Using the California Psychological Inventory to assess the Big Five personality domains: A hierarchical approach

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ABSTRACT

The present research developed a new, multi-step approach for hierarchically assessing the Big Five personality domains from a large and diverse pool of existing questionnaire items: those of the California Psychological Inventory (CPI). First, the Abridged Big Five Circumplex (AB5C) structural model was used to organize the CPI item pool in Big Five factor space. Using the 10 resulting CPI-AB5C circumplexes as starting points, 16 facet scales were then developed to assess specific personality characteristics within the broad Big Five domains. Finally, principal components analysis with validimax rotation was used to score the five domains from the facet scales. In three independent samples, the resulting CPI-Big Five measure demonstrated strong reliability, convergence with self- and peer-reports, and discriminant validity. Availability of the new measure brings more than a half-century's worth of archival CPI data to bear on contemporary research questions about the Big Five. Additionally, the process of developing the CPI-Big Five measure illustrates some of the challenges that may arise when attempting to assess new psychological constructs from existing measures, as well as methods for addressing such challenges.

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1. Introduction

A consensus has emerged among personality researchers that the most important individual differences in adults' personality characteristics can be organized in terms of five broad trait domains collectively known as the Big Five: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. This consensus has led to the construction of several dedicated Big Five measures since the early 1990s, such as the NEO Personality Inventory (Costa & McCrae, 1985, 1992; McCrae, Costa, & Martin, 2005), the Big Five Inventory (John, Donahue, & Kentle, 1991; see John, Naumann, & Soto, 2008), and sets of trait-descriptive marker adjectives (Goldberg, 1992; Saucier, 1994). Using these measures, much new data has been collected to address research questions ranging from how the Big Five affect job performance (Hogan & Holland, 2003) to how they are expressed in people's living spaces (Gosling, Ko, Mannarelli, & Morris, 2002).

Addressing some fundamental questions about the Big Five requires the analysis of long-term longitudinal data. Such questions include how and why the Big Five change across the life course, and how standing on the Big Five in adolescence and young adulthood predicts relationship, career, and health outcomes years or decades later. Unfortunately, long-term longitudinal data spanning the full life course are not yet available from studies using the many relatively new Big Five measures, nor will such data be available in the near future.

This situation creates a dilemma for researchers who wish to examine lifespan personality development from a Big Five perspective. Must such researchers twiddle their thumbs for the next few decades, waiting for recently begun longitudinal studies to run their course? Or are there other approaches that would help them address their research questions more immediately? The present research aims to address this dilemma by developing and validating a method for assessing the Big Five trait domains from an existing measure that has been widely used in personality research for more than a half century, namely the California Psychological

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Inventory (CPI; Gough, 1957, 1987; Gough & Bradley, 1996). Availability of a CPI-Big Five measure holds the promise of timely answers to questions about development of the Big Five domains across the lifespan. It would also bring the entire archive of existing CPI data to bear on contemporary questions about personality structure and process from a Big Five perspective. Finally, the process of developing a CPI-Big Five measure should yield insights for the general problem of assessing new psychological constructs from existing measures.

2. Relations of the CPI folk and vector scales with the Big Five

The CPI was developed to allow for the assessment of a wide variety of psychological characteristics important to everyday life, especially everyday social life (Gough & Bradley, 1996). Toward this end, the CPI is most commonly scored using a standard set of 20 folk scales and three vector scales. The folk scales assess characteristics—such as Social Presence and Flexibility—relevant to social functioning. Each of the three vector scales assesses a broad theme—such as Norm-favoring versus Norm-doubting—common to several of the folk scales.

These 23 standard CPI scales were not designed to measure the Big Five trait domains. In fact, most of them (Gough, 1957) were developed several years prior even to the initial discovery of the Big Five structure (Norman, 1963; Tupes & Christal, 1961), and decades before the widespread adoption of the Big Five structural model in personality research. Therefore, it would not be surprising if the Big Five domains were not fully captured by the standard CPI scales.

A previous study (McCrae, Costa, & Piedmont, 1993) investigated correlations of the 23 standard CPI scales with the Big Five domains, as assessed by the NEO Personality Inventory (NEO-PI; Costa & McCrae, 1985).[1] Its findings indicate that the standard CPI scales include good markers of only one of the Big Five domains, namely Extraversion. The CPI Sociability and Dominance scales each correlated strongly with NEO-PI Extraversion, and only weakly with each of the other four domains.

Although several CPI scales correlated moderately with NEO-PI Conscientiousness, Neuroticism, and Openness, none of these correlations reached even .50 in strength, and almost all of these scales correlated substantially—often almost identically—with multiple Big Five domains. For example, Achievement via Conformance, a potential marker of Conscientiousness ($r = .37$), correlated just as strongly with (low) Neuroticism ($r = -.36$). In fact, of the 17 CPI scales that correlated .30 or stronger with NEO-PI Conscientiousness, Neuroticism, or Openness, 14 correlated .30 or stronger with multiple domains. The only exceptions were Norm-favoring ($r = .39$ with Conscientiousness), Well-being ($r = -.45$ with Neuroticism), and Achievement via Independence ($r = .41$ with Openness).

Agreeableness was the domain least well represented by the standard CPI scales. Only a single scale, Femininity/Masculinity, correlated .30 or stronger with NEO-PI Agreeableness, and this correlation ($r = .45$) was not substantially stronger than the same scale's correlation with Neuroticism ($r = .40$). Moreover, because this sample included both men and women, the observed correlations of CPI Femininity/Masculinity with NEO-PI Agreeableness and Neuroticism may both be inflated by the presence of mean-level gender differences in Femininity/Masculinity, Agreeableness, and Neuroticism (Costa & McCrae, 1992; Gough & Bradley, 1996). Taken together, these findings indicate that four of the Big Five domains are only poorly captured by the standard CPI scales.

3. CPI scales assessing dimensions of social performance

In the late 1970s, Robert Hogan and John A. Johnson (see Johnson, 1997) constructed CPI scales to assess seven social-performance dimensions representing an alternative interpretation of what is now known as the Big Five structural model. These seven dimensions, proposed by socioanalytic theory (Hogan, 1983), are Sociability and Ambition (together similar to Big Five Extraversion), Likeability (similar to Agreeableness), Prudence and Ego Control (together similar to Conscientiousness), Adjustment (similar to Neuroticism, but with the poles reversed), and Intellectance (similar to Openness). They differ from the canonical Big Five in that they place special emphasis on two social motives: "getting along" and "getting ahead."

Johnson (1997) reported evidence for the convergent and discriminant validity of the seven CPI social-performance scales. The scales converged strongly with three versions of a contemporary socioanalytic measure, the Hogan Personality Inventory (Hogan & Hogan, 1992), with convergent correlations averaging .59 across three samples. However, as would be expected from their special focus on social performance, the scales converged less well with the canonical Big Five domains: convergent correlations with domain scores from the NEO-PI averaged only .45 in the sample recruited by McCrae et al. (1993), with one as low as .26 (Prudence with NEO-PI Conscientiousness). Moreover, several of the discriminant correlations between these two measures were quite substantial: six exceeded .30 in magnitude, and two exceeded .50.[2] These findings indicate that Hogan and Johnson's social-performance scales assess dimensions related to, but clearly distinguishable from, the canonical Big Five.

4. Prospects for assessing the canonical Big Five from the CPI

4.1. Encouraging features of the CPI

Although the canonical Big Five domains are not fully captured by the standard CPI scales or by Hogan and Johnson's social-performance scales, there are important reasons for optimism about the possibility of using the CPI to assess the Big Five. One such reason is the broadband nature of the CPI item pool. As noted above, the CPI was developed to assess a wide variety of psychological characteristics relevant to everyday life. To meet this goal, its item pool is both large and diverse. Versions of the CPI range in length from 434 to 480 items. Individual items assess thought patterns (e.g., *Think about other people's reactions before I do something.*), beliefs (e.g., *Believe that people should be willing to take orders.*), emotions (e.g., *Usually feel happy.*), personal preferences (e.g., *Would like to be a scientist.*), and overt behaviors (e.g., *Go to the movies frequently.*).[3] Because each of the Big Five domains is also relevant to everyday life (e.g., Mehl, Gosling, & Pennebaker, 2006), this item pool should include much content useful for measuring the Big Five, even those domains that are not well represented among the standard CPI scales.

Moreover, the breadth and depth of the CPI item pool should make it possible to assess not only the broad Big Five domains but also several more specific "facet" traits within each domain (cf. Costa & McCrae, 1992, 1995; Hofstee, de Raad, & Goldberg, 1992; Saucier & Ostendorf, 1999). For example, rather than only assessing Big Five Extraversion as a whole, it should be possible

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[1] Preliminary analyses in the present research indicated similar patterns of intercorrelation between the CPI standard scales and the NEO PI-R domain scores.

[2] Preliminary analyses in the present research indicated similarly modest convergence of the seven CPI social-performance scales with domain scores from the NEO PI-R, as well as several substantial discriminant correlations.

[3] Throughout this paper, the text of the CPI and NEO PI-R items is paraphrased, in compliance with copyrights held by Consulting Psychologists Press, Inc. and Psychological Assessment Resources, Inc.

to assess several facet traits within this domain, such as assertiveness, gregariousness, or activity level. The key advantage to such hierarchical measurement would be more precise personality description within an overarching Big Five framework—precision that would not be possible if only the broad domains were assessed.

A second encouraging feature of the CPI is its open-system measurement philosophy (Gough & Bradley, 1996). This philosophy supports the revision of existing CPI scales and the construction of new scales to capture psychological characteristics not represented by the standard scales. Consistent with this philosophy, the inventory's 15 original folk scales (Gough, 1957) have been revised several times, and the third edition of the inventory's manual (Gough & Bradley, 1996) supplements these scales with five additional folk scales, three vector scales, and 11 special-purpose scales, such as a Narcissism scale (Wink & Gough, 1990). Even newer scales have been successfully developed since the third edition (e.g., Adams & John, 1997; Jay & John, 2004). The present research was conducted in this spirit and constitutes an effort to capture the Big Five domains more fully than they are by the existing CPI scales.

A final source of encouragement concerns the CPI's consistent popularity across more than five decades. A recent search of the PsycINFO database for the keyword phrase "California Psychological Inventory" found 1118 publications from 1953 to 2007, including 875 articles in peer-reviewed journals. Of particular note, many of these publications are the result of longitudinal studies spanning several years, or even several decades (e.g., Cartwright & Wink, 1994; Dudek & Hall, 1991; Helson & Kwan, 2000; Helson & Soto, 2005; Karney & Coombs, 2000; Labouvie-Vief, Diehl, Jain, & Zhang, 2007; Plant & Telford, 1966; Sanford, 1962; Stewart, Ostrove, & Helson, 2001; Winter, John, Stewart, Klohnen, & Duncan, 1998). Thus, a method for assessing the Big Five domains from the CPI would bring a rich archive of existing data to bear on contemporary questions about the Big Five—including questions about their lifespan antecedents, consequences, and patterns of change.

4.2. Challenges posed by the CPI

Along with its encouraging features, the CPI also poses some important challenges to the task of Big Five measurement. A first challenge concerns the CPI's dichotomous, true-false response format. Most contemporary personality inventories use multiple-step (e.g., 5-point) response scales. Such scales allow a single item to distinguish among respondents at several levels of a personality trait; therefore, precise and reliable measurements can be obtained by aggregating only a handful of items. For example, the Big Five Inventory (John et al., 1991; see John et al., 2008) reliably assesses the Big Five using only 8–10 items per domain scale. By contrast, each CPI item can only distinguish between two groups of people: those for whom the item is *true*, and those for whom it is *false*. Because of this, a precise and reliable CPI scale must include many items, and such longer scales can be constructed only for psychological characteristics that are well represented in the CPI item pool.

Another challenge stemming from the CPI's true-false format is that responses may be substantially influenced by individual differences in acquiescent response style. In general, acquiescent response style is the tendency of an individual to consistently agree (yea-saying) or consistently disagree (nay-saying) with questionnaire items, regardless of their content (Jackson & Messick, 1958). When a multiple-item scale includes an unequal number of true-keyed and false-keyed items, individual differences in acquiescent responding will influence both scores on that scale and the scale's correlations with other imbalanced scales (McCrae, Herbst, & Costa, 2001; Soto, John, Gosling, & Potter, 2008). Previous research has documented the sometimes pronounced influence of individual differences in acquiescent responding on the measurement characteristics of the standard CPI scales (Jackson, 1960; Jackson & Messick, 1958). Therefore, researchers developing new CPI scales should be careful to either (a) include an equal number of true- and false-keyed items on each scale, or (b) use a scoring procedure that controls for individual differences in acquiescence, such as through ipsatization or within-person centering (cf. Soto et al., 2008).

A final challenge concerns the complex content of many CPI items. Most contemporary Big Five measures use items that are single trait adjectives (e.g., the Mini-Markers; Saucier, 1994), short phrases (e.g., the Big Five Inventory; John et al., 1991), or simple sentences (e.g., the NEO-PI-3; McCrae et al., 2005). These item formats make it easy to write and select items that each assess only a single Big Five domain, thereby avoiding item content that combines two or more domains. By contrast, many CPI items are more complex, and include a combination of Big Five content. For example, the CPI item *Would rather be steady and reliable than brilliant and unstable* includes trait terms relevant to Big Five Conscientiousness (*steady*, *reliable*), Openness (*brilliant*), and Neuroticism (*unstable*). Similarly, the item *Am nervous when meeting new people* combines content relevant to both Extraversion (*meeting new people*) and Neuroticism (*nervous*). Such items complicate the task of assessing the Big Five domains in a way that clearly distinguishes among them.

4.3. Overview of the present research

The present research had two central goals. The first was to develop an approach for assessing the Big Five personality domains from the CPI item pool. Ideally, this approach should use a hierarchical measurement strategy—allowing for the assessment of several more specific facet traits within each of the broad domains—that takes full advantage of the breadth and depth of the CPI item pool. It should also address the challenges posed by the CPI's true–false response format and items with complex combinations of Big Five content. The second goal was to investigate the psychometric characteristics of the resulting CPI-Big Five measure.

5. Method

5.1. Samples and procedures

To develop and validate the CPI-Big Five measure, we used data from three independent samples.

5.1.1. Scale development sample
This sample consisted of 433 undergraduate students enrolled in psychology courses at a public university in California. Most participants were in their early 20s ($M = 21.72$ years old, $SD = 4.11$ years), and 78% were female. The participants were diverse in terms of ethnicity: 31% were White/Caucasian, 50% were Asian/Asian-American, 8% were Hispanic/Latino, 2% were Black/African-American, and 9% were of another ethnicity.

All participants completed the 462-item version of the CPI (Gough, 1987), as well as three contemporary measures of the Big Five personality domains: the Revised NEO Personality Inventory (NEO PI-R; Costa & McCrae, 1992), the Big Five Inventory (BFI; John et al., 1991; see John et al., 2008), and the Mini-Markers (Saucier, 1994). Most participants ($N = 301$) also completed the Adjective Check List (ACL; Gough & Heilbrun, 1983), and many ($N = 141$) were described by a friend, romantic partner, or family member using the BFI. The CPI, Big Five measures, and ACL were each administered at least one week apart. The peer ratings were

obtained several weeks later. Therefore, responses to these different measures do not share time-of-testing effects, and correlations among them should be interpreted as retest coefficients.

5.1.2. Student validation sample

This sample consisted of 396 undergraduate psychology students attending the same university as members of the scale development sample. This sample was similar to the scale development sample in terms of age ($M = 21.63$ years old, $SD = 3.66$ years), gender (75% female), and ethnicity (30% White/Caucasian, 46% Asian/Asian-American, 8% Hispanic/Latino, 2% Black/African-American, 14% of another ethnicity). They completed the same measures, across the same time frame, as did members of the scale development sample. Most ($N = 330$) completed the ACL, and many ($N = 136$) were described by a friend, romantic partner, or family member using the BFI.

5.1.3. Community validation sample

This sample consisted of 520 adult residents of the Eugene-Springfield, Oregon area recruited by Lewis R. Goldberg (see Goldberg, 1999). Compared with the two student samples, members of this sample were more heterogeneous, and generally much older, in terms of age ($M = 51.80$ years old, $SD = 12.58$ years). They were also more heterogeneous in terms of gender (61% female) and level of education (16% no college, 27% some college, 32% graduated college, 25% post-college degree). The ethnic composition of this sample was also very different from those of the student samples. Reflecting the local demographics, almost all of these participants (97%) were White/Caucasian.

All members of this sample completed the 462-item version of the CPI, as well as the NEO PI-R, BFI, and Mini-Markers. Almost all of them ($N = 484$) were also described by one to three peers using the BFI ($M = 2.52$ peers). In the present research, all analyses of peer-reports were conducted using the average ratings of all available peers for each participant. Regarding time frame, the NEO PI-R was administered about six months after the CPI; the BFI, Mini-Markers, and peer-reports were obtained approximately four years after that. Thus, as with the student samples, correlations among these measures should be interpreted as retest correlations; however, the retest intervals were much longer for this sample than for the student samples.

5.2. Measures

5.2.1. The California Psychological Inventory

As described in Section 1, the CPI (Gough, 1957, 1987; Gough & Bradley, 1996) is a broadband psychological measure designed to assess personal attributes relevant to everyday life. The most recent version of the CPI includes 434 true–false items, and is most frequently scored using 23 folk and vector scales. Gough and Bradley (1996) summarized evidence that the standard CPI scales correlate in meaningful ways with other psychological measures, with peer-reports, and with a variety of outcome variables.

In developing the CPI-Big Five measure, we limited the item pool to only those 434 items that appear on all versions of the CPI, so that the new measure could be scored in any existing CPI data set. Also note that, in the present research, each *true* response to a CPI item was coded as a 1, and each *false* response was coded as a 0. Therefore, the scoring algorithm for the CPI-Big Five measure assumes *true* = 1, *false* = 0 response coding.

5.2.2. Controlling for individual differences in acquiescent response style on the CPI

As discussed in Section 4.2, acquiescent response style is the tendency to consistently agree (yea-saying) or consistently disagree (nay-saying) with questionnaire items, regardless of their content. Much previous research has shown that uncontrolled individual differences in acquiescence pose a serious threat to the validity of psychological measures, especially measures that, like the CPI, have a dichotomous (e.g., true–false) response format (Jackson, 1960; Jackson & Messick, 1958; McCrae et al., 2001; Soto et al., 2008).

In the present research, each participant's level of acquiescent responding was indexed using a subset of 100 CPI items. Specifically, these were 50 pairs of items with opposite implications for personality, selected by the authors on the basis of interitem correlations and rational judgments about item content. An example item pair is *Like to speak before groups* versus *Dislike having to speak in front of groups*. Acquiescence was indexed using these opposite-item pairs (rather than the full set of 434 CPI items) to avoid confounding the index with any substantive personality traits (cf. Soto et al., 2008).

Each participant's acquiescence score was computed as their mean response to this key-balanced subset of 100 CPI items. Because *true* item responses were coded 1 and *false* responses were coded 0, this mean was equivalent to the proportion of items marked *true*. Thus, perfect yea-saying (responding *true* to all 100 items) would yield a score of 1.00, perfect nay-saying (responding *false* to all 100 items) would yield a score of 0.00, and perfectly balanced responding (responding *true* to one item from each pair and *false* to the other item) would yield a score of 0.50. Acquiescence scores averaged .50 in the scale development ($SD = .06$, range = .36–.74) and student validation samples ($SD = .06$, range = .34–.73), and .46 in the community validation sample ($SD = .06$, range = .21–.64). These results indicate quite balanced responding by the average participant, as well as considerable individual differences in acquiescence. Scoring information for this index can be obtained from the authors.

In preliminary analyses, many of the CPI folk and vector scales correlated substantially with the acquiescence index. For example, in the scale development sample, 10 of the 23 standard CPI scales correlated .30 or stronger with the acquiescence index; the strongest correlations approached .50 in magnitude. Therefore, individual differences in acquiescence were controlled prior to further analysis. Specifically, each participant's full set of 434 CPI item responses was centered by subtracting their acquiescence score from each of their individual item responses, effectively removing individual differences in acquiescent responding while leaving substantive personality differences intact.

5.2.3. The Revised NEO Personality Inventory

The NEO PI-R (Costa & McCrae, 1992) is a 240-item inventory that assesses the broad Big Five trait domains, as well as six more specific facet traits within each domain. Its items are descriptive statements that respondents rate on a 5-point agreement scale. Domain scores are computed as validimax-rotated principal-component scores (McCrae & Costa, 1989). Costa and McCrae (1992) summarized evidence for the inventory's structural validity, reliability, and self-peer agreement. In our scale development sample, the alpha reliabilities of the five NEO PI-R domain scales ranged from .89 (Agreeableness) to .93 (Neuroticism), with a mean of .91. For the 30 facet scales, alphas ranged from .60 (Tender-Mindedness) to .85 (Depression), with a mean of .75.

5.2.4. The Big Five Inventory

The BFI (John et al., 1991; see John & Srivastava, 1999; John et al., 2008) consists of 44 items designed to measure the core aspects of each Big Five domain. Its items are short phrases that respondents rate on a 5-point agreement scale. In previous research, the BFI scales have shown strong internal consistency, retest reliability, structural validity, convergence with longer Big Five measures, and self-peer agreement (Benet-Martínez & John, 1998;

John et al., 2008; Rammstedt & John, 2007; Soto et al., 2008). In our scale development sample, alpha reliabilities for the five BFI scales ranged from .80 (Agreeableness) to .88 (Neuroticism), with a mean of .84.

5.2.5. The Mini-Markers

The Mini-Markers (Saucier, 1994) are a subset of 40 trait-descriptive adjectives selected from Goldberg's (1992) longer list of 100 Big Five markers. Respondents rate how accurately each adjective describes them, using a 9-point scale. Saucier (1994) presented evidence for the Mini-Markers' internal consistency, structural validity, and convergence with Goldberg's (1992) longer sets of marker adjectives. In our scale development sample, alpha reliabilities for the five Mini-Marker scales ranged from .83 (Neuroticism and Openness) to .88 (Extraversion), with a mean of .85.

5.2.6. Consensual definition of the Big Five domains

Although the NEO PI-R, BFI, and Mini-Markers were all designed to measure the Big Five, they define the five domains in somewhat different ways (John & Srivastava, 1999; John et al., 2008). To provide an empirical tool for scale development that would capture the elements common to all three measures, self-reports from the scale development sample on the 30 NEO PI-R facets, 44 BFI items, and 40 Mini-Marker items were jointly submitted to a principal components analysis.

As expected from this variable set, a scree test clearly indicated five major components: the first 10 eigenvalues were 19.59, 10.56, 8.57, 7.54, and 7.27, followed by 3.28, 2.35, 2.04, 1.87, and 1.78. When five components were extracted and varimax-rotated, 113 of the 114 variables had their highest loading on the expected component. The lone exception was the NEO PI-R Warmth facet of Extraversion, which loaded slightly higher on the Agreeableness component than on the Extraversion component. This discrepancy, however, was not surprising, since the BFI and Mini-Markers locate interpersonal warmth primarily within the Agreeableness domain: the Mini-Markers include *warm* as a marker of Agreeableness, and the BFI Agreeableness scale includes the false-keyed item *Can be cold and aloof* (cf. John & Srivastava, 1999; John et al., 2008).

In addition to the clear pattern of loadings, the five consensual components correlated strongly with each of the three original measures' domain scores. Mean convergent correlations with the NEO PI-R, BFI, and Mini-Marker domain scores were .90 for Extraversion, .87 for Agreeableness, .90 for Conscientiousness, .88 for Neuroticism, and .89 for Openness. These components clearly captured variance shared by the three Big Five instruments, while rendering the domains mutually orthogonal—a characteristic helpful for identifying and organizing the many CPI items with content relevant to multiple Big Five domains. Scores on the five components were therefore used as a key tool for development of the CPI-Big Five measure.

5.2.7. The Adjective Check List

The ACL (Gough & Heilbrun, 1965, 1983) is a diverse set of 300 trait-descriptive adjectives (e.g., *absent-minded*, *vindictive*) that respondents either check as self-descriptive or leave unchecked. The ACL has been widely used in psychological research for more than 40 years; notably, correlations with ACL items were used as a key criterion in validation of the NEO PI-R facet scales (Costa & McCrae, 1995; McCrae & Costa, 1992). ACL correlates were similarly used here to test the validity of the CPI-Big Five measure.

5.3. Development of the CPI-Big Five measure

We developed the CPI-Big Five measure in three stages. First, we organized the CPI item pool in terms of the Big Five. Second,

we constructed a set of 16 facet scales to measure specific personality characteristics within each of the broad Big Five domains. Finally, we developed an algorithm for scoring the five domains from the facet scales.

5.3.1. Organizing the CPI item pool in Big Five space, using the AB5C model

We began by examining correlations, in the scale development sample, between the CPI items and the consensually-defined Big Five components. We found that most CPI items were relevant for measuring the Big Five, but, as expected, most items included content relevant to more than just one of the five domains. Of the 434 CPI items, 406 (94%) had statistically significant correlations ($ps < .05$, two-tailed) with at least one of the consensual Big Five components. Of these 406 items, about two-thirds (267, or 66%) correlated significantly with multiple Big Five components, whereas only one-third (139, or 34%) correlated uniquely with a single component.

In view of the many CPI items relevant to multiple Big Five domains, we used the Abridged Big Five Circumplex model (AB5C; Hofstee et al., 1992) to organize the CPI item pool in Big Five factor space. We chose this model because it explicitly recognizes and represents combinations or blends of the Big Five domains. Specifically, the AB5C model decomposes the complex, five-dimensional Big Five space into a set of 10 simpler, two-dimensional circumplexes—one for each unique combination of two Big Five domains. These 10 circumplexes include, for example, the Extraversion–Agreeableness circumplex, also known as the interpersonal circumplex (Wiggins, 1979), and the Extraversion–Neuroticism circumplex, or affective circumplex (Watson & Tellegen, 1985; see also Saucier, 1992). The AB5C model further divides each of the 10 circumplexes into six bipolar regions. The complete set of circumplex regions thus provides a thorough representation of the many possible combinations or blends of the Big Five domains.

To organize the CPI item pool in terms of the AB5C model, we adapted the procedures pioneered by Hofstee et al. (1992). First, the CPI items were divided into 10 subsets on the basis of each item's two strongest correlations with the consensual Big Five components. For example, the item *Am nervous when meeting new people* correlated −.43 with the Extraversion component, .07 with Agreeableness, −.04 with Conscientiousness, .24 with Neuroticism, and −.05 with Openness. It was therefore placed in the Extraversion–Neuroticism item subset.

Next, the CPI items in each subset were plotted in the corresponding AB5C circumplex, resulting in 10 CPI–AB5C circumplexes. Fig. 1 provides one example, the Extraversion–Neuroticism circumplex. The axes of this circumplex are defined by the consensual Extraversion (horizontal or x axis) and Neuroticism (vertical or y axis) components. Each CPI item in the Extraversion–Neuroticism subset is represented by a point plotted within the circumplex. The coordinates for a particular point are that item's correlations with the consensual Extraversion and Neuroticism components. For example, the item *Am nervous when meeting new people* is represented by a point plotted at ($x = -.43$, $y = .24$), falling in the E−/N+ versus E+/N− region of the circumplex. This point is labeled *Example* in Fig. 1.

The Extraversion–Neuroticism circumplex presented in Fig. 1 is typical of the 10 CPI–AB5C circumplexes in two important ways. First, the item-representative points are not distributed evenly among the AB5C regions; some bipolar regions contain many items (e.g., N+/E− versus N−/E+) whereas others contain few (e.g., E+/N+ versus E−/N−). Second, the most domain-pure regions (those centered about the axes, such as N+/N+ versus N−/N−) contain only a few items, clearly illustrating the fact that most CPI items assess combinations of the Big Five.
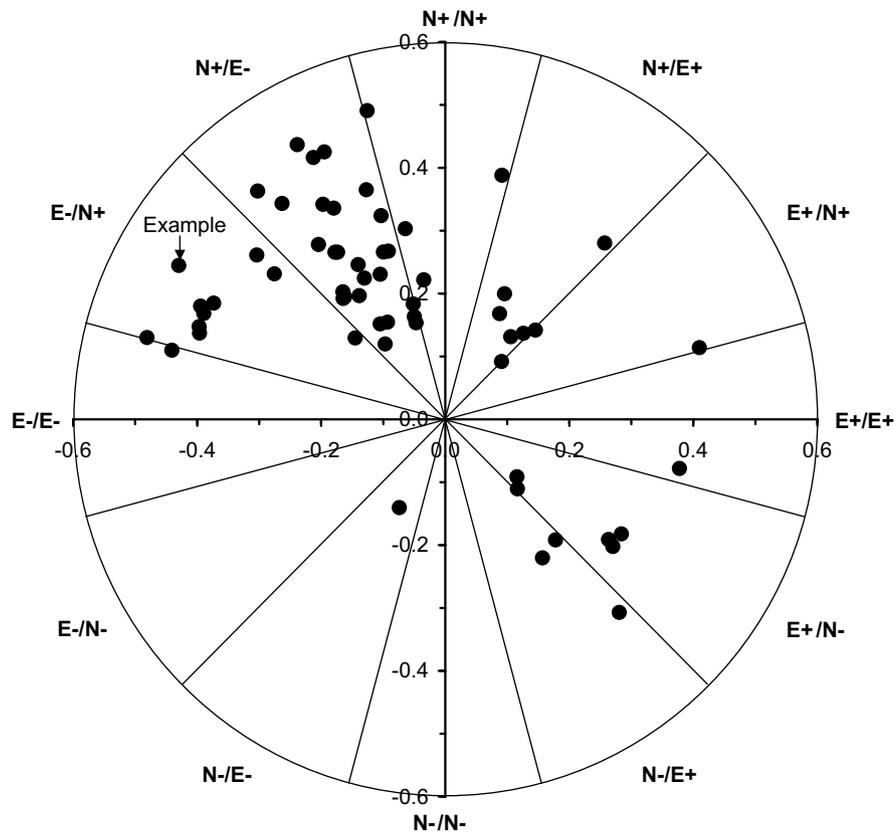
Fig. 1. The Extraversion–Neuroticism circumplex. Points represent individual CPI items. A point's horizontal and vertical coordinates are that item's correlations with the consensual Extraversion and Neuroticism components, respectively. The point representing the CPI item *Am nervous when meeting new people* is labeled Example.

5.3.2. Constructing facet-level CPI-Big Five scales

The second stage of developing the CPI-Big Five measure was constructing facet scales to assess specific personality characteristics within each of the broad Big Five domains. Because (a) the CPI item pool represents some specific traits more thoroughly than others, and (b) there is not yet consensus among personality researchers about which are the most important facet traits within each Big Five domain (John et al., 2008; Saucier & Ostendorf, 1999), we did not develop scales to measure a predetermined set of facet constructs. Instead, we used the 10 CPI–AB5C circumplexes as starting points to develop scales assessing specific Big Five facets that are well represented in the CPI item pool.

To construct these facets, we first examined the circumplexes to identify regions containing many CPI items that collectively defined a coherent personality characteristic. Second, for each such region, an initial facet scale was formed from items that were both located within the facet's circumplex region and clearly relevant to the facet construct. Third, items were added to the initial facet scales on the basis of conceptual relevance, correlations with the initial scales, and circumplex location. Item assignments at this stage were intended to be over-inclusive, with the goal of assigning as many CPI items as possible to each preliminary scale. Finally, the preliminary scales were trimmed on the basis of a second, more stringent, conceptual evaluation of item content, as well as a consideration of the scales' psychometric characteristics.

Using this procedure, we developed facet scales to measure 16 specific personality characteristics within the Big Five domains. Names, brief descriptions, and paraphrased example items for these scales are presented in Table 1.

5.3.3. Scoring the Big Five domains from the facet scales

The third and final stage of developing the CPI-Big Five measure was deriving a method for scoring the broad Big Five domains from the more specific facet scales. We considered several different approaches to the problem of domain scoring, including unit-weighted averaging of the CPI items or facets, multiple regression with existing Big Five measures as criterion variables, and principal components analysis of the CPI-Big Five facet scales.

We ultimately selected this last approach, due to three key advantages. First, it allowed us to impose an orthogonality constraint and thereby derive domain-scoring equations that each yield unique information. Second, by imposing more stringent structural constraints than would a multiple regression approach, it promoted more robust or replicable domain-scoring equations. Third, it allowed us to use validimax rotation, pioneered by McCrae and Costa (1989), and thereby position the CPI-Big Five domains in a way that maximized their joint convergence with the most widely used hierarchical Big Five measure, namely the NEO PI-R.

When the 16 CPI-Big Five facet scales were submitted to a principal components analysis, using data from the scale development sample, a scree test clearly indicated five major components: the first 10 eigenvalues were 4.34, 2.60, 1.90, 1.47, and 1.16, followed by .71, .55, .50, .47, and .42. Five components were therefore extracted and validimax-rotated to the position that maximized convergence—within the constraints of the observed simple correlations—between the CPI components and the NEO PI-R domain scores.

Table 2 presents the loading matrix for the five validimax-rotated components. As this table shows, each of the 16 CPI-Big Five facet scales had its highest loading on the intended component,

Table 1
The 16 CPI-Big Five facet scales: Names, descriptions, and example items.

Facet	*Description* and paraphrased example items
Extraversion	
Gregariousness	*Enjoyment of social events and the company of others.* Enjoy gatherings where I can be with people. Like to have lots of friends and an active social life.
Social Confidence vs. Anxiety	*Comfort speaking with strangers and in front of groups.* Like talking in front of groups of people. Am nervous when meeting new people. (R)
Assertiveness	*Preference for exerting control in a group setting.* Have a "strong" personality. When in a group, usually do what others want. (R)
Agreeableness	
Trustfulness vs. Cynicism	*Tendency to be trusting and friendly with others.* Am on my guard around very friendly people. (R) Believe that people pretend to care more than they actually do. (R)
Compassion vs. Insensitivity	*Concern for the welfare of others.* Would give money to right a wrong. Believe that people don't need to worry about others. (R)
Humility vs. Arrogance	*Tendency to be humble, rather proud and bossy.* Am likely to show off, when given the chance. (R) Sometimes act like I know more than I do. (R)
Conscientiousness	
Industriousness	*Work ethic and moral seriousness.* Am a reliable worker. Do as little work as I can get by with. (R)
Orderliness	*Tendency to plan ahead, and to be organized and neat.* Like to have everything in its place. Find that planning takes most of the fun out of life. (R)
Self-Discipline vs. Distractibility	*Ability to stay focused on tasks and long-term goals.* Find it hard to keep my mind on one thing. (R) Give up easily when I encounter problems. (R)
Neuroticism	
Anxiety	*Tendency to feel nervous and fearful.* Worry about many things. Have very few fears. (R)
Depression	*Tendency to experience depressive affect.* Am not as happy as others seem to be. Think that the future seems hopeless.
Rumination	*Susceptibility to intrusive thoughts, feelings, and habits.* Am often bothered by useless thoughts. Have bad habits that I can't fight.
Irritability	*Tendency to be easily annoyed and grouchy.* Am bothered when unexpected events happen. Am sometimes grouchy without reason.
Openness	
Idealism vs. Conformity	*Valuing art and individual expression.* Have tried my hand at poetry. Believe that people should conform to the people around them. (R)
Intellectualism	*Intellectual curiosity and breadth of interest.* Find the idea of research appealing. Don't particularly enjoy learning new things. (R)
Adventurousness	*Preference for novel and intense experiences.* Have had unusual experiences. Never do something for the thrill of it. (R)

Note: (R) indicates a false-keyed item. Scales with a majority of false-keyed items are named using both poles of the facet construct (e.g., Social Confidence vs. Anxiety).

Table 2
Developing domain scores: Loadings of the CPI-Big Five facet scales on validimax-rotated principal components.

Facet	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
Extraversion					
Gregariousness	**.86**	−.11	.02	−.16	.13
Social Confidence vs. Anxiety	**.74**	−.30	.10	−.30	.20
Assertiveness	**.57**	−.44	.19	−.36	.31
Agreeableness					
Humility vs. Arrogance	−.14	**.79**	−.05	.01	.01
Trustfulness vs. Cynicism	.33	**.66**	.13	−.40	.07
Compassion vs. Insensitivity	.38	**.60**	.04	.19	.40
Conscientiousness					
Industriousness	.04	.20	**.79**	.02	−.01
Orderliness	−.02	.01	**.76**	.13	−.32
Self-Discipline vs. Distractibility	−.02	.07	**.70**	−.42	.07
Neuroticism					
Anxiety	.04	.06	.09	**.84**	−.16
Depression	−.28	−.05	−.24	**.75**	−.21
Rumination	−.13	−.30	−.27	**.66**	.03
Irritability	−.12	−.36	.14	**.64**	−.30
Openness					
Idealism vs. Conformity	.12	.19	.09	.09	**.82**
Intellectualism	−.06	−.15	.28	−.30	**.72**
Adventurousness	.15	−.40	−.35	−.08	**.64**

Note: $N = 433$. Facets are ordered by their primary loadings, which are printed in boldface.

confirming that the Big Five dimensions could be clearly recovered from the facet scales. These intended primary loadings were uniformly large, averaging .72. Consistent with the AB5C approach used to develop the facet scales, there were also several substantial secondary loadings. For example, the Orderliness facet of Conscientiousness had a substantial secondary loading on (low) Openness, reflecting the fact that this aspect of Conscientiousness also relates with a preference for familiarity rather than novelty. Importantly, however, even the strongest of these secondary loadings were substantially weaker than the corresponding primary loadings. The equations for scoring these five validimax-rotated components from the 16 facet scales were retained as the final CPI-Big Five domain-scoring equations.

5.4. Algorithm for scoring the CPI-Big Five measure

Because there are multiple versions of the CPI, and because scoring the CPI-Big Five measure involves several stages—within-person centering of the CPI items, scoring of the 16 facet scales, and computation of the domain scores—it would be impractical to present the full scoring algorithm here. Scoring information can be obtained from the authors.

6. Results

After constructing the CPI-Big Five measure, we investigated its reliability and validity using data from our three samples.

We focused on comparisons between the CPI-Big Five and the NEO PI-R. These comparisons are of particular interest because (a) scoring of the CPI-Big Five domains is based on the NEO PI-R domain component scores and (b) the NEO PI-R is currently the most widely used hierarchical measure of the Big Five.

6.1. Reliability and validity of the CPI-Big Five domain scores

6.1.1. Reliability of the domain scores

Because the CPI-Big Five domain scores are rotated principal-component scores, their internal-consistency reliabilities cannot be computed directly. However, following Costa and McCrae (1992), their reliabilities may be estimated from domain scales formed by pooling all items included on the facet scales within each Big Five domain. Table 3 presents these domain-scale alpha reliabilities. Despite the CPI's dichotomous response format, the reliabilities were uniformly high and held up well in both validation samples, averaging .85 in the scale development sample, .84 in the student validation sample, and even .83 in the much older community validation sample. These reliabilities approached those of the NEO PI-R domain scales, also presented in Table 3, which ranged from .86 to .93 in the three samples.

6.1.2. Orthogonality of the domain scores

Table 3 also presents correlations among the CPI-Big Five domain scores. Consistent with the orthogonal validimax rotation used to generate the domain-scoring equations, these scores were perfectly independent in the scale development sample. More importantly, they remained impressively orthogonal in both of the validation samples. The average of the absolute intercorrelations was only .06 in the student validation sample and .05 in the community validation sample. Indeed, even the strongest domain intercorrelations were only −.13 in the student validation sample and −.06 in the community validation sample. These uniformly small intercorrelations were very similar to those among the NEO PI-R domain scores, the magnitudes of which averaged .08 in the scale construction and community validation samples, and .09 in the student validation sample.

6.1.3. Convergence with the NEO PI-R domain scores

Table 4 presents correlations of the CPI-Big Five domain scores with the NEO PI-R domain scores. Convergent correlations between the two measures were uniformly strong, averaging .72 in the scale development sample, .70 in the student validation sample, and even .69 in the community validation sample. Although convergence was especially strong for Neuroticism, no convergent correlation was less than .67 for any domain in any sample. These convergent correlations are comparable to, or even stronger than, those among contemporary Big Five measures, which typically range from about .50 to .80 (Goldberg, 1992; John & Srivastava, 1999; John et al., 2008). Convergence is particularly impressive given that the CPI and NEO PI-R were administered weeks (scale development and student validation samples) or months (community validation sample) apart, and so the convergent correlations were not inflated by any shared time-of-testing effects.

These strong convergent correlations contrast sharply with the uniformly small discriminant correlations between the CPI-Big Five and NEO PI-R domain scores. The magnitudes of the discriminant correlations averaged only .04 in the scale development sample, .06 in the student validation sample, and .07 in the community validation sample; no discriminant correlation reached a magnitude of .20 in any of the three samples.

6.1.4. Correlations with BFI peer-reports

Table 5 presents correlations of the CPI-Big Five and NEO PI-R domain scores with BFI peer-reports. As this table shows, convergence with BFI peer-reports was almost as strong for the CPI-Big Five as for the NEO PI-R. Convergent correlations for the CPI-Big Five averaged .40 in the scale development sample, .39 in the student validation sample, and even .40 in the community validation sample. The corresponding averages for the NEO PI-R were .43 in the scale development sample, .42 in the student validation sample, and .48 in the community validation sample.

Discriminant correlations with BFI peer-reports were also similar for the CPI-Big Five and NEO PI-R. For the CPI-Big Five, the magnitudes of these correlations averaged only .10 in the scale development sample, .13 in the student validation sample, and .07 in the community validation sample. For the NEO PI-R, the

Table 3
Reliability and intercorrelations of the CPI-Big Five and NEO PI-R domain scores.

	CPI-Big Five						NEO PI-R					
	Alpha	E	A	C	N	O	Alpha	E	A	C	N	O
Scale development sample (N = 433)												
Extraversion	.91	1.00					.90	1.00				
Agreeableness	.81	.00	1.00				.89	.11	1.00			
Conscientiousness	.82	.00	.00	1.00			.91	−.03	−.12	1.00		
Neuroticism	.90	.00	.00	.00	1.00		.93	−.11	.12	.13	1.00	
Openness	.83	.00	.00	.00	.00	1.00	.90	.02	.03	.00	−.10	1.00
Student validation sample (N = 396)												
Extraversion	.91	1.00					.90	1.00				
Agreeableness	.78	−.06	1.00				.86	.09	1.00			
Conscientiousness	.83	−.01	.06	1.00			.91	−.10	−.10	1.00		
Neuroticism	.90	−.13	−.13	−.10	1.00		.92	−.17	.06	.16	1.00	
Openness	.80	−.03	−.04	.01	.08	1.00	.89	−.02	.15	.04	.00	1.00
Community validation sample (N = 520)												
Extraversion	.91	1.00					.90	1.00				
Agreeableness	.77	−.03	1.00				.88	.07	1.00			
Conscientiousness	.81	.00	.03	1.00			.90	−.06	−.17	1.00		
Neuroticism	.87	−.06	−.06	−.05	1.00		.93	−.06	.07	.08	1.00	
Openness	.81	−.02	−.02	.00	.04	1.00	.91	.01	.09	−.13	−.05	1.00

Note: For the scale development and student validation samples, correlations ⩾.10 are statistically significant at α = .05 (two-tailed). For the community validation sample, correlations ⩾.09 are statistically significant at α = .05 (two-tailed).

Table 4
Convergent and discriminant correlations between the CPI-Big Five and NEO PI-R domain scores.

CPI-Big Five	NEO PI-R				
	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
Scale development sample (N = 433)					
Extraversion	**.67**	.00	−.01	−.09	.06
Agreeableness	.00	**.69**	−.03	.12	.00
Conscientiousness	−.01	−.03	**.74**	.03	−.03
Neuroticism	−.08	.11	.03	**.77**	−.05
Openness	.06	.00	−.03	−.06	**.73**
Student validation sample (N = 396)					
Extraversion	**.69**	−.01	−.06	−.19	.02
Agreeableness	−.09	**.69**	.03	.01	.06
Conscientiousness	−.02	.03	**.70**	−.04	.07
Neuroticism	−.19	−.02	−.06	**.74**	−.07
Openness	−.03	.00	−.11	.00	**.67**
Community validation sample (N = 520)					
Extraversion	**.68**	.01	−.04	−.14	.04
Agreeableness	−.03	**.70**	−.01	.07	.03
Conscientiousness	−.02	−.01	**.72**	.00	.01
Neuroticism	−.15	.06	−.01	**.75**	−.06
Openness	.01	.01	−.07	−.03	**.71**
Mean convergent validity	**.68**	**.69**	**.72**	**.75**	**.70**

Note: Convergent correlations are in boldface. For the scale development and student validation samples, all correlations ⩾.10 are statistically significant at α = .05 (two-tailed), and the CPI and NEO PI-R were administered at least one week apart. For the community validation sample, all correlations ⩾.09 are statistically significant at α = .05 (two-tailed), and the CPI and NEO PI-R were administered approximately 6 months apart.

Table 5
Convergent and discriminant correlations of CPI-Big Five and NEO PI-R domain scores with BFI peer-reports.

BFI peer-report	CPI-Big Five					NEO PI-R				
	E	A	C	N	O	E	A	C	N	O
Scale development sample (N = 141 targets, 1 peer per target)										
Extraversion	**.47**	−.33	.14	−.17	.00	**.50**	−.22	.15	−.27	.06
Agreeableness	.11	**.41**	.08	−.10	−.04	.12	**.40**	.03	−.05	.03
Conscientiousness	.10	.14	**.49**	−.23	−.08	−.01	.16	**.47**	−.09	−.14
Neuroticism	−.04	.16	−.04	**.36**	.00	−.04	.05	.02	**.43**	.03
Openness	.13	−.01	.07	−.09	**.26**	.20	.00	.17	.00	**.33**
Student validation sample (N = 136 targets, 1 peer per target)										
Extraversion	**.39**	−.23	.08	−.28	.05	**.38**	−.14	.02	−.29	−.01
Agreeableness	.21	**.32**	.07	−.25	−.07	.23	**.24**	.04	−.15	−.01
Conscientiousness	.12	.09	**.38**	−.24	−.12	.09	−.04	**.49**	−.07	−.03
Neuroticism	−.17	−.06	.07	**.41**	−.04	−.14	.00	.09	**.50**	−.05
Openness	−.05	.04	.19	−.08	**.43**	−.10	−.05	.17	.00	**.47**
Community validation sample (N = 484 targets, average of 2.52 peers per target)										
Extraversion	**.52**	−.15	.11	−.12	.04	**.54**	−.12	.10	−.13	.06
Agreeableness	.05	**.32**	.08	−.06	−.07	.13	**.42**	−.06	−.11	−.01
Conscientiousness	.01	.06	**.40**	−.07	−.18	−.03	−.02	**.43**	−.02	−.15
Neuroticism	.01	−.02	−.10	**.38**	.08	−.06	−.04	−.04	**.46**	.06
Openness	.15	.01	.02	.00	**.46**	.03	.02	−.07	−.03	**.54**
Mean convergent validity	**.46**	**.35**	**.42**	**.38**	**.38**	**.47**	**.35**	**.46**	**.46**	**.45**

Note: Convergent correlations are in boldface. For the scale development and student validation samples, all correlations ⩾.17 are statistically significant at α = .05 (two-tailed), and the peer-reports were obtained several weeks after the self-reports. For the community validation sample, all correlations ⩾.09 are statistically significant at α = .05 (two-tailed), and the peer-reports were obtained approximately 4 years after the self-reports.

average magnitudes were .09 in the scale development and student validation samples, and .06 in the community validation sample.

6.2. Reliability and validity of the CPI-Big Five facet scales

6.2.1. Reliability of the facet scales

Table 6 presents scale lengths and alpha reliabilities for each of the 16 CPI-Big Five facet scales. Collectively, these scales demonstrated strong reliability; their alphas averaged .72 in the scale development sample, .70 in the student validation sample, and .69 in the community validation sample. Averaged across the three samples, 15 of the 16 scales showed reliability of .60 or stronger, and more than half showed reliability of .70 or stronger. These reli-

abilities were almost as strong as those of the NEO PI-R facet scales, which averaged .75 in the scale development and community validation samples, and .73 in the student validation sample. Across the three samples, individual facet reliabilities ranged from .51 to .85 for the CPI-Big Five, and from .54 (Tender-Mindedness in the student validation sample) to .86 (Depression in the scale development sample) for the NEO PI-R.

6.2.2. Joint principal components analysis of the CPI-Big Five and NEO PI-R facet scales

To test for convergence between the 30 CPI-Big Five and 16 NEO PI-R facet scales in Big Five factor space, we jointly submitted them to a principal components analysis in each of the three samples. In

Table 6
Number of items and alpha reliabilities for the CPI-Big Five facet scales.

Facet		Alpha reliability in each sample			
	Items	Scale development	Student validation	Community validation	Mean
Extraversion					
Gregariousness	14	.79	.76	.77	.77
Social confidence vs. anxiety	13	.85	.85	.85	.85
Assertiveness	15	.80	.80	.81	.80
Agreeableness					
Trustfulness vs. cynicism	22	.78	.73	.73	.75
Compassion vs. insensitivity	18	.57	.51	.59	.56
Humility vs. arrogance	18	.63	.63	.57	.61
Conscientiousness					
Industriousness	21	.65	.65	.63	.64
Orderliness	17	.71	.71	.71	.71
Self-discipline vs. distractibility	11	.69	.68	.61	.66
Neuroticism					
Anxiety	27	.77	.77	.72	.75
Depression	22	.84	.82	.80	.82
Rumination	11	.61	.61	.58	.60
Irritability	24	.70	.68	.64	.67
Openness					
Idealism vs. conformity	24	.65	.60	.64	.63
Intellectualism	22	.77	.75	.74	.75
Adventurousness	20	.70	.64	.64	.66
Mean alpha reliability		.72	.70	.69	.70

Note: For scale development sample, $N = 433$. For student validation sample, $N = 396$. For community validation sample, $N = 520$.

each sample, a scree test clearly indicated the presence of five major components and so five components were extracted and varimax-rotated.

After rotation, each facet loaded substantially on its intended Big Five component in each sample. Note that the variables in this analysis included almost twice as many NEO PI-R facets as CPI facets, thus giving considerably more weight to the NEO PI-R. Nevertheless, the intended primary loadings were as strong for the 16 CPI-Big Five facets as for the 30 NEO PI-R facets. In the scale development sample, the intended primary loadings averaged .66 for both the CPI-Big Five and NEO PI-R facets; in the student validation sample, these loadings averaged .64 for each set of facets, and in the community validation sample they averaged .64 for the NEO PI-R facets and .63 for the CPI-Big Five facets.

6.2.3. Correlations of the CPI-Big Five facet scales with external criteria

To further test the convergent and discriminant validity of the CPI-Big Five facet scales, we examined their correlations, in the combined scale development and student validation samples (total $N = 829$), with facets and items from the NEO PI-R and, following Costa and McCrae (1992; McCrae & Costa, 1992), with items from the Adjective Check List (ACL). For each of the 16 CPI-Big Five facet scales, Table 7 lists (a) its two strongest NEO PI-R facet correlates, (b) three of its strongest NEO PI-R item correlates, and (c) its 10 strongest ACL adjective correlates. The mean strength of convergence was .51 with the listed NEO PI-R facets, .40 with the listed NEO PI-R items, and .27 with the listed ACL adjectives; all of these convergent correlations were statistically significant at the $\alpha = .05$ level (two-tailed).

As this table shows, the CPI-Big Five facets correlated in conceptually meaningful ways with the NEO PI-R facets and items, and with the ACL adjectives. As expected, given the CPI-Big Five's hierarchical structure, there was some overlap among the correlates of the facet scales within each Big Five domain, but there were also correlates uniquely associated with each facet. For example, the Gregariousness and Assertiveness facets of Extraversion both correlated strongly with the ACL adjective *outgoing*. However, the Gregariousness facet had uniquely strong correlations with *sociable*

and *energetic*, whereas the Assertiveness facet had uniquely strong correlations with *assertive* and *self-confident*.

To directly test whether the CPI-Big Five facet scales could be reliably distinguished on the basis of their correlates, we used a version of the facet-correlate matching task developed by McCrae and Costa (1992; see also Costa & McCrae, 1995) to validate the NEO PI-R facets. Specifically, the first author created two sets of 16 cards. Each card in one set presented the name of a CPI-Big Five facet scale and six example items from that scale. Each card in the second set presented a list of the 10 ACL adjectives and 10 NEO PI-R items that correlated most strongly with a particular CPI-Big Five facet scale.

Four judges who had not previously seen the ACL and NEO PI-R item correlates of the CPI-Big Five facet scales—one professor of personality psychology (the second author), two advanced students in a personality psychology graduate program, and one non-psychologist—were each presented with the two sets of cards in random order. The judges were instructed to match each facet card with what they thought was the corresponding correlate card.

Three of the four judges correctly matched all 16 pairs of facet and correlate cards. The remaining judge correctly matched 14 of the 16 card pairs, incorrectly matching only the Idealism vs. Conformity facet card with the Intellectualism correlate card and vice versa. Thus, the correct matching rate across all four judges was 62 of 64 card pairs, or 97%. In a similar effort to validate the NEO PI-R facets, McCrae and Costa (1992) found that two judges correctly matched 46 of 60 possible pairs (77%) of NEO PI-R facets with their strongest ACL adjective correlates. Costa and McCrae (1995) found that two judges correctly matched 54 of 60 possible pairs (90%) of NEO PI-R facets with their strongest California Adult Q-set (Block, 1961) item correlates. The present results therefore provide strong evidence for the discriminant validity of the CPI-Big Five facet scales.

7. Discussion

The present research developed a novel approach for hierarchically assessing the Big Five personality domains from an existing

Table 7
Strongest NEO PI-R facet and item correlates and ACL item correlates for each of the 16 CPI-Big Five facet scales.

CPI-Big Five facet	NEO PI-R facets	NEO PI-R items	ACL adjectives
Extraversion			
Gregariousness	Gregariousness (.64)	Am usually bored by social gatherings (−.51)	Outgoing, Sociable, Energetic, Talkative, Active, (−)Quiet, Flirtatious, Cheerful, (−)Timid, Attractive
	Warmth (.52)	Like to be around lots of people (.47)	
		Prefer doing things on my own (−.45)	
Social Confidence vs. Anxiety	Assertiveness (.63)	Have an easy time being outgoing with strangers (.50)	Outgoing, (−)Shy, (−)Quiet, (−)Timid, Talkative, Assertive, Outspoken, Active, Self-Confident, Confident
	Self-Consciousness (−.54)	Often dread making a social blunder (−.41)	
		Rarely feel self-conscious (.39)	
Assertiveness	Assertiveness (.76)	Am relied on to make decisions (.53)	Assertive, Self-Confident, Outgoing, Outspoken, Confident, (−)Shy, Talkative, (−)Quiet, Dominant, Opinionated
	Activity (.46)	Am dominant and assertive (.53)	
		Often lead the groups I belong to (.53)	
Agreeableness			
Trustfulness vs. Cynicism	Trust (.56)	Am suspicious when someone is too nice (−.51)	Kind, (−)Arrogant, Affectionate, Forgiving, Warm, (−)Cynical, (−)Resentful, Considerate, Appreciative, (−)Bitter
	Angry Hostility (−.49)	Think that most people can be trusted (.42)	
		Am often cynical and skeptical of others (−.40)	
Compassion vs. Insensitivity	Tender-Mindedness (.38)	Think all people deserve respect (.27)	Sympathetic, Understanding, Forgiving, Kind, Sensitive, Soft-Hearted, Sentimental, Affectionate, Interests Wide, Tolerant
	Aesthetics (.29)	Don't sympathize with pan-handlers (−.26)	
		Find it easy to empathize with others (.25)	
Humility vs. Arrogance	Straightforwardness (.50)	Am willing to manipulate people to get my way (−.41)	(−)Arrogant, (−)Self-Confident, (−)Argumentative, (−)Assertive, (−)Good-Looking, (−)Show-Off, (−)Aggressive, (−)Quarrelsome, (−)Dominant, (−)Opportunistic
	Modesty (.46)	Am not embarrassed to brag about my talents (−.37)	
		Know that I'm a better person than most (−.37)	
Conscientiousness			
Industriousness	Achievement Striving (.48)	Work hard to meet my goals (.41)	(−)Reckless, (−)Lazy, (−)Absent-Minded, (−)Hasty, (−)Rebellious, Reliable, (−)Careless, (−)Irresponsible, Responsible, Ambitious
	Dutifulness (.48)	Always aim for excellence (.40)	
		Strive to achieve (.37)	
Orderliness	Order (.60)	Like to have everything in its place (.48)	Organized, (−)Disorderly, Efficient, (−)Irresponsible, (−)Mischievous, Responsible, (−)Rebellious, Planful, (−)Absent-Minded, (−)Forgetful
	Achievement Striving (.46)	Keep my things neat and clean (.48)	
		Prefer not to plan everything in advance (−.39)	
Self-Discipline vs. Distractibility	Self-Discipline (.58)	Often can't make myself do what I should (−.45)	(−)Absent-Minded, Clear-Thinking, Responsible, Efficient, (−)Forgetful, Self-Confident, (−)Careless, Stable, Organized, (−)Lazy
	Competence (.54)	Am good at getting things done on time (.43)	
		Am quite self-disciplined (.39)	
Neuroticism			
Anxiety	Anxiety (.64)	Scare easily (.50)	Nervous, Worrying, Anxious, (−)Relaxed, Emotional, (−)Calm, (−)Self-Confident, (−)Handsome, Tense, Confused
	Vulnerability (.57)	Am rarely anxious or nervous (−.48)	
		Worry a lot about what might go wrong (.46)	
Depression	Depression (.74)	Often feel inferior to others (.60)	Dissatisfied, Gloomy, Worrying, (−)Self-Confident, (−)Confident, Self-Pitying, Confused, Bitter, (−)Optimistic, Complaining
	Vulnerability (.62)	Am rarely lonely or sad (−.51)	
		Am never completely successful at what I do (.48)	
Rumination	Depression (.54)	When things go wrong, just want to give up (.39)	Self-Pitying, Gloomy, Absent-Minded, Dissatisfied, Self-Punishing, (−)Mature, Confused, (−)Confident, (−)Responsible, (−)Clear-Thinking
	Vulnerability (.45)	Wish someone would solve my problems (.37)	
		Sometimes feel ashamed, and just want to hide (.35)	

Table 7 (continued)

CPI-Big Five facet	NEO PI-R facets	NEO PI-R items	ACL adjectives
Irritability	Angry Hostility (.43)	Am frustrated by minor annoyances frustrate (.41)	Complaining, Whiny, Temperamental, Worrying, Resentful, (−)Forgiving, Fault-Finding, Cynical, Fussy, (−)Easy-Going
	Vulnerability (.41)	Am difficult to anger (−.32) Am generally cheerful and high-spirited (−.31)	
Openness			
Idealism vs. Conformity	Aesthetics (.52) Values (.40)	Get excited by poetry or art (.46) Think controversial speakers only confuse people (−.35) Believe that aesthetics and art aren't important (−.30)	Interests Wide, Insightful, Reflective, Unconventional, (−)Interests Narrow, Imaginative, Intelligent, Individualistic, Artistic, Strong
Intellectualism	Ideas (.53) Actions (.35)	Am intellectually curious (.45) Have broad intellectual interests (.42) Am not interested in abstract theories (−.39)	Interests Wide, Progressive, Insightful, Unconventional, Individualistic, Opinionated, (−)Interests Narrow, Intelligent, Strong, Inventive
Adventurousness	Excitement-Seeking (.40)	Sometimes do things for a thrill (.39)	Rebellious, Daring, Mischievous, Adventurous, Spontaneous, Individualistic, Sexy, Courageous, Opinionated, Clever
	Ideas (.38)	Do things on a whim (.36) Like to be in on the action (.28)	

Note: Correlates listed for each CPI-Big Five facet scale are (a) the two strongest NEO PI-R facet correlates, (b) three of the 10 strongest NEO PI-R item correlates, and (c) the 10 strongest ACL adjective correlates. In each cell, correlates are listed from strongest to weakest; all correlations were statistically significant at the α = .05 level (two-tailed). Negative correlations are indicated by (−). N = 829 for NEO PI-R correlates. N = 631 for ACL correlates. The mean strength of convergence was .51 with the listed NEO PI-R facets, .40 with the listed NEO PI-R items, and .27 with the listed ACL adjectives.

item pool, that of the California Psychological Inventory. This approach addressed two important measurement challenges posed by the CPI: the influence of individual differences in acquiescent response style, and the many CPI items containing a complex combination of Big Five content. Beyond its application here, this approach should serve as a useful example for future research using the CPI, and for similar attempts to assess new psychological constructs from existing measures.

The present research also provided initial evidence for the reliability and validity of the resulting CPI-Big Five measure. This measure utilizes the breadth and depth of the CPI item pool to assess not only the broad Big Five domains, but also several more specific personality characteristics within each domain. Its availability now creates valuable opportunities to address contemporary questions about the Big Five using the rich archive of existing CPI data.

7.1. Summary of evidence for the reliability and validity of the CPI-Big Five measure

Initial evidence for the reliability and validity of the CPI-Big Five measure is very encouraging. In each of three independent samples, the CPI-Big Five domain scores converged strongly with those of the most widely used hierarchical measure of the Big Five, namely the NEO PI-R (see Table 4). They also demonstrated impressive levels of reliability (Table 3), discriminant validity (Table 3), and convergence with peer-reports (Table 5). As for the 16 CPI-Big Five facet scales, they converged in conceptually meaningful ways with NEO PI-R facets and items, and with ACL adjectives (Table 7). They also demonstrated levels of reliability (Table 6) and discriminant validity similar to those of the NEO PI-R facets.

The strong psychometric characteristics of the CPI-Big Five domain scores and facet scales are particularly impressive given that the CPI item pool was developed prior even to the initial discovery of the Big Five structure. These findings are a testament to the breadth and depth of the CPI item pool.

7.2. Lessons learned about scale construction and data analysis using the CPI

The present research introduces two methodological innovations relevant for future research using the CPI, and for the general problem of assessing new constructs from existing measures. The first

innovation concerns individual differences in acquiescent response style. Previous research has documented the substantial influence of such individual differences on the psychometric characteristics of the CPI (Jackson, 1960; Jackson & Messick, 1958). Although this influence can be minimized by using scales with an equal number of true- and false-keyed items, the content of the CPI item pool dictates that not all psychological constructs can be measured with fully balanced scales. For example, the CPI includes many items keyed toward a preference for organization and order (e.g., *Keep things neat and tidy*; *Like to plan things in advance*), but very few items keyed toward a preference for disorganization.

Instead of excluding such constructs from the CPI-Big Five measure, or ignoring the issue of acquiescence altogether, the present research developed a CPI acquiescence index, consisting of 50 opposite-item pairs, and used within-person centering around this index to control for individual differences in acquiescent responding. This control method proved highly effective. As noted in Section 5.2.2, 10 of the 23 CPI folk and vector scales correlated .30 or stronger with the acquiescence index in the scale development sample, with some correlations approaching .50 in magnitude. By contrast, none of the 21 CPI-Big Five domains and facets correlated .30 or stronger with the acquiescence index in any of our three samples. We therefore recommend that researchers use this index to control for individual differences in acquiescence when conducting research with the standard CPI folk and vector scales—many of which contain a substantial majority of true- or false-keyed items— or when developing new CPI scales.

The second innovation concerns the many CPI items containing a complex combination of personality content. Development of the CPI-Big Five measure took such content into account by using a circumplex-based structural model, the AB5C model (Hofstee et al., 1992), to organize the CPI item pool in Big Five factor space. The resulting CPI-AB5C circumplexes then provided starting points for scale development. We recommend similar circumplex-based approaches for future projects that aim to assess a multidimensional structure using an item pool with complex item content.

7.3. Personality structure beneath the Big Five

Since the emergence of the Big Five as a model of basic personality trait structure, researchers have begun to investigate how personality characteristics are organized at a more specific level

of analysis beneath the five broad domains (e.g., Costa & McCrae, 1992, 1995; DeYoung, Quilty, & Peterson, 2007; Hofstee et al., 1992; Roberts, Chernyshenko, Stark, & Goldberg, 2005; Saucier & Ostendorf, 1999). The present research contributes to this literature by identifying and developing scales to assess 16 specific Big Five facets.

As noted in the Method section, selection and definition of the CPI-Big Five facet scales was limited, to some extent, by the nature of the CPI. Specifically, the CPI's true-false response format required that the CPI-Big Five facet scales be relatively long (compared with, for example, the 8-item NEO PI-R facet scales) in order to achieve acceptable levels of reliability. Because of this need for length, and the diversity of the CPI item pool, some of the facets were defined rather broadly. For example, the Industriousness facet subsumes personality traits represented separately by the Dutifulness and Achievement Striving facets of the NEO PI-R. Moreover, some potentially important constructs within each Big Five domain could not be included on the CPI-Big Five measure because the CPI does not include enough relevant items to develop a scale for that construct (e.g., the positive emotionality aspect of Extraversion).

Nevertheless, each CPI-Big Five facet scale assesses an important personality characteristic, and any comprehensive Big Five facet model should be able to represent these constructs. Indeed, the fact that there is considerable overlap between the CPI-Big Five facets and those proposed by other models suggests progress toward a consensus about personality structure beneath the broad Big Five domains. For example, the sets of 16 CPI-Big Five facets, 30 NEO PI-R facets, and 17 lexical facets identified by Saucier and Ostendorf (1999) all include Assertiveness and Gregariousness/Sociability facets of Extraversion, Anxiety and Irritability/Hostility facets of Neuroticism, and Orderliness and Industriousness/Dutifulness facets of Conscientiousness (John et al., 2008). These three models show less agreement within the Agreeableness and Openness domains, indicating a need for further investigation of facet-level personality structure.

7.4. Conclusion: A look ahead

Availability of the CPI-Big Five measure creates tremendous opportunities for personality researchers. For example, scoring the CPI-Big Five domains in long-term longitudinal datasets would help researchers address questions about how the Big Five develop and interact with social and biological factors over the lifespan, without having to wait years or decades for new longitudinal studies to run their course. As a second example, scoring the CPI-Big Five facet scales in the many existing CPI datasets would yield high levels of statistical precision for addressing questions about specific personality characteristics and processes within an overarching Big Five framework. In sum, we are confident that the CPI-Big Five measure will help provide valuable new insights into personality structure, development, and process.

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