

Running head: PERIODIC TABLE OF PERSONALITY

Toward a Periodic Table of Personality: Mapping Personality Scales between the Five Factor
Model and the Circumplex Model

Stephen A. Woods Ph.D.
Surrey Business School
University of Surrey
Guildford, UK

&

Neil Anderson Ph.D.
Brunel Business School
Brunel University London, UK

Address for Correspondence:

Stephen A. Woods
People and Organizations Department
Surrey Business School
University of Surrey
Guildford
Surrey,
GU2 7XH
UK
S.a.woods@surrey.ac.uk

Abstract

In this study we examine the structures of ten personality inventories widely used for personnel assessment, by mapping the scales of personality inventories (PIs) to the lexical Big Five circumplex model resulting in a 'Periodic Table of Personality'. Correlations between 273 scales from ten internationally popular PIs with independent markers of the lexical Big Five are reported, based on data from samples in two countries (UK N = 286; USA N = 1,046), permitting us to map these scales onto the AB5C framework. Emerging from our findings we propose a common facet framework derived from the scales of the PIs in our study. These results provide important insights into the literature on criterion-related validity of personality traits, and enable researchers and practitioners to understand how different PI scales converge and diverge and how compound PI scales may be constructed or replicated. Implications for research and practice are considered.

Keywords: Periodic Table of Personality, personnel assessment, personality inventories, criterion validity, Big Five, circumplex model, AB5C

Toward a Periodic Table of Personality: Mapping Personality Scales between the Five Factor Model and the Circumplex Model

How do personality inventories (PIs) represent personality structure for the purposes of assessment in organizations, and how do the scales of different inventories converge and diverge? These are important questions for industrial, personnel selection, and personality psychology practitioners and researchers. Yet, the field lacks data and a standardized methodology to enable mapping of PI scales, and as a consequence there remains uncertainty over how to organize the personality domain in applied psychology research.

The conceptual problems presently facing the field of applied personality research suggest an intriguing parallel with the field of chemical science in the Nineteenth Century. Prior to the development of the periodic table, chemistry researchers arguably focused solely on chemical elements due to a lack of general understanding over the relations between elements and their underlying structure. In 1869, Dmitri Ivanovich Mendeleev, the eminent Russian chemist, published his now seminal periodic table of chemical elements allowing researchers to codify the underlying structure of relationships between individual elements (Mendeleev, 1869). This was a significant historical advance. Similarly, within personality measurement in applied settings the lack of an equivalent ‘periodic table of personality’ has hampered our understanding of underlying structures, measurement comprehensiveness, and synergistic developments. Yet despite past calls for, or commentaries on, the merits of attaining a so-called periodic table of personality traits (Hofstee, Goldberg & De Raad, 1992; Lamiell, 2000), we remain some way short of achieving it.

Addressing this gap would bring greater coherence to assessment research and practice, it would advance our understanding of criterion effects of personality variables, and crucially, it

will help assessment users to better understand how to integrate and differentiate information or data from different inventories. This study addresses these issues with the objective of advancing understanding of the structures of a variety of PIs used in organizational assessment by mapping personality scales from different inventories to a common circumplex framework based on the lexical Big Five personality factors. We examine a total of 273 scales drawn from ten internationally popular PIs, in samples originating from both the US and UK. For the first time, our findings allow researchers and practitioners to map work-related PI scales onto the lexical Big Five circumplex framework and to clearly understand how personality is represented in studies of traits in applied psychology.

The main contribution of our study is therefore the presentation of a coherent cross-inventory framework for personality traits, which akin the periodic table of chemical elements, has the unique advantage of permitting organization of the scales of the ten PIs in our study, whilst simultaneously identifying those aspects of personality most commonly assessed in personnel selection and assessment research versus those that may have been overlooked. From our findings we derive a common facet structure of personality traits underlying the majority of scales in the ten PIs we examined that has the potential to clarify the literature on criterion effects of facet-level personality traits in applied psychology measured using different PIs. Further, our findings have implications for understanding the convergence and divergence of higher-order PI structures, and for constructing compound PI scales, and for developing new lines of integrated research literature on personality structure. Finally, our results contribute to knowledge about how different PIs may be used in interchangeable and complementary ways by practitioners.

Personality Inventories in Organizational Assessment

The past two decades have seen substantial growth in the use of personality variables to explain individual work role performance in organizational settings (e.g. Viswesvaran, Deller, & Ones, 2007; Burch & Anderson, 2008; 2009; Hough & Johnson, 2013). This increasing popularity of personality assessment has led to the development of a huge variety of inventories, all available commercially for researchers to apply in scientific studies, and for practitioners to use in organizations (Prewett, Tett, & Christiansen, 2013). Beyond more generic issues of the criterion-related validity of these proprietary personality measures (see, for instance, Ones, Dilchert, Viswesvaran, & Judge, 2007; Morgeson, Campion, Dipboye, Hollenbeck, & Schmitt, 2007), this abundance of inventories gives rise to questions about the convergence and divergence of their underlying structures (e.g. Anderson & Ones, 2003; Woods & Hardy, 2012). For researchers, the benefits of addressing such questions center on the accurate integration of research findings collected using different inventories. For example, a common approach in meta-analyses of the relations between personality and organizational criteria is to use the Big Five personality dimensions (Extraversion, Agreeableness, Conscientiousness, Emotional Stability, Openness/Intellect) as an organizing framework, with scales from different inventories assigned to the most representative of the five dimensions. However, Hough and Ones (2001) have argued for the inadequacy of the basic Big Five in this respect, and called for a more detailed appraisal of personality structure in personnel assessment research (see also Ones & Anderson, 2003).

Interest in personality structure in applied psychology has been further fuelled by evidence that facets predict work relevant criteria beyond their broader higher-order factors (e.g. Ones & Viswesvaran, 2001; Roberts et al., 2005; Timmermann, 2006) with job context playing a part in their utility (Rothstein and Goffin, 2006). Hough and colleagues are strong proponents of using narrower personality variables than the Big Five to understand the relations of traits and

organizational behavior (e.g. Hough, Eaton, Dunette, Kamp, and McCloy, 1990; Hough and Schneider, 1996; Schneider and Hough, 1995). For example, Conscientiousness and Extraversion are argued to be too broad for many assessment contexts, with Conscientiousness comprising facets of dependability and achievement striving, and Extraversion comprising dominance and affiliation (Hough and Ones, 2001). The different facets of Conscientiousness show differential relations with job performance (e.g. Vinchur, Schippmann, Switzer and Roth, 1998), and the facets of Extraversion also predict criteria in different ways (Hough and Ones, 2001).

An alternative focus to facet-level traits is compound scales constructed from multiple PI scales. Ones and Viswesvaran (2001) introduced the concept of criterion-focused occupational personality scales (COPS) to describe their methodology of combining scales to produce superior predictive composites. The research literature on the criterion effects of personality traits in applied psychology has therefore reached a difficult intersection. Evidence points to the potential utility of examining both broad composite or compound personality traits, and narrower facets of personality to clarify criterion effects (Hough and Johnson, 2013). The foundations of this evidence are arguably the integrated findings from meta-analyses organized around the Big Five which brought coherence to the literature. By contrast however, pursuing these new research lines has the potential to fragment the literature as multiple frameworks and methodologies are applied by different researchers, with little clarity about how to bring findings together conceptually and empirically.

Criterion Validity and PI Structures.

The literatures on criterion effects of personality traits, and the criterion validities of specific PIs, underline the need for clarity over PI structures. At a conceptual level, theory building seeks to understand how personality traits affect outcomes, and for which criteria specific traits are more or less salient (e.g. Hough & Ones, 2001; Woods & Hardy, 2012). At a

measurement level, validation research is concerned with testing the criterion effects of specific instruments (e.g. Anderson & Ones, 2003; Oswald, Hough & Ock, 2013). In respect of both of these aspects, researchers could conceptualize and measure personality traits at various levels of breadth versus fidelity (e.g. facet, higher-order and compound-level), hence further complicating the picture. Structural understanding of PIs is important in examining all of these issues.

Building Theoretical Models. In order to build coherent theoretical models of how traits predict and interact with other variables, researchers must rationally explain how the traits featuring in the model influence behavior, and how that behavior may affect or interact with other factors in their models. In building theory, researchers must interpret findings of past studies that use a range of PIs requiring accurate knowledge of they each measure the trait domain. The absence of a coherent cross-inventory framework means that theorizing may be built upon imprecise or subjective information, such as the scale label, or operational statements about each scale, which in proprietary measures, are often written for potential clients rather than researchers.

A relevant example is the Achieving scale on the Occupational Personality Questionnaire (OPQ), which has been conceptualized as a component of Conscientiousness and used in its measurement (e.g. Barrick, Stewart, & Piotrowski, 2001; Lievens, Harris, Van Keer & Bisqueret, 2003). However, as we later show, the Achieving scale actually has a primary loading on Extraversion and is therefore more representative of that Big Five domain. The criterion effects of the OPQ Achieving scale may therefore be more appropriately examined in the context of Extraversion rather than Conscientiousness.

This issue is compounded when interpreting findings from different PIs. The OPQ Vigorous scale has also been used as a facet of Conscientiousness (e.g. Inceoglu & Warr, 2011), yet we later show that it is actually also more strongly indicative of Extraversion, and

conceptually similar to the HPI Ambition scale (which is acknowledged to be Extraversion loaded; Hogan & Hogan, 1992). The result is a situation in which different conceptual arguments (i.e. concerning Extraversion and Conscientiousness) could be made based on criterion effects of PI scales that are in fact similar. In short, the lack of coherent cross-inventory framework means that there is a very real risk of key pillars of theory on the one hand, and empirical tests of research hypotheses on the other, being built on insecure conceptual foundations.

Facet Models of Personality. The impact of the absence of a coherent cross-inventory framework is particularly acute in the classification of personality facets in meta-analyses. For example, a seminal study into personality and leadership by Judge, Bono, Illies and Gerhardt. (2002) reported effects of the Big Five and some specific facets of Extraversion, Conscientiousness and Emotional Stability with leadership criteria. Whilst analysis of the Big Five factors is clearly consistent with other studies of personality criterion effects, the selection and definition of facets in the study was necessarily less systematic. Judge and colleagues selected dominance and sociability in the Extraversion domain, achievement-orientation and dependability in the Conscientiousness domain, and self-esteem and locus of control in the Emotional Stability domain. Whilst conceptually and pragmatically justifiable, this selection of facets immediately presents issues of clarity about how findings could be applied or generalized to situations where different facet structures were employed (for example, the 30 facets of the NEO PIR or the 16 dimensions of the 16PF5). Moreover, the assignment of PI scales to the facet framework was limited in the sense that Judge et al. were restricted to “generally classifying only those traits that were identified by the same label (e.g. only traits specifically labelled as sociability, dominance, and achievement were coded as such)” (p769). It may be incorrect to assume the equivalence of scales based on their labels. For example, some scales labelled ‘Sociability’ reflect affiliation, whereas others rather reflect adventurousness or social boldness

(something we later illustrate in our data), which are meaningfully different, yet would be classified as equivalent in a facet structure based on their label. Imprecise classification of PI scales in meta-analyses may therefore lead to confounded findings.

Addressing this issue, recent contributions in this literature have adopted different approaches to modelling personality traits to clarify their criterion validities. For example, Judge, Rodell, Klinger, Simon & Crawford (2013) propose a hierarchy in which the Big Five are split first into the ten aspects proposed by De Young, Quilty and Peterson (2007). These ten aspects are then divided in various ways to give the thirty facets of the NEO-PIR model. Judge et al. (2013) report meta-analyses of the criterion validities of the facets at different levels of abstraction, confirming that specific facets of the Big Five tend to be more strongly and consistently associated with job performance than others. Nevertheless, the criticisms highlighted earlier around the selection of facets and classification of PI scales similarly apply. In particular the selection of the 30 NEO facets is somewhat arbitrary, being based on their widespread use rather than conceptual strength. Lack of systematic empirical data on the joint structures of different PIs prohibited any alternative classification methodology being employed by Judge et al (2013).

From a measurement perspective, researchers and practitioners draw on criterion validity evidence to support the use of specific PIs in personnel assessment practice (e.g. MacIver, Anderson, Costa, & Evers, 2014). Such data generally seeks to confirm that the PI predicts performance criteria in a particular sample to give confidence in the PI's validity. For instance, Mussel, Winter, Gelleri and Putra (2011) report criterion validities for facets of Openness to Experience, measured using the NEO PIR. They found that the facets Values, Actions and Ideas were the most strongly predictive of job performance. Whilst this is a useful finding for practitioners using the NEO PIR, beyond this specific PI, the results are of limited value.

However, if we were to know empirically which other PIs contained scales that closely converged with these NEO facets, then the findings of this validity study could be applied to multiple other inventories.

Higher-order Personality Dimensions. Similar issues of convergence apply at the higher-order level. Although the Big Five represent the common organizing framework for personality traits, representation of higher-order personality dimensions in PIs is dependent on the item and facet-scale inputs to those dimensions. For example, the NEO PIR five factor model differs somewhat from other representations of the Big Five (e.g. John, Donahue & Kentle, 1991). The HPI measures seven higher-order dimensions, which are designed to be more or less convergent with the Big Five (Hogan and Hogan, 1992), whereas the HEXACO model (Lee and Ashton, 2004) includes six higher-order dimensions. The paucity of studies examining scales of multiple PIs in the literature prevents straightforward generalization of findings from higher-order scales.

Compound Personality Constructs. An alternative perspective on clarifying the criterion validities of personality traits is the construction of compound traits, which comprise multiple basic traits that may or may not covary, with the aim of predicting specific outcome criteria (Hough & Schneider, 1996). For example, the Hogan Personality Inventory (HPI; Hogan & Hogan, 1992) includes six such compound scales (Reliability, Service Orientation, Sales Potential, Managerial Potential, Stress Tolerance, Clerical Potential), each made up of various combinations of the lower level HPI facet scales (Homogenous Item Clusters; HICs). Again, absence of data on the convergence of different PIs means that findings of the validity of such compound constructs are difficult to apply beyond the specific PI upon which they are based. Constructing equivalent compound traits from a different PI would require knowledge and

empirical data about the interrelations of the scales of the two PIs, often lacking in the research literature.

Conceptualizing Job Performance Criteria. PI structure research also has the potential to advance what we know about job performance and other organizational behaviors. Past research has approached job performance behavior modelling from the perspective of alignment with key personality and other individual difference variables, with the implication that it is possible to glean important information about performance at work from the pattern of correlates of particular performance criteria with personality variables (e.g. Bartram, 2005). Meta-analyses of personality and performance necessarily examine both traits and performance at a broad level of abstraction (e.g. Barrick & Mount, 1991 used the Big Five, and ‘general job proficiency’ as a performance criterion). Yet, research has shown the benefits of considering the conceptual relations of traits and performance criteria (Hogan & Holland, 2003). Better understanding of the structural and conceptual properties of the scales of different PIs could improve our knowledge of performance behavior.

For example, in the case of organizational citizenship behavior (OCB)⁺, Organ and Ryan (1995) reported in their meta-analyses that Conscientiousness was predictive of altruistic behavior, but the 95% CI ($\rho = .17$ to $.27$) implies variation across studies. If some of that variation were explainable by variation in the structural and conceptual properties of the scales classified as measuring Conscientiousness, then we would simultaneously learn more about the nature of compliance behavior as a component of OCB (because we could more precisely describe the trait antecedents) and achieve a more precise estimate of the relations of personality and compliance behavior (by focusing on PI scales that were conceptually most closely aligned to the criterion).

In summary, the robustness and utility of the criterion validity literature may be thought of as a function of the strength of the PI structure literature, and we argue that lack of progress in the latter has hampered progress in the former. Our study seeks to address this important issue.

Toward a ‘Periodic Table of Personality’.

As highlighted earlier, the conceptual problems currently facing the field of personality research in applied psychology are similar to those of chemical scientists who worked prior to the creation of the periodic table of elements. Whilst traits are not perfectly analogous to chemical elements, we nevertheless propose that there are desirable features of the periodic table that are transferable to personality research, and that would aid scientists in this field in the same way that chemical scientists benefit from their organizing structure for elements. So, in moving toward a periodic table of personality traits, we propose that an effective organizing structure should seek to 1) provide a coherent and logical means of defining personality traits or constructs (e.g. facets) in technical and conceptual (and not merely descriptive) terms; 2) provide the basis for a clear understanding of the structural relationships between different traits or constructs, such that different personality facets or PI scales can be meaningfully compared; 3) be constructed in such a way that it tells us about aspects of personality that are well-researched and frequently measured, as well as aspects that are less well understood (i.e. it should both describe what we know, and help identify what we don’t know); 4) facilitate prediction of the criterion effects of particular traits or PI scales as a result of understanding their structural properties; and finally, 5) help researchers understand compound level personality constructs (i.e. combinations of different traits) by providing technical and conceptual information about the constituent traits and how they combine.

Two lines of research are particularly relevant to addressing these fundamental issues. First, Hough and Ones (2001) proposed an innovative set of ‘working taxons’ to represent

personality structure. These taxons were derived conceptually from models and measures of personality commonly used in personnel assessment. Hough and Ones (2001) proposed two forms of their taxons. The first was a hierarchical model in which scales were organized into facets according to their associations with criteria rather than with other personality variables. The second were compiled using a blended factor approach. Compound variable measures (i.e. scales tapping more than one of the Big Five) were included in this second model and grouped according to their primary and secondary associations with the Big Five. Although key contributions to our understanding of organizing personality structures, one understandable limitation of the working taxons at the time was the absence of empirical data to back up the groupings of inventory scales within the taxonomic structures. Consistent with our earlier observations about the limitations of classifying PI scales to facet structures in meta-analyses, this was purely a function of the lack of available empirical studies into this important question. In the present study, empirical data are presented to address this notable gap.

A second recent approach is represented in the emergent literature on circumplex methodology in personnel assessment (e.g. Gonzalez-Mule, DeGeest, & Mount, 2013; Shoss & Witt, 2013). Unlike hierarchical approaches, which assign facets to specific higher-order factors such as those of the Big Five, circumplex approaches conceptualize personality trait constructs as blends of multiple higher-order factors. Shoss and Witt (2013) argue that modelling personality by blending the Big Five personality factors enables greater clarity about how traits might predict organizational behavior. Gonzalez-Mule et al (2013) also highlight the benefits of capturing otherwise-unmeasured predictor space between the Big Five, the effects of which they demonstrate empirically. In their study, blends of Conscientiousness, Agreeableness, and Emotional Stability exhibited higher criterion validities than the pure Big Five dimensions alone. This finding corresponds with similar evidence reported by Witt (2002) concerning the

interactive effects of the Big Five. In our study, we utilize the circumplex methodology as a foundation for our proposed solution to the problem of understanding PI structure in applied psychology.

Organizing Personality Factorial Space

In order to examine the underlying structures of personality inventories, it is sensible to begin with the more basic question of how to organize personality factorial space (i.e. how to represent personality structure systematically). Most studies of lower-order personality structure adopt a hierarchical approach to structural analyses (e.g. Goldberg, 2006). An alternative is the circumplex perspective, exemplified by the Abridged Five Dimension Circumplex Model (AB5C; Hofstee, De Raad and Goldberg, 1992). Goldberg (1993) argued that for purposes of trait structure research, models that emphasise horizontal relations (such as circumplex models) will typically be more informative than hierarchical models, because even after orthogonal rotation of factors, most personality variables have substantial secondary loadings. The result is that most personality traits and scales should be viewed as blends of two or more higher-order factors rather than as exclusively representative of a single factor (Soto & John, 2009).

Taking the Big Five personality factors as a foundation, the AB5C model utilises the factorial blending of personality traits to define and organize the so called “five-factor personality space”, that is the domain of personality captured in the Big Five and their various blended combinations. The AB5C model consists of ten circumplexes constructed from paired factors from the Big Five model (i.e. Extraversion x Agreeableness, Extraversion x Conscientiousness and so on). Each circumplex is sectioned into twelve 30-degree “sectors” (see Figure 1), with traits located within the circumplex space according to their primary and secondary factor loadings, a similar approach to that of Hough and Ones (2001). There are a total of 90 such sectors in the framework. Opposing sectors (e.g. E+A- and E-A+ in the Extraversion-

Agreeableness circumplex) may be considered bipolar opposite constructs (i.e. bipolar dimensional). In the AB5C facet model, the 90 sectors are therefore paired to give 45 facets (Goldberg, 1999).

Although to date, the main application of the AB5C has been to define or clarify the nature of specific personality traits or facets (e.g. Gonzalez-Mule et al, 2013; Johnson, 1994a; Johnson & Ostendorf, 1994), its functional advantage as a map for locating inventory scales has been largely overlooked (see also Oswald, Hough & Ock, 2013). For the purposes of understanding inventory structure, the AB5C model represents a common framework against which the scales of different inventories can be systematically examined. Theoretically, any PI scale could be quickly located on the framework using the lexical Big Five as anchor points, providing two key benefits. One, it would enable precise definition of the measurement domain of inventory scales in terms of blends of the Big Five. Two, as an alternative to computing correlations between the scales of multiple PIs, practitioners and researchers could more easily and precisely derive the convergence of a variety of different inventory scales by simply correlating each with lexical Big Five marker scales (e.g. Goldberg, 1992). This possibility unlocks the potential to more efficiently develop detailed knowledge about inventory criterion validity, convergence, divergence, interchangeability, and complementarity.

Mapping Personality Structure and PI Scales with the AB5C. In the present study we propose that the AB5C model has a number of potential advantages that make it especially relevant as a framework for personality traits in research and practice in personnel psychology. These are highly relevant to our study objectives of mapping structures of PIs used in organizational assessment, by developing and applying a standardized method that can be replicated by others.

First, the model is based around the Big Five model. Although there are alternative higher-order models of personality traits exist (e.g. the HEXACO model; Lee and Ashton, 2004), given our objective to promote integration of research findings of different studies, it is logical to apply a framework that utilises the most widely adopted higher-order model of personality (i.e. the Big Five; John, Naumann and Soto, 2008).

Second, with respect to facet structure, Hofstee et al. (1992) argue that by depicting facets of the Big Five as blends of two factors, the model achieves a tighter conceptual structure than the hierarchical models proposed by Costa and McCrae (1992) and others. The AB5C is unlike alternative facet structures such as the NEO 30 facets structure or HPI HICs. This is because of the combination of conceptual and methodological factors applied in the derivation of personality facet structures using deductive and inductive methods (Burisch, 1984).

Facet structures of specific PIs could be derived from either deductive or inductive approaches to test construction. In a deductive approach (where the designer specifies the traits or facets to be measured), the selection of items is naturally biased by the intended purpose of the inventory. However, even in an inductive approach, there is a degree of subjectivity in the PI construction, because designers must still decide on the item content to be included or excluded (indeed, it has long been argued that rational expert judgment is beneficial in PI development e.g. Jackson, 1971). Regardless of the approach taken to the item design, the PI is refined by emphasizing scale internal consistency (see for example, the 16PF5; Conn & Reike, 1994), and analysing the factor structure underlying the items and facets, with the objective of achieving a stable facet structure that can be replicated in either exploratory or confirmatory factor analysis (Jackson, 1971; see for example Lee & Ashton, 2007 for the case of the HEXACO PI). Logically, the final facet models of specific PIs are therefore determined by the PI item set.

The derivation of the 45 AB5C facets is based on a different approach. Rather than allow facet structure to settle based on the analysis of a fixed number of items of facet scales, the AB5C is explicitly conceptually deductive. The circumplex sectors were defined not by PI item content, but by the factor structure of the lexical Big Five. The lexical Big Five (Goldberg, 1990; 1992) were derived from a comprehensive list of more than 1400 personality trait adjectives (of which 100 were selected by Goldberg, 1992, as optimal markers for the lexical Big Five). Applying a rational proposition that traits could be more accurately classified as a function of their primary and secondary loadings on the Big Five resulted in a logical circumplex structure (Hofstee, De Raad and Goldberg, 1992; see Figure 1) capturing all of the factorial space of the Big Five.

The AB5C was therefore designed explicitly as a conceptual model, and so not determined by any particular, limited PI item set. Although items are listed in the International Personality Item Pool (Goldberg, 1999) to measure the AB5C facets, the scales are constructed in a deductive way empirically, to measure the factorial space defined by the model. The AB5C framework therefore has the unique advantage of being based on firm conceptual and empirical foundations (i.e. the orthogonal, lexical Big Five; Goldberg, 1992). Moreover, because the model is defined independently of the structures of any particular inventory, as a representation of personality factorial space, the model is not dependent, and by extension, biased, influenced or restricted by the selection or inclusion of particular inventory scales. Recent applications of the AB5C in empirical and conceptual research in applied personnel psychology (e.g. Gonzalez-Mule et al. 2013; Witt & Shoss, 2013) support its relevance and utility in this respect.

Third, the conceptual derivation allows the model not only to classify traits that are measured in PIs, but may also identify facets that are typically neglected or left unmeasured by PIs. Indeed, the AB5C model has already been influential in understanding the lower-order

structure of the Big Five model. The 45-dimension structure assessed by the IPIP AB5C inventory scales (Goldberg, 1999) has been included in an increasing number of personality structure studies (e.g. De Young et al., 2007; Roberts et al., 2005).

Fourth, with respect to the personality domain as a whole, the framework enables mapping and examination of personality trait constructs measured at different levels of breadth versus fidelity. The AB5C circumplex sectors may be thought of as locations in personality five-factor space. For the purpose of organizing PI scales, this has different benefits depending on the level at which the scale is constructed. At the lower-order facet level, sector locations of facet scales indicate their conceptual basis in terms of the Big Five, and the convergence with other PI facet scales. This enables comparison and data-driven classification of the main personality facets measured in personnel assessment. The AB5C is therefore a practical solution to the problem of how to organize the lower-order facet structure of personality traits in personnel assessment, with added utility as a descriptive framework against which all lower-order PI scales can be systematically mapped, and therefore classified accurately in, for example, meta-analyses.

At the higher-order level, scales measuring structures such as the seven HPI primary dimensions, or the five NEO PIR domains can also be located on the framework, so that they too can be compared (see also Johnson, 1994b). For example, it could be helpful to understand the pattern of lexical Big Five relations of higher-order scales that are typically considered equivalent (e.g. HPI Likeability and NEO PIR Agreeableness). Such information would clarify subtle or more substantive differences in the higher-order representations of traits in different PIs. Rather than answer these kinds of questions by either conceptual correspondence, or simple scale intercorrelations, location of these higher order scales on the AB5C framework allows similarities and differences to be more precisely specified in terms of the conceptual blending of a standard model of the Big Five (i.e. the lexical Big Five dimensions). At the compound scale

level, data concerning the constituent components or facets from which scales are constructed would enable data-driven reconstruction of similar or parallel scales using the facets of different inventories. The applied utility of validity studies of such compound scales would thereby be enhanced, because researchers and practitioners could more readily apply findings to their own situations, and choices of PI.

In summary, we argue that research on the fundamental structures of PI scales is needed in order to advance the literature on personality assessment in organizations, and particularly on criterion validity. By analogy with the construction of the periodic table of chemical elements, we identify a number of features and benefits that an organizing structure for personality should provide. For this purpose, we have next argued that the AB5C framework is uniquely placed in order to meet these needs, and to facilitate such research because of its specific conceptual and empirical foundations and properties. In the present study, we therefore apply the AB5C model as a framework structure to map the scales of 10 proprietary personality inventories. We use the results to derive conclusions about the personality traits assessed by these inventories, how they may be represented in a cross-inventory facet structure, and report how these findings may be applied by researchers, practitioners, and PI designers.

Method

Participants

We analyzed data from two separate samples. Sample 1 comprised 286 individuals from the U.K. working population (mean age 32 years; 66% female, 33% male). The participants worked in a range of different occupations and industry and job sectors (further details available from the first author). Sample 2 comprised 1046 normal population participants in the U.S. from the Eugene-Springfield Community Sample (ESCS; Goldberg, 2008; mean age 50 years; 53%

female, 47% male), with a variety of employment and educational backgrounds (further details available from the first author).

From these two samples, we were able to examine data from ten widely-used PIs: the Hogan Personality Inventory (HPI); the Occupational Personality Questionnaire (OPQ); the Sixteen Personality Factor Questionnaire (16PF5) Fifth Edition; the Personality and Preferences Inventory (PAPI); the Revised NEO Personality Inventory (NEO PIR); the California Psychological Inventory (CPI); the Multi-dimensional Personality Questionnaire (MPQ); the revised Jackson Personality Inventory (JPI); the Six Factor Personality Questionnaire (6FPQ); and the HEXACO Personality Inventory (HEXACO PI). Sample 1 completed the OPQ and PAPI. Sample 2 completed the NEO PIR, CPI, MPQ, JPI, 6FPQ, HEXACO PI, HPI and 16PF5. Both samples completed Goldberg's (1992) marker scales for the Big Five (TDA-100).

The participants in Sample 1 were a subset of a larger sample used in Woods and Hardy (2012). Woods and Hardy (2012) examined the higher-order factors of five PIs, including data from two (the OPQ and PAPI) included in the present study. Their objective was to test the higher-order factor structures of the PIs and explore cross-inventory second-order factors underlying the inventories. Note that the OPQ and PAPI data were factor analyzed and reported by Woods and Hardy, however the present study represents a substantially different treatment of the data by inclusion of the TDA-100 and location of the PI scales in AB5C circumplex space.

This sample completed the two PIs and the TDA-100 using different online systems. The OPQ and PAPI inventories were completed using their own unique online assessment systems. The TDA-100 were completed using an online survey client. Scale-level data from the OPQ and PAPI were returned to the researcher on the project after being processed by the respective publishers. Item-level data from the TDA-100 were downloaded and compiled from the online survey client. In order to match participants' data across the various inventories, each person

provided their full name when responding to each one. Data were anonymized prior to analysis. Participants completed the PIs at times convenient to them over a one-month period. Around forty graduate students and trainee psychologists were recruited to collect data from colleagues and family members as a professional development activity, or for dissertation research. There was some participant attrition within the study. All 286 participants completed the TDA-100, with sample sizes for the two PIs being above 200 (OPQ, $N = 219$; PAPI, $N = 236$).

Participants in Sample 2 were drawn from the ESCS and were recruited from a specific area of Oregon, US, beginning in 1993. Participants were recruited by mail, with those willing to commit to participating in research for at least 5-10 years added to the sample. All of the PIs included in the present study were completed by mail, with returned forms being rewarded with honorarium payments of between \$10 and \$25. The PIs were completed between 1993 and 2003. As with Sample 1, various combinations of the sample completed the PIs, with participant attrition and missing data leading to different sample sizes for each PI. Complete data for the TDA-100 was available for a total of 1046 participants. The sample sizes for the eight PIs were as follows: (NEO PI-R, $N = 857$; HPI, $N = 742$; 16PF5, $N = 680$; CPI, $N = 792$; 6FPQ, $N = 691$; JPI-R, $N = 711$; MPQ, $N = 733$; HEXACO PI, $N = 734$). Note that these PI data are also analyzed in the study of Grucza & Goldberg (2007), who examined the criterion validities of the inventories with self-reported behavioral acts, reports by informants and clinical indicators. More broadly, various subsets of the ESCS data have been analyzed and published in a range of studies, some focusing on traits and their structure (e.g. De Young, Quilty & Peterson, 2007; Roberts, Chernyshenko, Stark & Goldberg, 2005; Ashton & Lee, 2005; Hopwood & Donnellan, 2010; Evans & Rothbart, 2009), and others on effects of personality traits (e.g. Goldberg & Strycker, 2002; Hirsh, De Young, Xu & Peterson, 2010). For full details, see Goldberg (2008). However, our analyses of the data are concerned exclusively with the structures of the PIs, and

are again different from any previously reported from this sample (i.e. by using the TDA-100 to locate the PI scales in Big Five circumplex space).

Measures

Brief details of the ten PIs used in the study are presented below. Alpha reliabilities are quoted from published sources. This is because item-level data were unavailable for analyses in the data provided for the proprietary measures included in our study (with scale-level data being rather supplied). This is not unusual in studies using proprietary measures (see e.g. Barrick, Stewart, & Piotrowski, 2001; Salgado, Moscoso & Alonso, 2013). For the measures completed by Sample 2, all scale alphas are reported from the International Personality Item Pool (IPIP; Goldberg, 1999), data for which are based on subsets of the ESCS participants in our Sample 2. For the OPQ and PAPI PIs, scale alpha ranges are taken from the cited standardization studies.

The Hogan Personality Inventory (HPI). The HPI (Hogan & Hogan, 1992) is a 206-item inventory, measuring seven personality dimensions, derived from the FFM, and constructed from 44 facet scales (called Homogenous Item Clusters; HICs). The inventory comprises short statements to which people respond using a true/false scale. In standardization samples, the HPI demonstrates acceptable reliability. The mean alphas of the primary dimensions and the HICs taken from the IPIP website were 0.77 and 0.61 respectively.

Occupational Personality Questionnaire (OPQ). The OPQ 32n (normative version; Bartram, Brown, Fleck, Inceoglu, & Ward, 2006) comprises 230 items, measuring thirty-two personality facets. Respondents indicate the extent to which they agree with items using a five-point scale (1 = Strongly Disagree; 5 = Strongly Agree). In standardization samples (Bartram et al., 2006), scales comprising the OPQ demonstrated reliabilities between 0.72 and 0.90).

Sixteen Personality Factor Questionnaire: Version Five (16PF5). The 16PF version 5 (Conn & Reike, 1994) comprises 185 items measuring sixteen personality dimensions.

Participants use a three-point response scale, which varies across the items, but which always includes a question mark or neutral option. Consistent with other studies using the 16PF5 (e.g. Dancer & Woods, 2006), factor B (a numerical reasoning scale) was omitted from the present analyses, which was concerned with non-cognitive personality traits. The mean alpha reported on the IPIP website was 0.74.

Personality and Preference Inventory (PAPI). The Personality and Preference Inventory (PAPI; Lewis & Anderson, 1998) is a 126-item inventory comprising 21 scales. Participants respond to the items using a seven-point scale. The PAPI manual reports that the PAPI scales showed acceptable reliability standardization data (mean alpha = 0.84).

The Revised NEO Personality Inventory (NEO PI-R). The NEO PI-R (Costa and McCrae, 1992) is a 240-item inventory that measures thirty facets of personality, six for each of its higher-order five-factor domains. Participants use a five-point response scale to indicate their agreement with each item (1 = strongly disagree; 5 = strongly agree). The mean alpha taken from the IPIP website for the 30 facet scales is 0.75.

The California Psychological Inventory (CPI). The CPI (Gough & Bradley, 2002) comprises 462 true/false items. Following Gruzca and Goldberg (2007), 36 scales were scored for the CPI (20 basic scales, 3 vector scores and 13 special scales). The mean alpha reported on the IPIP website is 0.74.

The Multidimensional Personality Questionnaire (MPQ). The MPQ (Tellegen, 1982; Tellegen & Waller, 2008) comprises 276 true/false items, scored to give 12 scales. The mean alpha (including the Unlikely Virtues scale) reported on the IPIP website is 0.84.

The Revised Jackson Personality Inventory (JPI-R). The JPI (Jackson, 1994) comprises 300 items organized into 15 scales representing 5 scale clusters. The response format is true/false. The mean alpha reported on the IPIP website is 0.77.

The Six-Factor Personality Questionnaire (6FPQ). The 6FPQ (Jackson, Paunonen, & Tremblay, 2000) comprises 108 items rated on a five-point response scale (1 = strongly disagree; 5 = strongly agree). There are 6 primary scales, subsumed by 18 facets. The IPIP website reports the mean alphas for the primary scales and facets as 0.80 and 0.66 respectively.

The HEXACO Personality Inventory (HEXACO PI). The HEXACO PI (Lee & Ashton, 2004) comprises 192 items that measure 24 facets of personality, combined to give the 6 dimensions of the HEXACO model. Participants rate the items on a five-point response scale (1 = strongly disagree, 5 = strongly agree). The mean alpha for the HEXACO PI facets is reported on the IPIP website as 0.79.

Goldberg's Trait Descriptive Adjectives (TDA-100). The TDA-100 was included in the study in order to provide representations of the Big Five personality dimensions that could be used as reference points for locating the work-related inventories on the AB5C framework. It comprises 100 marker traits for the lexical Big Five proposed by Goldberg (1992). Participants used a nine-point rating scale to indicate the extent to which each trait was an accurate description of them (1 = highly inaccurate; 9 = highly accurate).

Analyses

Following Goldberg (1992) and Hofstee, Goldberg, & De Raad (1992), principal components analyses with varimax rotation were run on the TDA-100 to extract the orthogonal lexical Big Five factors. Scores for all scales of the ten PIs were then correlated with the regression-scored Big Five factors. Classification of scales to their most representative sectors in the AB5C framework was performed by examining the primary and secondary correlations with the Big Five (i.e. strongest and next strongest correlations). For example, a scale that has its strongest association negatively with Extraversion, and the next strongest positively with Agreeableness would be classified as E-A+. Following Hofstee, De Raad, and Goldberg (1992),

scales were classified as factor pure (denoted by matched letter codes e.g. E+E+) if the strongest association was 3.73 times as large as the next strongest. Finally, following Johnson (1994b), the “vector length” value of each scale was computed as the square root of the sums-of-squares of the primary and secondary correlations. In the AB5C model, vector lengths represent the projection of variables onto the circumplex space. In this study, the values may be thought of as an indicator of the loading of the scale on the respective sector of the framework. Higher values indicate a stronger convergence of the scale with the respective facet of the model.

Results

Defining the Lexical Big Five Anchors

The first step in examining the lexical Big Five associations of the scales of the PIs was to define replicable representations of the lexical Big Five, as measured by the TDA-100. To facilitate replication, we included all 100 of the trait markers in our analyses, and performed no data transformations prior to extracting the lexical Big Five factors. We performed principal components analysis, extracting five dimensions and rotating them to a varimax solution (see Tables 1). Generally, the 100 markers loaded in the rotated solution as expected. In Sample 1, a total of 87 out of 100 traits had their strongest loading on the expected factor. Of those that did not, 8 had their next strongest loading on the expected factor. In Sample 2, some 93 out of 100 traits loaded as expected and a further 6 had their next strongest loading on the expected factor. We were satisfied of the representation the lexical Big Five we achieved using this methodology, which also enables easy and straightforward replication of our methodology and alignment with other studies of the lexical Big Five. The rotated factor solution was used to create orthogonal factor scores using the regression method. Orthogonal factor scores simplify considerably the interpretations of the associations of the personality scales with the Big Five, which are not influenced by overlaps between the five dimensions.

Locating PI Scales on the AB5C Framework

The correlations of all of the scales included in the study with the lexical Big Five are shown in Table 2, which reports the assignment of the scales to the AB5C circumplex framework using letter codes organized around the Big Five for clarity, and reports the vector length values. As in the AB5C facet model, scales with opposing codes (e.g. E+A- versus E-A+) are grouped together as they represent direct bipolar opposites of one another located in opposing sectors of the framework (so for example, in Table 2, inventory scales with E+A- and E-A+ sector assignments are grouped together). We refer to these paired sectors as ‘facet sectors’ in our description of findings. The 45 facet sectors contained varying numbers of scales, giving an indication of the overall representation of the five-factor space in these inventories. Counts of the distribution of the scales of the ten PIs across the AB5C sectors show that they cover all but 4 of the 45 facet sectors of the AB5C model. However, this conclusion masks variation in the coverage of the facet sectors, with a number of areas of the framework being more heavily populated than others. Counting the numbers of scales in the 10 most densely populated facet sectors illustrates this, showing that they contain 144 of the 273 scales analyzed. Moreover, around one-third of all scales were located in just 5 facet sectors (E+A+/E-A-, E+O+/E-O-, ES+E+/ES-E-, ES+A+/ES-A-, O+C-/O-C+). The implication for the research literature is that because of the high numbers of scales located in these facet sectors, there will be an abundance of research findings in respect of these aspects of the personality domain.

By contrast, there are numerous facet sectors with none, or few scales, located within them. Four contain no scales at all (E+O-/E-O+, C+ES-/C-ES+, ES+O-/ES-O+, O+E-/O-E+). A count of those facet sectors that contained less than circa 1% of the scales analyzed (i.e. those with 3 or fewer scales) reveal that a further 15 are sparsely populated with scales. Choice of inventory also impacts on coverage. For example, five facet sectors are only covered by the

scales of a single PI. The implication is that for these aspects of personality there is likely to be a relative paucity of research findings, reflecting their poor representation in PIs used to measure traits in research.

Looking more closely at the facet-level scales contained in the AB5C facet sectors permitted us to specify a facet model organized under the Big Five. We focused on data in Table 2 relating exclusively to facet-level PI scales (i.e. we omitted 24 higher-order scales such as those for the NEO PIR domains and re-counted the sector classifications of the remaining 249 facet scales). Our facet model excluded any facet sectors that were poorly populated (i.e. those with less than circa 1% of facet scales analyzed; those containing 3 or fewer facet scales). The facets we identify are listed in Table 3 for easy reference. These facets are naturally tightly defined conceptually in the AB5C, and representative of the structures of popular PIs. We present proposed labels for these facets based on what we know about the respective facet sectors in the AB5C framework, and the scales from the ten PIs that are located within them (these labels feature in Tables 2 and 3, and in our proposed Periodic Table). We did not label AB5C sectors that were poorly populated in our counts for the simple reason of lack of representative scales to judge the nature of the facet. In Table 2, such facet sectors are headed with their sector classifications (e.g. E+C-/E-C+).

Extraversion. Extraversion contained seven well-populated facet sectors in the analyses, and is the most widely covered of the Big Five. An affiliation facet was clearly recognizable in the populated sectors E+A+/E-A-. Scales related to leadership were located in two facets, which appear to have subtly different conceptual cores. The sectors E+A-/E-A+ comprise scales relating to dominance and might be thought of as directive or controlling forms of leadership. E+O+/E-O- by contrast relates to adventurousness, or social boldness and presence. We tentatively label this facet as leadership (boldness). The blend of Extraversion and

Conscientiousness (E+C+/E-C- sectors) also contained an important work-relevant construct related to pace and vigour of work. Social confidence and poise were represented in the E+ES+/E-ES- sectors, and the E+ES-/E-ES+ sectors represented expressiveness and talkativeness. There were several factor-pure scales (E+E+/E-E-) reflecting the gregariousness essence of Extraversion.

Agreeableness. There were four facets of note in the circumplexes of Agreeableness. The sectors A+E+/A-E- contained scales related to belongingness and warmth. A+ES+/A-ES- may referred to as pleasantness comprising scales related to interpersonally positive traits (trust, caring, altruism). By contrast, scales located in the A+ES-/A-ES+ sectors are representative of sensitivity to emotions of others, or dependence. The sectors A+O-/A-O+ are well populated with scales that broadly appear to differentiate preferences for working with people versus data, which might be termed nurturance (versus self-reliance).

Conscientiousness. Facets of Conscientiousness were surprisingly tightly represented in our analyses given the relevance of Conscientiousness in personnel psychology. Five facets emerge. There are several scales giving a factor-pure representation of lexical Conscientiousness (C+C+/C-C-), reflecting organization and orderliness. Notably, C+O-/C-O+, although labelled as Orderliness in the AB5C model, rather seems to combine scales relating to inflexibility. The sectors C+E-/E-C+ are relevant for risk behavior at work, reflecting cautiousness. The sectors C+O+/C-O- comprise scales concerning hard work or industriousness, and the sectors C+ES+/C-ES- tend to reflect dutifulness.

Emotional Stability. We classified five facets with primary correlations with Emotional Stability. In the factor-pure sectors (ES+ES+/ES-ES-) were scales related to stability. Scales measuring positive emotionality (e.g. optimism, happiness) versus sadness and depression were located in the ES+E+/ES-E- sectors and those measuring emotional control and restraint in the

ES-E+/ES+E- sectors. The ES+A+/ES-A- sectors represented calmness versus hostility. A variety of different scale labels featured in the sectors ES+C+/ES-C-, which collectively concern normative adjustment (e.g. socialization).

Openness. Scales classified with primary correlations on Openness may be grouped into five facets. O+O+/O-O- very clearly represents the intellect aspect of Openness. Scales in the O+E+/O-E- sector represented ingenuity and creativity, as well as openness to change. Scales covering unconventionality versus tradition were represented in the O+C-/O-C+ sectors. An interesting observation was the well-populated O+A-/O-A+ sectors with scales covering critical enquiry and conceptual thinking versus rule conformity. Finally, the sectors O+ES+/O-ES- included scales concerning quickness and efficiency of thinking, plus inquisitiveness.

Integrating Results into a Periodic Table

Our results are represented in our proposed Periodic Table of Personality in Figure 2. The figure integrates our findings in a format resembling the periodic table of chemical elements. It enables straightforward navigation of the structural relations of the model, and examination of the structural locations of our facet model. It also provides a means to compare the relative abundance of PI scales in different areas of the table, reflecting our findings concerning the coverage of the AB5C in the PIs in our study. Within the proposed Periodic Table, we include facet labels and symbols for those facets we identified in Table 3. As explained earlier, we consider these facets to be sufficiently abundantly populated with scales to assert a representative label. We also include an ‘abundance’ number within each cell of the table to indicate the relative numbers of scales located in each from the PIs we analyzed. The abundance number is computed as [% of PI scales located in the sector / (1/45)]. This enables direct comparison of the relative numbers of scales in each cell. For example a facet with an abundance number of 2.00 has twice as many scales as a facet with an abundance number of 1.00, and four times as many

scales as a facet with an abundance number of 0.50. The presentation of this Periodic Table effectively distills our results enabling researchers to quickly examine our structural findings, and understand our cross-inventory framework.

Discussion

The purpose of this study was to examine in detail the structures of personality inventories used in applied psychology and personality assessment by mapping the locations of inventory scales in the five-factor space covered in the AB5C model of personality. In so-doing our aim was to move toward a so-called ‘Periodic Table of Personality’ to allow researchers and practitioners to examine underlying structures of personality in greater clarity, depth, and accuracy. Our data-driven approach complements and adds to past models of personality traits in applied psychology (e.g. the working taxons of Hough and Ones, 2001). For example, whereas the working taxons models was developed based on qualitative classification of scales by content experts, our approach draws on a coherent conceptual framework (the AB5C) and structural analyses, adding much-needed empirical quantitative data to support the examination of PI scale structures. Consequently, our analyses move the examination of PI structures beyond the boundaries of any particular PI, or set of PIs, providing a more complete modelling of personality traits in five-factor circumplex space.

Criterion Validity of PIs in Applied Psychology.

Our findings have implications for the literature on the criterion validity of PIs relevant for both researchers and practitioners. Further, these implications emphasize how the criterion validity literature may be more effectively interpreted and expanded, and applied in practice.

For researchers, our findings have implications for extending the literature in a number of ways. Firstly, the results of our mapping of PI scales and proposed facet structure represent an empirically derived, conceptually driven framework for the scales of PIs commonly used in

applied research. For meta-analyses of the criterion validities of personality constructs, this means that researchers will be able to organize the scales of different PIs into facet categories in a much more precise and accurate way than previously possible. For example, the data from classical meta-analyses such as the Barrick and Mount (1991) and Salgado (1997) studies of personality and performance could now be re-analyzed, organizing the scales of the included PIs around our facet framework (see also, Salgado, Anderson & Tauriz, 2014). Among the PIs included by Salgado (1997) in his meta-analyses were the 16PF5, HPI and NEO inventories. As an alternative to the broad Big Five framework to classify scales of these inventories. Our findings in Table 2 would enable data to be reanalyzed in much greater depth. For example, NEO Assertiveness, HPI Ambition (plus a number of HICs) and 16PF5 Dominance are all classified in the E+O+/E-O- sector of the AB5C framework, which in our facet model we label “Leadership – Boldness”. These scales, we show, are empirically and conceptually similar and can therefore be classified together. The fidelity and precision of this approach is a substantial advance and contrast to the comparative structural bluntness of the broad Big Five. Such re-analysis, and new analyses applying our model, have the potential to unlock novel findings from these extensive studies and datasets.

Second, our findings show that a substantial number of the facet sectors in the model contain no, or low numbers of scales, indicating that they are either not assessed at all, or assessed infrequently in studies in applied psychology. There are blends of the Big Five factors that, in these ten PIs, are absent in assessment. It appears that by emphasizing hierarchical methodology, and focusing on similar kinds of personality variables, personality assessment psychologists have left a very large, and potentially important volume of predictor space unmeasured, and unexamined. This raises important questions about why our focus has been on particular areas of the personality domain and not others, and indeed what the criterion effects

might be of those less commonly assessed blends of the Big Five. Our findings suggest that many of our conclusions about the criterion effects of personality traits at work and in organizations are based upon an incomplete coverage of the predictor space, which lays down an intriguing challenge to the applied psychology and personality research communities. That is, to understand why PI developers have focused on a largely restricted area of factor space in the personality domain, and more importantly, how the unmeasured or infrequently measured aspects of the AB5C framework predict work-related criteria. This situation is analogous to attempting to build an understanding of the properties of chemical elements whilst neglecting whole sections of the periodic table. True, some elements are more difficult to study and experiment with because of their rarity or because researchers know relatively little about them. However, as in chemistry, a complete understanding of the criterion effects of personality traits must be built on as comprehensive a representation of the personality domain as possible. Researchers should therefore seek to extend primary research beyond the coverage of the PIs we analyze, and into unmeasured Big Five factor space.

Initiating such research may require construction of PI scales to specifically tap these infrequently measured spaces. The method we used for our mapping of PI scales is informative in this respect. PI scales are clearly functions of the items they contain (Jackson, 1971). Therefore, theoretically, it would be possible to create a scale measuring any of the facets in the AB5C by examining the correlations of individual items with the lexical Big Five. Test designers could proceed by selecting individual items with the desired pattern of Big Five correlations to construct a scale. This same approach could also be put to use in other applications of our findings (which we highlight below).

Third, our results have the potential to contribute to theory building around the criterion effects of personality traits. For example, we earlier highlighted the study of personality and

work engagement of Inceoglu and Warr (2011) that used the OPQ to examine the relations of personality and engagement. In regression analyses, where all of the Big Five were entered together, only Conscientiousness and Emotional Stability remained predictive. Inceoglu and Warr (2011) also broke down Extraversion and Conscientiousness into two facets each (which they labelled Social Potency and Affiliation for Extraversion, and Achievement Orientation and Dependability for Conscientiousness). They reported that Achievement Orientation (comprising the OPQ scales Achieving and Vigorous) and Social Potency (comprising the scales Persuasive and Controlling) were predictive of engagement alongside Emotional Stability, contradicting the findings of other studies that emphasize the role of Extraversion and its facets in engagement (e.g. Woods and Sofat, 2013). How can these findings be reconciled? When examined in the context of our facet framework and scale mapping, the results are clarified. Our results in Table 2 show that the OPQ Vigorous and Achieving scales have their primary loadings on Extraversion (Vigorous in the E+C+ Work Pace facet, and Achieving in the E+A+/E-A- Leadership-Control facet). Indeed, the Achieving scale is co-located with the Controlling scale used to measure Social Potency indicating a strong conceptual similarity of these scales, plus the Persuasive scale also has a primary loading on Extraversion (located in the E+O+/E-O- Leadership Boldness facet sector). The sector locations of the PI scales comprising the Achievement Orientation construct measured by the OPQ in the Inceoglu and Warr (2011) study are informative about their conceptual nature, and suggest that they may share significant variance with Extraversion. The findings therefore seem to support rather than contradict the findings of Woods and Sofat (2013) and Langelaan, Bakker, van Doornen and Schaufeli (2006) concerning the role of Extraversion in engagement. In future theory building, the joint interpretation of these studies, facilitated by our framework and mapping, consistently point to the need to incorporate Extraversion and specific of its facets (e.g. Work Pace, Leadership-Boldness, and Leadership-Control) in models

of the antecedents of work engagement. Moreover, having built theory with greater precision, our framework and mapping also then helps researchers to test their theories. Our analyses provide researchers with a choice of two PIs that measure all three of these facets (HPI and OPQ), or alternatively, allow researchers to select specific scales from two or more PIs (e.g. NEO PIR Activity and Assertiveness, with 16PF5 Dominance scales), enabling them to select their measures in a highly informed way to test criterion effects of personality.

Fourth, our findings offers the potential to bring greater coherence and richness to the literature on criterion validity in the context of personnel selection. Whereas interpretation of single PI validity studies are somewhat restricted to the scales under scrutiny, data in our Table 2 would enable researchers to contrast their results with those of specific other PIs in a precise and structured way (i.e. by examining how their results compare with those of co-located PI scales). For example, we earlier highlighted the study of Mussel, Winter, Gelleri and Putra (2011) on facets of Openness and job performance, in which the NEO PIR scales Values, Actions and Ideas were most predictive of job performance. Consulting our Table 2 suggests that users of the JPI and HPI particularly could apply these findings well to their own situation because both inventories contain scales that are co-located on the AB5C framework with the Ideas, Values and Actions NEO PIR scales. If researchers' and practitioners' preferred PIs are not among the 10 we analyzed, they could replicate our study to clarify the PI's structural and criterion properties.

A fifth implication for the criterion validity literature is the clarification of the nature of performance behavior by examining personality-criterion effects. Given that many performance behaviors are predicted by multiple Big Five factors, it could be informative to conceptualize those behaviors as representing blends of the five factors, in the same way as the PI scales and facets in our model. The literature on proactive and innovative behavior at work is a good example (see Anderson, Potočnik, & Zhou, 2014; Unsworth & Parker, 2003), as a component of

contextual performance (e.g. LePine & Van Dyne, 2001). This broad area of performance behavior has been broken down into a number of specific components, which could potentially be better understood by considering their pattern of personality correlates. One aspect, personal initiative, has been found to correlate most strongly with Extraversion, and next with Conscientiousness (both positively; Fay & Frese, 2001). Reference to our facet model and the AB5C sector references suggests that this performance behavior is likely to reflect work pace or energy (which is a blend of Extraversion and high Conscientiousness). Reference to the personality scales that represent this sector therefore indicates a motivational component reflecting high activity. LePine and Van Dyne (2001) report correlations of cooperative and voice behavior with the Big Five. Voice behavior has a similar pattern of correlations to the Fay and Frese personal initiative construct (i.e. positive with Extraversion followed by Conscientiousness), indicating some similarity in the conceptual foundations of these behaviors, with work pace and activity again implicated alongside the theoretical arguments advanced by LePine and Van Dyne (e.g. Extraversion leading to a greater tendency to ‘speak up’ at work). Cooperative behavior correlates most strongly with Agreeableness followed by Conscientiousness. The A+C+/A-C- sector is one of the sectors of the AB5C that is covered poorly by the PIs we analyzed. Therefore related to our point two above (about the unmeasured aspects of the personality domain), this appears to be a missed opportunity to directly measure traits aligned to cooperative behavior. PI scale developers could seek to develop scales to tap this sector by examining the Big Five correlates of individual items and constructing scales from items that load with both Agreeableness and Conscientiousness. Such scales could then be examined as a predictor of cooperative behavior.

In sum, an examination of performance behavior through the lens of its personality correlates, alongside our facet model and mapping results, facilitates a deeper reciprocal

understanding. That is, it enables understanding of how performance behavior may represent expression of specific personality facets, and how different performance behaviors may have common antecedents.

Interchangeability and Higher-order Dimensions of Ten PIs.

The data we report in this study may be applied by those who use personality assessments in organizations for either research or practice to determine equivalence or convergence between different instruments they are using. This may be done at facet or higher-order levels of measurement. The need to compare inventory structures is particularly acute at the higher-order level because a) higher-order dimensions provide a concise summary of the orientation of the items in the inventory, and b) research findings are often communicated around higher-order dimensions derived from specific inventories, and so applying them to a situation where an alternative proprietary instrument is used, it is helpful to understand the comparability of the respective higher-order structures. To illustrate, we consider two instruments that are based around the five factor model (the NEO PIR and the HPI). The NEO PIR presents five personality domain scales, whereas the HPI has a rather different structure, comprising seven primary scales. In five factor space, NEO PIR Extraversion is located in the E+A+ sector, indicating that in that inventory, Extraversion is primarily concerned with interpersonal friendliness. By contrast the two Extraversion-related primary scales on the HPI, are located in the E+O+ sector, rather reflecting surgency, adventurousness and social boldness. This illustrates the importance of the secondary loading on the Big Five factors for determining the comparability of assessments made using the two instruments. NEO PIR Agreeableness is in the A+ES+ sector, reflecting pleasantness, whereas HPI Likeability has a secondary loading on Extraversion, making it closer to warmth aspects of Agreeableness. NEO PIR Conscientiousness blends lexical Conscientiousness with Emotional Stability (thereby emphasizing dutifulness) compared to

Prudence in the HPI, which has its secondary loading on Openness (negative) to emphasize conventionality. In terms of Emotional Stability, HPI Adjustment is ‘factor pure’, relating strongly to stability, whereas NEO PIR Neuroticism has a secondary loading on lexical Extraversion, indicating emphasis on negative versus positive emotionality. Finally, while NEO PIR Openness to Experience has a secondary negative loading on Conscientiousness, indicating an unconventionality theme, HPI Intellectance is factor pure with respect to lexical Openness, and Scholarship features a secondary loading on Emotional Stability. These between-PI variations represent meaningful construct differences in higher-order structures. For the first time, our data enable inspection of secondary loadings on a standardized framework to better understand structure, aiding practitioners wishing to compare or use alternative instruments, but also importantly, clarify differences in PI validities. It is possible that differences in the validities of higher-order dimensions of PIs may be explainable by their patterns of secondary loadings to the Big Five (i.e. their location in five factor space) rather than measurement superiority.

Constructing Compound Personality Scales from Ten PIs.

Further applied value of the data we report in this study comes from the possibility of using the sector locations of scales from the ten PIs to create new compound personality scales. Where PI users know the constituent facet scales used to construct compound measures, they can be located within the circumplex sectors of the AB5C model using data in our tables. Vector length values may be used to judge the strength of association of the target scale with its respective sector. Co-located scales from different PIs, with similarly strong vector lengths, could then reasonably be substituted for the target scale. This possibility unlocks a new line of cross-inventory research on the validity of compound personality scales. To illustrate how this might be applied, Bartram (2005) describes the combination of three OPQ scales (Caring, Democratic, and Affiliative; with Caring being double weighted) to create the compound

competency scale 'Supporting and Cooperating'. Locating these in Table 2 and examining the Big Five loadings of each of the scales, allows researchers insight into the nature of each construct. The respective sector locations of the scales are A+ES+/A-ES-, A+A+/A-A-, and E+A+/E-A-. Therefore, it would be possible to create a similar compound scale from different PI scales located in those sectors. For example, using existing PI scales, the HEXACO scales Gentleness, Sentimentality and Sociability could be combined to produce such a compound. Allowing for some minor variation in sector locations and Big Five loadings, the HPI HICs Easy to Live With, Sensitive, and Likes People would also provide a good representation of the compound. Alternatively, as highlighted earlier, test designers could examine the Big Five loadings of individual inventory items, select those that fit to the relevant AB5C sectors, and then construct a compound scale from those items.

The Periodic Table of Personality Traits: Critical Reflections

How does our organizing and descriptive framework fare against our objective to move towards a periodic table of personality traits? We outlined five key properties of the periodic table of chemical elements that we argued should feature in an organizing framework for personality. First, that it should provide a coherent and logical means of defining traits or personality constructs in technical and conceptual terms. Our approach achieves this by using the lexical Big Five and the logically partitioned circumplex space created by paired Big Five dimensions to organize personality space and to define technically the nature of specific traits and personality constructs. Further, we have also explained how individual PI scales may also be defined technically in our model through examination of their primary and secondary associations with the lexical Big Five. Second, we proposed that an effective framework would provide a basis for a clear understanding of the structural relationships between different traits and constructs, permitting comparison of different constructs and PI scales. By enabling scales of

different PIs to be located on a common framework permitting their direct comparison based on common technical properties (i.e. loadings on the Big Five), our model achieves this feature. Third, we stated that an organizing framework for personality research should both describe the personality dimensions or facets that are well researched and frequently measured, and identify those that are not. We have discussed at length the sector locations in the framework that are densely and lightly populated with PI scales, and therefore well- and poorly represented in applied personality research. The fourth key feature was to facilitate prediction of criterion effects of specific traits or PI scales through the structural understanding that the framework provides. Our model achieves this by enabling precise specification of the position of PI scales in Big Five circumplex space, and we have described a number of examples of the advantages for understanding and predicting criterion effects of traits and PI scales in practice. Finally, we proposed that in moving toward a periodic table for personality traits, any framework should enable explication of compound personality traits or PI scales by providing researchers with the means to understand the constituent traits that combine in the compound. We have provided examples above of how our study results can be applied in this regard.

In sum, we therefore believe that our paper provides good evidence of moving us toward a Periodic Table for Personality Traits, a first version of which we present in Figure 2. Reflecting the benefits of the periodic table of chemical elements, our motivation is to bring greater coherence to personality research in applied psychology, enhance understanding of the findings of research studies in the field, and promote new lines of research that apply our framework and methodology. However, at the same time, we do not present our Periodic Table framework as the definitive end-point of PI and personality trait structure research. On the contrary, our hope is that researchers take our findings as a foundation and use it to continue to build and extend further the literature on personality at work, and personality and PI structure.

Study Limitations

One potential conceptual limitation of the present study that needs to be acknowledged is that variance of any scales outside of the Big Five model may not be accounted for in our analyses. However, the broad bandwidth coverage of the Big Five, alongside their widespread acceptance in personality research mean that they can justifiably be considered to be the most adequate available anchors for creating an independent mapping framework. Added to this is the existing research underpinning the AB5C model, which has sought to map and understand the five-factor circumplex space existing between the orthogonal axes of the lexical Big Five. These are firm foundations upon which to build. Should an alternative circumplex structure emerge in future years (e.g. based on the HEXACO model), our methodology in this study could be transferable provided that a common set of marker traits for the axes were available.

A related limitation is the dependence of the AB5C model on solely primary and secondary loadings on the Big Five. The advantage of this methodology is the parsimony and conceptual clarity it achieves. However, it is obvious from inspection of the loadings of some scales that one might reasonably consider them to be blends of three of the Big Five (see also Shoss & Witt, 2013). To place this in context, it is important to underline the objectives of our study. Drawing on the clarity of the AB5C, we were able to provide the descriptive framework for PI scales, which we sought to achieve in our study. However, our reporting of the loadings of scales with all of the Big Five permit others to consider the relevance and impact of tertiary, quaternary, or even quinary loadings in understanding the nature of specific PI scales.

A further potential limitation of the data reported in this study concerns the multiple-inventory design. Whilst multi-inventory designs are beneficial in assessment research, one possible effect is that participant responses become over-practiced, primed, or polarized as more personality items are completed. This may have some influence on the correlations between

scales and the Big Five Markers. Alongside studies examining other inventories and the AB5C, it would therefore be useful for others to replicate analyses reported in the present study to help validate and verify the sector locations of the scales of these four work-related inventories.

Final Comments

At the outset of this paper we asked ‘how do PIs represent personality structure for the purposes of assessment in organizations, and how do the scales of different inventories converge and diverge?’ To answer these questions and produce a coherent cross-inventory framework for PI scales, we mapped 273 PI scales to the Big Five circumplex space of the AB5C model, in order to propose a Periodic Table of Personality. We have discussed the various ways in which our findings advance the literature on personality assessment and structure in applied psychology. The development and publication of our Periodic Table of Personality, we hope, will stimulate further structural and applied research in the personality assessment domain and advance theory and understanding of the impact of personality traits more generally.

Acknowledgments

We very gratefully acknowledge the contribution of scientists at the Oregon Research Institute (ORI) for allowing us to analyze data from the Eugene-Springfield Community Sample as part of our study.

References

- Anderson, N. R. (2005) Relationships Between Practice and Research in Personnel Selection: Does the Left Hand know what the Right is Doing? In A. Evers, N. R. Anderson, & O. Smit-Voskuyl, (Eds), (pp. 1-24), The Blackwell Handbook of Personnel Selection, Oxford, U.K.: Blackwell.
- Anderson, N. R., & Ones, D. S., (2003). The construct validity of three entry-level personality inventories: Cautionary findings from a multiple inventory investigation. European Journal of Personality, *17*, 1-28.
- Anderson, N. R., Potočník, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, *40*, (5), 1297-1333.
- Anderson, P. and Lewis, C. (1998) PAPI Technical Manual, London, PA Consulting.
- Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review*, *11*(2), 150-166.
- Ashton, M. C., & Lee, K. (2005). Honesty-Humility, the Big Five, and the Five-Factor Model. *Journal of personality*, *73*(5), 1321-1354.
- Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: a meta-analysis. *Personnel psychology*, *44*(1), 1-26.
- Barrick, M. R., Stewart, G. L., & Piotrowski, M. (2002). Personality and job performance: test of the mediating effects of motivation among sales

- representatives. *Journal of Applied Psychology*, 87(1), 43.
- Bartram, D. (2005). The Great Eight competencies: a criterion-centric approach to validation. *Journal of applied psychology*, 90(6), 1185.
- Bartram, D., Brown, A., Fleck, S., Inceoglu, I. & Ward, K. (2006). *OPQ32 Technical Manual: Part 1*. Thames Ditton, UK: SHL Group.
- Burch, G. & Anderson, N. R. (2008). Personality in Workplace and Occupational Settings: Recent Research and Future Directions. In G. P. Hodgkinson & J. K. Ford (Eds.). International Review of Industrial – Organizational Psychology, (pp.261-306), Oxford: John Wiley & Sons.
- Burch, G. & Anderson, N. R. (2009). Personality at Work. In P. Corr & G. Matthews (Eds.). Cambridge University Press Handbook of Personality. (pp.748-763), Cambridge: Cambridge University Press.
- Burisch, M. (1984). Approaches to personality inventory construction: A comparison of merits. *American Psychologist*, 39(3), 214.
- Conn, S. R., & Rieke, M. L. (1994). *The 16PF Fifth Edition Technical Manual*. Champagne, IL: Institute for Personality and Ability Testing, Inc.
- Costa, P. T., Jr., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
- DeYoung, C. G., Quilty, L. C., Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology*, 93 880–896.
- Evans, D. E., & Rothbart, M. K. (2009). A two-factor model of temperament. *Personality and individual differences*, 47(6), 565-570.

- Fay, D., & Frese, M. (2001). The concept of personal initiative: An overview of validity studies. *Human Performance, 14*(1), 97-124.
- Ferguson, E., Payne, T., & Anderson, N. (1994). Occupational personality assessment: Theory, structure and psychometrics of the OPQ FMX5-Student. *Personality and Individual Differences, 17*(2), 217-225.
- Goldberg, L. R. (1990). An alternative "description of personality": the big-five factor structure. *Journal of personality and social psychology, 59*(6), 1216.
- Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment, 4*, 26-42.
- Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality Psychology in Europe, Vol. 7* (pp. 7-28). Tilburg, The Netherlands: Tilburg University Press.
- Goldberg, L. R. (2006). Doing it all Bass-Ackwards: The development of hierarchical factor structures from the top down. *Journal of Research in Personality, 40*, 347-358.
- Goldberg, L. R., & Strycker, L. A. (2002). Personality traits and eating habits: The assessment of food preferences in a large community sample. *Personality and individual differences, 32*(1), 49-65.
- Gonzalez-Mulé, E., DeGeest, D., & Mount, M. K. (2013). Power of the Circumplex: Incremental validity of intersection traits in predicting counterproductive work behaviors. *International Journal of Selection and Assessment, 21*(3), 322-327.
- Gough, H. G., & Bradley, P. (1996). *CPI manual*. Palo Alto.

Grucza, R. A., & Goldberg, L. R. (2007). The comparative validity of 11 modern personality inventories: Predictions of behavioral acts, informant reports, and clinical indicators.

Journal of Personality Assessment, 89, 167-187.

Hirsh, J. B., DeYoung, C. G., Xu, X., & Peterson, J. B. (2010). Compassionate liberals and polite conservatives: Associations of agreeableness with political ideology and moral values. *Personality and Social Psychology Bulletin*, 36(5), 655-664.

Hofstee, W. K. B., de Raad, B., & Goldberg, L. R. (1992). Integration of the big five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology*, 63, 146-163.

Hogan, R. and Hogan, J. (1992). *Hogan Personality Inventory Manual*. Tulsa, OK: Hogan Assessment Systems.

Hogan, J., & Holland, B. (2003). Using theory to evaluate personality and job-performance relations: a socioanalytic perspective. *Journal of Applied Psychology*, 88(1), 100.

Hopwood, C. J., & Donnellan, M. B. (2010). How should the internal structure of personality inventories be evaluated?. *Personality and Social Psychology Review*, 14(3), 332-346.

Hough, L. M., Eaton, N. K., Dunnette, M. D., Kamp, J. D., & McCloy, R. A. (1990). Criterion-related validities of personality constructs and the effect of response distortion on those validities. *Journal of applied psychology*, 75(5), 581.

Hough, L. M., & Johnson, J. W. (2013). Use and importance of personality variables in work settings. In I. B. Weiner (Ed.-in-Chief) & N. Schmitt & S. Highhouse (Vol. Eds.),

Handbook of psychology: Vol. 12. Industrial and organizational psychology (pp. 211-243).
New York: Wiley.

Hough, L. M., & Ones, D. S. (2001). The structure, measurement, validity, and use of personality variables in industrial, work, and organizational psychology. In N. Anderson, D. S. Ones, H. K. Sinangil & C. Viswesvaran (Eds.), *Handbook of Industrial, Work and Organizational Psychology* (Vol. 1: Personnel Psychology, pp. 233-277). London, UK: Sage.

Hough, L. M., & Schneider, R. J. (1996). Personality traits, taxonomies, and applications in organizations. *Individual differences and behavior in organizations*, 31-88.

Inceoglu, I., & Warr, P. (2011). Personality and job engagement. *Journal of Personnel Psychology*, 10(4), 177-181.

Jackson, D. N. (1971). The dynamics of structured personality tests: 1971. *Psychological review*, 78(3), 229.

Jackson, D. N. (1994). *Jackson Personality Inventory-Revised*. Sigma Assessment Systems, Research Psychologists Press Division.

Jackson, D. N., Paunonen, S. V., & Tremblay, P. F. (2000). SFPQ manual. *Sigma Assessment Systems, Port Huron, MI*.

John, O. P., Donahue, E. M., & Kentle, R. L. (1991). The big five inventory—versions 4a and 54. *Berkeley: University of California, Berkeley, Institute of Personality and Social Research*.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative big five trait taxonomy. *Handbook of personality: Theory and research*, 3, 114-158.

Johnson, J. A. (1994a). Clarification of factor five with the help of the AB5C model. *European*

Journal of Personality, 8, 311-334.

Johnson, J. A. (1994b). Multimethod replication of the AB5C model of personality traits. In B.

De Raad, W. K. B. Hofstee, & G. L. M. Van Heck, *Personality psychology in Europe*,

Volume 5 (pp. 42-49). Tilburg, The Netherlands: Tilburg University Press.

Johnson, J. A., & Ostendorf, F. (1993). Clarification of the five factor model with the Abridged

Big Five-Dimensional Circumplex. *Journal of Personality and Social Psychology*, 65, 563-

576.

Judge, T. A., Bono, J. E., Ilies, R., & Gerhardt, M. W. (2002). Personality and leadership: a

qualitative and quantitative review. *Journal of applied psychology*, 87(4), 765-780.

Judge, T. A., Rodell, J. B., Klinger, R. L., Simon, L. S., & Crawford, E. R. (2013). Hierarchical

representations of the five-factor model of personality in predicting job performance:

Integrating three organizing frameworks with two theoretical perspectives. *Journal of*

Applied Psychology, 98, 875-925.

Lamiell, J. T. (2000). A periodic table of personality elements? The " Big Five" and trait"

psychology" in critical perspective. *Journal of Theoretical and Philosophical*

Psychology, 20(1), 1.

Langelaan, S., Bakker, A. B., Van Doornen, L. J., & Schaufeli, W. B. (2006). Burnout

and work engagement: Do individual differences make a difference?. *Personality*

and individual differences, 40(3), 521-532.

Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO Personality

Inventory. *Multivariate Behavioral Research*, 39(2), 329-358.

LePine, J. A., & Van Dyne, L. (2001). Voice and cooperative behavior as contrasting

forms of contextual performance: evidence of differential relationships with big five

personality characteristics and cognitive ability. *Journal of Applied Psychology*, 86(2), 326.

Lievens, F., Harris, M. M., Van Keer, E., & Bisqueret, C. (2003). Predicting cross-cultural training performance: the validity of personality, cognitive ability, and dimensions measured by an assessment center and a behavior description interview. *Journal of Applied Psychology*, 88(3), 476.

MacIver, R. Anderson, N. R., Costa, A. C., & Evers, A. (2014). Validity of interpretation: A user validity perspective beyond the test score. *International Journal of Selection and Assessment*, 22, 149-164.

Mendeleev, D. I. (1869). "Über die Beziehungen der Eigenschaften zu den Atomgewichten der Elemente". *Zeitschrift für Chemie* (in German). Published later in Mendeleev, D. I. (1901). *Principles of Chemistry*. New York: Collier.

Morgeson, F. P., Campion, M. A., Dipboye, R. L., Hollenbeck, J. R., Murphy, K., & Schmitt, N. (2007). Reconsidering the use of personality tests in personnel selection contexts. *Personnel Psychology*, 60(3), 683-729.

Mussel, P., Winter, C., Gelléri, P., & Schuler, H. (2011). Explicating the openness to experience construct and its subdimensions and facets in a work setting. *International Journal of Selection and Assessment*, 19(2), 145-156.

Ones, D S, & Anderson, N R (2002). Gender and ethnic group differences on personality scales in selection: Some British data. *Journal of Occupational and Organizational Psychology*, 75, 255-276.

Ones, D.S., & Viswesvaran, C. (2001). Personality at work: Criterion-focused occupational personality scales (COPS) used in personnel selection. In B.W. Roberts & R.T. Hogan

- (Eds.), *Applied Personality Psychology: The Intersection of Personality and I/O Psychology* (pp. 63-92). Washington, DC: American Psychological Association.
- Ones, D. S., Dilchert, S., Viswesvaran, C., & Judge, T. A. (2007). In support of personality assessment in organizational settings. *Personnel Psychology, 60*(4), 995-1027.
- Organ, D. W., & Ryan, K. (1995). A meta-analytic review of attitudinal and dispositional predictors of organizational citizenship behavior. *Personnel psychology, 48*(4), 775-802.
- Oswald, F. L., Hough, L. M., & Ock, J. (2013). Theoretical and empirical structures of personality: Implications for measurement, modeling, and prediction. In N. D. Christiansen & R. P. Tett (Eds.), *Handbook of Personality at Work*. (pp11-29) New York: Taylor & Francis.
- Prewett, M. S., Tett, R. P., & Christiansen, N. D. (2013). A Review and Comparison of 12 Personality Inventories on Key Psychometric Characteristics. In N.D. Christiansen & R.P. Tett (Eds.) *Handbook of Personality at Work*, New York: Routledge.
- Roberts, B. W., Chernyshenko, O. S., Stark, S., & Goldberg, L. R. (2005), The structure of conscientiousness: An empirical investigation based on seven major personality questionnaires. *Personnel Psychology, 58*, 103-139.
- Rothstein, M. G., & Goffin, R. D. (2006). The use of personality measures in personnel selection: What does current research support?. *Human Resource Management Review, 16*(2), 155-180.
- Salgado, J. F. (1997). The Five Factor Model of personality and job performance in the European Community. *Journal of Applied psychology, 82*(1), 30.
- Salgado, J. F., Anderson, N. R., & Tauriz, G. (2014). The validity of ipsative and quasi-ipsative

forced-choice personality inventories for different occupational groups: A comprehensive meta-analysis. *Journal of Occupational and Organizational Psychology*, DOI: 10.1111/joop.12098, (in press).

Schneider, R. J., & Hough, L. M. (1995). Personality and industrial/organizational psychology. *International review of industrial and organizational psychology*, 10, 75-130.

Shoss, M. K., & Witt, L. A. (2013). Other Configural Approaches to Personality. In N.D. Christiansen & R.P. Tett (Eds.) *Handbook of Personality at Work*, New York: Routledge.

Soto, C. J., & John, O. P. (2009). Ten facet scales for the Big Five Inventory: Convergence with NEO PI-R facets, self-peer agreement, and discriminant validity. *Journal of Research in Personality*, 43(1), 84-90.

Tellegen, A. (1982). Multidimensional personality questionnaire manual. *Unpublished manuscript*.

Tellegen, A., & Waller, N. G. (2008). Exploring personality through test construction: Development of the Multidimensional Personality Questionnaire. *The SAGE handbook of personality theory and assessment*, 2, 261-292.

Timmerman, T. A. (2006). Predicting turnover with broad and narrow personality traits. *International Journal of Selection and Assessment*, 14(4), 392-399.

Unsworth, K., & Parker, S. K. (2003). Promoting a proactive and innovative workforce for the new workplace. *THE NEW WORKPLACE: A GUIDE TO THE HUMAN IMPACT OF MODERN WORKING PRACTICES*, D. Holman, TD Wall, CW Clegg, P. Sparrow, A. Howard, eds., Chichester: John Wiley & Sons.

Vinchur, A. J., Schippmann, J. S., Switzer III, F. S., & Roth, P. L. (1998). A meta-analytic review of predictors of job performance for salespeople. *Journal of applied*

psychology, 83(4), 586.

Viswesvaran, C., Deller, J., & Ones, D. S. (2007). Personality measures in personnel selection:

Some new contributions. *International Journal of Selection and Assessment*, 15, 354–358.

Witt, L. A. (2002). The interactive effects of extraversion and conscientiousness on performance.

Journal of Management, 28(6), 835-851.

Woods, S. A., & Hardy, C. (2012). The higher-order factor structures of five personality

inventories. *Personality and individual differences*, 52(4), 552-558.

Woods, S. A., & Sofat, J. A. (2013). Personality and engagement at work: the mediating

role of psychological meaningfulness. *Journal of Applied Social Psychology*,

43(11), 2203-2210.

Table 1.

Rotated factor solutions of the TDA-100 in Samples 1 and 2.

	Factor									
	A		O		C		E		ES	
	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1
Considerate	.703	.688	.192	.281	.176	.286	-.061	-.060	.034	.008
Kind	.664	.637	.205	.294	.093	.281	-.005	.034	.000	.002
Unkind	-.640	-.686	-.271	-.129	-.133	-.280	-.054	-.143	-.168	-.186
Unsympathetic	.629	-.694	-.254	-.108	-.033	-.216	.008	-.109	-.085	-.105
Generous	.611	.402	.144	.199	.010	.164	.176	.016	-.022	.024
Sympathetic	.608	.612	.033	.212	-.018	.338	.007	-.006	-.021	.021
Warm	.600	.751	-.002	.192	.034	.117	.272	.234	.018	.054
Helpful	.594	.601	.223	.322	.160	.355	.123	.063	-.047	.028
Cooperative	.589	.645	.116	.174	.252	.327	-.022	.021	.087	.061
Agreeable	.575	.538	.119	.185	.070	.247	-.045	.080	.105	.035
Uncharitable	-.535	-.529	-.166	-.147	-.070	-.290	-.060	-.166	-.177	-.147
Pleasant	.532	.674	-.012	.305	.174	.298	.075	.115	.146	.114
Uncooperative	-.531	-.549	-.084	-.106	-.292	-.325	.019	-.086	-.241	-.182
Rude	-.530	-.592	-.080	.000	-.197	-.377	.042	.063	-.277	-.168
Cold	-.498	-.576	-.032	.026	-.021	-.056	-.251	-.269	-.221	-.072
Unemotional	-.480	-.510	-.128	-.067	.058	-.127	-.202	-.193	.205	.209
Harsh	-.449	-.640	.005	.136	-.047	-.101	.049	.042	-.440	-.229
Selfish	-.409	-.490	.067	.046	-.211	-.131	-.054	-.057	-.335	-.260
Trustful	.315	.525	-.188	.140	.142	.135	.152	.098	.063	.107
Creative	.084	.195	.648	.664	-.015	-.084	.134	.033	.014	.097
Imaginative	.121	.186	.645	.703	-.046	.024	.149	.021	-.012	.116
Intellectual	.108	.059	.632	.610	.142	.286	.048	.152	.021	.061
Unimaginative	-.184	-.335	-.619	-.574	-.011	-.088	-.219	-.092	-.137	-.152
Uncreative	-.115	-.221	-.596	-.605	-.045	-.015	-.150	-.056	-.095	-.187
Innovative	.031	.152	.588	.703	.027	.044	.190	.081	.109	.078
Deep	.049	.019	.585	.604	.034	.091	-.007	-.115	-.136	-.236
Uninquisitive	-.143	-.023	-.582	-.441	-.014	-.226	-.124	-.168	-.126	-.025
Unintelligent	-.200	-.219	-.581	-.340	-.146	-.317	-.041	-.120	-.147	-.340
Bright	.062	.207	.579	.534	.180	.327	.184	.261	.006	-.009
Complex	-.095	-.210	.567	.449	-.009	.010	-.045	-.012	-.256	-.278
Unreflective	-.265	-.202	-.563	-.357	-.063	-.344	.003	-.061	-.023	.007
Unintellectual	-.167	-.049	-.550	-.413	-.190	-.376	-.069	-.164	-.126	-.051
Artistic	.089	.147	.524	.504	-.114	-.227	.027	-.072	-.011	.019

Introspective	.125	.003	.518	.262	-.040	.088	-.205	-.398	-.170	.019
Philosophical	.056	.152	.471	.489	-.062	-.014	-.091	-.049	-.035	.097
Shallow	-.330	-.382	-.458	.354	-.207	-.407	-.107	-.102	-.212	-.268
Imperceptive	-.072	-.236	-.366	-.294	-.122	-.254	-.086	-.156	-.167	-.180
Unadventurous	-.073	-.116	-.348	-.350	-.011	-.048	-.303	-.172	-.171	-.156
Simple	.036	.223	-.347	-.117	-.055	-.118	-.113	-.151	-.097	.050
Unsophisticated	-.098	-.171	-.341	-.248	-.188	-.331	-.137	-.207	-.121	-.170
Undemanding	.114	.315	-.261	.049	-.114	-.187	-.196	-.286	.245	.130
Organized	-.018	.097	-.015	.011	.751	.691	.089	-.018	-.021	-.068
Efficient	.134	.289	.201	.207	.696	.691	.099	-.018	-.030	-.068
Disorganized	.053	-.103	.078	.090	-.679	-.728	-.095	-.065	-.114	-.091
Unsystematic	-.068	-.135	-.220	-.128	-.667	-.661	-.051	-.057	-.065	-.073
Thorough	.051	.112	.136	.117	.643	.621	-.007	.046	-.028	.007
Systematic	-.117	.028	.124	.205	.642	.657	-.009	-.055	-.050	-.023
Inefficient	-.069	-.289	-.038	-.057	-.607	-.539	-.152	-.186	-.119	-.184
Sloppy	-.203	-.072	-.022	-.026	-.577	-.670	-.167	-.075	-.107	-.166
Neat	.091	.186	-.155	-.011	.577	.587	.098	-.052	-.074	-.092
Haphazard	-.133	.085	-.071	.127	-.569	-.631	.062	-.035	-.240	-.181
Careless	-.204	-.261	-.049	-.024	-.541	-.698	.020	-.036	-.223	-.140
Practical	.063	.297	.067	.354	.527	.434	-.063	.042	.069	.126
Negligent	-.300	-.285	-.148	-.129	-.524	-.559	-.104	-.099	-.216	-.192
Impractical	-.048	-.272	.019	-.226	-.500	-.498	.023	-.102	-.239	-.128
Inconsistent	-.038	-.158	-.045	.081	-.492	-.592	-.044	-.113	-.359	-.279
Steady	.286	.313	-.024	.086	.455	.478	-.016	-.115	.125	.164
Careful	.336	.331	.065	.018	.447	.574	-.268	-.176	-.080	-.094
Undependable	-.340	-.404	-.177	-.101	-.405	-.472	-.046	-.160	-.106	-.183
Conscientious	.384	.371	.267	.181	.391	.563	-.049	.074	-.011	-.037
Energetic	.188	.161	.256	.293	.360	.302	.358	.349	.053	.078
Prompt	.056	.148	-.063	-.053	.356	.571	.011	.023	-.001	.000
Extraverted	.142	.170	.094	.197	-.042	-.018	.724	.642	-.035	-.020
Quiet	-.033	-.013	-.033	-.038	.099	.122	-.711	-.775	.064	-.023
Introverted	-.150	-.225	.137	-.050	-.094	.008	-.697	-.767	-.164	-.088
Shy	.006	-.022	-.082	-.035	-.039	-.090	-.690	-.710	-.185	-.207
Talkative	.200	.387	.030	.214	-.005	-.001	.658	.639	-.154	-.062
Bashful	.039	.025	-.036	-.054	-.058	-.146	-.653	-.556	-.208	-.234
Reserved	-.066	-.045	-.003	.070	.141	.119	-.626	-.753	.012	-.137
Withdrawn	-.232	-.314	.016	.083	-.141	-.223	-.621	-.596	-.318	-.293
Timid	.024	-.085	-.213	-.040	-.125	-.215	-.613	-.575	-.271	-.314
Untalkative	-.325	-.395	-.147	-.088	-.055	-.118	-.605	-.587	-.070	-.088
Assertive	-.025	.051	.323	.362	.210	.354	.566	.484	-.050	.050

Verbal	.132	.237	.221	.331	.027	.057	.527	.562	-.130	-.067
Bold	-.148	-.250	.323	.385	.058	-.026	.513	.450	-.059	.045
Inhibited	.013	-.084	-.062	-.098	-.033	-.051	-.487	-.537	-.297	-.155
Vigorous	.058	-.014	.171	.306	.231	.237	.436	.252	.033	-.008
Daring	-.102	-.075	.323	.577	-.029	.003	.360	.312	-.029	.052
Active	.187	.144	.138	.310	.260	.304	.326	.166	.048	.111
Unexcitable	-.293	-.398	-.086	-.151	-.029	-.243	-.325	-.385	.224	.022
Unrestrained	-.167	-.178	-.011	.126	-.242	-.291	.265	.264	-.117	-.104
Fretful	-.015	-.020	-.094	-.067	-.082	-.081	-.108	-.225	-.666	-.692
Anxious	.101	.197	-.064	-.147	-.002	.023	-.068	-.319	-.644	-.675
Moody	-.177	-.246	.016	.089	-.093	-.055	-.140	-.126	-.632	-.699
Temperamental	-.186	-.232	-.052	.127	-.131	-.105	.050	-.055	-.622	-.674
Irritable	-.243	-.296	.066	.107	-.067	.040	-.069	-.065	-.613	-.629
High Strung	-.038	-.143	.022	-.091	-.024	-.076	.205	-.051	-.613	-.665
Nervous	.088	.060	-.153	-.135	-.086	-.121	-.178	-.434	-.596	-.637
Fearful	.082	.148	-.134	-.229	-.128	-.070	-.220	-.414	-.586	-.558
Touchy	-.083	-.091	-.088	.133	.002	-.187	.012	.054	-.579	-.643
Self Pitying	-.185	-.105	-.140	.020	-.161	-.307	-.217	-.220	-.574	-.651
Insecure	.088	.107	-.066	-.092	-.236	-.158	-.337	-.260	-.558	-.619
Envious	-.132	-.151	-.061	-.074	-.161	-.139	-.088	-.057	-.553	-.596
Jealous	-.118	-.252	.003	-.075	-.145	-.169	-.015	.016	-.495	-.615
Emotional	.429	.468	.104	.118	-.064	.074	.149	.102	-.473	-.609
Demanding	-.289	-.343	.211	.170	.129	.104	.220	.321	-.437	-.386
Relaxed	.102	.210	-.017	.250	-.007	.017	.037	.082	.403	.467
Imperturbable	-.015	-.042	.144	.281	.050	-.094	-.048	.028	.336	.354
Distrustful	-.248	-.370	.173	-.052	-.121	-.015	-.179	-.130	-.262	-.344
Unenvious	.025	.116	-.014	.161	.003	.081	-.014	-.107	.251	.389

A = Agreeableness; O = Openness; E = Extraversion; C = Conscientiousness; ES = Emotional Stability; S1 = Sample 1 loadings; S2 = Sample 2 loadings.

Table 3.
Correlations of 273 personality scales with the lexical Big Five and associated AB5C sector

locations.

Inventory	Scale	E	A	C	ES	O	Primary r	Secondary r	Vector Length
Extraversion									
Gregariousness									
16PF5	H Social Boldness	64	05	04	10	12	E+	E+	65
HEXACO PI	Extraversion	68	13	06	-01	18	E+	E+	70
HPI	Likes parties	36	04	04	03	-03	E+	E+	36
OPQ	Outgoing	81	09	-21	00	-01	E+	E+	83
PAPI	X Need to be Noticed	61	-12	-01	12	15	E+	E+	62
Affiliation									
16PF5	F Liveliness	37	17	-10	-09	01	E+	A+	41
6FPQ	Affiliation	48	24	-02	10	01	E+	A+	54
HEXACO PI	Sociability (X:Soci)	44	24	-02	-03	-09	E+	A+	50
HPI	Likes crowds	21	12	01	-05	-06	E+	A+	24
HPI	Likes people	41	25	-01	12	-03	E+	A+	48
JPI	Sociability	34	20	-02	-03	-16	E+	A+	39
MPQ	Social Closeness (SC)	41	29	01	00	-13	E+	A+	50
NEO PI-R	Extraversion	65	21	07	02	09	E+	A+	69
NEO PI-R	Gregariousness (E2)	43	22	-03	03	-16	E+	A+	48
NEO PI-R	Positive Emotions (E6)	41	34	-02	13	09	E+	A+	53
OPQ	Affiliative	50	26	-11	05	-11	E+	A+	56
PAPI	S Social Harmonizer	42	38	-14	16	00	E+	A+	57
16PF5	N Privateness	-39	-22	13	08	02	E-	A-	44
Leadership (Control)									
OPQ	Achieving	32	-22	09	03	05	E+	A-	39
OPQ	Decisive	33	-22	-09	08	12	E+	A-	40
OPQ	Outspoken	38	-34	-01	-02	20	E+	A-	51
OPQ	Controlling	43	-26	06	11	18	E+	A-	51
PAPI	T Pace	31	-19	16	12	10	E+	A-	36
PAPI	I Ease in Decision Making	32	-25	-11	20	21	E+	A-	41
PAPI	P Need to Control Others	41	-24	03	21	16	E+	A-	47
PAPI	K Need to be Forceful	44	-39	01	06	28	E+	A-	58
Work Pace									
CPI	Communality (Cm)	10	02	10	05	03	E+	C+	14
HPI	Competitive	28	-01	25	04	23	E+	C+	38
JPI	Energy Level	28	-14	22	20	20	E+	C+	35
NEO PI-R	Activity (E4)	43	-01	23	-03	19	E+	C+	49
OPQ	Vigorous	23	-06	17	16	-12	E+	C+	29
E+C-/E-C+									

OPQ	Modest	-38	04	11	05	-04	E-	C+	39
Social Poise									
CPI	Leadership (Lp)	38	02	24	35	24	E+	ES+	51
CPI	Masculinity (B-MS)	45	-14	12	33	29	E+	ES+	56
HEXACO PI	Liveliness (X:Live)	45	13	12	19	15	E+	ES+	49
HPI	Self confidence	40	-07	20	25	18	E+	ES+	47
OPQ	Socially Confident	54	06	-05	22	01	E+	ES+	59
Expressiveness									
CPI	Narcissism (Nar)	35	-24	03	-27	25	E+	ES-	44
HEXACO PI	Expressiveness (X:Expr)	59	10	-01	-25	17	E+	ES-	64
NEO PI-R	Excitement-Seeking (E5)	29	-08	-02	-15	05	E+	ES-	33
HEXACO PI	Greed Avoidance (H:Gree)	-18	14	-05	18	-02	E-	ES+	25
OPQ	Emotionally Controlled	-50	-17	18	19	02	E-	ES+	53
Leadership (Boldness)									
16PF5	E Dominance	45	-22	18	-07	23	E+	O+	50
6FPQ	Extraversion	55	03	08	03	21	E+	O+	59
6FPQ	Dominance	31	-15	19	-02	24	E+	O+	39
6FPQ	Exhibition	55	01	00	-01	23	E+	O+	60
CPI	Dominance (Do)	49	-08	18	10	32	E+	O+	59
CPI	Capacity for Status (Cs)	35	02	-07	14	35	E+	O+	49
CPI	Sociability (Sy)	52	09	02	11	23	E+	O+	57
CPI	Social Presence (Sp)	42	-02	-10	11	28	E+	O+	50
CPI	Self-acceptance (Sa)	48	-06	05	05	35	E+	O+	59
HEXACO PI	Social Boldness (X:SocB)	55	-05	10	09	30	E+	O+	63
HPI	Leadership	41	-10	19	-02	28	E+	O+	50
HPI	No social anxiety	43	-05	05	21	23	E+	O+	49
HPI	Exhibitionistic	35	-06	-06	-19	24	E+	O+	42
HPI	Entertaining	34	-01	-01	-08	21	E+	O+	40
HPI	Ambition	49	-05	22	23	28	E+	O+	56
HPI	Sociability	46	00	-05	-07	24	E+	O+	51
JPI	Social Confidence	62	-04	04	07	29	E+	O+	68
MPQ	Social Potency (SP)	54	-07	11	-10	26	E+	O+	60
NEO PI-R	Assertiveness (E3)	60	-09	16	01	24	E+	O+	65
OPQ	Behavioural	17	07	-08	-03	10	E+	O+	20
OPQ	Persuasion	37	-08	-06	05	15	E+	O+	40
PAPI	L Leadership Role	39	-18	06	18	23	E+	O+	45
CPI	Vector 1 (V1)	-53	08	-04	08	-33	E-	O-	63
Agreeableness									
A+A+/A-A-									
HEXACO PI	Sentimentality (E:Sent)	04	51	-03	-09	00	A+	A+	51
OPQ	Democratic	08	38	10	06	-10	A+	A+	40
Warmth									
16PF5	A Warmth	32	35	01	-03	-12	A+	E+	48
HPI	Caring	19	31	-02	03	04	A+	E+	36
HPI	Likeability	26	41	-04	20	-05	A+	E+	48

NEO PI-R	Warmth (E1)	43	48	-03	09	-05	A+	E+	64
PAPI	O Need to Relate Closely to Individuals	12	35	-07	-12	-09	A+	E+	37
PAPI	B Need to Belong to Groups	18	33	-08	13	-15	A+	E+	38
16PF5	Q2 Self-Reliance	-22	-22	02	-04	17	A-	E-	31
A+E-/A-E+									
OPQ	Competitive	21	-27	06	-11	-01	A-	E+	34
PAPI	A Need to Achieve	16	-23	14	-12	02	A-	E+	28
A+C+/A-C-									
HPI	Sensitive	05	25	12	-01	02	A+	C+	28
A+C-/A-C+									
16PF5	I Sensitivity	-05	28	-12	-04	09	A+	C-	31
HPI	Math ability	00	-18	13	12	06	A-	C+	22
OPQ	Data Rational	-07	-26	12	10	04	A-	C+	29
Pleasantness									
HEXACO PI	Fairness (H:Fair)	-01	29	13	19	-08	A+	ES+	35
HEXACO PI	Gentleness (A:Gent)	-26	31	-15	28	-11	A+	ES+	41
HEXACO PI	Honesty	-14	25	03	23	-12	A+	ES+	34
HPI	Trusting	07	23	-04	21	01	A+	ES+	31
HPI	Easy to live with	04	26	-04	20	-08	A+	ES+	33
JPI	Responsibility	00	25	11	18	-13	A+	ES+	30
NEO PI-R	Agreeableness	-11	50	01	28	-24	A+	ES+	57
NEO PI-R	Trust (A1)	13	33	-01	31	-05	A+	ES+	45
NEO PI-R	Straightforwardness (A2)	-12	31	08	24	-23	A+	ES+	39
NEO PI-R	Altruism (A3)	10	55	11	20	-11	A+	ES+	58
OPQ	Caring	12	59	04	17	-10	A+	ES+	62
PAPI	Social Desirability	-13	17	02	15	01	A+	ES+	22
Emotional Sensitivity									
CPI	Femininity (Fe)	-13	36	-04	-16	-13	A+	ES-	40
HEXACO PI	Dependence (E:Depe)	12	26	-04	-23	-13	A+	ES-	35
HEXACO PI	Emotionality	-04	42	-02	-34	-17	A+	ES-	55
HPI	Not autonomous	-02	22	00	-15	-13	A+	ES-	26
JPI	Empathy	08	43	-03	-24	-01	A+	ES-	49
6FPQ	Independence	-09	-30	-11	25	22	A-	ES+	39
A+O+/A-O-									
NEO PI-R	Feelings (O3)	25	30	-04	-18	30	A+	O+	42
Nurturance (versus Self-reliance)									
CPI	Femininity (B-FM)	-18	30	09	17	-20	A+	O-	36
HEXACO PI	Fearfulness (E:Fear)	-17	29	02	-17	-21	A+	O-	36
MPQ	Harmavoidance (HA)	-13	25	15	01	-17	A+	O-	30
NEO PI-R	Tender-Mindedness (A6)	-01	36	-08	02	-13	A+	O-	38
6FPQ	Autonomy	-12	-32	-09	14	27	A-	O+	42
6FPQ	Self Reliance (-Succorance)	-07	-27	-02	14	21	A-	O+	34
HPI	Thrill-seeking	13	-15	-02	-04	13	A-	O+	20
OPQ	Evaluative	15	-33	25	-02	26	A-	O+	42

OPQ	Independent Minded	19	-37	01	01	37	A-	O+	52
Conscientiousness									
Orderliness									
16PF5	Q3 Perfectionism	03	-03	56	-04	-12	C+	C+	57
6FPQ	Methodicalness	-09	-02	62	09	-05	C+	C+	62
6FPQ	Order	07	-04	58	03	-07	C+	C+	59
HEXACO PI	Organization (C:Orga)	10	-01	56	01	-14	C+	C+	57
HEXACO PI	Conscientiousness	06	01	61	07	09	C+	C+	62
HPI	Mastery	02	10	42	-04	-04	C+	C+	43
JPI	Organization	08	-09	59	06	-10	C+	C+	59
NEO PI-R	Order (C2)	04	-05	67	-02	-12	C+	C+	68
OPQ	Conscientious	-02	-03	54	09	-11	C+	C+	55
PAPI	D Attention to Detail	-07	05	49	-05	-01	C+	C+	50
PAPI	C Organised Type	08	-02	55	-05	-07	C+	C+	56
PAPI	N Need to Finish a Task	00	03	48	00	-07	C+	C+	49
C+E+/C-E-									
HEXACO PI	Diligence (C:Dili)	22	-05	39	04	21	C+	E+	45
NEO PI-R	Achievement Striving (C4)	25	-09	43	06	16	C+	E+	50
PAPI	H Integrative Planner	12	01	39	-02	-12	C+	E+	41
Cautiousness									
6FPQ	Cognitive Structure	-12	01	41	02	-09	C+	E-	43
6FPQ	Deliberateness (- Impulsivity)	-22	-01	47	20	03	C+	E-	52
6FPQ	Seriousness (-Play)	-18	-08	22	-01	-06	C+	E-	28
MPQ	Control (CO)	-21	06	45	15	-11	C+	E-	50
C+A+/C-A-									
HPI	Validity	16	21	25	12	-06	C+	A+	32
C+A-/C-A+									
OPQ	Forward Thinking	06	-17	26	04	00	C+	A-	30
Dutifulness									
CPI	Law Enforcement Orientation (Leo)	20	-03	40	22	-13	C+	ES+	46
HEXACO PI	Prudence (C:Prud)	-14	06	40	26	13	C+	ES+	48
MPQ	Unlikely Virtues	10	09	23	23	-07	C+	ES+	32
NEO PI-R	Conscientiousness	09	-02	69	21	04	C+	ES+	72
NEO PI-R	Competence (C1)	17	-02	49	28	19	C+	ES+	56
NEO PI-R	Dutifulness (C3)	00	08	48	20	-06	C+	ES+	52
NEO PI-R	Self-Discipline (C5)	12	-03	60	23	03	C+	ES+	64
NEO PI-R	Deliberation (C6)	-18	02	40	23	02	C+	ES+	46
Industriousness									
6FPQ	Industriousness	-03	-04	31	06	18	C+	O+	35
6FPQ	Endurance	01	-06	23	07	23	C+	O+	32
HEXACO PI	Perfectionism (C:Perf)	-05	05	38	-09	13	C+	O+	41
HPI	Intellectual games	-03	01	02	12	05	C+	O+	13

MPQ	Achievement (AC)	15	-07	27	-02	23	C+	O+	35
Inflexibility									
CPI	Vector 2 (V2)	05	04	37	16	-17	C+	O-	41
HPI	Moralistic	04	10	23	10	-14	C+	O-	27
HPI	Not spontaneous	-11	04	20	12	-12	C+	O-	23
HPI	Prudence	-15	27	33	21	-27	C+	O-	43
OPQ	Detail Conscious	-08	-06	69	02	-21	C+	O-	72
PAPI	G Role of the Hard Worker	07	07	37	-07	-15	C+	O-	40
16PF5	M Abstractedness	02	-08	-41	-14	39	C-	O+	56
JPI	Tolerance	09	07	-19	15	16	C-	O+	25
CPI	Flexibility (Fx)	03	06	-45	02	28	C-	O+	53
Emotional Stability									
Stability									
CPI	Well-being (Wb)	13	02	09	47	06	ES+	ES+	48
CPI	Work Orientation (WO)	-03	08	12	47	01	ES+	ES+	48
HPI	Not anxious	09	-05	-03	50	08	ES+	ES+	50
HPI	Adjustment	04	09	04	59	-01	ES+	ES+	60
HPI	Impression management	-05	-07	-06	-34	-03	ES-	ES-	34
JPI	Anxiety	-05	12	-02	-58	-09	ES-	ES-	59
MPQ	Stress Reaction (SR)	-14	03	-03	-54	-10	ES-	ES-	55
Positive Emotionality									
16PF5	C Emotional Stability	21	02	16	45	00	ES+	E+	50
CPI	Managerial Potential (MP)	22	05	16	32	20	ES+	E+	39
HPI	No guilt	14	02	13	38	11	ES+	E+	41
HPI	No somatic complaints	12	-07	08	28	10	ES+	E+	30
HPI	No depression	21	08	09	34	04	ES+	E+	40
MPQ	Wellbeing (WB)	24	11	02	25	10	ES+	E+	35
OPQ	Relaxed	23	-08	-10	57	09	ES+	E+	61
OPQ	Optimistic	34	03	-01	44	03	ES+	E+	56
16PF5	O Apprehension	-26	19	-03	-39	-12	ES-	E-	47
CPI	Anxiety (Anx)	-18	-02	-10	-30	-05	ES-	E-	35
NEO PI-R	Neuroticism	-19	03	-19	-63	-13	ES-	E-	66
NEO PI-R	Anxiety (N1)	-17	12	-05	-57	-13	ES-	E-	59
NEO PI-R	Depression (N3)	-25	00	-17	-51	-09	ES-	E-	57
NEO PI-R	Self-Consciousness (N4)	-36	06	-13	-37	-19	ES-	E-	52
OPQ	Worrying	-32	19	06	-37	-12	ES-	E-	49
Emotional Control									
6FPQ	Even-tempered (- Aggression)	-21	15	-04	43	-11	ES+	E-	48
CPI	Self-control (Sc)	-20	13	19	44	-14	ES+	E-	48
HPI	Calmness	-15	-08	05	48	06	ES+	E-	50
PAPI	E Emotional Restraint	-18	14	-13	50	02	ES+	E-	53
CPI	Acquiescence (D-AC)	11	-07	-02	-21	03	ES-	E+	23
Calmness									
16PF5	IM Impression	04	21	06	43	-05	ES+	A+	48

	Management								
6FPQ	Agreeableness	-13	16	-12	38	-10	ES+	A+	41
6FPQ	Good-natured (– Defendence)	-07	14	-12	32	-10	ES+	A+	35
CPI	Responsibility (Re)	00	12	10	26	05	ES+	A+	28
CPI	Tolerance (To)	-03	18	-04	26	09	ES+	A+	31
CPI	Amicability (Ami)	-10	20	10	43	-13	ES+	A+	47
HEXACO PI	Sincerity (H:Sinc)	-06	10	05	22	-01	ES+	A+	24
HEXACO PI	Forgiveness (A:Forg)	00	16	-11	17	-10	ES+	A+	23
HEXACO PI	Flexibility (A:Flex)	-16	20	-10	26	-09	ES+	A+	33
HEXACO PI	Patience (A:Pati)	-19	22	-10	37	-03	ES+	A+	43
HEXACO PI	Agreeableness	-19	29	-15	34	-11	ES+	A+	45
HPI	Empathy	-06	19	-13	45	-09	ES+	A+	49
HPI	Even-tempered	-07	17	01	45	-04	ES+	A+	48
HPI	No hostility	-07	24	-17	26	-08	ES+	A+	35
HPI	Virtuous	-09	18	03	26	-07	ES+	A+	32
HPI	Avoids trouble	-11	22	10	24	-14	ES+	A+	32
NEO PI-R	Compliance (A4)	-25	33	-03	36	-16	ES+	A+	48
OPQ	Social Desirability	-13	24	09	31	04	ES+	A+	39
OPQ	Trusting	18	27	-08	35	-01	ES+	A+	44
16PF5	L Vigilance	-02	-14	04	-23	-05	ES-	A-	26
16PF5	Q4 Tension	04	-19	07	-39	02	ES-	A-	43
MPQ	Aggression (AG)	12	-20	04	-28	10	ES-	A-	35
MPQ	Alienation (AL)	-02	-06	03	-19	00	ES-	A-	20
NEO PI-R	Angry Hostility (N2)	06	-18	-01	-58	01	ES-	A-	61
ES+A-/ES-A+									
OPQ	Tough Minded	07	-18	-11	48	09	ES+	A-	51
HEXACO PI	Anxiety (E:Anxi)	-07	15	-01	-45	-13	ES-	A+	48
Socialization									
CPI	Socialization (So)	-03	13	21	29	-15	ES+	C+	36
CPI	Good Impression (Gi)	-01	19	22	45	-09	ES+	C+	50
CPI	Achievement via Conformance (Ac)	13	07	28	29	13	ES+	C+	40
CPI	Tough-mindedness (Tm)	27	-14	30	38	18	ES+	C+	49
CPI	Social Desirability (D-SD)	17	10	22	36	12	ES+	C+	42
HPI	Identity	08	02	13	27	04	ES+	C+	30
NEO PI-R	Impulsiveness (N5)	09	07	-29	-37	00	ES-	C-	47
NEO PI-R	Vulnerability (N6)	-21	09	-23	-44	-21	ES-	C-	49
ES+C-/ES-C+									
6FPQ	Abasement	00	09	-13	14	-03	ES+	C-	19
6FPQ	Individualism (–Soc. Recog.)	-02	-13	-13	29	04	ES+	C-	32
ES+O+/ES-O-									
CPI	Vector 3 (V3)	04	09	-06	35	25	ES+	O+	43
HPI	Self focus	-04	05	-07	-29	14	ES-	O-	32

JPI	Cooperativeness	-14	14	09	-25	-24	ES-	O-	34
Openness									
Intellect									
HPI	Reading	-04	02	-06	08	29	O+	O+	30
HPI	Intellectance	13	-14	-07	08	51	O+	O+	53
JPI	Complexity	00	-07	-13	-09	48	O+	O+	50
JPI	Breadth of Interest	10	00	-09	09	39	O+	O+	41
NEO PI-R	Ideas (O5)	02	-08	-05	06	55	O+	O+	56
PAPI	R Conceptual Thinker	-02	-16	-14	11	62	O+	O+	64
Ingenuity/Creativity									
6FPQ	Change	16	-13	-13	05	27	O+	E+	31
CPI	Independence (In)	32	-20	07	26	44	O+	E+	54
CPI	Empathy (Em)	30	12	-14	16	31	O+	E+	44
HEXACO PI	Creativity (O:Crea)	16	-05	-14	-01	59	O+	E+	61
HPI	Experience-seeking	24	-07	-10	05	36	O+	E+	43
HPI	Generates ideas	31	-03	-07	07	47	O+	E+	57
JPI	Innovation	19	-10	-13	02	62	O+	E+	65
OPQ	Variety Seeking	25	-18	-15	18	30	O+	E+	39
HPI	Impulse control	-23	10	23	19	-29	O-	E-	37
NEO PI-R	Modesty (A5)	-25	21	-01	-02	-27	O-	E-	37
O+A+/O-A-									
HEXACO PI	Aesthetic Appreciation (O:AesA)	-07	18	-14	07	42	O+	A+	46
MPQ	Absorption (AB)	02	12	-11	-10	32	O+	A+	34
NEO PI-R	Aesthetics (O2)	00	22	-13	-01	36	O+	A+	43
Critical Enquiry (versus Rule Conformity)									
HPI	Science ability	00	-18	-01	06	41	O+	A-	44
HPI	Curiosity	01	-17	04	05	26	O+	A-	31
JPI	Risk Taking	24	-26	-09	-04	30	O+	A-	39
HEXACO PI	Modesty (H:Mode)	-15	26	-03	11	-27	O-	A+	37
PAPI	W Need for Rules and Supervision	-09	25	20	-19	-44	O-	A+	50
PAPI	F Need to be Supportive	-04	26	09	-08	-28	O-	A+	38
O+C+/O-C-									
6FPQ	Achievement	14	08	21	08	24	O+	C+	32
CPI	Psychological-mindedness (Py)	06	-05	-03	29	35	O+	C+	45
HPI	Good memory	05	-01	16	06	29	O+	C+	33
Unconventionality									
16PF5	Q1 Openness to Change	12	-04	-14	05	49	O+	C-	51
6FPQ	Openness to Experience	09	-04	-17	11	50	O+	C-	52
6FPQ	Understanding	-01	-04	-14	09	48	O+	C-	49
HEXACO PI	Unconventionality (O:Unco)	02	-13	-22	-05	50	O+	C-	55
HEXACO PI	Openness	03	-03	-19	05	64	O+	C-	67
HPI	Culture	-02	08	-17	03	35	O+	C-	38

NEO PI-R	Openness to Experience	10	14	-23	-03	55	O+	C-	59
NEO PI-R	Fantasy (O1)	05	03	-30	-10	39	O+	C-	50
NEO PI-R	Actions (O4)	13	09	-22	08	32	O+	C-	39
NEO PI-R	Values (O6)	04	05	-20	02	28	O+	C-	34
OPQ	Conceptual	07	-16	-17	01	45	O+	C-	49
OPQ	Innovative	08	-11	-22	14	61	O+	C-	65
16PF5	G Rule-Consciousness	-02	15	25	09	-29	O-	C+	38
HPI	Appearance	06	15	15	-11	-16	O-	C+	22
JPI	Traditional Values	-05	11	22	02	-33	O-	C+	40
MPQ	Traditionalism (TR)	00	08	25	-02	-33	O-	C+	42
OPQ	Convention	-13	15	23	-13	-46	O-	C+	51
OPQ	Rule Following	-09	25	26	-03	-39	O-	C+	47
Efficiency of Thought/Inquisitiveness									
6FPQ	Breadth of Interest	09	07	-12	13	42	O+	ES+	44
CPI	Achievement via Independence (Ai)	00	-03	-08	20	39	O+	ES+	44
CPI	Intellectual Efficiency (Ie)	12	-05	-03	28	39	O+	ES+	48
HEXACO PI	Inquisitiveness (O:Inqu)	-01	-09	-07	14	44	O+	ES+	46
HPI	Education	-04	-07	04	11	26	O+	ES+	28
HPI	Scholarship	-01	-08	10	13	35	O+	ES+	37
PAPI	Z Need for Change	21	-08	-08	23	35	O+	ES+	41
O+ES-/O-ES+									
CPI	Creative Temperament (CT)	17	02	-31	03	41	O+	ES-	51
JPI	Social Astuteness	13	-05	00	-14	20	O+	ES-	24
HPI	Good attachment	01	03	11	19	-20	O-	ES+	27

Sample 1 Pearson's $r > .07$, $p < 0.05$. Sample 2 Pearson's $r > .14$, $p < 0.05$. Decimal points omitted.

E=Extraversion, A=Agreeableness, C=Conscientiousness, ES=Emotional Stability, O=Openness.

Vector lengths are computed as the square-root of the sums-of-squares of the primary and secondary loadings of the scales.

Table 4.

Twenty-six Facets of Personality Frequently Assessed by PIs in Personnel Assessment.

Facet	AB5C Sectors	Indicative Characteristics
Extraversion		
Gregariousness	E+E+/E-E-	Outgoing and preference for social stimulation
Affiliation	E+A+/E-A-	Sociability and affiliative tendency
Leadership (Control)	E+A-/E-A+	Dominance, directive and controlling forms of leadership
Work Pace	E+C+/E-C-	Pace and vigour of work activity
Social Poise	E+ES+/E-ES-	Social- and self-confidence
Expressiveness	E+ES-/E-ES+	Talkativeness, tendency to express self outwardly
Leadership (Boldness)	E+O+/E-O-	Adventurousness, social boldness and presence
Agreeableness		
Warmth	A+E+/A-E-	Belongingness and warmth toward others
Pleasantness	A+ES+/A-ES-	Interpersonal pleasantness (trust, care, and altruism)
Emotional Sensitivity	A+ES-/A-ES+	Sensitivity to the emotions of others
Nurturance (versus Self-reliance)	A+O-/A-O+	Preference for working with people rather than data/things
Conscientiousness		
Orderliness	C+C+/C-C-	Organization and preference for order
Cautiousness	C+E-/C-E+	Cautiousness or risk-aversiveness of behavior
Dutifulness	C+ES+/C-ES-	Adherence to external or

		formalized expectations of behavior or conduct
Industriousness	C+O+/C-O-	Hard working, activity endurance/stamina
Inflexibility	C+O-/C-O+	Lack of spontaneity, unadaptable, predictability
Emotional Stability		
Stability	ES+ES+/ES-ES-	Absence of anxiety, mood consistency and low stress/worry
Positive Emotionality	ES+E+/ES-E-	Experience of positive emotions (e.g. optimism, happiness) versus sadness or depression
Emotional Control	ES+E-/ES-E+	Restraint and active control of emotions
Calmness	ES+A+/ES-A-	Evenness of emotion expression, patience, versus hostility and anger
Socialization	ES+C+/ES-C-	Normative adjustment, conformity to social norms of behavior
Openness		
Intellect	O+O+/O-O-	Preference for intellectual activity and wide ranging interests and ideas
Ingenuity/Creativity	O+E+/O-E-	Creativity and idea generation
Critical Enquiry (versus Rule Conformity)	O+A-/O-A+	Critical and conceptual thinking versus rule conformity
Unconventionality	O+C-/O-C+	Openness to new experiences and change ,versus traditionalism

Efficiency of Thought / Inquisitiveness	O+ES+/O-ES-	Quickness and efficiency of thinking, curiosity
--	-------------	--

Figure 1.

AB5C Circumplex of Extraversion and Agreeableness.

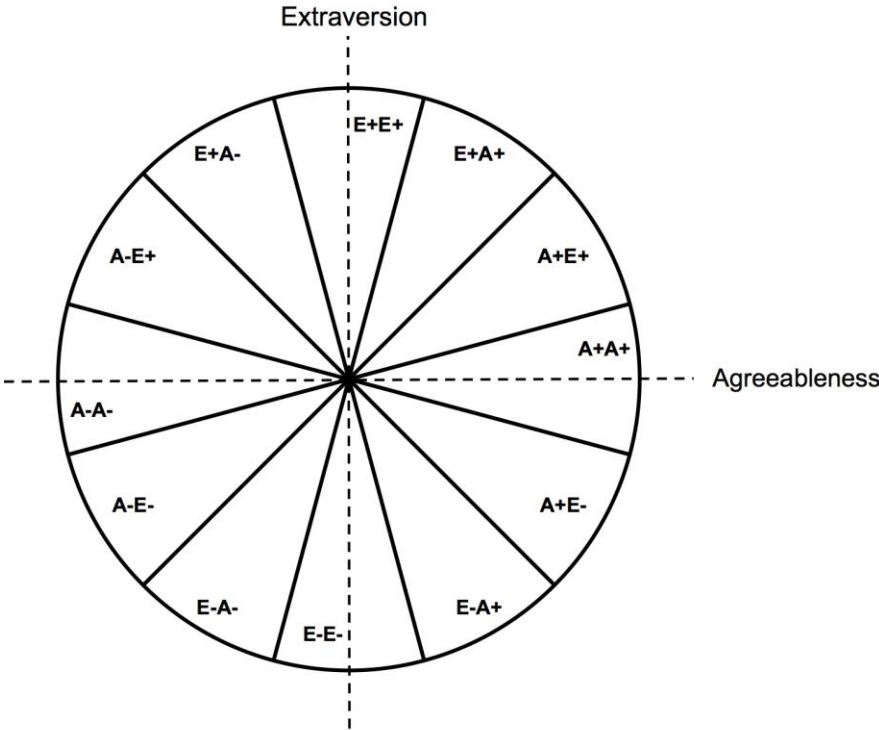


Figure 2.

A Periodic Table of Personality.

	E	A	C	ES	O
E+	E+E+/E-E- GR Gregariousness 0.82	A+E+/A-E- WA Warmth 1.15	C+E+/C-E- -- . 0.49	ES+E+/ES-E- PE Positive Emotionality 2.47	O+E+/O-E- IC Ingenuity / Creativity 1.65
E-		A+E-/A-E+ -- 0.33	C+E-/C-E+ CA Cautiousness 0.66	ES+E-/ES-E+ EC Emotional Control 0.82	O+E-/O-E+ -- 0.00
A+	E+A+/E-A- AF Affiliation 2.14	A+A+/A-A- -- 0.33	C+A+/C-A- -- 0.16	ES+A+/ES-A- CM Calmness 3.96	O+A+/O-A- -- 0.49
A-	E+A-/E-A+ LC Leadership (Control) 1.32		C+A-/C-A+ -- 0.16	ES+A-/ES-A+ -- 0.33	O+A-/O-A+ CE Critical Enquiry (versus Rule Conformity) 0.99
C+	E+C+/E-C- WP Work Pace 0.82	A+C+/A-C- -- 0.16	C+C+/C-C- OR Orderliness 1.98	ES+C+/ES-C- SO Socialization 1.32	O+C+/O-C- -- 0.49
C-	E+C-/E-C+ -- 0.16	A+C-/A-C+ -- 0.49		ES+C-/ES-C+ -- 0.33	O+C-/O-C+ UC Unconventionality 2.97
ES+	E+ES+/E-ES- SP Social Poise 0.82	A+ES+/A-ES- PL Pleasantness 1.98	C+ES+/C-ES- DU Dutifulness 1.32	ES+ES+/ES-ES- ST Stability 1.15	O+ES+/O-ES- EF Efficiency of Thought / Inquisitiveness 1.15
ES-	E+ES-/E-ES+ EX Expressiveness 0.82	A+ES-/A-ES+ ES Emotional Sensitivity 0.99	C+ES-/C-ES+ -- 0.00		O+ES-/O-ES+ -- 0.49
O+	E+O+/E-O- LB Leadership (Boldness) 3.79	A+O+/A-O- -- 0.16	C+O+/C-O- ID Industriousness 0.82	ES+O+/ES-O- -- 0.49	O+O+/O-O- IL Intellect 0.99
O-	E+O-/E-O+ --	A+O-/A-O+ NU Nurturance (versus Self- reliance)	C+O-/C-O+ IF Inflexibility	ES+O-/ES-O+ --	

	0.00	1.48	1.48	0.00	
--	------	------	------	------	--

Footnote:

E: Extraversion; A: Agreeableness; C: Conscientiousness; ES: Emotional Stability; O: Openness. +/- represent valence of the loading of the facet on the respective Big Five dimensions (e.g. for Leadership (Control), the high pole of the facet loads positively on Extraversion, and negatively on Agreeableness; the low pole loads negatively on Extraversion and positively on Agreeableness). Each cell denotes 1) the AB5C sector location; 2) a symbol and facet label, *if included in our facet model reported in Table 4*; 3) an ‘abundance number’, which shows how well the facet is represented in the 10 PIs analysed in the study. The abundance number is computed as the ratio of [% of PI scales located in the sector / (1/45)]. This enables sector comparison, for example, a sector with an abundance number of 2.00 is twice as abundantly populated with PI scales than a sector with a number of 1.00. Greyed boxes are spaces in the table; no facet can be classified E+E- for example.