

Analysis of the Big-five Personality Factors in Terms of the PAD Temperament Model

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The big-five personality factors were investigated using the trait pleasure–arousability–dominance (PAD) temperament model to assess overlap, and, specifically, similarities and differences, among the five dimensions. Results showed that extraverts were primarily dominant and secondarily pleasant. Agreeableness resembled dependency with pleasant, arousable, and submissive characteristics, but involved greater pleasantness. Conscientiousness included equal degrees of pleasant and dominant qualities. Emotional stability involved almost equal degrees of pleasant and unarousable characteristics, lacking the important dominant feature in this trait. Sophistication was weighted primarily by dominant, and secondarily by arousable, characteristics. The PAD scales explained approximately 75% of the reliable variance in three of the factors (extraversion, emotional stability, agreeableness) that have been identified, albeit sometimes with differing labels, in alternative general approaches to personality description. PAD components of the big-five factors helped explain the substantial overlap among the factors.

The big-five personality factors were first identified by Tupes and Christal (1961), who conceded that their five factors were not the only basic personality factors (p. 12). A subsequent, and widely cited, apparent corroboration of their work by Norman (1963) was criticised on the grounds that, in designing his study, Norman did not use an adequate sample of the trait domain, but, instead, specifically selected variables that he knew would load on the big-five (Boyle, Stankov, & Cattell, 1995). Block (1995) also noted that the supposed discovery of the five factors could be attributed, in part, to constraints imposed on the variable sets selected for study.

It would seem, then, that Norman (1963) and subsequent proponents of the big-five were selecting variables to improve assessment of the five factors, instead of casting a wide net to re-examine the validity of the hypothesised five factors. Indeed, work emerging from an alternative and broader based orientation identified a somewhat different set of five basic factors. Extensive factor analytic data based on Cattell's Sixteen Personality Factor Questionnaire (Cattell, Eber, & Tatsuoka, 1970), the Eysenck Personality Inventory (Eysenck & Eysenck, 1975), and the Comrey Personality Scales (Comrey, 1980) yielded a different version of the big-five that included extraversion and neuroticism, along with tough poise, control, and independence as five higher order factors for personality (Boyle, 1989; Noller, Law, & Comrey, 1987).

In short, the foundation and apparent generality of the Tupes and Christal (1961) and Norman (1963) factors as a comprehensive system for describing personality can be called into question. Since, however, the big-five factors have enjoyed a surge in popularity over the course of the last decade, it was deemed important to scrutinise the five dimensions from an alternative theoretical perspective. Objectives of the present study were to (a) investigate the degree of overlap among the five dimensions of the big-five, (b) identify basic components within each of the five so that similarities and differences among the five dimensions could be noted, and (c) examine the big-five within a framework that would help pinpoint characteristics of each of the five dimensions in reference to established personality scales in the literature.

The PAD temperament model. The alternative personality framework used was the PAD temperament model (e.g., Mehrabian, 1996). Unlike other factor-based approaches to personality

description, the PAD temperament model evolved from work *outside the field of personality*. Osgood, Suci, and Tannenbaum (1957) originated the semantic differential technique to identify basic dimensions of meaning. They thus dealt with an important aspect of conceptual (or higher level cognitive) functioning. Paradoxically, their highly general factors of evaluation, activity, and potency (EAP) related to an affective substrate and metaphorical foundation for comparing objects and events in distinct and apparently unrelated realms of experience (Osgood, 1969). Thus, for instance, stimuli in different sense modalities (e.g., a jagged line drawing and a dissonant musical piece) could be matched by subjects because the distinct stimuli evoked similar emotional connotations, as assessed by the EAP factors (Osgood, 1960). In short, the EAP factors appeared to have successfully identified the *lowest common denominators of cognitive functioning, namely, emotional connotations* of objects, events, and ideas.

Considering that the EAP identified basic factors of emotion and/or low-level cognitive counterparts of emotion, Mehrabian and Russell (1974, Chap. 2) proposed the following set of three dimensions to correspond to the EAP factors and to specifically describe emotions or affect: *pleasure–displeasure* (i.e., positive versus negative affective states) related to positive–negative evaluation of objects, events, or ideas; *arousal–nonarousal* (i.e., mental and/or physical activation) was a positive correlate of stimulus activity; and *dominance–submissiveness* (i.e., control versus lack of control over stimuli or events) was a negative correlate of stimulus potency.

The three nearly orthogonal PAD emotion dimensions have been shown to provide a reasonably comprehensive description of emotional states (e.g., Mehrabian, 1995a). Excitement, elation, or jubilation, for instance, consist of pleasure, high arousal, and dominance; loneliness and depression consist of displeasure, low arousal, and submissiveness. Anxiety, pain, and discomfort involve displeasure, high arousal, and submissiveness, whereas anger and hostility include displeasure, high arousal, and dominance.

In line with a fundamental distinction offered by Cattell and Scheier (1961), Mehrabian (1978) distinguished between emotional *states* and emotional *traits*. He defined emotional traits or temperament as characteristic individual emotional predispositions that could be assessed, for example, by averaging an individual's emotional states across a representative sample of everyday situations. Noting that an adequately general descrip-

tion of emotional states could be achieved with the PAD emotion factors, he suggested that a corresponding general description of emotional traits could be devised with an analogous set of PAD temperament factors.

Accordingly, the following three basic scales of temperament were developed: Trait Pleasure–Displeasure, Trait Arousability, and Trait Dominance–Submissiveness. The Trait Pleasure–Displeasure Scale assessed generalised individual predispositions toward positive versus negative affective states (Mehrabian, 1978). Validity data showed that the Trait Pleasure–Displeasure Scale distinguished personality characteristics associated with positive affect and psychological health (e.g., agreeableness, affiliation, extraversion, achievement, empathy, nurturance, optimism) from those associated with negative affect and maladjustment (e.g., trait anxiety, neuroticism, defensiveness or defence, aggression, loneliness, shyness, suicide proneness, binge eating, anorexia, depression) (e.g., Mehrabian, 1996; Mehrabian & Bernath, 1991; Mehrabian & O'Reilly, 1980).

Trait arousability was defined in terms of arousal amplitude and duration of habituation of arousal in response to complex, varied, and unpredictable (i.e., high-information) stimuli. A thorough review of the theoretical and experimental underpinning of the concept was offered, showing that the Trait Arousability Scale constituted a very general measure of emotionality (i.e., emotional sensitivity and/or reactivity) and was devoid of the negative affective bias typically present in measures of emotionality (Mehrabian, 1995c).

Trait dominance–submissiveness was defined in terms of generalised expectations of control and influence over relationships, events, and outcomes versus expectations that one is under the influence of situations, circumstances, and others (Mehrabian, 1994). The extensive validation data bearing on the Trait Dominance–Submissiveness Scale has been reviewed (Mehrabian, 1996).

Number of items in the three PAD temperament scales differ because each scale was developed independently of the other two and was designed to include all relevant characteristics that uniquely defined the particular trait it measured. Thus, in the process of scale development and revisions over a period of two decades, no arbitrary limit was set on the number of items that could be included in any one of the three scales.

The three dimensions of the PAD temperament model define a three-dimensional space where individuals are represented as points, personality types are represented as regions, and personality scales are represented as straight lines passing through the intersection point of the three axes. This framework has been used to analyse specific personality scales and to compare and contrast groups of personality scales in terms of distinct weights of the PAD components common to each group. Brief verbal descriptions of personality scales in reference to PAD space are facilitated by dichotomising each of the PAD scales at its respective mean and by using the abbreviated notations +P, +A, and +D to refer to pleasant, arousable, and dominant temperament, respectively, and by using –P, –A, and –D to refer to unpleasant, unarousable, and submissive temperament, respectively. Since most personality scales load on two or more of the PAD temperament dimensions, it has been useful to describe four diagonals in PAD space as follows:

Exuberant–Bored = (+P+A+D) vs. (–P–A–D)
 Dependent–Disdainful = (+P+A–D) vs. (–P–A+D)
 Relaxed–Anxious = (+P–A+D) vs. (–P+A–D)
 Docile–Hostile = (+P–A–D) vs. (–P+A+D)

It has been found that extraversion, arousal seeking, nurturance, and affiliation consist of pleasant, arousable, and dominant characteristics; anxiety and neuroticism consist of unpleasant, arousable, and submissive characteristics, whereas depression consists primarily of unpleasant and submissive qualities; dependency is composed of pleasant, arousable, and submissive qualities; and aggression or hostility includes unpleasant, arousable, and dominant characteristics (Mehrabian, 1995–96; Mehrabian & O'Reilly, 1980).

Hypotheses of the present study regarding relationships of the big-five factors with the PAD scales were based on the following findings from a preliminary study: extraversion includes pleasant and dominant characteristics; agreeableness consists of pleasant and submissive qualities; conscientiousness relates positively to trait pleasure; emotional stability includes pleasant and unarousable qualities; and sophistication is comprised of pleasant, arousable, and dominant characteristics (Mehrabian, 1995b).

METHOD

Participants

The 72 participants (28 men, 44 women) were recruited by laboratory assistants and consisted of friends and relatives of the assistants. Although the sample was relatively small, the participants were extremely motivated and conscientious, as evidenced by their willingness to participate without pay and to visit the UCLA campus to be tested. No demographic data were obtained for the present sample; however, experience with similarly recruited participants in our laboratory indicates that age and socioeconomic characteristics of such samples are far more diverse than corresponding characteristics of university student samples. More importantly, given that the present participants volunteered and made special efforts to be in our study, the high quality of data more than adequately compensated for more numerous data that could have been gathered from less careful and less motivated university student participants.

Materials

The following two sets of scales were used to assess the big-five and PAD dimensions. There was no similarity or overlap between items from the two sets.

The big-five measures. An thoroughly tested set of markers for each of the big-five factors, provided by Goldberg (1992), was used. There were 100 adjective markers, with 20 markers corresponding to each of the five factors (e.g., careful, efficient, harsh, selfish, complex, relaxed). Participants rated the 100 adjective markers using a 9-point scale with regard to accuracy–inaccuracy of self-description.

In the present study, the markers were used in such a way as to facilitate cross-study comparisons of results. Accuracy ratings of each set of 20 markers corresponding to a single factor were transformed into a total scale score, as follows. The sum of accuracy ratings of negatively worded markers for the factor was subtracted from the sum of accuracy ratings of positively worded markers of that factor. This approach was preferred over the factor scores approach recommended by Goldberg (1992), because it (a) provided a convenient and standardised scaling procedure that could be replicated exactly across different experiments and (b) allowed an assessment of the degree of interrelatedness of the five sets of markers.

Goldberg (1992) standardised (*z*-scored) responses of each participant to his markers in an effort to eliminate individual differences in use of his rating scale. Also, *z* scoring, compared with scoring based on raw scores, reduced the average intercorrelations among his five marker subsets by .02, .12, and .05, respectively, for each of three data sets (Goldberg, 1992, Table 5). Thus, *z* scoring produced only marginal reductions in intercorrelations among markers assigned to different factors and, in the judgment of the present investigator, did not constitute a sufficient improvement to warrant the added complications of *z* scoring.

The PAD Temperament Scales. The 22-item Trait Pleasure–Displeasure Scale (Mehrabian, 1978) consisted of semantic-differential items that highlighted differences in pleasure–displeasure (e.g., affectionate–nasty, excited–enraged). Participants reported how they felt habitually by placing a check mark in one of nine spaces separating each pair of adjectives.

The 34 items of the Trait Arousability Scale (Mehrabian, 1995c) assessed amplitude of arousal response and slowness of habituation to sudden increases in stimulus complexity, variabil-

ity, and novelty (e.g., "I am not affected much by sudden or intense events" (-) or "My strong emotions in a situation carry over for one or two hours after I leave it" (+)).

The 26 items of the Trait Dominance-Submissiveness Scale (Mehrabian, 1994) assessed generalised feelings of control and influence over one's relationships and life circumstances (e.g., "I control situations rather than let them control me" (+), "I work best when someone has outlined a job for me" (-), or "Domineering people don't intimidate me" (+)).

Procedure

Participants were run individually or in small groups at UCLA. They were asked not to record their names on any of the questionnaires. Each participant received the three PAD (Pleasure, Arousal, Dominance) scales followed by Goldberg's (1992) 100 big-five factor markers.

RESULTS AND DISCUSSION

Internal Consistencies of the Scales

Alpha internal consistency coefficients for the three PAD scales and the big-five factors are given as diagonal elements in Table 1. Alpha coefficients for the Trait Pleasure, Trait Arousal, and Trait Dominance scales were .95, .87, and .94 respectively. Alpha coefficients of the scales derived from Goldberg's markers were as follows: extraversion (.91), agreeableness (.90), conscientiousness (.87), emotional stability (.83), and sophistication (.90).

One interpretation of a high alpha coefficient is that it may be due to item redundancy at the expense of scale validity (e.g., Boyle, 1991). This problem was recognised when the PAD scales were developed. Each of the three scales was (a) developed from a heterogeneous sample of items representing the trait and (b) instead of a focus on achieving high scale homogeneity, was designed to represent diverse, though interrelated, aspects of the respective temperament dimension. For instance, the initial version of the Trait Arousal Scale included five distinct arousal, and four stimulus screening, factors. Stimulus screening, or selectivity in processing complex information, had been hypothesised to be the converse of arousal, that is, with greater selectivity effectively reducing stimulus complexity and, as a consequence, lowering arousal responses to stimuli. The four stimulus screening factors (thermal, auditory, olfactory, and tactual and kinesthetic screening) consistently exhibited the expected negative relationships with the five arousal factors (Mehrabian, 1977). The Trait Dominance-Submissiveness Scale was also founded on a broad initial sample of 457 items representing 64 content groups (Mehrabian & Hines, 1978). Substantial validity evidence is available on each of the three scales and was reviewed by Mehrabian (1995c, 1996).

Intercorrelations Among the Big-five and PAD Scales

Table 1 provides the intercorrelation matrix among the big-five and three PAD scales. In contrast to the typically negligible intercorrelations among the PAD temperament scales obtained in previous studies (e.g., Mehrabian, 1995b), intercorrelations among the PAD scales given in Table 1 were unusually high and averaged .20 in absolute value. Absolute values of intercorrelations among the big-five factors averaged .33, showing a substantial interdependence among the five. The difference between the high degree of interdependence, obtained here, and that reported by Goldberg (1992, Table 5) may be attributed only in part to the use of raw-score items in the present study.

Furthermore, the present findings raise questions as to results Goldberg (1992) might have obtained had he used oblique rotation methods instead of varimax rotation to identify the five sets of factor markers in his study. The following comments from two independent sources regarding this issue are noteworthy: "It is important to recognise though, that to assume orthogonality *a priori*, without first checking on the degree of obliquity of the factor correlations using an oblique rotational strategy ... is potentially problematic" (Boyle, 1989, pp. 1294-1295): "Oblique rather than orthogonal rotation of three factors was used to avoid artificially forced independence among the extracted factors and to permit assessment of possible interrelatedness of the three factors" (Mehrabian, 1995a, pp. 349-350).

The Big-five Analysed as Functions of the PAD Scales

Five linear regression analyses were used to analyse each of the big-five factors as functions of the Trait Pleasure (P), Trait Arousal (A), and Trait Dominance (D) scales. The resulting equations are given below for standardised variables. All nonzero beta coefficients in Equations 1 through 5 were significant at the .05 level.

$$\text{Extraversion} = .24 P + .72 D \quad (1)$$

$$\text{Agreeableness} = .76 P + .17 A - .19 D \quad (2)$$

$$\text{Conscientiousness} = .29 P + .28 D \quad (3)$$

$$\text{Emotional stability} = .50 P - .55 A \quad (4)$$

$$\text{Sophistication} = +.28 A + .60 D \quad (5)$$

Multiple correlation coefficients for Equations 1 through 5 were .83, .76, .46, .73, and .59, respectively. Hypothesised relationships were supported entirely in the case of extraversion and emotional stability. The two hypothesised components of agreeableness (pleasant, submissive) were confirmed; however, agreeable persons were also found to be arousable. Also, in addition to the predicted pleasantness component for conscientiousness, a dominance component was also obtained. Finally, only two of three temperament components of sophistication (arousable and dominant) were confirmed.

Table 1 Intercorrelations among the PAD and Big-five Scales

Mean	SD	Scale	1	2	3	4	5	6	7	8
39.7	24.5	1. Trait pleasure	.95	.04	.30*	.46*	.71*	.38*	.48*	.28*
35.3	31.6	2. Trait arousal		.87	-.26*	-.10	.25*	-.06	-.54*	.12
10.9	36.1	3. Trait dominance			.94	.79*	-.01	.36*	.40*	.52*
11.4	23.4	4. Extraversion				.91	.29*	.43*	.39*	.46*
35.0	18.6	5. Agreeableness					.90	.52*	.27*	.16
29.6	20.4	6. Conscientiousness						.87	.30*	.40*
-45.8	18.8	7. Emotional stability							.83	.11
37.6	19.7	8. Sophistication								.90

* $p < .05$.

Note.

Scale means and standard deviations are given in the first and second columns, respectively. Alpha internal consistency coefficients of the scales are given in the diagonal.

Stability of Relationships Between the Big-five and PAD Scales

Comparable data bearing on relationships between the big-five and PAD scales were available from an earlier study where 138 University of California undergraduates served as participants (Mehrabian, 1995b). The average absolute intercorrelation among the five Goldberg (1992) scales in that study was .21. Also, intercorrelations among the PAD scales were as follows: trait pleasure correlated .03 ($p > .05$) with trait arousability; trait pleasure correlated .15 ($p > .05$) with trait dominance; trait arousability correlated .07 ($p > .05$) with trait dominance. Thus, inter-scale relatedness within each of the two models was generally lower than in the present study.

Table 2 provides comparisons of regression Equations 1 through 5, obtained here, with corresponding equations obtained by Mehrabian (1995b). For Equations 1B through 5B in Table 2 (from Mehrabian, 1995b), all nonzero beta coefficients given were significant at the .05 level. A total of 15 big-five/PAD relationships were tested within each of the two studies. It is seen that 12 of 15 relationships assessed were the same in the two studies in terms of significance versus nonsignificance and relationship direction. Using the cumulative binomial distribution, the probability of 12 or more similar results in the two studies was less than .05. Thus, substantial stability of relationships was evident across the two studies.

Because of similarity of results in the two studies, a third inter-correlation matrix was computed in which the correlation between each pair of variables was the average of the corresponding correlations from the present, and from Mehrabian's (1995b), study. The resulting averaged correlations were used to compute a third, and more stable, set of equations (1C through 5C), also given in Table 2. Comparison of findings obtained in the present study (Equations 1 through 5) with averaged results from both studies (Equations 1C through 5C) shows a high degree of similarity.

Gender Differences in PAD/Big-five Relationships

The small participant sample in the present study was insufficient for examination of possible gender differences in PAD/big-five relationships. Therefore, raw data from the present study, and from Mehrabian's (1995b) study, were combined and analysed to assess gender differences. Regression analyses were used to approximate the classic experimental approach to analysis of variance. In the first of five regression equations, the dependent variable was extraversion, independent variables entered first were trait pleasure and trait dominance (known to be significant first-order components of extraversion; note Table 2, Equation 1C), and, next, possible significant additional contributions of gender by trait pleasure and gender by trait dominance were assessed. The two interaction terms involving gender did not achieve significance ($p > .05$); that is, adjusting for the significant effects of trait pleasure and trait dominance left no additional significant variance in extraversion due to gender by trait pleasure or gender by trait dominance. In short, gender did not moderate relationships of trait pleasure or trait dominance with extraversion.

In the second regression analysis, agreeableness was the dependent variable; trait pleasure, trait arousability, and trait dominance (known significant first-order components of agreeableness; Table 2, Equation 2C) were entered first and, next, possible significant additional contributions of gender by trait pleasure, gender by trait arousability, and gender by trait dominance were assessed. None of the latter three interaction terms yielded significance ($p > .05$), showing that gender did not moderate relationships of the PAD variables with agreeableness.

Similar regression analyses for conscientiousness, emotional stability, and sophistication also showed that once effects of the known significant first-order PAD components of each of these measures were partialled out, interactions of gender with the PAD variables failed to explain additional variance. Overall, then, results were consistent in showing that PAD/big-five relationships summarised in Equations 1C through 5C (Table 2) did not differ significantly for men and women.

Composition and Validity of Each of the Big-five Factors

Extraversion. Equation 1 shows that trait dominance was, by far, the strongest component of the extraversion factor, with trait pleasure being a weaker and positively weighted component. (The Fisher r -to- z transformation yielded a z difference score of 3.35, $p < .01$, for the extraversion/trait dominance, versus the extraversion/trait pleasure, correlation.) Thus, within the big-five framework, the primary characteristic of extraverts was their generalised feelings of control and influence over their life situations and relationships and, secondarily, their generalised positive affective responses to situations and others.

A comparison of the results in Equation 1 with comparable results obtained for the Extraversion Scale (Eysenck & Eysenck, 1975) by Mehrabian and O'Reilly (1980, Equation 1) is instructive.

$$\text{Extraversion (Eysenck)} = .21 P + .17 A + .50 D \quad (6)$$

In terms of its trait dominance and trait pleasure components, particularly those based on averaged results from two studies (Table 2, Equation 1C), Goldberg's extraversion factor approximated the Eysenck scale. The major difference between the two scales was that the Eysenck scale included a positive trait arousability component, whereas the Goldberg factor did not.

McCrae and Costa (1985) defined extraversion as including "warmth, gregariousness, assertiveness, activity, excitement seeking, and positive emotions" (p. 712). Findings have shown that measures of affiliation (warmth, gregariousness) tend to involve pleasant, arousable, and dominant temperament characteristics, listed in decreasing order of importance (e.g., Mehrabian & O'Reilly, 1980, Equations 6 and 8). Craving for excitement and change (or arousal seeking) is associated with dominant, arousable, and pleasant characteristics, listed in decreasing order of importance (Mehrabian & O'Reilly, 1980, Equations 2 and 4). Positive emotions relate positively to trait pleasure, activity relates positively to trait arousability, and assertiveness relates positively to trait dominance. In short, a combination of all the latter factors would suggest extraversion involves pleasant, arousable, and dominant characteristics. Thus,

Table 2 Assessment of the Stability of Relationships between the PAD and Big-five Scales

Extraversion	= .24 P	+ .72 D	(1)
Extraversion	= .31 P	+ .45 D	(1B)
Extraversion	= .29 P	+ .59 D	(1C)
Agreeableness	= .76 P + .17 A	-.19 D	(2)
Agreeableness	= .71 P	-.15 D	(2B)
Agreeableness	= .74 P + .13 A	-.18 D	(2C)
Conscientiousness	= .29 P	+ .28 D	(3)
Conscientiousness	= .20 P		(3B)
Conscientiousness	= .25 P	+ .19 D	(3C)
Emotional stability	= .50 P	-.55 A	(4)
Emotional stability	= .37 P	-.44 A	(4B)
Emotional stability	= .43 P	-.49 A	(4C)
Sophistication	=	+ .28 A + .60 D	(5)
Sophistication	= .21 P + .24 A	+ .37 D	(5B)
Sophistication	= .16 P + .24 A	+ .46 D	(5C)

Note.

P = trait pleasure-displeasure, A = trait arousability, D = trait dominance-submissiveness. $p < .05$ for all nonzero beta weights given. $N = 72$ for Equations 1 through 5, obtained in the present study, and $N = 138$ for Equations 1B through 5B, obtained by Mehrabian (1995b). Corresponding correlation coefficients in the two studies were averaged and used in regression analyses to yield Equations 1C through 5C. The latter equations provided more stable estimates of relationships based, effectively, on 210 observations across the two studies.

insofar as it lacked a trait arousability component, Goldberg's extraversion factor was less faithful to the definition of extraversion than the Eysenck scale.

Agreeableness. Digman and Takemoto-Chock (1981) offered "Friendly Compliance versus Hostile Noncompliance" as an alternative label for agreeableness. The latter label or definition suggests a substantial overlap of this factor with affiliative and friendly (and their opposite, nonaffiliative, unfriendly, indifferent, or even interpersonally negative) social orientations — characteristics that have been shown to be associated with pleasant, arousable, and dominant attributes (e.g., Mehrabian & O'Reilly, 1980, Equations 6 through 9). However, since "compliance" is strongly suggestive of submissiveness and "hostile noncompliance" and "hostility" involve dominance (Mehrabian & O'Reilly, 1980, Equation 30), on balance, Digman and Takemoto-Chock's definition of agreeableness can be translated into pleasant, arousable, and submissive temperament components within the PAD temperament model. Results in Equation 2 were completely consistent with the latter inference and showed that Goldberg's agreeableness factor did indeed reflect pleasant, arousable, and submissive characteristics, with a strong emphasis on pleasantness. (For instance, the Fisher r -to- z transformation yielded a z difference score of 5.2, $p < .01$, for the agreeableness/trait pleasure, versus the agreeableness/trait dominance, correlation.) In other words, within the big-five framework, agreeable persons were primarily pleasant and were secondarily arousable and submissive. Given the obtained results for agreeableness, it is important to reproduce findings bearing on the Succorance (or dependency) Scale (Jackson, 1984) from Mehrabian and O'Reilly (1980, Equation 29).

$$\text{Succorance (Jackson)} = .20 P + .23 A - .34 D \quad (7)$$

Jackson (1984) defined succorance as "frequently seeks the sympathy, protection, love, advice, and reassurance of other people" (Table 1). Thus, Goldberg's agreeableness factor resembled succorance or dependency in terms of arousability and submissiveness, but involved a considerably stronger contribution from pleasantness. (The Fisher r -to- z transformation yielded a z difference score of 4.9, $p < .01$, for the agreeableness/trait pleasure, versus the succorance/trait pleasure, correlation.) In short, Goldberg's agreeableness factor described a variant of dependent person with an extraordinarily pleasant temperament.

Conscientiousness. Digman and Takemoto-Chock (1981) used "Will to Achieve" as the label for the conscientiousness factor, and McCrae and John (1992) defined it in terms of being "thorough, neat, well-organised, diligent, and achievement-oriented" (p. 197). Equation 3 showed the conscientiousness factor to be weighted almost equally and positively by trait pleasure and trait dominance. This result was consistent with findings showing that achievement orientation involved pleasant and dominant temperament components (Mehrabian & O'Reilly, 1980, Equations 20 and 21). However, conscientiousness (or the tendency to be neat, well organised, and diligent) differed from achievement orientation, because achievement was weighted primarily by trait dominance, whereas conscientiousness involved almost equal degrees of pleasant and dominant temperament characteristics.

Emotional stability. Equation 4 for emotional stability showed it to be an almost equally weighted function of trait pleasure and of low trait arousability. As hypothesised, then, emotionally stable individuals were pleasant and unarousable. It is useful to compare the findings in Equation 4 with findings for Trait Anxiety (Mehrabian, 1995–96; Spielberger, Gorsuch, & Lushene, 1970) and Neuroticism (Eysenck & Eysenck, 1975) scales.

$$\text{Trait Anxiety (Spielberger)} = -.43 P + .29 A - .37 D \quad (8)$$

$$\text{Trait Anxiety (Mehrabian)} = -.47 P + .33 A - .18 D \quad (9)$$

$$\text{Neuroticism (Eysenck)} = -.26 P + .49 A - .25 D \quad (10)$$

Equations 8 and 10 are from Mehrabian and O'Reilly (1980, Equations 14 and 13, respectively) and Equation 9 is from Mehrabian (1995–96). Scales of "emotional instability" (i.e., trait

anxiety or neuroticism) clearly and consistently included moderate degrees of unpleasant, arousable, and *submissive* temperament characteristics. Conversely, "emotional stability" was expected to include moderate degrees of pleasant, unarousable, and dominant characteristics. Thus, Goldberg's emotional stability factor (Equation 4) was partially lacking in validity because it failed to include one of three essential ingredients (i.e., dominance) in this trait.

Sophistication. The sophistication factor was labelled "Culture" by Tupes and Christal (1961) and by Norman (1963), and was defined as consisting of intellectual and artistic interests. The everyday or dictionary definition of sophistication is "(unduly) complicated, worldly, and subtle". Together, these attributes imply a tendency to make things complicated, and imply high arousability, whereas "being cultured" implies social stature, hence dominance. Results given in Equation 5 for Goldberg's sophistication factor showed it to be weighted primarily by dominance and, secondarily, by arousability. (The Fisher r -to- z transformation yielded a z difference score of 2.7, $p < .01$, for the sophistication/trait dominance, versus the sophistication/trait arousability, correlation.) Although the latter results were generally consistent with our definition of sophistication, arousability was clearly less important than dominance in this factor.

Averaged results from both studies (Table 2, Equation 5C) also showed a secondary positive trait pleasure component to sophistication, thus yielding a very close approximation to the Eysenck Extraversion Scale (Equation 6). Since, in addition, the extraversion and sophistication factors intercorrelated .46 ($p < .05$), our findings provided little justification for sophistication as a basic and independent factor of personality.

Overlap among the Big-five Factors

Analysis of the big-five factors in terms of the PAD temperament model helps explain the degree of overlap among the five factors. For instance, a correlation of .43 ($p < .05$) between the extraversion and conscientiousness factors is understandable because both were positively weighted by trait pleasure and trait dominance. Similarly, a correlation of .46 ($p < .05$) between the extraversion and sophistication factors can be explained because both included trait dominance as primary components. Again, the low and nonsignificant correlation of .11 ($p > .05$) between the emotional stability and sophistication factors is understood because these two factors involved mostly non-overlapping temperament components. In short, analysis of the big-five factors in terms of fundamental dimensions of temperament helps assess the validities of the labels (measures) and explain some of the unexpectedly high intercorrelations among the factors.

Estimation of "True" Relationships between the Big-five and PAD Scales

Relationships between the big-five and PAD scales, given in Equations 1 through 5, underestimated true relationship, insofar as the scales used in the equations lacked perfect reliabilities. To estimate potential true relationships that could have been obtained with perfectly reliable scales, each of the intercorrelations in Table 1 was first *corrected for attenuation* using Spearman's (1904) formula (i.e., the intercorrelation between each pair of scales was divided by the square root of the product of reliabilities of the two scales). A new set of regression equations, based on the preceding "corrected" correlations, yielded Equations 1D through 5D that have been written for standardised variables and .05-level significant effects.

$$\text{Extraversion} = .23 P + .12 A + .82 D \quad (1D)$$

$$\text{Agreeableness} = .83 P + .19 A - .21 D \quad (2D)$$

$$\text{Conscientiousness} = .32 P + .30 D \quad (3D)$$

$$\text{Emotional stability} = .57 P - .65 A \quad (4D)$$

$$\text{Sophistication} = +.33 A + .67 D \quad (5D)$$

Multiple correlation coefficients for Equations 1D through 5D were .90, .83, .50, .85, and .65, respectively. Thus, it is seen that

when adjusted for attenuation due to unreliability, relationships between the big-five and PAD scales were strengthened and the PAD scales accounted for 81%, 69%, 25%, 72%, and 42% of the variance in the extraversion, agreeableness, conscientiousness, emotional stability, and sophistication factors of the big-five, respectively. The latter figures are given in Table 3.

An alternative approach was used also and provided estimates of the proportion of reliable variance in each of the big-five scales accounted for by the PAD scales. For Equation 1, the ratio of the squared multiple correlation to the square of the alpha reliability coefficient for extraversion ($.83^2/.91^2 = .83$) showed that 83% of the reliable variance in the Extraversion scale was explained in terms of the PAD scales. Similar computations for Equations 2 through 5 yielded 71% for agreeableness, 28% for conscientiousness, 77% for emotional stability, and 43% for sophistication. Results of this second approach are also given in Table 3.

Estimates of variance accounted for by the PAD scales, obtained with each of the two approaches and summarised in Table 3, were highly similar, although the second method consistently yielded more generous estimates. It is noteworthy that the PAD scales were most effective in explaining the variance of three of the factors (extraversion, emotional stability, agreeableness) that have been identified, albeit sometimes with differing labels, in alternative general approaches to personality description (e.g., the Eysenck & Eysenck, 1985, extraversion and neuroticism factors, and the tough poise factor identified by Boyle, 1989, and by Krug & Johns, 1986).

Estimation of Trait Pleasure, Trait Arousability, and Trait Dominance Scores Using the Big-five Scales

Three linear regression analyses were used to analyse each of the PAD scales as functions of the extraversion, agreeableness, conscientiousness, emotional stability, and sophistication factors. The resulting equations, written for standardised variables and .05-level significant effects, are given below.

$$\text{Trait pleasure} = .59 \text{ agreeableness} + .25 \text{ stability} + .19 \text{ extraversion} \quad (11)$$

$$\text{Trait arousability} = -.65 \text{ stability} + .42 \text{ agreeableness} \quad (12)$$

$$\text{Trait dominance} = .77 \text{ extraversion} - .27 \text{ agreeableness} + .21 \text{ sophistication} \quad (13)$$

Multiple correlation coefficients for Equations 11 through 13 were .79, .67, and .85, respectively. Equations 11 through 13 are reproduced in Table 4 along with comparable results from Mehrabian's (1995b) study (Equations 11B through 13B). Also, as in Table 2, the averaged correlation matrix from the two studies was analysed and yielded Equations 11C through 13C, which should provide more stable estimates of relationships. It is seen, then, that PAD scores can be estimated with moderate

Table 3 Amount of Reliable Variance in Each of the Big-five Scales Accounted for by the PAD Scales

	Results of Equations 1D-5D	Squared multiple-correlation divided by squared alpha reliability
Extraversion	81%	83%
Agreeableness	69%	71%
Conscientiousness	25%	28%
Emotional stability	72%	77%
Sophistication	42%	43%

Note.

Quantities in the first column are squared multiple correlations from regression equations for the big-five scales as functions of the PAD scales using intercorrelations that have been corrected for attenuation (Equations 1D through 5D). Quantities in the second column represent the ratio of squared multiple correlations divided by squared alpha reliabilities of the dependent measures (Equations 1 through 5).

accuracy when only big-five scores are available and investigators also wish to analyse their data in relationship to the PAD temperament model.

Explanatory Clarity of the PAD Versus the Big-five

Relationships among anxiety, depression, and hostility will be used below to illustrate substantial differences between the PAD and big-five models. Within the big-five model, factor analysis of the NEO-PI facet scales yielded an "emotional stability" factor with high loadings from the Anxiety, Depression, and Hostility scales, thus suggesting near-equivalence of the latter three (Goldberg, 1992, Table 6). In contrast, the PAD temperament model facilitated conceptual and psychometric differentiation among such important personality traits. For instance, despite its smaller number of variables, the PAD approach provided clear distinctions between Anxiety and Depression scales. Simply, the two shared unpleasant and submissive temperament components, but differed in terms of trait arousability: anxiety correlated positively with trait arousability and depression evidenced weak positive or nonsignificant relationships with trait arousability (Mehrabian, 1995-96, Equations 10 and 11; Mehrabian & Bernath, 1991).

Comparable analysis of similarities and differences between Anxiety and Depression scales within the big-five model would yield equations in which anxiety (or depression) were expressed as functions of extraversion, agreeableness, conscientiousness, emotional stability, and sophistication. Results would, in turn, be paraphrased along the following lines: "In comparison with depression, anxiety involves less emotional stability, more extroversion, more sophistication ...". Clearly, such an analysis would provide minimal guidance in applied settings, such as, for rapid and convenient differential diagnosis of the two conditions or for the treatment of either. In comparison, the PAD approach shows simply that anxiety involves significantly greater trait arousability than depression and, furthermore, can be ameliorated, in part, by reducing the "information rate" (i.e., complexity, novelty, variability) of an anxious client's everyday environment.

In addition, the PAD approach shows that anxious and depressed clients can be helped by identifying and possibly altering those aspects of their physical surroundings, work, or relationships where the clients lack feelings of control (i.e., feel submissive) and which are persistent sources of displeasure. For instance, a vocational guidance counsellor would guide her anxious client toward work settings that (a) involve a fixed and

Table 4 Prediction of the PAD Scale Values Using the Big-five Scales

P =	.59 Agree + .25 Stab + .19 Extra	(11)
P =	.60 Agree + .14 Stab + .21 Extra	(11B)
P =	.59 Agree + .19 Stab + .21 Extra	(11C)
A =	-.65 Stab + .42 Agree	(12)
A =	-.47 Stab + .18 Agree + .20 Soph	(12B)
A =	-.57 Stab + .30 Agree + .15 Soph	(12C)
D =	.77 Extra - .27 Agree + .21 Soph	(13)
D =	.45 Extra - .25 Agree + .35 Soph	(13B)
D =	.60 Extra - .32 Agree + .25 Soph + .17 Conc	(13C)

Note.

P = trait pleasure-displeasure. A = trait arousability. D = trait dominance-submissiveness. Extra = extraversion. Agree = agreeableness. Conc = conscientiousness. Stab = emotional stability. Soph = sophistication. $p < .05$ for all beta weights given. $N = 72$ for Equations 11 through 13, obtained in the present study, and $N = 138$ for Equations 11B through 13B, obtained by Mehrabian (1995b). Corresponding correlation coefficients in the two studies were averaged and used in regression analyses to yield Equations 11C through 13C. The latter equations provided more stable estimates of relationships based, effectively, on 210 observations across the two studies.

predictable schedule with few intrusions, interruptions, or noise (less information rate), (b) are not overly competitive but preferably cooperative in nature (typically more pleasant social exchanges), and (c) provide greater privacy during work and greater control over the tasks performed (more dominance).

Again, within the PAD model, anxiety and aggression were found to share unpleasant and arousable components, but to differ in terms of dominance. Aggression (or hostility) was associated with dominance, whereas anxiety was associated with submissiveness (e.g., Mehrabian & O'Reilly, 1980, Equations 14 and 30). For example, such results would suggest that repeated frustration at work (i.e., persistent displeasure, high arousal, submissiveness) is far more likely to elicit workplace violence when the worker has a dominant, rather than a submissive, temperament. PAD analysis of anxiety versus aggression also suggests that a frustrated and anxious worker is far more likely to be abusive toward those subservient to him or her (e.g., subordinates at work or children at home) than toward equals or superiors. Alternatively, such a worker is more likely to engage in covert, inconspicuous, and less detectable, but nevertheless costly, acts of sabotage than in overt destructive actions costly to the employer.

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