of personality is the Big Seven Structure of Personality (Benet & Waller, 1995) that challenges the comprehensiveness of the Big Five structure. The Big Seven dimensions were developed in recognition of the fact that five of their factors were similar to, but not isomorphic with the higher order factors of the Big
Five. The two remaining dimensions in the structure – labeled Positive and Negative Valence – seemingly tap aspects of self-evaluation that are not measured by popular lexically informed personality inventories (e.g., Costa & McCrae, 1985; Goldberg, 1992).

A recent significant contribution to the field of personality assessment has been the development of the *International Personality Item Pool* (IPIP; see International Personality Item Pool, 2001) scales by Goldberg (1999). These scales were developed on the substrate of a pool of Dutch items originally developed by Hofstee, De Raad, and Goldberg (1992) to reflect the Five-Factor structure of personality, that were later translated into English by Goldberg. A new set of English items was added to the translated items to arrive at Goldberg’s five IPIP personality scales. Further, each of the IPIP dimensions was constructed to reflect nine lower facets of each of the Big Five dimensions. For example, the scale measuring core Conscientiousness could be divided into nine individual scales, each measuring some aspect of conscientiousness in addition to being a blend of one of the other five factor dimensions.

The IPIP dimensions have been compared with the original 16PF (Conn & Rieke, 1994; Russell & Karol, 1994), AVA (Hasler, Judd, & Merenda, 1987), CPI (Gough, 1996), TCI (Cloninger, Przybeck, Svrakic, & Wetzel, 1994), HPI (Hogan & Hogan, 1995), and NEO-PI-R (Costa & McCrae, 1992) scales to arrive at the conclusion that the IPIP scales have comparable internal consistency estimates to each of the other measures (Goldberg, in press). Validity findings indicate that the IPIP scales are also high in predictive utility (cf. Johnson, 2000; Goldberg, in press).

The strength of associations between personality dimensions (as evidenced by the above classifications of personality) and demographic variables is an important issue that needs to be addressed in personality assessment. Demographic variables primarily refer to variables such as age, gender, race, and ethnic identity. Correlates of education and socioeconomic status have also been included in the demographic domain in recent times as they often exercise a strong influence on performance (Goldberg, Sweeney, Merenda, & Hughes, 1998). According to Goldberg et al (1998):

“There are at least two ways in which demographic variables can be associated with personality: (a) demographic variables could influence the variance of one or more personality traits; for example men and women may show no mean difference on some dimension, as a group of men could be more variable on this dimension than the women; (b) demographic variables might ‘moderate’ the relationship between pairs of measures; for example personality variables could be more predictive of job performance for women than they are for men...."
Of the four major demographic variables, viz. age, gender, ethnic/racial status and education, gender is the one variable whose relations with personality have been studied most frequently (cf. Hall, 1984; Feingold, 1994). However, a common problem with gender-personality studies has been the confounding of gender differences by racial identity. While there exists almost no quantitative review addressing the relationship between ethnic/racial status and education with personality, the only demographic variable that has been found to meaningfully correlate with the Big Five domains is ‘age’. Furthermore, Conscientiousness is the only Big Five factor that has been found to be monotonically related to age. Essentially, aging leads to people becoming more conservative, organized, dependable, practical and cautious – all facets of Conscientiousness in the Big Five factor structure (Goldberg et al, 1998).

As evident from above discussion, a few research attempts have addressed the relationship between demographic variables and personality (in general) over the last few years. However, the existing evidence is relatively limited and raises the necessity for a more organized approach to studying the role of demographic status on personality traits. Moreover, the relationship between demographies and Conscientiousness, in particular, is of interest as past research has frequently delineated Conscientiousness as one of the main personality variables meaningfully associated with demographic data (cf. Goldberg, 1998).

Conscientiousness includes such traits as reliability, perseverance, and self-discipline, and these traits in turn contribute to healthful behaviors (Wiebe & Christensen, 1997). Higher scores on Conscientiousness have been associated with health-protective behaviors both prospectively (cf. Brickman, Yount, Blaney, Rothberg, & Kaplan De-Nour, 1996; Siegler, Feaganes, & Rimer, 1995) and concurrently (Arthur & Graziano, 1996; Castle, Skinner & Hampson, 1999; Marks & Lutgendorf, 1999; Vollrath, Knoch, & Cassano, 1999). However, past research investigating the moderating effect of Conscientiousness in the prediction of healthful and safety-related behavior has produced limited results (Wiebe & Christensen, 1997; Hampson, Andrews, Barckley, Lichtenstein, & Lee, 2000).

A study by Heaven, Mulligan, Merrilees, Woods and Fairooz (2001) revealed that unhealthy and constrained eating habits are significantly associated with Conscientiousness, in particular, cautiousness, self-discipline, and achievement striving. Costa and McCrae (1985) describe conscientious types as “strong-willed” and “determined” people who “structure their lives tightly.” Therefore, it follows that low conscientious people are more likely to indulge in poor and unstructured eating habits.
Similar results were found in a more recent study by Goldberg and Stryker (2002) wherein people who regulated their eating habits described themselves in traits that reflected conscientiousness, dutifulness, and orderliness. Overall, research on the relationship between personality and health behaviors suggests that, similar to demographic data, Conscientiousness is one of the primary factors that repeatedly emerges as having a significant correlation to healthful behaviors and eating habits. Therefore, the present study further investigates the meaningfulness and implications of the correlations between Conscientiousness facets, demographic data, and health behavior variables.

The purpose of the following study was to study the psychometric properties of the nine lower order facets of Conscientiousness derived from the IPIP Conscientiousness scale. The scales were first tested for internal consistency, and were then correlated with preexisting scales of personality, health behavior checklists and demographic data to test for concurrent, discriminant and convergent validities. In addition, the scales were factor analyzed to add supplementary information about the factorial stability of the scales. The ultimate goal was to run a standard data analysis involved in scale development and psychometric evaluation of the facets of Conscientiousness. The database was scored to reflect the domain of Conscientiousness and then tested for their psychometric properties. Based on existing findings on the relationship between personality correlates and demographic variables, the following hypotheses were generated which address the validity of the Conscientiousness scales:

1.1 Concurrent validity: Correlations between a new test (or scale) and existing tests (or scales) measuring the same construct are often cited as evidence of concurrent validity (cf. Gregory, 2000). Therefore, each Conscientiousness scale was expected to correlate highly and significantly with the Conscientiousness facet of the IPIP Big Five as well as the other IPIP facet that it was blended with.

1.2 Discriminant validity is indicated by the presence of low and non-significant correlations with measures that assess different and unrelated constructs (Gregory, 2000). Therefore, the nine Conscientiousness scales were expected to correlate non-significantly with the facets of the IPIP Big Five that they were not blends of.

1.3 Convergent validity is assessed by significant correlations with other theoretically related constructs (Gregory, 2000). Therefore, in the present study, the Conscientiousness scales were hypothesized to correlate positively and significantly with health behaviors and negatively with unhealthy behavioral patterns, based on earlier evidence that Conscientiousness is associated with health behaviors both
prospectively (Brickman et al., 1996) and concurrently (Arthur & Graziano, 1996).

1.4 Demographic variables: ‘Age’ was expected to correlate significantly with Conscientiousness based on Goldberg et al’s (1999) finding that conscientiousness increases monotonically with age. Similar significant correlations were expected with other demographic variables such as ‘gender’ and ‘ethnicity’, thereby lending additional support for the convergent validity of the Conscientiousness scales.

METHOD

Participants

Participants consisted of a sample of undergraduate students from the University of Illinois (N = 364) and a sample of members in a small midwestern community (N=69). Undergraduate participants were recruited from the department research subject pool where age and gender of participants were balanced prior to recruitment. A large convenience sample from the midwestern community was selected from both genders and from varied ethnic backgrounds (African American, American Indian / Native American, Hispanic / Chicano / Mexican American, Asian American, and Caucasian / European American) through mail recruitment and public advertisement. Mean age was 18.5 years for the undergraduate sample and 55 years for the community sample. Participants completed a battery of questionnaires (self-report measures) in classroom and laboratory settings.

Measures

Self-Report Measures of Personality. Scales from Goldberg’s (1999) 45-facet International Personality Item Pool (IPIP) Big Five scales were used to assess and score the Big Five dimensions of Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Intellect, with each scale comprised of 10 items. According to Goldberg (1999), the 45 IPIP scales targeted at the lower order level of the Big Five demonstrate higher than average internal consistency reliability (average of .80) and in comparative validity studies predicted hypothesized criteria as well, if not better than existing personality questionnaires. Scores for each of the Big Five dimensions were calculated by averaging the nine facets that make up each trait domain. Respondents rated each item on the IPIP questionnaire on a five-point scale from 1 (very uncharacteristic of me) to 5 (very characteristic of me).

In addition to Goldberg’s Big Five IPIP scales a set of adjectives was selected from which additional Big Five scales could be developed. This set of adjectives contained primary adjectival markers for the Big Five and an additional set of adjectives from the domain of Conscientiousness.
Examples of trait adjectives drawn from the Big Five are*: ‘extraverted’ (reflecting Extraversion), ‘kind’ (reflecting “Agreeableness), ‘organized’ (reflecting Conscientiousness), ‘unenvious’ (reflecting Emotional Stability), and ‘intellectual’ (reflecting Openness). The adjectives selected to assess the Big Five and the domains of Conscientiousness were drawn from the 540 and 1710 Trait Descriptive Adjective systems (540TDA and 1710TDA; Goldberg, 1982, 1992; Hofstee et al., 1992). Additional Conscientiousness adjectives were selected that reflected blends of Conscientiousness with high and low extraversion, agreeableness, emotional stability, and intellect, respectively. These adjective systems served as the basis for Goldberg’s longstanding research delineating the structure of phenotypic traits and served as the basis for the development and confirmation of the Big Five factor structure (Goldberg, 1992). According to Goldberg (1992) the construct of Conscientiousness consists of pure markers of Conscientiousness, and the facets of Conscientiousness that are blends of Conscientiousness and each of the remaining Big Five personality traits. They summed to a total of nine scales (with 10 items in each scale) namely**: Conscientiousness, Efficiency (e.g., ‘alert’, ‘ambitious’), Cautiousness (e.g., ‘careful’, ‘cautious’), Dutifulness (e.g., ‘responsible’, ‘dependable’), Rationality (e.g., ‘stern’, ‘strict’), Purposefulness (e.g., ‘through’, ‘steady’), Perfectionism (e.g., ‘perfectionistic’, ‘ritualistic’), Organization (e.g., ‘dignified’, ‘refined’), and Orderliness (e.g., ‘conventional’, ‘traditional’). These were administered to the participants in a paper-and-pencil format.

Health-related behaviors. Two measures of health behavior were administered to participants. The first measure was the Health Behavior Checklist (HBCL; Vickers, Conway, & Hervig, 1990). The HBCL is a 40-item checklist that consists of four subscales: Preventative Health Behaviors, Accident Control Behaviors, Risk Taking Behaviors, and Substance Risk Behaviors. The Preventative Health Behaviors subscale consists of items such as “I exercise to stay healthy,” and “I see a doctor for regular checkups.” The Accident Control Behaviors subscale consists of items such as “I have a first aid kit in my home,” and “I fix broken things around the home right away.” The Risk Taking Behavior subscale consists of items such as “I speed while driving,” and “I cross busy streets in the middle of the block.” Finally, the Substance Risk Behavior subscale consists of items such as “I do not drink alcohol,” and “I don’t smoke.” Respondents rated each item from the HBCL on a five-point scale from 1 (very uncharacteristic of me) to 5 (very characteristic of me). Reliability estimates across for the HBCL scales were marginally acceptable, ranging from .63 to .79 (mean = .69).
The second measure consisted of scales drawn from the Behavioral Risk Factor Surveillance System (BRFSS; National Center for Chronic Disease Prevention and Health Promotion, 2000) and the Youth Risk Behavior Survey (YRBS; National Center for Chronic Disease Prevention and Health Promotion, 1999). These two surveys are used nationally to track health risk factors in adolescents and adults. Scales assessing nine behavioral factors (a total of 45 items) were drawn from the BRFSS and YRBS surveys measuring: Seatbelt Wearing Habits (e.g., "I rarely wore seatbelts in the past month"), Drunk Driving (e.g., "I have driven after drinking alcohol"), Eating Fruits and Vegetables (e.g., "I have eaten fruit during the last one week"), Amount of Exercise (e.g., "During the past month I have participated in physical activities or exercises such as running, calisthenics, golf, or walking for exercise"), Experience of Violence (e.g., "I have participated and been injured in a physical fight"), Alcohol Consumption (e.g., "I have consumed alcohol on one more occasions"), Tobacco Consumption (e.g., "I have tried cigarette smoking, even one or two puffs"), Drug Consumption (marijuana, speed, heroin, etc) (e.g., "I have used marijuana"), and Suicidal Tendencies (e.g., "I often feel sad and hopeless"). Respondents rated each item from the combined BRFSS and YRBS survey on a five-point scale from 1 (very uncharacteristic of me) to 5 (very characteristic of me). Where necessary, items from each domain were z-scored and summed to form more reliable composite scores indicating greater or lesser risk for each domain. Reliability estimates for the BRFSS and YRBS scales were also quite good, ranging from .62 to .89 (mean = .77).

Procedure
All participants completed all five measures, namely, the complete Goldberg IPFP Big Five scales, the Health Checklist, the combined Behavioral Risk Factor Surveillance System and Youth Risk Behavior Survey, and the set of Adjectives assessing the Big Five and lower order Facets of Conscientiousness. In order to control for order effects, the five checklists were counterbalanced such that 120 unique combinations of questionnaires were generated and administered to participants. The battery of tests did not take more than an hour and a half to complete. The relevant adjectives measuring the lower order Facets of Conscientiousness and the Big Five dimensions are represented in Tables 1 and 2 respectively.

RESULTS
Internal Consistency Analysis
Analysis of internal consistency of scales revealed that the scales with the highest internal consistency were those that measured Conscientiousness (alpha = .85), Dutifulness (alpha = .82), and
Purposefulness (alpha = .78). Scales with moderate internal consistency were those measuring Organization (alpha = .71), Efficiency (alpha = .71) and Cautiousness (alpha = .70). Scales measuring Rationality (alpha = .61), Perfectionism (alpha = .57) and Orderliness (alpha = .55) showed comparatively lower internal consistency. As noted by Nunnally (1978, p. 245), scales with internal reliabilities of .70 to .80 are acceptable for research purposes because correlations with such scales are not attenuated to any great degree by measurement error. As indicated by Cronbach’s alphas, six out of the nine Conscientiousness scales demonstrated acceptable internal consistency for reliable scale construction.

**TABLE 1 Correlations between Scales of Conscientiousness and IPIP Measures**

<table>
<thead>
<tr>
<th></th>
<th>IPIP</th>
<th>IPIP</th>
<th>IPIP</th>
<th>IPIP</th>
<th>IPIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extra</td>
<td>Agree</td>
<td>Con</td>
<td>E S</td>
<td>Intell</td>
</tr>
<tr>
<td>Con</td>
<td>0.11</td>
<td>0.24</td>
<td>0.57**</td>
<td>0.24</td>
<td>0.20</td>
</tr>
<tr>
<td>Efficiency</td>
<td>0.17</td>
<td>0.19</td>
<td>0.43**</td>
<td>0.10</td>
<td>0.29**</td>
</tr>
<tr>
<td>Cautiousness</td>
<td>-0.08</td>
<td>0.20</td>
<td>0.49**</td>
<td>0.28*</td>
<td>0.21</td>
</tr>
<tr>
<td>Dutifulness</td>
<td>0.07</td>
<td>0.33**</td>
<td>0.40**</td>
<td>0.27</td>
<td>0.26</td>
</tr>
<tr>
<td>Rationality</td>
<td>0.09</td>
<td>-0.17</td>
<td>0.15</td>
<td>-0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>Purposefulness</td>
<td>0.20</td>
<td>0.22</td>
<td>0.48**</td>
<td>0.35**</td>
<td>0.24</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>0.06</td>
<td>0.04</td>
<td>0.37**</td>
<td>-0.03</td>
<td>0.13</td>
</tr>
<tr>
<td>Organization</td>
<td>0.02</td>
<td>0.19</td>
<td>0.48**</td>
<td>0.29**</td>
<td>0.24*</td>
</tr>
</tbody>
</table>

**significant at the 0.01 level  *significant at the 0.05 level**

Extra = Extraversion, Agree = Agreeableness, Con = Conscientiousness, E S = Emotional Stability, Intell = Intellect

**Concurrent / Discriminant Validity**

Table 1 shows correlations between the nine scales of Conscientiousness and corresponding IPIP measures. All scales correlate significantly with the IPIP Conscientiousness scale demonstrating good concurrent validity. Correlations range from .30 (Orderliness) to .57 (Conscientiousness) at the .01 level. However, this pattern is not seen for scale 5 (Rationality) that has a low and non-significant correlation with Conscientiousness (.15) at the .01 level. In addition to correlating with the IPIP Conscientiousness measure, each scale also correlates highly
and significantly with the other IPIP measure that it is a blend of. This effect is most pronounced for Dutifulness ($r = .33$ with IPIP Agreeableness), Purposefulness ($r = .35$ with IPIP Emotional Stability), and Organization ($r = .24$ with IPIP Intellect).

However, this effect is not seen for Cautiousness ($r = -.08$ with IPIP Extraversion), Rationality ($r = -.17$ with IPIP Agreeableness), Perfectionism ($r = -.03$ with IPIP Emotional Stability) and Orderliness ($r = -.03$ with IPIP Intellect).

Table 1 also shows that almost all nine Conscientiousness scales have low and non-significant correlations with those IPIP scales that measure other traits. Scale 1 (Conscientiousness) has low correlations (less than .25) with all scales of the IPIP other than Conscientiousness, thus demonstrating discriminant validity. This pattern can be seen for all scales with the exception of Scales 7 (Perfectionism) and 9 (Orderliness), that fail to correlate significantly with any of the IPIP measures other than Conscientiousness.

**Convergent Validity**

Convergent validity was assessed by correlating the Conscientiousness adjectives with demographic and health behavior data.*** The resulting correlation matrix was analyzed and interpreted to arrive at the conclusion of convergent validity for each scale of Conscientiousness. Most of the Conscientiousness scales correlated significantly and positively with preventive health behaviors ($r$ ranging from .13 to .24) and accident control ($r$ ranging from .12 to .26) at the .01 level. Similarly, there were significant and negative correlations with risk taking ($r$ ranging from -.05 to -.32) and substance risk behaviors ($r$ ranging from -.08 to .28) at the .01 level. Three scales (Conscientiousness, Efficiency and Cautiousness) negatively and significantly correlated with experience of violence, tobacco consumption, alcohol consumption, consumption of marijuana, heroin, hallucinogens etc, and suicidal tendencies. However, the latter health behavior scales did not correlate significantly with the other six scales of Conscientiousness.

Age was found to be positively and significantly correlated ($rs$ ranging from .02 to .23, $p < .01$) with all Conscientiousness scales, except scale 5 (Rationality). Gender correlated significantly only with Conscientiousness ($r = .12$) and Dutifulness ($r = .11$), while ethnicity did not correlate significantly with any of the scales. While risk taking behaviors and substance risk correlated significantly with most scales, wearing seatbelts, driving drunk, eating fruits and vegetables, and amount of exercise had almost negligible and non-significant correlations with most scales.
TABLE 2 Results of Principal Components Analyses-representing Rotated Eigen Values for each Factor and Percentage of Variance Accounted for by that Factor (in parentheses)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Factor 1 (40.53)</th>
<th>Factor 2 (17.76)</th>
<th>Factor 3 (17.23)</th>
<th>Factor 4 (12.71)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscientiousness</td>
<td>4.05</td>
<td>1.68</td>
<td>1.27</td>
<td>1.48</td>
</tr>
<tr>
<td>Efficiency</td>
<td>2.30</td>
<td>1.72</td>
<td>1.52</td>
<td>1.45</td>
</tr>
<tr>
<td>Cautiousness</td>
<td>2.31</td>
<td>1.53</td>
<td>1.48</td>
<td>1.21</td>
</tr>
<tr>
<td>Dutifulness</td>
<td>3.03</td>
<td>1.52</td>
<td>1.45</td>
<td>1.21</td>
</tr>
<tr>
<td>Rationality</td>
<td>2.05</td>
<td>1.52</td>
<td>1.45</td>
<td>1.21</td>
</tr>
<tr>
<td>Purposefulness</td>
<td>2.38</td>
<td>2.16</td>
<td>1.55</td>
<td>1.21</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>1.64</td>
<td>1.55</td>
<td>1.45</td>
<td>1.21</td>
</tr>
<tr>
<td>Organization</td>
<td>2.18</td>
<td>1.56</td>
<td>1.37</td>
<td>1.21</td>
</tr>
<tr>
<td>Orderliness</td>
<td>2.31</td>
<td>1.72</td>
<td>1.37</td>
<td>1.21</td>
</tr>
</tbody>
</table>

**Factor Analysis**

The nine scales of Conscientiousness were factor analyzed both together and separately to assess the factor structure of the scales, both unidimensional and multidimensional. Principle component analysis resulted in the extraction of one factor for all nine scales together, which accounted for 75.33% of total variance in the scales. This is in keeping with expectations that all nine scales assess the one common factor of Conscientiousness. All components loaded heavily on the one factor that was extracted with the highest loading being for scale 3 Cautiousness (loading = .92) and lowest being for scale 5 Rationality (loading = .74). Factor communalities after extraction revealed that the only scales that did not fit in well with the factor solution were Rationality (communality = .55) and Perfectionism (communality = .66). The scree plot confirmed the above findings showing the distinct presence of one main factor influencing a large portion of variance for all scales together. Thus, factor analysis confirms that Conscientiousness is the main factor that influences scores on all nine scales.

Next, each of the nine scales was factor analyzed separately. The results of unidimensional factor analysis are given in Table 2. Results of factor analysis of scale 1 (Conscientiousness) revealed a two-factor solution for the scale, with the two factors accounting for 57.28% of the total variance in the scale. Out of the 10 items in the scale, 7 loaded
consistently on the first factor, with the other 5 items loading on the second factor. Item communalities showed that two items ‘Careless = .33’ and ‘Unsystematic = .29’, did not fit well into the scale, with all other items showing good fit.

Factor analysis of scale 2 (Efficiency) revealed a two-factor solution for the scale, with the two factors accounting for 40.28% of total variance. Six items loaded consistently on the first factor, while the other four items loaded on the second factor. Item communalities were low for all items resulting in questionable goodness of fit of the items.

Looking at scale 3 (Cautiousness), results of factor analysis showed a three-factor solution emerge, with the three factors accounting for 50.94% of total variance. Out of ten items, five loaded on the first factor, three on the second factor and two on the third factor. Item communalities were moderate, with one item, ‘unruly,’ showing poor communality (.4).

Factor analysis of scale 4 (Dutifulness) resulted in three factors being extracted for the scale, accounting for 60.43% of total variance. Six of the ten items loaded on the first factor, two on the second factor and two on the third factor. Item communalities were good for all items with one exception, ‘mannerly’ (communality = .32).

Items in scale 5 (Rationality) were extracted into four factors, with the four factors accounting for 62.23% of total item variance. Six items loaded consistently on the first factor, two on the second factor, and one each on the third and fourth factors. Factor communalities indicated good item fit for all items.

Analysis of scale 6 (Purposefulness) revealed a two-factor structure with the two factors accounting for 45.44% of total variance. Exactly half the items loaded on the first factor, while the other half loaded on the second factor. Factor communalities indicated a moderate but consistent fit.

A four-factor structure emerged for scale 7 (Perfectionism) that accounted for 65.10% of total variance. Five items loaded on the first factor, two each on the second and third factors, and one item loaded on the fourth factor. Communalities indicated good fit for all items except one ‘ritualistic’ (communality = .33).

Factor analysis of scale 8 (Organization) resulted in a three-factor structure, with 56.80% of total variance being accounted for by the three factors. Four items loaded on the first factor, two on the second factor, and three loaded on the third factor. Communalities were high for all items except two ‘lax’ (communality = .45), and ‘unmethodical’ (communality = .42).

Analysis of the last scale (Orderliness) resulted in the extraction of a two-factor solution, with 40.34% of the total variance being accounted
for by the two factors. Seven out of ten items loaded consistently on the first factor, while three loaded on the second factor. Five items showed very low communality, thereby endangering the goodness of fit of the items in the scale. On the whole, results of factor analysis showed that all nine scales separately and together have good factorial stability, with a few exceptions in each scale.

**DISCUSSION**

Scales constructed to evaluate the nine facets of Conscientiousness from the IPIP Big Five scales were examined for their factorial stability and psychometric properties. Reliability analysis of the each scale separately indicated that the reliability coefficients ranged from .5 to .84. Three scales fell below the target reliability of .7 that was aimed at when the nine scales were constructed (cf. Nunnally, 1978). These scales were scale 5 (Rationality, alpha = .61), scale 7 (Perfectionism, alpha = .57) and scale 9 (Orderliness, alpha = .55). Overall, the size of the reliability coefficients indicated that six out of nine scales were internally consistent thereby leading to the conclusion that the Conscientiousness scales, in general, have an acceptable level of internal consistency to be useful for personality research.

The scales were then correlated with preexisting personality measures to test for concurrent/discriminant and convergent validity. Each scale was correlated with the IPIP Big Five measures and a correlation matrix was arrived at using Pearson’s product moment correlation coefficients. Concurrent validity requires that a scale possess the same measurement properties as any other scale that measures the same characteristic, whereas discriminant validity indicates that the measurement properties of a scale are unique and hence differentiates the scale from any other scale that measures different characteristics (cf. Gregory, 2000). In other words, high and significant correlations between scales measuring the same facet are an indicator of concurrent validity, while low and non-significant correlations between scales measuring different facets are an index of discriminant validity.

In keeping with initial expectations, the Conscientiousness scales demonstrated both concurrent and discriminant validities when correlated with the IPIP Big Five scales, indicating that the measurement properties of the former are comparable to the latter, while at the same time having unique and distinct properties that qualify the Conscientiousness scales as a new and valid measure of personality. Eight of the nine Conscientiousness scales each represent a blend of the facet of Conscientiousness with one other facet of the IPIP Big Five measures. Correlations with the IPIP measures revealed that almost all scales correlated highly and significantly with IPIP measures that they
represented, while at the same time correlating non-significantly with those IPIP scales that represented other facets that they did not represent. The two scales that did not demonstrate the pattern of correlations and therefore were contrary to expectations were Rationality and Perfectionism. Interestingly, these two scales also had low internal consistency. On the whole, the overall pattern of correlations indicated that the nine scales of Conscientiousness had good concurrent and discriminant validity.

Next the nine scales were correlated with health behavior data and demographic variables to test for convergent validity. Convergent validity is demonstrated when a test correlates highly with other theoretically related variables with which it shares an overlap of constructs (Gregory, 2000). Past research has demonstrated meaningful relationships between Conscientiousness and demographic variables such as age (Goldberg et al, 1998), as well as health behaviors (cf. Arthur & Graziano, 1996; Castle et al., 1999). Therefore, significant correlations with health behaviors and demographic data were treated as indices of convergent validity in the present study.

The correlation matrix indicated that most of the Conscientiousness scales were significantly correlated with health behavior data. The scales, on average, failed to correlate significantly with demographic variables, particularly ‘gender’ and ‘ethnicity.’ However, in support of initial hypotheses, ‘age’ was found to be significantly correlated with almost all scales of Conscientiousness, leading to the interpretation that an increase in age is positively associated with an increase in Conscientiousness. This is in keeping with earlier findings by Goldberg et al (1999) that an increase in age is associated greater conscientious behaviors. Also in keeping with expectations, most Conscientiousness scales correlated significantly and positively with positive health behaviors, and significantly and negatively with negative health behaviors. This leads to the conclusion that high Conscientiousness is a positive index of health behavior and is a negative index of unhealthy behaviors.

As before, the aberrant scales were Rationality, Perfectionism and Orderliness, which failed to correlate significantly with most health behaviors, positive or negative. This indicates that the convergent validity of these three scales may be subject to question, as is the reliability as was revealed by the internal consistency analysis. On the whole, it can be concluded that the scales of Conscientiousness are high in convergent validity as far as health behaviors are concerned. However, they do not show a significant relationship with gender and ethnicity of the respondent, opening to debate the overall convergent validity of the Conscientiousness scales.
Factor analysis was conducted to test the overall factorial stability of the nine Conscientiousness scales. Overall factor analysis of all nine scales led to the extraction of a one-factor solution to describe Conscientiousness data. This is in keeping with expectations that all nine scales of Conscientiousness measure one core facet of conscientiousness. Factor loadings and percentage of variance accounted for by the Conscientiousness factor indicated that all nine scales loaded heavily on the main factor and were hence representative of the facet of Conscientiousness. However, as in the previous internal consistency and validity analyses, factor analysis also revealed two aberrant scales, namely Rationality and Perfectionism. This was revealed both in the overall and separate analyses of nine scales. It is interesting that these two scales with weak factorial structures also had low internal consistency. These two scales had relatively low factor loadings and low communalities. The factorial stability of these two scales is suspect and suggests revision.

One case in point that perhaps attenuated the results could be the structure of the data set. The inclusion of a non-uniform sample spanning a vast range of age groups and ethnicities may perhaps have given rise to final results being skewed in favor of a particular population. The results may have been biased in favor of the larger sample (undergraduates) or vice versa (the community sample). This might make inferences about convergent validity difficult to arrive at and are also likely to have adversely affected the factorial stability of the scales.

The study examined the psychometric properties of the nine scales designed to measure the facets of Conscientiousness. Reliability analysis revealed that all scales were internally consistent. Analyses also revealed a stable factorial structure for the scale, in addition to concurrent and discriminant validities. Furthermore, since a large proportion of the Conscientiousness scales correlated significantly with many health behaviors and age, we conclude that the nine facets of Conscientiousness are indicative of positive health behaviors while being a function of age. Thus, analyses revealed that the scales of Conscientiousness convergent validity. The above results were replicable across methods. In conclusion, the present study suggests that the scales measuring the nine Facets of Conscientiousness are a valid and reliable measure of personality.

REFERENCES


Note: The following tables are available upon request:

* Complete set of trait adjectives reflecting each of the nine facets of Conscientiousness

** Trait adjectives drawn from the Big Five Factor markers

*** Complete set of correlations of Conscientiousness facets with demographic and health behavior data