5

Five Strong and Recurrent Personality Factors

Revisiting Tupes and Christal (1961)

John A. Johnson

BACKGROUND TO THE STUDY

After Allport and Odbert (1936; see Chapter 2 of this volume) found 17,953 words for human traits in Webster's unabridged *New International Dictionary*, an important question arose: how can we reduce this list to a more manageable number of traits? Allport and Odbert suggested reducing the list by using only words that referred to objectively real, stable behavioural tendencies such as *aggressive, introverted* and *sociable*, and setting aside words that referred to temporary states (e.g., *frantic*), value judgements (e.g., *worthy*), or characteristics only remotely related to personality (e.g., *lean*). This procedure narrowed the list to 4504 terms that Allport and Odbert considered to be suitable for a scientific description of personality.

Still, trying to measure 4504 personality traits would have been impractical, so personality researchers looked for additional ways to shorten the list of traits. Raymond Cattell (see Chapter 3 of this volume) reduced the list by grouping trait-words into 160 clusters, where each cluster contained words that were very similar in meaning. Cattell next had 100 people rate each other's personalities with these clusters, and, based upon patterns in these ratings, further reduced the number of trait-word clusters to 67. He compared his clusters to trait clusters described in a dozen published rating studies and retained only 35 personality trait clusters that were confirmed by other investigators.

Finally, Cattell reduced his set of 35 personality variables one more time with a statistical procedure called *factor analysis*. Factor analysis can identify a relatively small number of general themes, or *common factors*, within a larger set of personality measurements. His factor analyses indicated 11 personality factors in one study and 12 personality factors in a second study (Cattell, 1945, 1947).

All might have been well, except that another set of factor analyses published by Donald Fiske (1949; see Chapter 3 of this volume) repeatedly showed five rather than the 11 or 12 factors discovered by Cattell. The Tupes and Christal (1961/1992)[1] study was designed to explain the difference between Cattell's and Fiske's results.

Tupes and Christal note in the introduction to their paper that the difference between Cattell's and Fiske's results could have been due to Fiske's using only 22 of the 35 rating scales employed by Cattell. Or, the differences could have been a result of differences in the type of people being rated or the type of raters in each study. Yet another possible reason for the differences could have been the different forms of factor analysis used in each study. By reanalysing Fiske's and Cattell's data along with data they collected from U.S. Air Force personnel, Tupes and Christal hoped to clarify whether the universe of personality traits was better represented by five or 12 factors.

In addition to determining whether there were five or 12 broad factors in personality ratings, Tupes and Christal also hoped to convince readers that ratings of personality traits could predict important life outcomes, such as job performance. During the 1960s, some psychologists seriously doubted whether personality could be accurately measured by either self-report or ratings from acquaintances. Some even doubted whether there was enough consistency in people to say that they *have* personalities. Most of the introduction to the Tupes and Christal paper is actually devoted to reviewing and responding to those doubts and criticisms. In their introduction Tupes and Christal showed that if you measure personality properly, these measurements *will* predict important life outcomes. If Walter Mischel (see Chapter 6 of this volume) had read the introduction to the Tupes and Christal report, he might have never written his criticisms of personality.

DETAILED DESCRIPTION OF THE STUDY

THEORY

The word 'theory' does not appear in the Tupes and Christal (1961/1992) report because their research was not based on any particular psychological theory. They did list some hypotheses about the possible reasons why the Fiske and Cattell studies produced different results. First, Fiske (1949) used only 22 of the 35 rating variables that Cattell (1947) used. Furthermore, Fiske edited the wording of some of Cattell's rating scales. For example, whereas one of Cattell's rating scales was defined by 'sophisticated, intelligent, assertive' vs. 'simple, stupid, submissive', Fiske (1949) used only two trait-words for this scale: 'assertive vs. submissive' (John, Angleitner, & Ostendorf, 1988, p. 182). Tupes and Christal (1961/1992) also hypothesized that the differences in the number of factors could have been due to the different raters and persons rated across studies.

However, Tupes and Christal suspected that none of the possible reasons just listed were the real causes for the different results from the Cattell and Fiske studies. Rather, Tupes and Christal believed that the most likely reason for the different results was that Cattell used what is called *oblique rotation* of factors in his statistical analyses, while Fiske used what is called *orthogonal rotation* of factors. The difference between the two rotation strategies is that oblique factors are allowed to overlap with each other, whilst orthogonal factors are independent of each

other – they do not overlap. Tupes and Christal (1961/1992) set up their study to test whether using the same (orthogonal) rotation method would produce the same factors across different sets of personality rating data, despite differences in the types of raters, types of persons being rated, and specific wording of the rating instruments.

METHODOLOGY

To see whether the same factors would emerge from different samples when the same form of factor analysis was employed, there was no need for Tupes and Christal to gather new data. Rather, they simply reanalysed eight existing datasets. In all of the samples, subjects had been rated with 22 or more of Cattell's (1947) 35 rating scales. Two data samples were from Fiske (1949), one from Cattell (1947), one from Cattell (1948), and four from one of their previous studies (Tupes & Christal, 1958). Tupes and Christal described the diversity of raters, the persons rated, and the nature of the relationship between raters and persons rated as follows:

> Briefly, they differ in length of acquaintanceship from 3 days to a year or more; in kind of acquaintanceship from assessment programs to a military training course to a fraternity house situation; in type of subject from airmen with only a high-school education to male and female undergraduate students to first-year graduate students; and in type of rater from very naïve persons to clinical psychologists or psychiatrists with years of experience in the evaluation of personality. (Tupes & Christal, 1992, p. 228)

Tupes and Christal's method was motivated by the observation that differences in the number of personality factors found in previous studies could have been due to either the differences in the participants and rating scales or to differences in the method of factor analysis (especially the type of rotation) used. By reanalysing data from these diverse samples with the same form of factor analysis, they reasoned that if similar factors are found across the samples, these factors might be 'universal enough to appear in a variety of samples, and [...] are not unduly sensitive to the rating conditions or situations' (p. 227). 'It would appear that any factors common to all of these groups would have a wide range of generality both in terms of type of subject and type of rating situation' (p. 228).

Today, desktop computers can perform a factor analysis in less than a second. Such computational power was not available to researchers who did factor analyses before 1950. Researchers like Cattell and Fiske had to manipulate large tables of data by hand, employing linear algebra with only the aid of mechanical adding machines. Short-cuts and estimations were used to save time and labour. Tupes and Christal (1961/1992) did have access to an IBM 650 computer, which was about 5 ft × 3 ft × 6 ft in size and weighed between 2000 and 3000 pounds. However, computer time was very expensive, so they used the computer to perform the orthogonal rotation of the factors in only one of their eight samples.

All of their other computations, which involved between 22 and 35 variables for the eight samples, were computed by hand with a desk calculator.

FINDINGS

Tupes and Christal (1992) summarized their findings in the following sentence: 'In every sample except one there appeared to be five relatively strong and recurrent personality factors and nothing more of any consequence' (p. 245). What Tupes and Christal meant by 'five strong and recurrent personality factors' is that, regardless of the total number of factors found in any sample, in every sample each of the first five factors was clearly defined by the same unique set of trait-words. Tupes and Christal labelled the common theme among the trait-words that defined each of the five factors with a term from previous factor-analytic studies. In particular, they often chose the labels used by John French (1953), a scientist at the Educational Testing Service who had published a thorough review of previous personality factor analyses. The traits that defined each factor and the labels chosen by Tupes and Christal are described below.

Tupes and Christal's first factor was defined by the following traits in all eight samples: *Silent vs. Talkative*; *Secretive vs. Frank*; *Cautious vs. Adventurous*; *Submissive vs. Assertive*; and *Languid, Slow vs. Energetic*. Additionally, *Self-Contained vs. Sociable* helped to define the first factor in six of the eight samples. (Keep in mind that some ratings cannot show high loading in all eight samples because some samples used only 22 or 30 of Cattell's 35 rating scales.) Together, according to Tupes and Christal, these traits described a recurrent factor labelled by French (1953) as *Surgency* and by others as *Extroversion*.[2]

Traits defining the second factor in all eight samples were *Spiteful vs. Good-Natured; Obstructive vs. Cooperative*; *Suspicious vs. Trustful*; *Rigid vs. Adaptable*; and *Cool, Aloof vs. Attentive to People*. In six of the eight samples, *Jealous vs. Not So; Demanding vs. Emotionally Mature*; *Self-Willed vs. Mild*; and *Hard, Stern vs. Kindly* helped to define the second factor. Tupes and Christal noted that this second factor corresponded closely to the *Agreeableness* factor described by French (1953).

Traits that defined the third factor in all eight samples were *Frivolous vs. Responsible* and *Unscrupulous vs. Conscientious*. In addition, *Relaxed, Indolent* vs. *Insistently Orderly*; *Quitting vs. Persevering*; and *Unconventional vs. Conventional* defined the third factor in six of the eight samples. Tupes and Christal, following French (1953), labelled this factor *Dependability*.

Traits defining the fourth factor in all eight samples were *Worrying, Anxious, vs. Placid*; *Easily Upset vs. Poised, Tough*; and *Changeable vs. Emotionally Stable*. Additional traits that defined this factor in six of the eight samples were *Neurotic vs. Not So*; *Hypochondriacal vs. Not So*; and *Emotional vs. Calm*. Tupes and Christal chose their own label, *Emotional Stability*, for this factor.

The fifth factor was less clearly defined than the first four. For one, the personality traits that defined this factor in the seven male samples split into two different factors in the female sample, which we might call 5A and 5B. Overall, only the following three traits defined the fifth factor in all eight samples: *Boorish vs. Intellectual,*

Cultured; *Clumsy, Awkward vs. Polished*; and *Immature vs. Independent-Minded.* In four of the male samples, *Lacking Artistic Feelings vs. Esthetically Fastidious* helped to define the fifth factor. *Lacking Artistic Feelings vs. Esthetically Fastidious* also helped to define factor 5B in the female sample. And, *Practical, Logical vs. Imaginative* helped to define the factor in four of the male samples, but was barely related to either factor 5A or 5B in the female sample. Following French (1953), Tupes and Christal labelled the fifth factor *Culture.*

The first paragraph of the Discussion section and the last two sentences of the Tupes and Christal (1992) article summarize well the major findings of their research:

> The results of these analyses clearly indicate that differences in samples, situations, raters, and lengths and kinds of acquaintanceship have little effect on the factor structure underlying ratings of personality traits. Statistical tests are not needed to indicate the similarity of corresponding factors from one analysis to another. There can be no doubt that the five factors found throughout all eight analyses are recurrent. (p. 244)

And,

> The five recurrent factors were labelled as (*a*) Surgency, (*b*) Agreeableness, (*c*) Dependability, (*d*) Emotional Stability, and (*e*) Culture. While no claim is made by the authors that the five factors identified are the only personality dimensions, reasons are given in support of their fundamental nature and probable invariance.

IMPACT OF THE STUDY

Historical reviews of the five major personality factors (e.g., Digman, 1990; Goldberg, 1993, 1995; Johnson, 2017; McCrae, 1992) agree that the Tupes and Christal (1961/1992) study would have had zero impact on the field of personality because it appeared as an obscure Air Force technical report, but for the fact that Warren Norman, a professor at the University of Michigan, became aware of the report when he was contracted by the Air Force to develop a self-report version of the peer-rating instrument used by Tupes and Christal. Eventually Norman (1963) published in a mainstream academic journal a peer-rating study similar to Tupes and Christal's. Using four rating scales that he thought best represented each of the five factors identified by Tupes and Christal, Norman (1963) found exactly the same five factors as Tupes and Christal, although he chose slightly different names for some of the factors. Norman used the following Roman numerals and labels for the factors. *I. Extroversion or Surgency*; *II. Agreeableness*; *III. Conscientiousness*; *IV. Emotional Stability*; and *V. Culture.* Identifying the five factors in this order with Roman numerals became standard in subsequent research (e.g., Hofstee, de Raad, & Goldberg, 1992).

Research published by Jack Digman and Lewis R. Goldberg led to increased acceptance of the five personality factors (Goldberg, 1993). Also, in the realm of

self-report personality questionnaires. Hogan (1986) published a new personality inventory based explicitly on the Tupes and Christal factors. Johnson (2017) reported that Hogan invited Paul T Costa, Jr and Robert R. McCrae to Johns Hopkins in the late 1970s to convince them to add Agreeableness and Conscientiousness scales to their NEO personality inventory (which had been designed around three clusters they found in Cattell's 16PF questionnaire), but Costa and McCrae were not convinced. At least not until Goldberg showed them how he and Digman kept finding the Tupes and Christal factors in every dataset they analysed. After a meeting with Goldberg, Costa and McCrae revised their inventory so that its five major domain scales paralleled the five factors identified by Tupes and Christal (McCrae & Costa, 1985). By comparing scores on their new inventory (NEO PI; Costa & McCrae, 1985, 1992) to nearly every other major personality inventory, Costa and McCrae were able to demonstrate that all of these other inventories assessed at least some of the Tupes and Christal factors and nothing significant beyond them (Johnson, 2017).

The combined efforts of trait-word analysts Norman, Digman and Goldberg with NEO PI authors Costa and McCrae finally led to a broad acceptance of the Big Five or Five-Factor Model (FFM) as the dominant view of the basic factors of personality from the 1990s to the present (Johnson, 2017). The Big Five or Five-Factor Model (FFM) has had a strong influence on research undertaken during this time. Researchers who submitted for publication manuscripts on narrow personality traits without mentioning the Big Five were often asked by reviewers and editors to explain how their work related to the five major personality factors. Researchers who wanted to perform personality meta-analyses (studies that reanalysed and compared results of research that had already been completed) now had a framework for comparing results from studies that used different personality measures. All that had to be done was to translate the measures of each study into Big-Five terms, and studies that previously could not have been compared could now be compared. One of the most important examples of such a meta-analysis was a study by Barrick and Mount (1991).

Prior to the Barrick and Mount (1991) study, psychologists were largely sceptical about the ability of personality measures to predict job performance. Part of this scepticism arose from the general criticism of personality traits in the 1960s. But the absence of positive consensus about applying personality assessment to personnel selection was also due to the fact that dozens of different personality measures had been used in research on this topic and there was no way of comparing and combining research findings. By classifying personality measures with the Big Five, Barrick and Mount (1991) were able to reach solid conclusions about the personality traits that influenced and various aspects of job performance. The Barrick and Mount article became a citation classic; it has been cited 9392 times (via Google Scholar [April 24, 2018]).

Another landmark meta-analysis of the impact of the Big Five on important life outcomes was published by Roberts, Kuncel, Shiner, Caspi and Goldberg (2007). In this study they compared the impact of the Big Five personality traits to cognitive ability and socioeconomic status on mortality, divorce and occupational attainment.

They concluded that the amount of personality influence was similar to the influence of cognitive abilities and socioeconomic status.

When many meta-analyses of a particular topic have been completed, it is possible to do a meta-analysis of the meta-analyses, which is called a *metasynthesis study*. Strickhouser, Zell and Krizan (2017) did a metasynthesis study of 36 meta-analyses of the impact of personality on physical and mental health. They found a significant impact of personality on overall health, with a multiple correlation of .35 with the Big Five traits. The impact of personality on mental health was found to be stronger than the impact on physical health, and the effects were stronger for Agreeableness, Conscientiousness and Neuroticism than for Extraversion and Openness to Experience.

Another major influence of the Big Five model has been its impact on how we think about personality disorders. Prior to the Big Five model, personality disorders were seen as categories – you were either in a personality disorder category or not. When the *Diagnostic and Statistical Manual* (DSM) was revised from Version IV-TR to Version V, the personality disorder category system was not abandoned completely, but was revised to include a five-dimensional diagnosis system highly similar to the Big Five (Widiger, Gore, Crego, Rojas, & Oltmanns, 2017). In this new way of thinking, the line between normal and disordered personality is blurred. Personality disorder is now considered a matter of degree, where extremely high or low scores on the Big Five can indicate disorder.

The integrating framework of the Big Five also made it possible to better understand the heritability of personality. Genetic effects account for about half of the differences in each Big Five personality factor, while the remaining differences are due to environmental influences that make family members different from one another (Kandler, Bleidorn, Riemann, Angleitner, & Spinath, 2011).

The Big Five model has also been found useful for studying different kinds of personality change and stability over the lifespan. A meta-analysis of 152 longitudinal studies (Roberts & DelVecchio, 2000) examined what is called *rank-order stability versus change* in personality traits (e.g., whether the most extraverted young adults continue to be the most extraverted individuals during middle age and late adulthood). They found an increase in rank-order stability across the decades of life, rising from average correlations in the .40s during the first decade of life to about .74 in the 50s. Because the rank-order of stability of .74 is close to the reliability of personality measurement, one can conclude that rank-order of personality traits is extremely stable by age 50.

Another meta-analysis of 92 longitudinal studies by Brent Roberts and his colleagues (Roberts, Walton, & Viechtbauer, 2006) examined changes in the *average level* of the Big Five personality traits. The study found that people generally increased in Social Dominance (one aspect of Extraversion), Agreeableness, Conscientiousness and Emotional Stability over the lifespan. In contrast, while initially increasing in Openness to Experience and Social Vitality (a second aspect of Extraversion) during the first two decades of life, people decreased thereafter.

In summary, Tupes and Christal's five-factor view of personality has had an enormous impact on personality research since 1990. By providing an organizing

framework, the Five-Factor Model has allowed meta-analyses of the impact of personality on important life outcomes such as divorce, health and mortality, and occupational behaviour and job performance, as well as meta-analyses of genetic and environmental influences on personality and change and stability of personality over the lifespan. These demonstrations of the ability of personality assessments to predict significant life outcomes was exactly what Tupes and Christal (1961/1992) hoped that personality research could achieve.

CRITIQUE OF THE STUDY

Although strong and solid in many respects, the Tupes and Christal (1961/1992) study is not without weaknesses. One of the first questions one should ask about any study is, 'How representative is the subject sample?' Unlike so many published studies that employed one group of undergraduate students as subjects, Tupes and Christal used eight groups, and only two of them were undergraduates. However, two of the samples were psychology graduate students (a rather exclusive group), and the other four were students or graduates of Officer Candidate School for the US Air Force (again, a rather specialized group). Worst of all, only one of the eight samples was female, and in this sample the ratings that defined the Culture factor in the seven male samples split into two factors. This should immediately raise the question of whether personality factor structure is actually the same for males and females.

Tupes and Christal (1961/1992) do not report the nationality and ethnicity of subjects in the eight samples. Neither do the original reports from which they drew their data, but we can be fairly confident that nearly all of them were native-English-speaking, Caucasian Americans. Subsequent research has revealed consistent sex differences on some of the Big Five traits, with women expressing higher levels of Agreeableness and Neuroticism than men (e.g., Costa, Terracciano, & McCrae, 2001), but no studies have presented evidence that there are different basic personality factors for men and women. Costa et al. (2001) also report that the sex differences they obtained were greater in modern, egalitarian societies than in more traditional societies. This finding, which was confirmed in a later study by Schmitt, Realo, Voracek and Allik (2008), is important for understanding the biological and cultural basis for the Big Five traits.

The cultural and national factors that Tupes and Christal ignored have been the focus of intense, cross-cultural research on language and personality. The Allport–Odbert strategy of compiling a comprehensive list of personality trait-words from the dictionary has now been repeated in many languages other than English. Saucier and Goldberg (2001) provided one of the first reviews of non-English-language personality studies. They noted that factor analyses of German personality traits ratings produced nearly exactly the same Big Five factors found in English and therefore referred to these personality factors as the Anglo-Germanic Big Five or AGBF. Factor solutions highly similar to the AGBF have also been reported in Dutch, Polish, Czech and Turkish language studies. Italian,

Hungarian and Korean studies also produced the Big Five, but with two separate Agreeableness factors: one emphasizing a peaceful, quiet versus irritable disposition and the other, sincerity or integrity versus selfishness. Finally, two similar seven-factor solutions were reported – one for Hebrew and the other for Filipino. Analyses of these languages produced the Big Five with two Agreeableness factors similar to the Italian, Hungarian and Korean studies, but also produced a factor called Negative Valence, consisting of a mixture of undesirable traits from the Big Five. Saucier and Goldberg (2001) concluded that that AGBF can be found in many languages, but that the personality factors most likely to be found across most languages were Extraversion, Agreeableness and Conscientiousness.

A second major review of cross-language personality studies was done by de Raad, Barelds, Timmerman, de Roover, Mlačić and Church (2014). In addition to the studies cited by Saucier and Goldberg (2001), de Raad et al. noted studies of Albanian, Arabic, Bulgarian, Chinese, Croatian, French, Greek, Indian, Japanese, Maa, Malay, Norwegian, Persian, Portuguese, Russian, Slovak, South African, Spanish and Supyire-Senufo. A majority of these studies produced five or six interpretable factors. If there is a sixth major factor beyond the Big Five, the best candidate appears to be what has been called *Sincerity, Integrity,* or *Honesty-Humility* (Ashton, Lee, & Son, 2000).

Even with a good deal of consensus about the presence of the Big Five across languages and cultures, there are still critics who question the use of ordinary language for scientific purposes. The reasoning behind this criticism is that concepts in other, much more-developed sciences such as physics, biology and astronomy have evolved far beyond the concepts that in ordinary language describe everyday experiences. Everyday experience told us for thousands of years that the sun moves across a bowl-shaped sky above the earth, that whales and dolphins are fish, that bats are a type of bird, and that mass and time are not affected by velocity. However, modern astronomy tells us that the earth revolves around the sun, modern biology tells us that whales, dolphins and bats are mammals like us, not fish or birds, and modern physics tells us that mass increases and time slows as velocity increases.

A related objection to the Big Five factors from ordinary language is that there is no theory that explains the factors. In contrast to modern astronomy, biology and physics, which explain visible appearance in terms of unseen, theoretical entities, factor analyses of trait ratings merely describes how some personality judgements are related to other personality judgements, with no theory to explain why personality ratings cluster into five factors and what these factors really represent (Block, 1995; McCrae, 1990; McCrae, Costa, & Piedmont, 1993).

Authors of many personality *questionnaires*, on the other hand, have designed their questionnaires to assess supposedly scientific, theoretical concepts (McCrae & John, 1992). Hans Eysenck, for example, created a theory of personality based on theoretical differences in genes, behaviouristic learning and physiology. He viewed the psychiatric patients he saw at Maudsley Hospital and criminals as exhibiting extreme forms of traits found in the normal population. He concluded after a review of the literature on questionnaires, ratings and other assessment methods

that three recurrent personality dimensions underlay normal and extreme variations in personality: extraversion, neuroticism and psychoticism, and his factor analyses (with orthogonal rotation) of items on existing questionnaires confirmed his conclusions (Jensen, 1958).

Two major responses can be made to the criticism that the Big Five model is unscientific because a scientific model of personality should employ theoretical concepts that go beyond ordinary language. One is to distinguish between two scientific questions: (a) what is the nature of qualities inside of persons that give rise to personality? versus (b) how do people's perceptions of personality in others in everyday life influence their behaviour? Without considering the answer to (a), one can still do scientific research on (b) how ordinary persons' perceptions of personality (described in everyday language) influence their behaviour toward the persons they perceive. The perception of others' personalities is a topic that lies at the intersection between personality and social psychology and is used to help explain phenomena such as aggression, altruism, coalition formation, cooperation and prejudice.

Another response to the criticism that the Big Five model has no theory behind it is to admit that the model *is* atheoretical, but to point out that sciences often begin with observations and descriptions of patterns, followed by alternative theories of these patterns, which then direct future research. Even a psychologist as theoretically inclined as Eysenck declared that 'description, classification, and measurement must be worked out in the personality field before worthwhile attempts can be made to explain the underlying causes of differences in personality' (Jensen, 1958). After the Big Five model was widely accepted, various theories have been proposed to explain the five factors. A number of these theories have been published in a book edited by Wiggins (1996).

CONCLUSIONS

Tupes and Christal (1961/1992) not only helped to initiate the enormously successful Big Five or Five-Factor Model, they also contributed to our understanding of how sound personality assessment can predict significant life outcomes. Their research was not perfect. Despite an unusually large subject sample with a variety of raters and persons rated, females were underrepresented, as were non-Caucasian, non-English-speaking participants. Science advances by correcting for weaknesses in any research study, and research building on the Tupes and Christal study affirmed that the Five Factors are found in women as well as people of various ages, educational levels and ethnicities living in different cultures.

An irony of the Tupes and Christal study is that they developed their peer rating scales to overcome a concern that self-report measures of personality would be biased by self-enhancement, but the peer rating project was dropped because of a similar concern from the officer candidates that their peers were giving them biased, low ratings in order to improve their own chances (Christal, 1992).

'In Christal's words, "some applicants would stab their mother to be a pilot"' (Kyllonen, 2013). Personality researchers are still concerned today about how to obtain accurate, unbiased self-reports and acquaintance judgements of personality (Funder, 1995; Johnson & Hogan, 2006). Again, science advances by noting methodological problems and devising solutions for them.

A history of any subject always has to simplify reality by ignoring the countless, messy details in order to create an understandable story. Many details of the research leading up to the Tupes and Christal classic study could not be included in this chapter. Likewise, only a small sampling of current controversies and developments of the Big Five after Tupes and Christal has been presented here. The reader is encouraged to read any of the references in the reference list for more details on past and present Big Five research. In particular, the John, Angleitner and Ostendorf (1988) article gives a detailed, interesting history of personality assessment through trait-words. If you read the portion of this article that describes Cattell's research programme, you will be amazed by the number of inconsistencies and uncertainties in his reports and will probably see the emergence of the reliable Big Five as a miracle. Goldberg (1981, 1990, 1993, 1995), a central figure in promoting the Tupes and Christal model, is a genuine wordsmith; his articles are as enjoyable as they are informative. Finally, for understanding the place of Tupes and Christal within the overall history of Big-Five research, there is Johnson (2017).

NOTES

1. 'Recurrent personality factors based on trait ratings' was originally submitted as a US Air Force technical report by Ernest C. Tupes and Raymond E. Christal in 1961. The report is unclassified and lies in the public domain because it was written for and funded by the federal government. A PDF copy can be obtained from the Defense Technical Information Center at the following URL: www.dtic.mil/dtic/tr/fulltext/u2/267778.pdf. In 1992, Robert R. McCrae edited a special issue of the *Journal of Personality* on the Five-Factor Model (FFM). Because the Tupes and Christal (1961) report was considered to be a pivotal step toward the development of the FFM, McCrae approached Christal about reprinting the report in the special issue. Christal agreed. McCrae described the editing for the 1992 reprint version as follows: 'In preparing it for publication, the front matter and appendices have been omitted, the entries in the tables have been given to two decimal places where possible, and the format of tables and references has been updated. Except for minor corrections, approved by Dr. Christal, the text has been given verbatim; occasional editorial clarifications are given in brackets' (p. 218). The only significant information missing in the 1992 reprint are the complete matrices of correlations and factor loadings that appear in the appendix of the 1961 report. In accordance with APA citation style, the Tupes and Christal report is cited in this chapter as (1961/1992), unless the citation includes a direct quotation, in which case a reference is made to the more legible 1992 *Journal of Personality* reprint.
2. Although the spelling *extroversion* is seen more common today, *extraversion* is actually the original spelling used by the originator of the term, C. G. Jung. Kaufman (2015) has reviewed the history of the spelling of this word, arguing that *extraversion* is the preferred spelling.

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2. Although the spelling *extroversion* is very common today, *extraversion* is actually the original spelling used by the originator of the term, C. G. Jung. Kaufman (2015) has reviewed the history of the spelling of this word, arguing that *extraversion* is the preferred spelling.

FURTHER READING

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