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Big-Five Model

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Synonyms

B5M; FFM; Five-factor model; OCEAN

Definition

The Big-Five Model (B5M) is a representation of the universe of personality traits in terms of five broad personality dimensions: Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Intellect or Imagination. These five dimensions emerged reliably over decades of research factor-analyzing the way people describe each other with ordinary language traits such as *aggressive*, *introverted*, and *sociable*. The B5M is nearly identical to the Five-Factor Model (FFM), which emerged from research based on personality questionnaires. Although both the B5M and FFM have common roots in the research of Raymond Cattell and although the terms B5M and FFM are often used interchangeably today, the two models have distinctive histories, are based on different methods and theoretical assumptions, and hold slightly different conceptions of the factors, especially the fifth factor, labeled

Openness to Experience in the FFM. The FFM also uses the opposite of Emotional Stability, Neuroticism, to label the fourth factor, and some individuals reorder the factors to spell the acronym OCEAN.

Introduction

This encyclopedia entry reviews the history of the B5M and FFM and discusses issues with the models that are being addressed by current research. This research includes studies that address (1) the best way to conceptualize the factors, (2) optimal ways of operationalizing the factors, (3) optimal division of each of the factors into subfactors of personality, and (4) whether the factors might be combined into superfactors.

History of the Big-Five Model

In their overview of the five major personality factors, McCrae and John (1992) observed that the Big-Five Model and Five-Factor Model emerged from two distinct historical pathways. The first, and older, historical origin of the B5M can be found in analyses of personality-descriptive words from ordinary language. Because these words were identified from a dictionary (lexicon), this line of research is often called the *lexical research program* or lexical tradition. The second historical path to the five major personality factors

is found in questionnaires designed by professional psychologists to represent theoretical constructs or for practical applications such as psychiatric diagnosis or personnel selection. This second historical line of research is therefore called the questionnaire research program or tradition.

The Lexical Research Program

John et al. (1988) have provided a detailed account of the history of the lexical research program. The lexical research program has been based on what has been called "the fundamental lexical hypothesis – namely that the most important individual differences in human transactions will come to be encoded as single terms in some or all of the world's languages" (Goldberg 1990, p. 1216). Various researchers from England, Germany, and the United States were guided by the fundamental lexical hypothesis, the most influential being Gordon W. Allport.

Gordon W. Allport. Harvard psychologist Gordon W. Allport and Dartmouth psychologist Henry S. Odbert undertook a project to exhaustively catalog every word in the English language that is "descriptive of personality or personal behavior (save those that are obsolete) included in Webster's New International Dictionary" (Allport and Odbert 1936, p. 24). After identifying 17,953 personality-descriptive words, Allport and Odbert sorted these traits into several categories. Most of the words fell into categories that they considered to be ill-suited for a scientific description of personality. The inappropriate words included 4541 terms that described temporary states or activities (e.g., *satisfied, scared*), 5226 terms that described social evaluations (e.g., *fascinating*, *insignificant*), and 3682 miscellaneous terms that described physical characteristics commonly associated with psychological traits (e.g., *lean*, *redheaded*), capacities and talents (e.g., *gifted*) or were metaphorical or obscure (e.g., *hard*, *piggish*).

The only category they considered to be appropriate for personality description contained 4504 terms that referred to stable traits that objectively describe people (e.g., *aggressive, introverted, sociable.*). This subset of 4504 terms, which trait researchers have called *prime trait terms*, became the starting point of future efforts to derive a set of basic personality traits.

Raymond B. Cattell. The next step toward the Big-Five Model was undertaken by Raymond B. Cattell. Cattell was responsible for advancing both the lexical and questionnaire research tracks that initially went in different directions until they were reunited in the 1970s. Cattell recognized that a list of 4504 personality trait terms was still impractically long for research studies and undertook a procedure for reducing this list. Cattell's descriptions of his procedure were sometimes imprecise and inconsistent across publications. The summary of that procedure below reconstructs as accurately as possible what Cattell did.

Cattell first added to Allport and Odbert's (1936) list of 4504 prime trait terms 100 terms from their list of temporary states or moods. Next, he and a student of literature sorted the terms into roughly 160 clusters of terms they judged to be synonyms or nearly identical in meaning (e.g., *effusive, gabby, loquacious, talkative*). Most of these clusters were bipolar, which means he paired each trait word with an opposite (e.g., *talkative* vs. *silent*). He wanted each cluster to have roughly the same number of terms, so he selected about 13 terms from each cluster to represent the cluster and discarded the remaining terms. Not satisfied with limiting his study to words from ordinary language, Cattell supplemented his clusters by adding new clusters based on technical terms from psychological research, especially terms dealing with neurosis and psychosis. He also added a cluster representing general intelligence, 9 special abilities, and 11 clusters describing interests. In some reports the total number of clusters he reports is as high as 181 or 182, but most of his publications concern research on 171 clusters (John et al. 1988).

Next, Cattell had knowledgeable acquaintances of 100 adults rate how characteristic or uncharacteristic each of the 171 clusters was in describing the target person's personality, and then Cattell computed Pearson correlation coefficients among all 171 variables. Pearson correlation coefficients represent how strongly any two

ratings are related. For example, when acquaintances rated the "talkative" cluster to be characteristic of a target person, they also considered the "enthusiastic" cluster (which included the terms *enthusiastic*, *exuberant*, *high spirited*, and *lively*) to be characteristic of the same person, so ratings for these two trait clusters were highly correlated. Mathematically, Pearson correlation coefficients can range from −1.00 to 1.00.

This phase of his research was prior to the advent of computers, so the Pearson correlations had to be computed by hand using mechanical adding machines. The amount of human error in these calculations is unknown, but some clerical errors have been documented (Goldberg 1993). The result of these computations was a 14-square foot table of correlations that was so large that it had to be spread out on the floor of a gymnasium for examination. Cattell's research team literally crawled around the floor, inspecting the correlations to find the largest values. When they found correlations greater than 0.83, Cattell considered the clusters identical (measuring the same thing). Correlations between 0.45 and 0.83 were considered to indicate clusters that were similar enough to belong together. Any three clusters that belonged together he called a triad; four clusters, a tetrad, and five clusters, a pentad. By grouping the 171 clusters into triads, tetrads, and pentads, Cattell reduced the number of clusters from 171 to 67 (Cattell 1943) or 69 (Cattell 1946). Cattell later reported that he retained only 58 clusters that were replicated in further analyses. Over a period of time, by simply looking at and thinking about the content of the clusters, he dropped many of them, added others, and eventually reduced the number of clusters to 35, 36, or 42 (John et al. 1988).

Finally, using the University of Illinois' first computer, ILLIAC I, Cattell submitted ratings on the 35 broad clusters to a statistical procedure called factor analysis. Numerous variants of factor analysis exist, but they are all designed to reduce data by identifying sets of measurements that are related to each other, yet relatively unrelated to other sets of measurements. Each set of related measurements is called a factor. Cattell employed a variant of factor analysis that included what is called *oblique rotation*, which allows the factors to overlap somewhat. This is rarely done today, as researchers prefer *orthogonal rotation*, which produces factors that are completely distinct and independent of one another. Factor analyses with oblique rotation tend to produce more factors than analyses with orthogonal rotation. Cattell's factor analysis produced 12 lexical factors.

Not satisfied with this number, Cattell added four personality constructs that he felt were necessary for covering all essential personality traits. He created a self-report questionnaire, still in use today, called the 16PF, to measure the 16 personality factors. Cattell therefore contributed to both the lexical research program by reducing Allport's list of prime trait terms to 35 clusters or 12 factors and to the questionnaire research program by constructing a questionnaire based on the lexical factors. The precise way in which the 16PF led to the Five-Factor Model in questionnaire research will be explained in the later section on this history of the questionnaire research program. The next question for the lexical research program is how Cattell's 12 lexical factors eventually became five factors.

Ernest Tupes and Raymond E. Christal. Ernest C. Tupes and Raymond E. Christal were two relatively unknown research psychologists working at Lackland Air Force Base in Texas during the 1950s and 1960s. The project that eventually gave them recognition as fathers of the Big-Five Model was an attempt to use peer ratings of personality to select pilots. Their peer rating study was motivated by a concern that self-reports could be too easily faked. Ironically, their peer rating system was never used for pilot selection out of concern that peers might provide biased ratings in order to improve their own chances of being selected.

Tupes and Christal took interest in an article by Donald Fiske (1949), who conducted a factor analysis of simplified descriptions of 22 of Cattell's clusters and reported five factors instead of 12. Fiske forwarded several possible reasons for finding five rather than 12 factors, one of which was his decision to use a rotation that resulted in relatively independent rather than overlapping factors. Tupes and Christal (1961/1992)

followed up on this suggestion by reanalyzing the staff ratings and teammate ratings from Fiske's sample and the ratings from two of Cattell's samples, using orthogonal rather than oblique rotation. They similarly analyzed ratings of Cattell's 35 personality clusters with data from four new samples: three large samples of Air Force Officer Candidate School graduates and a large sample of students from the Air Force Command and Staff School Class. In all eight data sets, they found clear evidence of the same five factors, which they labeled *Surgency*, *Agreeableness*, *Dependability*, *Emotional Stability*, and *Culture*.

Scholars today agree that the discovery of the five major personality factors by Tupes and Christal might have languished in obscurity because their results were reported in an Air Force technical report, except that Warren Norman, a professor at the University of Michigan, read their report and attempted a replication with students at his university.

Warren Norman. Rather than use all 35 of Cattell's personality clusters, Norman (1963) chose four clusters that he thought best represented each of the five factors identified by Tupes and Christal. He then had members of four groups of students (ROTC seniors, two fraternity samples, and dormitory residence hall men) nominate one-third of the other members of his group who best represented one pole of a personality cluster (e.g., *talkative*) and the one-third who best represented the other pole (e.g., *silent*). The summed ratings were subjected to factor analysis with orthogonal rotation. Norman (1963) reports a clear replication of Tupes and Christal (1961/1992), although he chose slightly different names for some of the five factors.

The factor names and summary labels for the personality cluster scales used by Norman are as follows: (I) *Extroversion or Surgency* (talkative-silent; frank, open-secretive; adventurous-cautious; sociable-reclusive), (II) *Agreeableness* (good-natured-irritable; not jealous-jealous; mild, gentle-headstrong; cooperative-negativistic), (III) *Conscientiousness* (fussy, tidy-careless; responsible-undependable; scrupulous-unscrupulous; persevering-quitting, fickle), (IV) *Emotional Stability* (poised-nervous, tense; calm-anxious; composed-

excitable; not hypochondrical-hypochondriacal), and (V) *Culture* (artistically sensitive-artistically insensitive; intellectual-unreflective, narrow; polished, refined-crude, boorish; imaginative-simple, direct). This ordering of the five factors, complete with Roman numerals, became a standard in subsequent lexical research (e.g., Hofstee et al. 1992).

Norman ended his article by quoting and commenting on the following concluding remarks in Tupes and Christal's technical report, "It is unlikely that the five factors identified are the *only* fundamental personality factors. There are quite likely other fundamental concepts involved among the Allport-Odbert adjectives on which the variables used in the present study were based [p. 12]" (Norman 1963, p. 582). Norman (1963) suggested that the next step in the lexical research program should be "to return to the total pool of trait names in the natural language – there to search for additional personality indicators not easily subsumed under one or another of these five recurrent factors" (p. 582).

Returning to the total pool of trait names is exactly what Norman (1967) did in subsequent research. He repeated what Allport and Odbert (1936) had done with the 1925 unabridged edition of *Webster's New International Dictionary*, using the more recent third edition of *Webster's New International Dictionary*. Although he reported finding about 9046 additional trait words, he said that most of the "new" terms were previously identified words with added prefixes or suffixes. Only 171 truly new words were added to the Allport and Odbert list. From this complete list, Norman selected what he considered to be 2800 prime trait terms. He reduced this set of terms to 1431 by eliminating terms that University of Michigan students had trouble understanding. He then organized these 1431 terms into 75 categories based on his understanding of their similarities in meaning. However, he did not subject his set of trait terms to factor analysis. That task was undertaken by Lewis R. Goldberg.

Lewis R. Goldberg and John M. (Jack) Digman. Despite the apparent potential of the five recurring personality factors for providing a basic taxonomy for personality research, that

potential was not realized until decades later. Critiques of personality assessment during the late 1960s and throughout the 1970s virtually stopped the publication of personality measurement research in what was sometimes called "the decade of doubt" (Digman 1996). Robert Hogan, today one of the most important personality psychologists in the history of the Big-Five Model, reported (Hogan and Foster 2016) "In the late 1960s and early 1970s, there was a wall of resistance against personality assessment in academic psychology. The first 13 papers R. Hogan submitted for publication came back without being reviewed. Editors said things like 'Everyone knows personality assessment doesn't work, so we're not going to review this paper'" (p. 40).

Lewis R. Goldberg of the University of Oregon and the Oregon Research Institute helped to make personality measurement research acceptable again by extending the work of Warren Norman. Goldberg administered Norman's 1431 trait terms, along with some additional terms, to a sample of university students. This methodology differs considerably from prior lexical research in that research participants rated themselves on hundreds of individual trait words rather than being rated by others on clusters of personality traits. When he summed the 1431 ratings according to Norman's 75 categories and submitted the scores to factor analysis, they produced the familiar five-factor structure. The Zeitgeist was still negative for personality measurement research, however. Instead of publishing his results in peer-reviewed journals, Goldberg presented them in a symposium organized by Jack Digman for the annual meeting of the Western Psychological Association (Goldberg 1980) and described them in two invited book chapters (Goldberg 1981, 1982). In his 1981 chapter, he coined the term "big five" (in lower case and in quotation marks). The 1980s saw an improvement in the climate for publishing personality measurement research. By the end of the decade, Goldberg (1990) was able to publish his extensive factor analyses of Norman's trait terms.

There was another reason that Goldberg did not advocate for the Big-Five Model until 1990. In an historical review of the Big-Five Model,

Goldberg (1993) said that initially he and Norman were both skeptics about the Big-Five structure. Norman's skepticism is what led him to repeat the Allport and Odbert (1936) lexical search and to develop his own 75 clusters of personality trait terms. While acknowledging throughout the 1980s that the Five-Factor Model was compelling, Goldberg (1993) wrote that he actually preferred an alternative three-factor model (general evaluation, assertiveness, and impulse expression) proposed by colleague Dean Peabody (Peabody and Goldberg 1989). Another close colleague, Jack Digman, was at first equally skeptical about the Five-Factor Model, believing that as many as ten factors were necessary to account for teachers' ratings of their students' personalities.

However, when Digman examined Cattell's studies carefully, he found clerical errors in two of Cattell's matrices (Goldberg 1993). On reanalysis of six data sets, including Cattell's data, Digman and Takemoto-Chock (1981) found a striking convergence toward the Five-Factor Model. "Regardless of whether teachers rate children, officer candidates rate one another, college students rate one another, or clinical staff members rate graduate trainees, the results are pretty much the same" (Digman and Takemoto-Chock 1981, pp. 164–65).

Digman's conclusions were echoed by Goldberg (1981). Upon analyzing Norman's 75 clusters, he wrote "it hardly matters what number of factors are extracted, since the loadings on the first five factors are always nearly the same... Clearly, there is something *to* this structure. It is not simply a matter of extracting a particular number of factors or using a particular type of rotational algorithm. These are data speaking for themselves" (Goldberg 1981, p. 160).

Convinced that the Five-Factor Model was the most robust, replicable model of personality trait words, Goldberg (1992) turned to the development of marker scales for the five factors. His 1992 article presents both a set of 100 individual trait words and a set of 35 bipolar rating scales anchored pair of trait words for measuring the five major personality factors. He continued to collaborate with other researchers on lexical research (e.g., Hofstee et al. 1992; Saucier and Goldberg

1998). But by the end of the 1990s, he turned his focus from individual trait words to short phrases indicative of personality (Goldberg 1999), creating a public domain website for his International Personality Item Pool (IPIP; Goldberg et al. 2006). The IPIP (http://ipip.ori.org) contains a number of different public domain inventories for measuring the Big Five with short phrases.

Digman also played a crucial role in promoting the Big-Five Model. In addition to his own publications supporting the B5M, he authored an article for the *Annual Review of Psychology* summarizing research in support of the model (Digman 1990). Digman and Goldberg both discussed at length alternative labels for the five factors. Digman preferred the label *Will to Achieve* for the Conscientiousness factor (Digman and Takemoto-Chock 1981); however, that label never became mainstream. Goldberg, on the other hand, successfully substituted the label *Intellect* for Norman's fifth factor, Culture. Goldberg (1993) noted that the culture label was an artifact of Cattell's removing intellect-related personality words in favor of an actual intelligence test. Both Digman and Goldberg also introduced a more subtle change in the labeling of the first factor, using the spelling *Extraversion* rather than Norman's *Extroversion*. *Extraversion* was the spelling preferred by the originator of the term, Carl Jung (Kaufman 2015).

During the 1980s, Goldberg and Digman's lexical research also had an enormous impact on the direction of personality questionnaire research. During this decade, major personality inventories were authored or revised to align with the Big-Five Model, and other major personality inventories began to be reinterpreted in terms of the five factors. The details of how this happened are described in the next section.

The Personality Questionnaire Research Program

A defining feature of the lexical research program is that it has been descriptive and atheoretical. The only "theory" underlying this research program is the lexical hypothesis – the assumption that, over millennia, human beings noticed important individual differences in each other and coined words for them. The job of academic psychologists in the lexical tradition has been simply to measure how people use these words to describe one another and to use statistical methods to model the basic dimensions within personality description through ordinary language.

In contrast to the descriptive, atheoretical nature of lexical research, much personality questionnaire research has involved measurement of purportedly scientific, theoretical constructs (McCrae and John 1992). Many psychologists, including Cattell, believed that personality words from ordinary language were not sufficient for a truly scientific description of personality (McCrae 1990; McCrae et al. 1993). They designed self-report questionnaires, not to measure ordinary traits such as *shyness*, but to measure constructs proposed by theorists such as Henry Murray's *need for affiliation* or *need for harm avoidance*. Cattell refused to use ordinary English words for the constructs on his questionnaire, opting for terms he made up such as *Parmia* and *Harria*.

A sampling of well-known personality questionnaires indicates a diversity of theoretical constructs. Gordon Allport's Harvard colleague, Henry Murray, devised a theory of 20 "manifest needs" that he considered to be important determinants of human behavior. This list served as the basis for two widely used personality inventories, Alan Edwards' Edwards Personal Preference Schedule and Douglas Jackson's Personality Research Form. The Allport-Vernon-Lindzey Study of Values was designed to assess adherence to the six major types of values proposed by Eduard Spranger and thought to be important in vocational choice. Jung's theory of psychological types was the basis for the Myers-Briggs Type Indicator (MBTI). Hans Eysenck developed a behavioristic-genetic-physiological theory of traits that distinguish normal people from criminals and the mentally ill and created the Eysenck Personality Inventory and Eysenck Personality Questionnaire to assess these traits. J. P. Guilford and Wayne Zimmerman's Guilford-Zimmerman Temperament Survey (GZTS) was created by factor-analyzing existing inventories of theoretical constructs. Harrison Gough constructed the California Psychological Inventory to assess *folk*

concepts – the concepts used by ordinary people in everyday life to describe human behavior.

The above are but a few examples of questionnaires developed between 1900 and 1970 (see Goldberg 1971, for a more thorough review). Three noteworthy points about these inventories are as follows: (1) many bear the name of the persons who developed them; (2) each developed a loyal following devoted to the theory behind the inventory; and (3) researchers devoted to a particular inventory tended to work in isolation of research based on other inventories. As a consequence, it was difficult to see if these inventories were really measuring different concepts or whether they measured something in common. Order within the cacophony of questionnaire research did not emerge until the construction of new personality inventories by Robert Hogan and by Paul T. Costa, Jr. and Robert R. McCrae.

Robert Hogan. Robert Hogan was a student of Harrison G. Gough, author of the California Personality Inventory (CPI). After conducting research with the CPI for several years at Johns Hopkins University, Hogan decided it would be more convenient to create his own personality inventory for research and consulting. Well aware of the Norman (1963) study, Hogan chose to construct his inventory around the five factors described by Norman. As a first step toward constructing such an inventory, he worked with graduate student John A. Johnson to see if the CPI could be scored to yield scores on Norman's factors (Johnson 1997). Hogan then placed Johnson in charge of constructing the initial item pool and developing the preliminary scales for a new inventory, the Hopkins Personality Inventory. After Johnson and Hogan left Hopkins, Hogan revised and renamed the inventory, publishing it as the Hogan Personality Inventory (HPI; Hogan 1986; Hogan and Hogan 1992). Hogan Assessment Systems has used the HPI successfully in hundreds of studies of personnel selection and organizational behavior.

Paul T. Costa, Jr. and Robert R. McCrae. As indicated in the earlier section on Raymond Cattell, Cattell's 16PF questionnaire contained 16 different scales. Paul T. Costa, Jr. and Robert R. McCrae had included the 16PF in a major

longitudinal study, but they believed that the scales of the 16PF were too redundant, with overlapping meanings. They therefore conducted a cluster analysis on the items in the 16PF (Costa and McCrae 1976). Two item clusters revealed by the analysis were Neuroticism and Extraversion, familiar dimensions in the history of personality questionnaires, especially due to the research of Eysenck (Goldberg 1971). The third cluster, Openness to Experience, was rarely discussed in the literature. Believing that they could write better items to measure these three domains more validly, McCrae and Costa (1983) authored their own inventory, which they called the NEO Inventory. It contained three "domain scales" to measure the factors N, E, and O, but each of the domain scales contained six "facet scales" that measured narrower aspects of each domain. For example, Neuroticism contained facet scales for anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability.

In 1978 Costa and McCrae moved from Boston to accept new positions with the National Institute of Aging in Baltimore, where they joined the Baltimore Longitudinal Study of Aging (BLSA). Shortly after their arrival in Baltimore, Hogan invited them to Johns Hopkins where he and his graduate students presented a seminar on the HPI project. Hogan tried to convince Costa and McCrae that their NEO measured only three of the important five factors identified by Norman. Costa and McCrae left the seminar in disagreement with Hogan. Costa argued (much as Allport might have) that Agreeableness and Conscientiousness were merely "social evaluations" rather than substantial personality traits. Agreeableness reflects our personal like or dislike of people, and Conscientiousness reflects whether they share our moral values, he said. According to Costa, these dimensions say more about observers' personal values than about the objective personalities of the people they are judging.

However, soon after the meeting at Hopkins, Costa and McCrae became aware of the work presented by Digman and Goldberg at the WPA symposium in Hawaii. They invited Lewis Goldberg to present his research at the NIA Gerontology Center in Baltimore in 1983. Digman's and

Goldberg's data convinced Costa and McCrae that Agreeableness and Conscientiousness were important domains, so they created two scales for their inventory and renamed the NEO Inventory the NEO Personality Inventory (NEO PI; Costa and McCrae 1985). Perhaps because they were aware of the imminent publication of the HPI (Hogan 1986), Costa and McCrae's NEO PI was rushed to press without the development of facet scales for Agreeableness and Conscientiousness. These facet scales were developed later and were included in a revised version of the NEO PI (NEO PI-R; Costa and McCrae 1992).

Once the NEO PI was published, Costa and McCrae's research program became the most influential force promoting a Five-Factor view of personality questionnaires. Costa and McCrae had at their disposal one of the largest longitudinal databases in the world. Participants in the BLSA had already completed a large number of personality measures and had also provided personality ratings from informants who knew them well. Whenever Costa and McCrae wanted to test a new measure, they could administer it to the BLSA participants. To demonstrate the power of the Five-Factor Model, Costa and McCrae methodically compared scores on their NEO PI and NEO PI-R to scores on all of the major personality inventories. From their results they argued that all major inventories measured at least some of the five factors, and none produced important information beyond the five factors. The B5M/FFM became a kind of standard against which any other measure could be compared, and the NEO PI-R became the most widely used personality questionnaire in FFM research.

Although the lexical research program and questionnaire research program became integrated when Costa and McCrae incorporated Agreeableness and Conscientiousness into the NEO PI-R, certain unresolved issues remained. Debates about the best way to conceptualize the factors continued, especially about the fifth factor, usually labeled Intellect in the B5M and Openness to Experience in the FFM. Further research was necessary to see whether the rating scales employing trait adjectives or questionnaires employing full-sentence items were preferable.

Finally, researchers continued to investigate ways of dividing the five broad factors into narrower components and ways of combining the five factors into higher-level superfactors. These topics are addressed in the next major section of this entry.

Current Issues in Big-Five Model Research

Conceptualizing the Big Five Factors

Discerning the meaning of factors produced by any factor analysis always involves subjective judgment on the part of the researcher. These judgments are informed by the magnitudes of *factor loadings* for the factor. A factor loading can be thought of as the correlation between an item and a factor. Factor meanings are derived by locating the items with the highest loadings on the factor and intuiting a common theme running through the items. For example, the following items in Norman's (1963) rating study showed high loadings on Factor I in sample C: talkative-silent (0.90), frank, open-secretive (0.78), adventurous-cautious (0.79), and sociable-reclusive (0.86). (These items also showed similarly high loadings in the other samples.) Norman decided that the common theme running through these items is the same theme identified by Tupes and Christal (1961/1992) in their analyses of these items, alternatively called *Extroversion* or *Surgency*.

Norman (1963) also chose labels that were the same or similar to the labels used by Tupes and Christal (1961/1992) for the remaining factors. Both labeled Factor II *Agreeableness*. Tupes and Christal labeled Factor III *Dependability* and Norman labeled this factor *Conscientiousness*. Both used *Emotional Stability* to label Factor IV and *Culture* to label Factor V.

But judging the similarity of factors in different studies requires more than simply comparing the labels used in each study. What matters is whether the same items show similarly high loadings across studies. In this case, the four items with the highest loadings on Factor III in the Norman (1963) study also showed high loadings in the

Tupes and Christal (1961/1992) study. This implies factor similarity across the studies despite the different labels. Assuming that the labels *Dependability* and *Conscientiousness* indicated different interpretations of the factor would have been an example of what Jack Block (1995) called the *jangle fallacy.* The jangle fallacy refers to mistakenly assuming that different labels for two psychological measures imply two different psychological concepts.

Determining whether factors are the same across studies becomes more complex when the same items are not used in each study because one cannot compare item factor loadings. Although Costa and McCrae's (1992) NEO PI-R had its origin in a cluster analysis of Cattell's 16PF, which itself was derived from ratings that led to the lexical Big Five, the fifth factor in the NEO PI-R questionnaire is labeled *Openness to Experience* rather than *Intellect*. Although the content of items in the Openness to Experience scale seems similar to trait terms that define the Intellect factor in lexical studies, McCrae (1990) has claimed that the technical, scientific concept *Openness to Experience* is not well represented in ordinary language. He admitted that a number of trait words from one lexical measure of Intellect (*artistic*, *clever*, *imaginative*, *ingenious*, *insightful*, *inventive*, *original*, *sharp-witted*, and *witty*) do partially describe Openness to Experience, but he pointed out that other trait words from this Intellect scale showed higher loadings on one of the other four factors. He concluded that "the fifth factor identified in lexical studies is best interpreted as a variant of the more psychologically fundamental dimension of *Openness to Experience*" (McCrae 1990, p. 123) and asserted that the facets of the NEO PI-R Openness to Experience scale cover the domain of the fifth factor more completely than any lexical scale.

McCrae's assertions did not, however, close the debate on the best interpretation of the fifth factor. In 1994, an entire special issue of the *European Journal of Personality* was devoted to articles on interpretations of the fifth factor (de Raad and Van Heck 1994). McCrae maintained his position in his contribution to the special issue. As indicated earlier in the section on the history of personality questionnaires, questionnaire authors tend to remain committed to the conceptual basis of their questionnaires. In contrast to McCrae, several other contributors to the special issue independently suggested that the core of the fifth questionnaire factor is better represented by the Openness to Aesthetics and Openness to Ideas facets of the NEO PI-R Openness scale than the other four Openness facets. They concluded that the conceptual core of Factor V, revealed by both questionnaire research and lexical studies, is best represented by the label *Creative Intellect* or *Imagination*.

Interpretation of the other four factors has been much less contentious, although there have been disagreements about where particular traits belong in the Big-Five Model. Johnson and Ostendorf (1993) reviewed these disagreements before proposing a way to resolve them. They noted that some researchers believe that positive emotions are an aspect of Extraversion, while others locate positive emotions in Agreeableness. Some researchers conceptualize Conscientiousness as a proactive tendency to methodically strive toward the achievement of goals. This interpretation locates *ambition* as part of Factor III and aligns with Digman and Takemoto-Chock's (1981) view of this factor as *Will to Achieve*. Other researchers regard Conscientiousness as a restraining force, a denial of antisocial impulses leading to conformity to social expectations and norms. For them, ambition is energetic social engagement reflected in the term *Surgency*, an alternative label for Extraversion. Researchers who favor the proactive view of Conscientiousness see conformity as an aspect of Agreeableness and nonconformity as an aspect of Openness to Experience.

Johnson and Ostendorf (1993) further observed that *Impulsivity* has been a particularly slippery concept in psychology. Eysenck initially saw impulsivity as part of Extraversion until he relocated the concept to his Psychoticism dimension, often interpreted as low Agreeableness and low Conscientiousness in the B5M (McCrae and John 1992). In Costa and McCrae's (1992) NEO PI-R, impulsivity is a facet subscale within their factor IV domain scale, Neuroticism. Finally,

Johnson and Ostendorf (1993) noted that the location of terms related to intelligence such as *intelligent*, *intellectual*, and *perceptive* has depended upon how a researcher conceptualized Factor V. Those favoring the lexical view of the fifth factor as Intellect have located intelligence-related terms within this factor, while those favoring an Openness view of the fifth factor have located such terms within Factor III.

Johnson and Ostendorf's (1993) resolution to these disagreements (see also Johnson 1994a) drew upon an extension of the five-factor lexical model called the Abridged Big Five-Dimensional Circumplex (AB5C; Hofstee et al. 1992). The impetus for the AB5C model was the observation that the very best efforts to identify a set of personality trait words that show high loadings on one and only one factor (e.g., Goldberg 1992) have not been totally successful. Hofstee et al. (1992) decided that this is because very few – if any – personality trait words reflect only one factor. More often, trait words show appreciable factor loadings on two or more factors. If one were to completely specify a particular trait word in terms of the orthogonal Big-Five factors, one would have to include its loadings on all five factors. Geometrically, each trait word would be represented by a point in five-dimensional hyperspace, with the five loadings corresponding to the coordinates on the five axes.

Fortunately, Hofstee et al. (1992) argue, a five-dimensional model is not necessary because most personality terms show only one appreciable secondary factor loading in addition to the main loading. Personality terms can therefore be located in one of the ten two-dimensional planes defined by a pair of Big-Five factors, hence the expression "Abridged Big Five-Dimensional Circumplex" (AB5C). For example, the terms *alert*, *ambitious*, *firm*, and *purposeful* showed a primary positive loading on Conscientiousness with a secondary positive loading on Extraversion (Hofstee et al. 1992). In AB5C terms, they would be classified as III+ I+ traits. In contrast, the terms *careful*, *cautious*, *punctual*, *formal*, *thrifty*, *principled*, and *circumspect* show a primary positive loading on Conscientiousness but a secondary negative loading on Extraversion (denoting a tendency toward introversion). These terms would therefore be designated III+ I−. Such differences in secondary loadings, Johnson and Ostendorf (1993) argue, could explain differences in the way researchers conceptualize and measure the five factors and locate trait terms within the factors. A researcher who conceptualizes Factor III as organized purposefulness is likely to use a measure of that dimension that contains many III+ I+ items. A second researcher who conceptualizes Factor III as inhibitory impulse control is more likely to use a measure of that dimension that contains many III+ I− items. The fact that term such as *ambitious* shows appreciable loadings on both Conscientiousness and Extraversion could explain why some researchers locate the term on Factor III and some on Factor I.

Geometrically, all of the III+ I+ and III+ I− terms listed above (as well as I+ III+, I+ III−, I−III+, I−III−, III−I+, and III−I− terms) can be graphed in a plane where Extraversion forms the vertical axis and Conscientiousness the horizontal axis (Hofstee et al. 1992). Their exact distance and direction from the origin (0,0) can be defined by coordinates representing the magnitudes of loadings on the two factors. Hofstee et al. (1992) suggested a further simplification, ignoring the distance from the origin and projecting all Conscientiousness-Extraversion-related terms onto a circle (circumplex) with its center at the origin. The terms would then be described simply by their degree location within the 360° circle. Within the Factor I x Factor III circumplex, some terms with their two highest loadings on these factors will have secondary loadings that are so relatively small that they will appear within 15 degrees of either the Factor I or Factor III axes. These I+ I+ or I−I− and III+ III+ or III−III− terms Hofstee et al. (1992) called *factor pure*. Other terms lie between the axes but closer to one than the other. For example, *ambitious* lies closer to III+ than I+ and is therefore designated as III+ I+, an extraverted form of conscientiousness. A I+ III+ term such as *competitive* lies closer to Extraversion than Conscientiousness and is therefore seen as a conscientious form of extraversion.

By taking into account the secondary loadings of personality trait terms, the AB5C lexical model can account for variations and commonalities in the measurement and interpretation of the five factors. For example, Factor V scales originating in the work of Norman (1963) and Goldberg (1992), who interpreted the factor as *Culture* or *Intellect*, respectively, were found to have a V+ III+ (*controlled intellect*; see Peabody and Goldberg 1989) character. In contrast, the Factor V scale based on adjectives chosen by McCrae and Costa (1985), who interpret Factor V as *Openness to Experience*, had a V+ I+ (*expressive intellect*; see Peabody and Goldberg 1989) character. Hogan and Johnson (1981) authored two different sets of Factor V adjective scales. The first they initially called *Intellectance*, later renamed *Mentality* (Johnson 1997), which was designed to reflect an Intellect version of the factor, and a second scale they initially called *Ego Control* and, later, *Novelty* (Johnson 1997) which is similar to Openness to Experience. The *Intellectance/ Mentality* scale was found to have a V+ III+ character, while the *Ego Control/Novelty* scale had a V+ I+ character.

According to Johnson and Ostendorf's (1993) analyses, researchers who measured the Big Five with trait adjectives chose adjectives whose secondary loadings supported their preferred variant of each factor (e.g., Factor V as Intellect vs. Openness to Experience; Factor III as organized purposefulness vs. inhibitory impulse control). Johnson (1994a, b) found that personality questionnaire scales from different research programs also showed different secondary factor loadings when mapped onto the AB5C model.

Although the AB5C model can explain different interpretations of the five factors, it cannot say which interpretations are more absolutely correct or fundamental. There are no grounds for saying that organized purposefulness (III+ I+) or inhibitory impulse control (III+ I−) is a better way to conceptualize or measure Conscientiousness. Furthermore, there is no absolutely correct rotation of a pair of factors in defining any of the ten circumplexes in the AB5C model. Prior to the AB5C model, McCrae and Costa (1989) observed that the Wiggins Interpersonal Circumplex, defined by a vertical axis of status (dominant vs. submissive) and a horizontal axis of love (warm vs. coldhearted) was a 30–45° rotation of a circumplex defined by their Extraversion and Agreeableness factors. To McCrae and Costa, Wiggins' *dominance* is a disagreeable form of their own Extraversion, while Wiggins' *warmth* is an agreeable form of Extraversion. But from Wiggin's perspective, Extraversion could be called a warm form of dominance and Agreeableness a submissive form of warmth.

Johnson and Ostendorf (1993) and Johnson (1994a), although affirming that the five factors cannot be absolutely, objectively defined, offered a method of resolving differences across lexical and questionnaire research programs. They suggested aggregating data from theoretically diverse measures of the five factors and then applying Hofstee et al.'s AB5C algorithm. Items mapped as "factor pure" (e.g., I+ I+, I−I−, II+ II+, etc.) from the aggregated data would represent a core of agreement across diverse research programs. In their analyses they found the following consensual cores for each factor: Factor I, social communicativeness (*extraverted*, *frank/open*, *fun-loving*, *sociable*, *talkative*, *straightforward*); Factor II, softness (*acquiescent*, *mild/gentle*, *soft hearted*); Factor III, constraint (*careful*, *fussy/tidy*, *hardworking*, *neat*, *punctual*, *scrupulous*, *thrifty*, *well organized*); Factor IV, freedom from negative affect (*calm*); and Factor V, creativity (*artistic*, *creative*, *imaginative*).

Preferred Formats for Assessing the Big-Five Factors

Despite the fact that the B5M/FFM originated in analyses of individual trait adjectives, trait-adjective scales such as those proposed by Goldberg (1992) have been used in research and practice far less often than questionnaire measures of the five factors. Goldberg (1999) provides three reasons why individual trait words are not ideal for personality assessment. First, the finite number of trait words in any language limits researchers' ability to assess complex nuances of personality. Second, trait adjectives and type nouns are relatively abstract. This abstractness can be associated with ambiguity about the meanings of these words

without behavioral or contextual specification. Third, one-to-one translations of single words often cannot be found across languages, limiting international, collaborative research. Also, researchers such as Block (1995) and McCrae (1990; McCrae et al. 1993) have questioned whether words from ordinary language can be sufficient for a scientific analysis of personality, because a mature science (e.g., physics) uses concepts that transcend the appearances found in ordinary experience and expressed in everyday language. Astronomy tells us that the earth orbits the sun rather than vice versa, biology tells us that whales and bats are mammals like us, not fish or birds, and physics tells us that time is relative rather than absolute.

Consequently, Hofstee et al. (1992) and Goldberg (1999) recommended assessing personality with short phrases rather than individual trait words from ordinary language. This is the format of items in the International Personality Item Pool (IPIP; Goldberg et al. 2006), which contains several inventories for assessing the five factors, and the items in the widely used Big-Five Inventory (Soto and John 2016). Very short, adjective-based measures such as the Ten-Item Personality Inventory (TIPI; Gosling et al. 2003) continue to be used in projects with serious time constraints, but questionnaires employing short phrases or sentences are used more often, particularly when researchers want to assess subdomains of the Big-Five factors (e.g., Johnson 2014). The NEO PI-R remains a widely used personality questionnaire for measuring the five factors and is sometimes called the "gold standard" for Five-Factor measurement (Muck et al. 2007).

Big-Five Subfactors and Superfactors

Cattell. The Big-Five Model has almost always been seen as *hierarchical*, which is to say that each of the five broad traits in the model has been defined by a cluster or interrelated, narrower traits or subfactors. Each of Cattell's (1943) basic, lexical rating scales was not a single trait adjective, but, rather, the labeling of a set of adjectives judged by Cattell to have a common underlying meaning. For example, he listed his first rating variable (Cattell 1943, p. 490) as follows:

Alert	Absent-minded
Observant, vigilant, omnipercipient	Dreamy, indefinite, depersonalized

Therefore, even each basic rating scale in Cattell's original study was hierarchical, representing a broader meaning perceived by Cattell in a set of individual trait words. Cattell then clustered his 171 ratings even further by identifying ratings that correlated empirically. His resulting 60 clusters therefore represented yet another hierarchical level – clusters of adjective clusters.

In subsequent rating studies (e.g., Cattell 1947), Cattell augmented the 35 rating scale clusters he retained for factor analyses by adding descriptions of each pole of the rating scales. Raters were no longer given rating scales anchored only by sets of trait words. Instead, the rating scales contained Cattell's summary interpretations of each pole. For example, instead of a scale anchored by *Cooperative...Obstructive* (with a few trait adjectives listed under each term; Cattell 1943), Cattell (1947, p. 201) used the following rating scale:

1. *Readiness to cooperate* Generally tends to say yes when invited to cooperate. Outgoing. Ready to meet people at least halfway. Finds ways of cooperating despite difficulties	2. *Obstructiveness* Inclined to raise objections to a project, cynical, or realistic. "Cannot be done." Uninterested or unfavorable attitude to joining in. Inclined to be "difficult"

These written descriptions encompassed a range of behaviors, perhaps introducing yet another level of hierarchical abstraction. Cattell's description-enhanced rating scales were the rating scales used by Tupes and Christal (1961/1992) and by Norman (1963). Therefore, when the Big Five were identified by these researchers as five very general, abstract dispositions, Cattell had already created, through his own personal judgment, several layers of hierarchical organization beneath the Big Five.

Norman and Goldberg. Subsequent lexical studies by Norman (1967) and Goldberg (1990) returned to the level of individual trait adjectives,

but, again, trait words that were judged to be similar in meaning were grouped together to form synonym clusters. Goldberg (1990) demonstrated that factor-analyzing Norman's 75 clusters yielded the Big Five, but he questioned whether it was necessary to include all 1431 of the adjectives chosen by Norman and whether one might group the adjectives differently, using more objective techniques. Goldberg (1990) therefore selected 479 terms from Norman's list and regrouped them into 133 synonym clusters with the help of lexicographers using dictionaries and synonym finders. After collecting new ratings on the 479 terms, Goldberg (1990) further reduced the terms to 339 trait adjectives organized into 100 clusters. Goldberg (1990, p. 1223) described the factors that emerged from a factor analysis of the 100 clusters as "nearly perfect examples of the Big-Five." The 100 clusters (25 for Extraversion, 32 for Agreeableness, 23 for Conscientiousness, 9 for Emotional Stability, 11 for Intellect) remain as one standard intermediate level between individual trait adjectives and the broad lexical Big Five.

Hogan. Before items were written for the earliest version of the Hogan Personality Inventory, Robert Hogan (1986) had his graduate students think of as many different ways a person could present himself or herself to create an impression on the Big Five. For example, Hogan's students thought of six ways people present themselves as agreeable or likeable: being easy to live with, being even tempered, caring about others, trusting others, liking people, and taking others' opinions into consideration. These six Factor II categories became targets for writing items. After data for these provisional items were collected, item analyses confirmed which items were answered similarly within each category of each Big Five dimension. These item clusters, generally varying in length between three and eight items, were called *homogeneous item composites* or HICs. Further analyses after additional data collection led to reassignment of some items to other HICs and even some HICs to other Big-Five factors (Hogan and Hogan 1992). Some of the HIC reassignments contradicted typical ways of thinking about lower levels for the Big Five. For

example, the *Not Depressed* HIC was reassigned from Adjustment (Hogan's label for Emotional Stability) to Ambition (One of two HPI Extraversion scales) because Hogan observed that ambitious people are rarely depressed.

Costa and McCrae. In the questionnaire tradition, Costa and McCrae's (1995) facet subscales remain the most widely used scheme of organizing the Big Five into narrower traits. Costa and McCrae (1995) arrived at their facets by compiling a list of traits that have been widely discussed in the literature on trait measurement and choosing six traits that they thought best represented each of the Big Five domains. For example, they decided that Neuroticism (the opposite end of Emotional Stability) was best represented by Anxiety, Angry Hostility, Depression, Self-Consciousness, Impulsiveness, and Vulnerability. They confirmed their rational assignment of items to these facet subcategories and facets to the five domains by statistical analyses.

Intermediates between facets and domains. DeYoung et al. (2007) demonstrated that it is possible to assess personality at an intermediate level between Costa and McCrae's facets and the broad Big-Five domains. By factor-analyzing facet scores from the NEO PI-R and an IPIP version of AB5C facet scales within each of the five domains, DeYoung et al. (2007) found two factors within each domain that were broader than facets but narrower than the Big Five. Ten-item IPIP scales were developed to assess each of the ten intermediate aspects of the Big Five and were placed in the public domain at http://ipip.ori.org/BFASKeys.htm.

Superfactors. Others have proposed that the Big Five traits themselves are interrelated, forming even broader superfactors. Five orthogonally rotated factors from any factor analysis are statistical abstractions that are forced to be independent of one another. But the actual rating scales or questionnaire scales from different Big-Five domains do in fact correlate with one another and should therefore be considered to point to higher-level factors.

Typically, when oblique rather than orthogonal rotation is used, researchers have found that Agreeableness, Conscientiousness, and Emotional Stability form one higher-order factor,

while Extraversion and Intellect (or Openness to Experience) form a second higher-order factor (Digman 1997). Digman labeled the first superfactor α and the second superfactor β. Digman discussed the α and β superfactors from a number of different theoretical perspectives and concluded that α represents the dispositions that encourage normative moral development, accommodating one's self to the expectations of society. Indeed, the three Big Five traits under α are the traits that tend to increase over the life course. In contrast, Digman interpreted superfactor β as a tendency toward self-enhancement, personal growth, and the achievement of status and power. The typical developmental path for the two Big Five traits under β is curvilinear: an increase during the first part of the life course and a decrease toward the end. DeYoung et al. (2002) provided an additional interpretation of α and β, which they call *Stability* and *Plasticity*, in terms of the serotonergic and dopaminergic neurotransmitter systems. They suggested that Stability encourages conformity, while Plasticity discourages conformity.

Finally, Musek (2007) has suggested that if the α/Stability and β/Plasticity second-order factors are allowed to correlate through oblique rotation, one can also posit a third-order general superfactor, similar to the *g* factor in intelligence research. Musek (2007) discusses possible interpretations of the General Personality Factor or GPF. Noting that the GPF represents a blend of all aspects of personality that are positively valued, he dismissed the idea that the GPF is just an artifact of biased responding. Instead, he suggested that the GPF represents a profile of positive emotionality, motivation, well-being, and self-esteem.

Conclusion

Despite the uncertain, nebulous path provided by Cattell's initial reduction of Allport's 4504 prime trait terms into 12 or 16 personality factors, the Big-Five Model eventually emerged from Cattell's work as a clear, widely accepted framework for conceptualizing the universe of personality traits at a broad level. As with any scientific model, the BFM has not been without critics (e.g., Block 1995; McAdams 1992). Furthermore, a number of issues about the BFM have not been fully resolved. These include the best way to conceptualize and measure each of the Big-Five domains, the replicability of the Big-Five across cultures and languages, whether significant factors beyond the Big Five exist, the optimal way of dividing the Big Five into subfactors, and whether the Big Five should be combined into superfactors.

Nonetheless, progress on these issues has been achieved, and research on the Big Five has given a clear picture of their genetic origin, development over the life span, and ability to predict significant life outcomes. Initially a purely descriptive endeavor involving ordinary language, Big-Five theorizing has grown to include concepts ranging from neurotransmitters to dyadic interactions to human evolution (Wiggins 1996). The documented success of the Big-Five Model for organizing and generating personality research has led to a wide acceptance of the model today.

Cross-References

- ▶ Agreeableness
- ▶ Allport, Gordon
- ▶ Cattell, Raymond
- ▶ Conscientiousness
- ▶ Extraversion
- ▶ Goldberg, Lewis R.
- ▶ Hogan, Robert
- ▶ Lexical Approach
- ▶ McCrae, Robert R.
- ▶ Neuroticism
- ▶ Openness

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