

ADVANCES IN THE ASSESSMENT OF THE FIVE-FACTOR MODEL

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Recent developments in the assessment of the Big Five and the Five-Factor Model (FFM) are reviewed. These are centred on six themes, including the conceptual status of traits, the validity of the lexical hypothesis as a starting point to examine the main factors of personality, the developmental status of the Big Five, the organisation of traits at the lower level, the predictive validity of personality measures, and finally the bandwidth-fidelity dilemma. Criticisms and developments are discussed from an assessment point of view, examining how the rationale behind the construction of new inventories such as the Five Factor Personality Inventory (FFPI; Hendriks, Hofstee, & De Raad, 1999) and the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 1999) helps to clarify and (partially) answer previously identified problems. The review concludes with a discussion of the future agenda for personality assessment.

Introduction

The revival of trait psychology in the nineties did not go unnoticed by applied and clinical psychologists (De Fruyt & Mervielde, 1999a; 1999b; Hogan, 1998). Deary and Matthews (1993) argue that the trait approach is not only 'alive and well', but flourishing. They highlight various 'bright spots' in current trait theory including a growing agreement concerning the number, character and stability of personality dimensions; a greater understanding of the heritability of personality traits, and hence a greater appreciation of the role of the environment; a growing sophistication of research which aims to elucidate the biological and social bases of trait differences; and an appreciation of the extent to which personality differences predict outcomes, or act as moderators, in cognitive and health research.

They assert, as many others have done before them, two fundamental points: (1) the primary causality of traits, - the idea that causality flows from

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traits to behaviour- and (2) the inner locus of traits - the idea that traits describe the fundamental core qualities of a person that are latent rather than manifest. The causes of personality traits have always been acknowledged to be both biological and social. The increasing evidence for the former is primarily based on behaviour genetics.

The fact that there were so many competing theories, typologies and measures of traits has not served the trait position well. The pre-paradigmatic state of affairs meant that it was difficult to take the trait arguments seriously with so many competing and poorly psychometrized systems. However, there is growing consensus over the emergence of the 'Big Five' as fundamental higher-order orthogonal factors. After more than two decades of neglect and criticism (Mischel, 1968), psychologists outside the trait field, started to include individual differences measures in their research. The current lively interest for trait measures largely stems from the popularity of the Big Five or the Five-Factor Model dimensions (FFM) and their operationalisations among personality psychologists (Furnham & Heaven, 1999).

The attractive features of the FFM are that it serves as a framework to conduct systematic research and that it advances an integration of the diversity of individual differences measures (McCrae & Costa, 1996). The re-discovery of the Big Five and the development of the FFM have generated an influential stream of research, taking advantage of the FFM's strengths. Besides a number of well-psychometrized inventories, the model proved very useful to accommodate and integrate the results of trait-criterion research. Barrick and Mount's meta-analysis on the validity of traits to predict job performance (1991) is a good example of the model's impact on a domain in psychology. They were among the first to introduce the FFM to industrial and organisational (I/O) psychologists, using it as a generic model to sort personality scales related to different performance criteria. This meta-analysis turned out to be the most frequently cited article published in *Personnel Psychology* in the 1990s (Mount & Barrick, 1998) and has significantly contributed to the re-entrance of traits in the field of I/O psychology. Indeed a special issue of the journal *Human Performance* (Vol. 11, No 2/3) was dedicated to "Personality and Job Performance" which included two FFM reviews (Mount, Barrick, & Stewart, 1998; Salgado, 1998).

The increasing impact of trait psychology, and the FFM in particular, on the research agenda is not limited to I/O psychology, but extends to other domains in psychology such as for example the field of psychopathology and personality disorders (Costa & Widiger, 1994; Widiger & Trull, 1992), clinical psychology (Williams, Surwit, Babyak, & McCaskill, 1998), behaviour genetics (Loehlin, 1992), developmental (Costa, Yang, & McCrae,

1998; McCrae, Costa, de Lima, Simoes, Ostendorf, Angleitner, Marusic, Bratko, Caprara, Barbaranelli, Chae, & Piedmont, 1999; John, Caspi, Robins, Moffit, & Stouthamer-Loeber, 1994) and cross-cultural psychology (McCrae, Costa, Del Pilar, Rolland, & Parker, 1998). Dimensional representations of psychopathology and maladaptive behaviour have been suggested as alternatives for typological symptom classification systems. The findings on the stability of traits are certainly new and provocative for developmentalists, brought up with theories postulating qualitatively different developmental stages. Cross-cultural psychologists are now confronted with at least four cross-culturally replicable dimensions to denote individual differences, suggesting that there is at least some common ground to develop personality inventories useful in a range of cultures. Finally, there have also been further stimulating explorations of the personality and intelligence interface (Furnham, Forde, & Cotter, 1998a; Saklofske, Matthews, Zeidner, Deary, Austin, & Sternberg, 1999). This overview demonstrates that the current trait viewpoint, suggesting stable and robust dimensions with strong genetic roots, has challenged different domains in psychology.

Parallel with these evolutions, critics have repeatedly argued against over-optimistic reviews of the state-of-the-art of the search for the basic dimensions underlying individual differences. Several authors have formulated criticisms and contrarian views of the current trait, and more particularly, the five-factor approach (Blinkhorn & Johnston, 1990; Block, 1995; Brand, 1994; Eysenck, 1991, 1992; Pervin, 1994). They pointed to the divergent conceptual definitions of traits and questioned the validity of the lexical hypothesis as a starting point to delineate the main factors of personality. They further highlighted 'unresolved' issues -even among five-factor enthusiasts- such as the developmental antecedents of the Big Five and the largely different viewpoints regarding the organisation of traits at the lower level. From a more applied perspective, the predictive validity of personality measures was questioned, as well as the bandwidth-fidelity dilemma.

The objectives of the present review are to investigate these criticisms and examine how advances in the assessment of the FFM may help to clarify these 'unresolved issues'. First, the conceptual status of traits will be reviewed. Secondly, alternative strategies than the adjective-based lexical approach will be examined to infer the basic dimensions of personality. Third, the developmental roots of the Big Five are examined, followed by a review of the different strategies that can be used to infer the optimal higher and lower level of traits. Finally, the validity and the level of the trait hierarchy at which predictions should be made are discussed.

Conceptual Status of Traits and Their Operationalization

Reviewing the trait literature, Pervin (1994, p. 108) concludes that all trait theorists will agree that: "a trait represents a disposition to behave expressing itself in consisting patterns of functioning across a range of situations". However, he noticed that it is less clear at the measurement level how one should understand these patterns of functioning. Indeed, inspection of the item content of personality questionnaires shows a heterogeneous item pool, referring to values, feelings, emotions, habits, social effects, preferences, social skills, desires, overt behaviour, and cognitions. He concludes that it is not clear at the operational level what should be included or excluded from the trait definition. Furthermore, there is no agreement on the conceptual status of a trait. The literature shows diverging opinions, with on the one hand authors claiming that traits are only descriptive, whereas others advocate that traits are genotypic and explain behaviour (Costa & McCrae, 1992; Eysenck, 1990). These different positions are confusing, illustrating the need for an integrative theoretical framework, defining the conceptual status of traits and providing guidelines for their operationalization.

The Five-Factor Theory (FFT)

Recently, McCrae and Costa (1996) described a meta-theoretical framework for personality theories providing a conceptual definition of traits and advancing a clear distinction between traits and their operationalizations. The framework ascribes a central role to *basic tendencies*, defined as abstract potentialities and dispositions, including motivational tendencies, which are largely inherited (McCrae & Costa, 1996; McCrae, Costa, Ostendorf, Angleitner, Hrebickova, Avia, Sanz, Sanchez-Bernardos, Kusdil, Woodfield, & Saunders, 2000). FFM traits are defined at the level of basic tendencies, as well as, among others, cognitive capacities and physical characteristics. Basic tendencies further constitute the core of the individual and define his/her potential and direction at each stage in development. They are genotypic (Jang, McCrae, Angleitner, Riemann, & Livesley, 1998) and provide explanations for behaviour. Given their abstract and latent nature, basic tendencies, are inferred from *characteristic adaptations*, which are a conceptually distinct element in this framework, and acquired and result from the interaction of the individual and the environment. Peoples' characteristic adaptations, such as recurrent behaviours, preferences, attitudes, habits, and attitudes, are signs of the underlying traits, so individual's standing on the basic tendencies is delineated from their resemblance to characteristic adaptations described in

personality inventories. Popular measures such as the California Psychological Inventory (CPI), Eysenck's Personality Questionnaire-Revised (EPQ-R), the NEO-Personality Inventories (NEO-PI-R, NEO-FFI) and the Minnesota Multiphasic Personality Inventory (MMPI) include items referring to a range of characteristic adaptations. Although the item-pool of these questionnaires is very heterogeneous (Pervin, 1994), including relationships, preferences, attitudes, behaviour and habits, the basic traits they reflect show more similarities and are defined at a conceptually distinct level (McCrae & Costa, 1996). McCrae and Costa's framework clearly articulates the genotypic character of primary traits and helps to resolve the methodological confusion between traits and their operationalizations mentioned by Pervin (1994). However, it remains an empirical question as to whether character and number of basic traits are dependent of the range of characteristic adaptations included in the inventories.

FFPI and HiPIC

Recently, two personality inventories were developed, homogeneous with respect to item format and the kind of characteristic adaptations referred to. The items in these questionnaires are all brief statements referring to overt behaviour that is observable for peers or parents and others. Given their divergent background, but common item format, they provide a unique opportunity to examine the robustness of the FFM dimensions across different methods to describe the personality domain. The first questionnaire, the Five-Factor Personality Inventory (FFPI; Hendriks, 1997) was developed within the psycholexical tradition and is based on the Abridged Big 5 Circumplex Model (Hofstee, De Raad, & Goldberg, 1992) of Dutch trait adjectives. The FFPI is a 100-item questionnaire assessing five broad dimensions of individual differences in behaviour, i.e.: Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Autonomy. Forty bipolar facet scores can be calculated as blends of the five main factors. The second questionnaire, the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 1999) was designed to describe individual differences among children aged 6 to 12 years. The HiPIC includes 144 items, hierarchically organised under five higher order domains, that can be conceptually linked to the adult Big Five. The HiPIC domain scales are labelled as Extraversion, Benevolence, Conscientiousness, Emotional Stability and Imagination. Eighteen lower-level facets are grouped under the higher order domains. The HiPIC was primarily constructed as a measurement tool to be used by parents or teachers to rate the behaviour of children, whereas the FFPI was designed as an instrument to elicit both self- and peer ratings. The items for both

inventories were written according to explicit guidelines developed by Hofstee (1991). The rules were applied to elicit ratings as objective as possible from observers and parents. All items are formulated in the third person singular, avoid negations, do not include trait adjectives and refer to overt behaviour.

Four out of Five

The restriction to overt behaviour enables the investigation whether the nature of the inventories' item pool affects the kind and number of underlying dimensions. In other words, does the restriction to overt behavioural items leads to a different personality descriptive model or do the same basic trait dimensions emerge from the analysis of a heterogeneous range of characteristic adaptations?

A comparison of the labels assigned to the higher-level scales of the NEO-PI-R, the FFPI and the HiPIC suggests that there is well-established consensus on the importance and labels for the first four of the Big Five. The NEO-PI-R is taken as a point of comparison, because this inventory has a heterogeneous item content and evolved to a standard to assess the FFM. There is a slight deviation for the Benevolence factor of the HiPIC, grouping Agreeableness facets with compliance and dominance, but this deviation may be explained by the specific target population of the HiPIC, i.e. children aged 6 to 12 years rated by their parents. For the fifth factor, however, there is less consensus regarding its importance and its most appropriate label (De Raad & Van Heck, 1994). The fifth factor of the NEO is entitled 'Openness to Experience', whereas in the FFPI this factor is called 'Autonomy'; the fifth of the HiPIC is entitled 'Imagination', grouping facets of Intellect, Creativity and Curiosity. The corresponding factor in the psycholexical studies is usually referred to as Intellect or Culture. In this respect, De Fruyt and Mervielde (1998) and Hendriks, Hofstee and De Raad (1999) conclude that the NEO-PI-R and the FFPI are *not* equivalent instruments to assess the Big Five, provided their different background, construction and labels for the fifth factor.

McCrae (1990) has argued that part of the controversy on the appropriate label for the fifth factor can be attributed to the exclusive reliance in the psycholexical studies on trait adjectives to define the range of individual differences. Although he acknowledges that there are a number of trait adjectives referring to openness to ideas, there are not enough adjectives to denote other facets of openness in the English language, such as openness to aesthetics. He suggests that sentence items might be more suited to assess Openness.

McCrae's hypothesis is supported by the portraying of an Imagination

factor in the HiPIC, constructed along an alternative route of the lexical hypothesis, not starting from trait adjectives, but developed from parental free descriptions. The first two of the three Imagination facets, i.e. Creativity, Curiosity and Intellect, illustrate that the Openness factor can be easily recovered from *sentence* items representing *overt* behaviour. In the construction of the FFPI, however, a clearly different fifth factor emerged, despite clear attempts to write sentence items referring to intellect. The FFPI fifth factor is different from both the lexical studies, accentuating an Intellect or Culture interpretation, and from Openness to Experience, despite clear attempts to include enough intellect items right from the beginning. The initial item pool for constructing the FFPI included 228 items primarily loading the fifth factor (149 items with positive loadings and 79 items with negative loadings) on a total of 914 items. The best-filled AB5C facet (V+III+, items targeted at primarily loading Intellect and having a secondary loading on Conscientiousness) had 52 items, but this facet was not represented by a single item in the final FFPI. On the other hand, the final FFPI item set included 6 of the 36 items that were initially written to represent the V+I+ (items targeted at primarily loading Intellect, with a secondary loading on Extraversion) facet. It is unclear to what extent the FFPI-item selection criteria, such as the AB5C facet projection, self-peer(s) correlation, difficulty, observability and social desirability, have contributed to this complete underrepresentation of V+III+ items and the advantaging of the V+I+ items, finally ending up with an Autonomy factor. Contrary to the FFPI, the HiPIC factor and facet structure underscores that an Openness-Imagination factor can be easily recovered from sentence items referring to overt behaviour. There is thus convergence on the number of trait dimensions across different theoretical and methodological traditions to define the personality domain within the lexical tradition, although the nature of the fifth dimension seems to be different.

Extending the Lexical Approach

The lexical approach has been frequently questioned by its almost exclusive reliance on personality descriptive adjectives taken from dictionaries (Block, 1995; Brand, 1994; Pervin, 1994). The lexical hypothesis has been examined to a more limited extent for other single word categories, such as personality descriptive verbs (De Raad, Mulder, Kloosterman, & Hofstee, 1988; Hrebickova, Ostendorf, Osecka, & Cermak, 1999) and nouns (De Raad, 1992). With exceptions for the Hungarian (Szirmak & De Raad, 1994) and the Italian languages (DiBlasi & Forzi, 1999), the Big Five has been replicated cross-culturally in a series of Indo- and Non-Indo-European cultures (Yang & Bond, 1990; Somer & Goldberg,

1999) examining the underlying structure of adjectives. The results for the other word categories are less equivocal. McCrae and Costa (1987) attempted to see if the Big Five factors could be retrieved when factoring the items and scales of popular personality questionnaires. They convincingly demonstrated that the majority of the personality scales were substantially related to the five factors and that no further factor was replicable across instruments. The previous studies, however, all started from a pre-defined set of personality descriptors – a list of adjectives or personality scales- and one cannot exclude that other replicable factors would emerge, starting from another source of personality descriptors.

Inspired by the work of John (1990a, 1990b), who elicited personality descriptors from Californian college students, an international group of trait researchers examined the underlying structure of parental free descriptions of their children's personality (Kohnstamm, Halverson, Mervielde, & Havill, 1998). The study of free descriptions can be considered as an extension of the lexical approach, enabling an examination of the active instead of the passive personality descriptive vocabulary. The analysis of free descriptions further provides insight in the way people phrase personality description in daily transactions and it takes into account the frequency of use of descriptors. Phrasing and frequency of use are inherent characteristics of the lexical approach, but they had not been subject to systematic investigation. The study of free descriptions further avoids theoretical biases about the descriptors thought to be relevant to denote individual differences and it enables to define the range of behaviour of particular groups, such as children. For example, is Rhythmicity indeed a salient dimension to describe differences among children from a parents' perspective, or is it only important in Thomas and Chess' nine dimensional temperament model (1977, 1989)?

Kohnstamm and his international research group (1995) developed coding rules to decompose transcribed interviews with parents into brief personality descriptive units. Parents were simply asked: "Can you tell me what you think is characteristic of your child?" to elicit personality descriptions. No additional instructions and only neutral prompts were given. Interviews were tape-recorded and transcribed verbatim afterwards. His team further developed a category system to assign all personality descriptive units from the interviews. This personality descriptive lexicon was inspired by the FFM, with the first five categories explicitly referring to the five factors. Eight additional categories were included from the developmental literature, tentatively labelled as Independence (VI), Mature for age (VII), Illness, handicaps and health (VIII), Rhythmicity (IX), Gender appropriate behaviour (X), Physical attractiveness (XI), Cuddliness and clinging behaviour (XII), Relationships with siblings and parents (XIII), and

finally a rest category for descriptors that could not be classified (XIV). The category system partly follows the FFM, but does not preclude that other dimensions outside the FFM will emerge (Kohnstamm et al., 1995).

The results show that between 70 to 80 per cent of all parental free descriptors could be classified as instances of the Big Five (Kohnstamm et al., 1995, 1998). Furthermore, Mervielde (1998) demonstrated that 68 percent of all parents referred to at least four of the Big Five categories, whereas less than 10 percent referred to only two or just one category. These results only tentatively underscore the comprehensiveness and saliency of the Big Five, because they just reflect the results of a classification process, rather than providing insight into the dimensions underlying individual differences assembled through a free description procedure.

Developmental Antecedents of the Big Five

The Little Five

The majority of the research on the basic dimensions of personality has been conducted with adults. Little is known, however, about the developmental precursors of these dimensions. Buyst, De Fruyt and Mervielde (1994) have argued that the structure of adult individual differences cannot be transposed to the study of children without empirical verification. A review of the temperament literature suggests that not all of the Big Five factors are salient dimensions for the description of childhood personality, at least not in their adult conceptualisations (Halverson, Kohnstamm, & Martin, 1994). Thomas and Chess' nine-dimensional model and Buss and Plomin's Emotionality, Activity and Sociability (EAS) dimensions, for example, suggest that not all of the Big Five are to be considered as main dimensions for the description of children's individual differences. Thomas and Chess further suggest dimensions outside the FFM, such as for example Rhythmicity. Findings from temperament research contradict trait-studies that demonstrate that the Big Five can be retrieved in parent (Buyst et al., 1994; Slotboom, Havill, Pavlopoulos, & De Fruyt, 1998) and teacher ratings (Digman, 1963; Mervielde, Buyst, & De Fruyt, 1995) using adjective lists or Q-sort methodology (Block & Block, 1980; John, et al., 1994; Van Lieshout & Haeselager, 1994). More recently, Mervielde and De Fruyt (2000) demonstrated that children's peer perception follows a multi-dimensional scheme that can be represented in terms of combinations of the Big Five dimensions. The temperament field has been separated from the trait domain for a long time, with the first mainly focussing on dimensions that are prominent early in development with a

strong biological and genetic basis, whereas that trait approach has been mainly concerned with the study of lexically derived dimensions of individual differences in adults.

The Big Five and Beyond From a Developmental Perspective

The previous studies, however, do not provide evidence that only the Big Five are salient and replicable for children, because all studies started from a pre-defined set of trait adjectives (Digman, 1963; Mervielde et al, 1994), Q-sort items (John et al., 1994) or nomination scales (Mervielde & De Fruyt, 2000). One cannot exclude the possibility that other dimensions prove to be necessary to describe the range of individual differences among children. If the objective is to examine the validity of the Big Five as the underlying structure of the childhood behavioural repertoire, then one must first define the range of characteristic behaviour of children in the age groups of interest. One approach is by assembling the items of temperament and childhood personality questionnaires and examining their underlying structure. This approach parallels Costa and McCrae's (1992) work with adult inventories. However, almost all temperament and personality scales for children are developed from a theoretical and conceptual (often clinically based) starting point and usually cover a too broad age range. Buss and Plomin's EAS, for example, is used to describe the temperament of subjects ranging from 3 to 15 years. However, the behavioural repertoire of 4-year old children is considerably different from the behaviour of children leaving primary school, so the available measures probably do not reflect the full range of individual differences that can be reliably observed among children. What is often the case is that trait researchers develop measures of "adult traits" for children, for example the Junior Eysenck Personality Inventory (Eysenck, 1965). Another good example is the locus of control literature where there are now nearly fifty different measures, some very specifically devised to measure the beliefs of children and adolescents (Furnham & Steele, 1993).

The Structure of Free Descriptions

Kohnstamm's international research group applied an alternative procedure to define the range of childhood behaviour and examined the content and structure of parental free descriptors of children aged 3 to 12 years (Kohnstamm, Halverson, Mervielde, & Havill, 1998). Kohnstamm et al. (1995) and Slotboom et al. (1998) demonstrated that parents provided more descriptors that could be classified as instances of the first five categories of the personality descriptive lexicon with increasing age of the children. Inspired by Norman's clustering work (Norman, 1967) with trait

adjectives, Mervielde and De Fruyt (1999) further structured the categories of the personality descriptive lexicon into small clusters, relatively homogeneous with respect to the behaviour included. Three item pools were assembled, closely reflecting the content of the clusters, for children aged 5 to 7, 8 to 10 and 11 to 13. Principal component analysis, followed by varimax rotation, shows a five-factor structure for all age groups, with clearly identifiable Extraversion, Benevolence-Agreeableness, Conscientiousness, Emotional Stability and Imagination components. Although, the labels for two of the five are somewhat different from the adult Big Five, all factors can be conceptually and empirically related to the adult Big Five (De Fruyt, Mervielde, Hoekstra, & Rolland, in press). Longitudinal research will ultimately demonstrate whether these dimensions and facets can be considered as developmental precursors of the adult Big Five and their lower level traits. The analysis of the parental free descriptions strikingly parallels Shiner's (1998) literature search for the most important constructs to describe individual differences in children. Both the empirical and the conceptual analysis of children's individual differences do not reveal important dimensions outside the five-factor framework and thus extend and confirm the results from the lexical approach starting from trait adjectives.

The Broad Versus the Specific Level

Lower-Level Structure

Although consensus at the broad level is far from complete (Eysenck, 1991, 1992; Block, 1995; Pervin, 1994, Tellegen & Waller, in press; Zuckerman, 1991; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993), the conceptualisation of traits at more specific levels of measurement is even more divergent. The majority of the personality psychologists agree that assessment at intermediate levels of the hierarchy, in-between the higher level factors and specific behaviour, is not only feasible for applied purposes, but is also necessary for making up personality theories. Hofstee, De Raad and Goldberg (1992) distinguish 45 bipolar facets in their AB5C model, whereas Costa and McCrae measure 30 facets in the NEO-PI-R (1992). Gough's California Psychological Inventory (CPI) includes 30 to 35 lower-level facets, Cloninger's TCI (Cloninger, Svrakic, & Przybeck, 1993) has 25 and Mervielde and De Fruyt's (1999) HiPIC assesses 18 lower-level traits. The NEO has a similar number of facets under each domain, whereas the HiPIC and the TCI group an unequal number of scales under their higher-level factors. Agreement on the optimal number of lower-level traits is thus far from established.

Nearly 50 years ago, Eysenck (1953) distinguished between four hierarchical levels, which he called the type level, the trait level, the habitual response level and the specific response level. In the applied fields of clinical, educational and work psychology, researchers and practitioners favour working with more fine-grained constructs, as opposed to the super-trait level (Big Three or Big Five) favoured by personality theorists. Successful business executives, police officers and nurses, for example, may all share the profile of being stable, conscientious, extraverts (super trait descriptions) (De Fruyt & Mervielde, 1999b) but once examined on the second level they appear quite different: thus within the Conscientiousness super trait business people may be very high on achievement striving but moderately low on order and dutifulness, whereas for police officers and nurses the reverse may be true, though they both have identical total conscientiousness scores (Furnham, Crump, & Whelan, 1997).

Strategies to Infer the Lower-Level

Three different strategies can be identified in the recent personality scale-development literature to delineate the character and optimal number of lower level traits. The most commonly applied strategy is a "top-down" approach where external criteria are used to determine character and number of traits that should be distinguished at the lower level. Clinical and I/O practice or the personality descriptive literature can be used as criteria to judge the importance of traits at the lower level. A review of the personality assessment literature helps to identify the most important traits that have survived several years of empirical research. For example, a trait such as 'hostility', turned out to be the major element in the type A behavioural pattern, responsible for the relationship between personality and the development and progress of cardiovascular disease. Thus, if the objective is to construct a comprehensive omnibus trait questionnaire, 'hostility' should be included as a facet. Costa and McCrae's NEO-PI-R (1992) was constructed adopting this strategy. However, this strategy is less appropriate to delineate the optimal number that should be represented at the lower level. There are, for example, no empirical arguments why there should be exactly six facets grouped under each NEO-PI-R domain. Nevertheless, the strategy is appealing, because it helps to identify constructs in which theorists and practitioners are interested for research and applied purposes. An alternative strategy is to define lower-level traits in terms of their usefulness to describe external criteria, such as for example psychopathology. Cloninger's Temperament and Character Inventory (Cloninger, Svrakic, & Przybeck, 1993) distinguishes 25 subscales thought to be necessary to adequately describe adaptive and maladaptive behaviour.

A second strategy delineates the kind and number of facets using more empirical and data-driven procedures. The first step is to define the domain and range of individual differences that ought to be represented. Mervielde and De Fruyt (1999b) and Elphick, Slotboom and Kohnstamm (1997), for example, assembled a large pool of parental personality descriptors of children using a free description procedure. The second step is to sort all the descriptors into small clusters, largely homogeneous with respect to descriptive meaning. The third step is to write items to represent the content of these clusters (Mervielde & De Fruyt, 1999) or to select representative descriptors from the descriptors in each cluster (Slotboom & Elphick, 1997). The final assembled item pool is then submitted to a large number of raters. The higher order level can be easily identified using factor analytic procedures, with the replicability of the obtained factor solutions across different samples as an important criterion to judge on the number of factors to retain. Once the higher order factors are established, different procedures can be applied to further structure the items primarily loading a factor. Principal component analysis of the items primarily loading each factor, followed by oblique rotation, was used to delineate the kind and number of facets for each HiPIC domain factor. It should be clear that the successful application of such a strategy is critically dependent on the number of personality descriptors at the start. A large initial item pool is primarily necessary to guarantee that all salient individual differences are included and is especially important to end up with enough items to construct facet scales. The HiPIC, for example, was constructed from a large redundant pool of near to 10,000 free personality descriptors, represented by almost 350 items. Although each of the facets constructed this way, measures a relatively narrowly defined trait, bandwidth is created by the number of facets included in the questionnaire, making the HiPIC a comprehensive tool to describe individual differences.

Finally, a third strategy is the further segmentation of circumplex representations of traits, inferring facet scores from blending the primary factors. Forty bipolar facet scores can be calculated, for example, in the FFPI, as blends of the five factors (Hendriks, 1997). Although, this procedure inevitably leads to a more fine-grained description, the facet scores calculated this way are only linear combinations of the primary factors and thus one cannot expect that they will capture specific variance not included in the main factor measures. An alternative approach is to write items to measure all facets that can be constructed by pairing all the primary factors. This approach is advocated by Goldberg (1999) and applied for the construction of the International Personality Item Pool project (IPIP).

Importance of Level

Research on the kind and optimal number of lower-level traits is of particular importance for the study of personality development and current behaviour genetic research. An established hierarchy of traits allows for testing heterotypic continuity models that predict higher correlations between different traits across two developmental stages than between the same traits. A model defining the optimal higher and lower level of traits provides the best opportunity to detect such heterotypic relationships, linking facet x_1 from domain X at stage I to facet y_1 from domain Y at stage II for example. Another possibility is that a lower level trait achieves higher-level status later in development or vice versa. A temperament factor such as 'Activity' might merge with other facets into a broad Extraversion component later in development. The recent interest and progress in the investigation of links between genes and behaviour further necessitates the availability of reliable and fine-grained behaviour taxonomies and assessment instruments. Inventories, incorporating higher and lower-level traits, such as the TCI and the NEO-PI-R, are frequently used in studies on the molecular genetic basis of individual differences. Recent genetic research investigates the association between genes of small effect size in multiple-gene systems, the so-called quantitative trait loci (QTL), and phenotypic traits (Plomin & Caspi, 1998; Plomin & Rutter, 1998). The first QTL association for personality was reported for 'novelty seeking', a trait assessed by the TPQ and the TCI (Cloninger, Adolfsson, & Svrakic, 1996). Finding such QTL associations for personality traits is critically dependent, among other factors, on the availability of reliable and valid phenotypic assessment instruments. In order to advance the comparison and replication of research findings, one further needs information on the equivalence of the used inventories (De Fruyt, Van De Wiele, & Van Heeringen, 2000).

Predictive Validity of Traits

Although some critics are not convinced that predictive validity is the best measure of a theory (Pervin, 1994), we believe it is a crucial criterion by which to evaluate models and theories. Of the many types of validity described by psychometricians (face, concurrent, divergent), it is predictive validity that is without doubt the most important, but often most difficult, to establish. Indeed, a theory may explain a phenomenon *post hoc*, but competing theories explain the same observation in sometimes radically different ways, with usually little opportunities to empirically verify the suggested processes and mechanisms. Predicting *a priori*-defined, specific,

behavioural criteria, however, enables a comparison and evaluation of the usefulness and validity of competing models. Personality measurement involves the assessment of typical rather than maximal characteristic adaptations and the prediction of future behaviour is best understood in terms of the regularities found in past behaviour. Consistent interest in the whole topic of lying and dissimulation in self-report measures is no doubt due to the fact that it threatens the fundamental predictive validity of all personality questionnaires (Furnham, 1986; Goffin & Woods, 1995; Hofstee, Ten Berge, & Hendricks, 1998).

The predictive validity of traits has been extensively examined in the field of I/O psychology. Reviewing the recent literature and especially the meta-analyses (Barrick, & Mount, 1991; Salgado, 1997; Tett, Jackson, & Rothstein, 1991; Tett, Jackson, Rothstein, & Reddon, 1994; Ones, Mount, Barrick, & Hunter, 1994), the balance seems to be in favour of the hypothesised relationship between personality and occupational outcomes. Despite early scepticism (Guion & Gottier, 1965), Barrick and Mount's meta-analysis re-introduced traits to I/O psychologists, generating a wide stream of studies in which personality traits played a central role. The introduction of the FFM to I/O researchers and practitioners influenced their work in at least three different ways. First, the FFM framework was used for new meta-analyses (Ones, Viswesvaran, & Schmidt, 1993, 1995; Salgado, 1997, 1998; Tett, Jackson, & Rothstein, 1991) aimed at replicating and extending previous findings relating personality measures to different criteria, or the model formed the basis to organise reviews of the personality and vocational literature (Tokar, Fischer, & Mezyldo Subich, 1998). Secondly, once I/O researchers were convinced of the validity of traits to predict performance, trait measures were included in research and practice (e.g. De Fruyt & Mervielde, 1999; Dunn, Mount, Barrick & Ones, 1995). Finally, the FFM inspired and guided a re-analysis of previously collected data sets, including markers for (some of) the Big Five (Fried, Hollenbeck, Slowik, Tieg, & Ailan Ben-David, 1999; Wooten, Timmerman, & Folger, 1999). The correlation coefficients between these traits and performance criteria usually range from .10 to .40, suggesting that traits play an important role in understanding the criteria of interest (De Fruyt & Mervielde, 1999b). Furthermore, traits explain job performance over and above other predictors, such as general mental ability, underscoring their incremental validity in selection and assessment procedures (Schmidt & Hunter, 1998).

There are reasons to assume that the magnitude of the previous correlations is probably an underestimation of the true validity of traits. Personality scales in the meta-analytic studies (Barrick & Mount, 1991; Salgado, 1997; Tett et al., 1991) are assigned to only one factor, on the assumption that a scale is a factor-pure marker for a Big Five dimension.

This type of approach neglects the relationships between a trait or a scale and other Big Five dimensions. The research by Hofstee, De Raad and Goldberg (1992) has demonstrated that a considerable number of traits have substantial secondary loadings, and that the trait sphere may therefore best be described in terms of circumplexes. Classification of the scales according to their position in the AB5C space would create less heterogeneous groups of 'personality measures', probably leading to an increase in the validity coefficients. A similarly refined grouping of occupations is also to be recommended. Although the meta-analyses supported the validity of Conscientiousness and to a lesser extent of Emotional Stability across occupational groups, Extraversion was (inconsistently) related to job performance in jobs involving social interaction, such as managers and sales representatives (Barrick & Mount, 1991). Salgado (1997), however, could not replicate the job-specific findings for Extraversion in studies with West European subjects.

It is not clear whether these inconsistencies reflect real cultural differences or can be explained in terms of similar occupational titles referring to different job content. The majority of the validity studies are restricted to a few occupational groups, and the meta-analyses lack a coherent framework for the description of the common characteristics underlying different jobs. Classification by occupational group is usually based on the occupational title provided in the original research. However, similar titles may represent jobs covering a substantial variety of tasks, methods, objectives and acquired traits, resulting in heterogeneous occupational clusters and hindering proper assessment of job-specific validity. Even if a job title adequately represents the content of a particular job, it generally fails to capture the organisational context and may therefore hinder optimal analysis of the relationship with performance criteria.

Bandwidth-Fidelity Problem

The bandwidth-fidelity dilemma has been discussed in detail the past years (Ashton, 1998; Hogan & Roberts, 1996; Moberg, 1998; Ones & Viswesvaran, 1996; Paunonen, 1998; Schneider, Hough, & Dunette, 1996). In general, narrow traits are thought to be more useful in making specific predictions, whereas higher order traits are expected to be better to make broader and more general predictions. Ones, Schmidt and Viswesvaran (1995) and Ones and Viswesvaran (1996), however, posit that a broad integrity based factor subsumes several of the Big Five dimensions. This general factor of personality is positively correlated with Conscientiousness, Agreeableness and Emotional Stability and is assumed to be the core

element underlying many of the trait-performance criteria relationships. In their view, this general integrity factor is similar in scope as the g factor underlying cognitive functioning. This factor is therefore expected to outperform narrow traits in prediction studies. Ones et al's claim has been discussed and discounted by several researchers providing empirical evidence that narrow traits outperform broader traits, depending on the criteria. Ashton (1998) questioned the existence of a broad, integrity-related, general factor and demonstrated that two narrow traits had higher validities than the Big Five dimensions to predict self-reported workplace delinquency. Paunonen (1998), in two separate studies, compared the accuracy of higher and lower level traits in predicting a set of criteria with social significance. The results were convergent and demonstrated that aggregating lower level traits into their higher level factors might lead to a decreased predictive accuracy, due to the loss of trait specific variance that might be relevant to predict the criteria under consideration. Moberg (1998) demonstrated that lower-level traits were predictors of conflict strategy, rather than higher level traits that failed to show consistent relationships. In their comment on Ones and Viswesvaran (1996), Hogan and Roberts (1996, p. 627) summarise viewpoints and facts and suggested that: "... the nature of the criterion dictates the choice of predictors and matching predictors with criteria always enhances validity".

The Future of Personality Assessment

The rejuvenation and revitalization of personality research, partly because of the general acceptance of the FFM, has inspired a new generation of personality test psychometricians. Whilst there remain cynics and sceptics in the whole enterprise (Kline, 1998; Maraun, 1997), there is an air of excitement and progress in the area of personality measurement. The present review has demonstrated that FFM researchers and scale-constructors took advantage of several previously raised criticisms, incorporating them in their research programme.

The articulation of the Five-Factor Theory provides a conceptual framework to define traits and delineate their operationalizations. The emergence of an 'Imagination' factor in the research with children, with facets referring to Openness and Intellect, underscored the importance of the fifth factor of the Big Five, whereas the 'Autonomy' label for the fifth factor in the FFPI underscored McCrae's contention that Openness is not well represented in lexical research starting from adjectives. The work on the underlying structure of parental free descriptions has extended the adjective-based lexical research, demonstrating that the FFM is also a useful

framework to sort the active personality descriptive vocabulary. Developmental antecedents of the adult FFM dimensions proved to be both sufficient and exhaustive to describe childhood individual differences, expanding the research agenda for personality psychologists interested in longitudinal research. Three different strategies were described to infer the kind and number of lower-level traits, though consensus in this area was not achieved. Finally, progress in domain and facet level assessment and the use of meta-analytic techniques demonstrated that traits have predictive validity.

A close inspection of the major journals over the last decade suggests a number of additional themes along which future assessment developments should focus. First, the older questionnaires have been subjected to detailed scrutiny using the latest advanced multivariate statistics of which the favourite appears to be structural equation modelling (Bedford & Deary, 1997; Perugini, 1999). This has allowed researchers to take a much more critical look at particular questionnaires and to relate their scores to others in the same area (Costa & McCrae, 1995). Along with meta-analytic work this re-examination of the psychometric properties of established questionnaires has helped clarify the differentiated predictive validity of certain traits over others.

Second, there has been an active research programme concerned with personality test taking style. There have been many objections to the reliance on self-report questionnaires by personality theorists. Perhaps the most common criticism concerns the issue of faking which threatens the validity of all tests. However, there has also been a series of studies on the self-report of attitudes and behaviours that show that precisely how the questions are asked in inventories considerably shapes the answers. In a useful review Schwarz (1999) has demonstrated how response alternatives, question context and frequency alternatives can have a tremendous impact on outcome scores. Various researchers have highlighted differences in computerized vs conventional administration of well-established questionnaires (Merten & Siebert, 1997). Others have concentrated on particular features of test taking like time (response latency) and indecisiveness (use of don't know) (Furnham, Forde, & Cotter, 1986b; Holden & Hibbs, 1995; Jackson, Furnham, & Lawty-Jones, 1999). These test taking styles have been particularly useful in detecting faking as well as measures of neuroticism in their own right.

Third, while personality questionnaires have again become popular in clinical, educational and I/O psychology, considerable interest in biological correlates of individual differences has led biological factors to be seen as useful correlates of personality. Biological factors have been considered both as independent and dependent variables such that personality change or disturbance has been seen to be a consequence of certain genetic, hormonal,

pharmacological or other factors; while personality factors have been shown to have a direct influence on personal physical health. Indeed, it is the area of biological perspectives on personality structure and measurement that promises to be most interesting over the next decade.

The long soul searching period of the 1970s and 1980s that was characterized by situationalism, interactionism and constructivism seems to have been replaced by a period of optimistic and sophisticated expansionism – not least in the whole area of personality measurement. The assessment of the fundamental personality traits is clearly moving into a new phase of its development.

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