

## VERBAL-QUANTITATIVE DIFFERENTIAL AS INDICATOR OF TEMPERAMENTAL DIFFERENCES

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### ABSTRACT

With verbal and quantitative scores commonly available, the correlation of the difference between these two ability scores (VQDF) and temperamental differences would be of interest to clinicians and researchers. Previous research has suggested such correlations exist, although the personality measures, subject characteristics and methods of determining VQDF have varied widely. In the present study VQDF (verbal minus quantitative) scores are correlated with personality (16PF and HSPQ) and vocational interest scores for males and females in both high school and college populations. Results show consistent trends for correlations of the VQDF with a number of personality and vocational interest variables: high verbal persons are more tenderminded, bold, less anxious and similar to lawyers; high quantitative persons are more guilt prone, anxious, tough-minded and similar in interests to mathematicians. Results are discussed in relation to age differences. Arguments are presented for use of this methodology for studying VQDF and personality correlations. An example for the clinical use of these results is given.

### INTRODUCTION

Nearly everyone has a verbal and a quantitative ability score these days: they are provided by commercial multilevel ability batteries for high school and lower grades and the SAT, ACT and GRE for college and graduate school. Of sporadic but continued interest over the years has been the difference between verbal and quantitative scores (VQDF). The VQDF is cheap information, and its usefulness to practitioner and researcher is determined by its correlates. In this paper the concern is with temperamental and interest correlates measured by Cattell's 16PF and HSPQ, and the Strong-Campbell Interest Inventory. In other words, given the ubiquity of verbal and quantitative scores (and hence the difference between them) are there any consistent non-cognitive correlates of the difference that can be useful to practitioners?

Even if one ignores tempting ramifications of VQDF in such areas as cognition, ability factors, cognitive styles and the like, it is possible to trace a considerable history of research on VQDF. In the domain that comprises the main focus of this paper, personality and interest correlates of VQDF, one finds important studies across the years, with McCarthy (1953) presenting one of the early ones.

Her study investigated personality profiles characterizing differential verbal-quantitative ability. Half of the 44 variables which comprised the noncognitive measures differentiated between high quantitative (Q) and high verbal (V) women at the .05 level. The relevant variables were measures of interest, occupational preferences, avocational choices, values and personality factors. In the area of personality, as measured by the 16PF, McCarthy found Q women to be warm and outgoing (factor A+), astute and worldly (factor N+)

and self-sufficient, preferring independent decisions (factor  $Q_2+$ ). V women also scored significantly higher on Bohemianism (unconventional and imaginative).

From several later studies using projective personality indices, evidence emerged that is fairly consistent with McCarthy's findings. A high quantitative ability has been associated with greater objectivity, outer orientations, and a more conservative attitude, whereas V ability is associated with independence of authority (Sanders, Mefford & Bowan, 1960; Spilka & Kimble, 1958). Altus (1952) reported that females with a high Q profile can be described as more anxious, conventional and straight-forward than high V females who are more adventurous and less anxious. In a later study, Altus (1958) found that high Q males tend to have a more masculine attitude than high V males who tend to be more sophisticated or less naive. In another study of male subjects, Sanders, Mefford & Bowan (1960) utilized both projective and objective personality measurements. These investigators characterized high Q males as being objective, introspective, perseverant, factual and dependent on authority and group affiliation. Males in the high V group tended to be somewhat idealistic, subjective, imaginative, intuitive and independent of authority and group affiliation.

More recently, Turner & Hibbs (1977) compared groups with distinctive patterns of abilities along parameters of vocational interest and personality correlates. Their comparisons of vocational interest, as measured by the Vocational Preference Inventory, reveal that high V males score significantly higher than Q males on Social and Artistic interests, while females of similarly composed groups score significantly higher only on Artistic interests. Comparisons of scores on the 16PF also differentiate between the high Q and high V groups. Both sexes in the high V group score higher on Imagination (factor M) and females of the V group score higher on Dominance (factor E) and Rebelliousness (factor  $Q_1$ ).

A summary mapping of results of these researches is displayed in Table 2, in the rows designated "expected direction." Sex of persons in the researches is indicated by the traditional "F" and "M," and the direction of the result by the algebraic sign. Thus, on factor A on the 16PF, women with higher verbal over quantitative scores have been found to score on the low (reserved) end of the outgoing/reserved polarity.

While there are, then, certain similarities of results in earlier studies, the exact specification of VQDF and the method of displaying results have varied widely.

McCarthy (1953) defined groups on the basis of one-standard-deviation difference between verbal and quantitative scores, while Turner & Hibbs (1977) used an 80-point difference (SAT) as their criterion. By matching high and low scores, Sanders, Mefford & Bowan (1960) compared three groups ( $V_q$ ,  $vQ$ , and  $VQ$ ) whereby the mean of the high scorers fell at the 85th percentile and the mean of the low group at the 25th percentile. Altus (1958), examined the magnitude of the discrepancy by dividing subjects into quartiles and comparing the two extreme groups. The present authors have a strong preference for defining VQDF simply as the remainder in the operation " $VQDF = V - Q$ ," and for presenting results of researches in this area as correlations of that remainder with other variables of interest. This point receives more elaboration toward the end of the present report.

## PROCEDURES

The data used in this study were from seven different groups ranging from high school to college populations, both sexes. Sample characteristics and sample sizes are shown in Table 1. The identifying letters for samples are acronyms: HSM1 is the first group of high school males, CSM is college student males, CSF is college student females.

Table 1

## Sample Characteristics

Sample	Age	Variable	M	SD	N
HSM1 (Private School)	13-15	CAT VR+V	198	52	105
		CAT MR + M U	183	57	
		CATVQDF	15	37	
HSM2 (Public School)	16-18	KAV	42	9.5	101
		KAQ	48	7.6	
		KA VQDF	-6.0	10.8	
CSM 1 (Seminarists)	17-22	SAT V	466	89	33
		SAT Q	458	101	
		SAT VQDF	10	100	
HSF (Public School)	16-18	KA V	44	9.1	133
		KA Q	47	7.5	
		KA VQDF	-3.1	8.8	
CSM 2 (Vocational Counselees)	18-48	SAT V	457	95	49
		SAT Q	480	101	
		SAT VQDF	-23	121	
HSM 3 (Private School)	13-16	LT V	119	10.5	60
		LT Q	122	11.3	
		LT VQDF	-3.4	12.8	
CSF (Vocational Counselees)	18-48	SAT V	463	98	44
		SAT Q	477	100	
		SAT VQDF	-14	87	

Personality characteristics for the younger groups (18 years and below) were measured by the High School Personality Questionnaire (HSPQ); for the adult samples the Sixteen Personality Factor Questionnaire (16PF) was used (see Figure 1). The HSPQ and the 16PF are comparable personality measures, both based on the factoring of questionnaire responses and matched across instruments. The HSPQ gives 14 primary factor scores (personality dimensions) and the 16PF gives 16 primary factor scores (see Figure 1). For groups CSM2 and CSF no personality test scores were available but selected subscores from the Strong Campbell Interest Inventory (SCII) were used. Selection of the subscores was necessary for practical reasons, and was designed to be representative of the entire inventory.

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Figure 1 — Factors On The HQP2 and 16PF Personality Questionnaire

<u>Factor</u>	<u>Low Pole</u>	<u>High Pole</u>
A	Reserved	Outgoing
B	Low Intelligent	High Intelligent
C	Affected by Feelings	Emotionally Stable
D*	Undemonstrative	Excitable
E	Humble	Assertive
F	Sober	Happy-go-lucky
G	Expedient	Conscientious
H	Shy	Bold
I	Tough-minded	Tender-minded
J*	Zestful	Reflective
L+	Trusting	Suspicious
M+	Practical	Imaginative
N+	Forthright	Shrewd
O	Placid	Apprehensive
Q <sub>1</sub> +	Conservative	Experimenting
Q <sub>2</sub> +	Group dependent	Self sufficient
Q <sub>3</sub> +	Impulsive	Controlled
Q <sub>4</sub> +	Relaxed	Tense

\*HSPQ only

+Not on HSPQ

Measures for verbal and quantitative scores were taken from existing file records. For the high school groups scores were from the Kuhlman-Anderson Measure of Academic Potential (KA), the California Achievement Test (CAT), and the Lorge-Thorndike (LT). Verbal and Quantitative scores for the college groups were obtained from the Scholastic Aptitude Test (SAT).

#### METHOD

For each group, scores on quantitative measures were subtracted from the scores on the verbal measures to give the differential between verbal skills and quantitative skills (VQDF). This VQDF was then intercorrelated with the personality or interest measure scores. For groups HSM2 and HSF, raw scores from the HSPQ were entered, while for all other samples the calculated sten scores for the HSPQ and 16PF or SCII scores as given by the commercial score report were used.

For groups HSM2 and HSF, since as a whole the ability scores were on the average one standard deviation lower than for the other samples, only the top half of the sample on the KA were used. This was done by summing the verbal and quantitative scores for the whole group and dropping out the lower 50% of this sample. The VQDF was then calculated as for the other samples.

## RESULTS

Table 1 also presents means and standard deviations for the cognitive variables in this report by subgroup.

All groups are average or above on the measures of cognitive ability, and separated by sex. Separation by sex was done in accord with the general hypothesis about the nature of temperamental differences associated with VQDF, as reported above. In an early analysis, subjects comprising HSM2 and HSF were tested as part of a larger group (N = 393) of mixed sex and lower average ability. The results of this preliminary analysis on this combined group did not harmonize with other results in this study nor with prior research. Accordingly, only students above the median on summed V and Q scores from this sample were included in subsequent analyses, and these were separated by sex to form groups HSM2 and HSF. Scores on the LT are deviation IQ; on the KA are percentiles; on the SAT are in standard CEEB metric. Scores on the CAT are summations of achievement subscores originally reported as standard scores with a mean of 100, standard deviation of 20. The verbal is the sum of Verbal Reasoning and Vocabulary, the quantitative, the sum of Math Reasoning and Math Usage.

Means and standard deviations for the noncognitive variables (HSPQ, 16PF, SCII) were all within normal range for these variables, are readily available in test manuals, and have not been presented here to save space.

Table 2  
Correlations of VQDF with Personality & Interest Variables

Sample N/Test	Personality (16PF, HSPQ)																Value of r*			
	A	B	C	D	E	F	G	H	I	J	L	M	N	O	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	1-tail	2-tail
HSM 1 105/CAT	-15	-20	14					11	20	05	X	X	X	-03	X			-13	.16	.19
HSM2 101/KA	00	19	12					17	11	10	X	X	X	-13	X			-20	.16	.20
HSM3 60/LT	11	-25	-03					02	37	-16	X	X	X	10	X			-15	.21	.25
HSF 33/KA	01	20	-03					03	10	23	X	X	X	-03	X			-11	.14	.17
CSM 1 33/SAT	40	16	07	X				10	28	X		14	-31	-27				12	.28	.33
Expected Direct'n	F-				F+							M+ F+	F+	F+	F+					

Sample N/Test	SCII Themes							Basic Scales <sup>a</sup>				Occ. Scales <sup>b</sup>					Value of r*	
	IE	R	I	A	S	E	C	Mth	Art	Law	Ofc	Eng	Art	SWk	Act	Law	1-tail	2-tail
MF/44/SAT	-11	-03	-03	12	-11	-08	28	-35	09	09	-26	-17	30	09	-01	29	.24	.29
SM2/49/SAT	-15	-03	-11	24	04	06	-05	-28	16	21	13	-14	02	15	-08	26	.23	.27
Expected Direction					M+ F+			M- F-		M+ F+			M+ F+			M+ F+		

Mth=Mathematics  
Law=Law & Politics  
Ofc=Office Practice

Eng=Engineer  
Art=Artist  
SWK=Social Worker  
Act=Accountant  
Law=Lawyer

\* p < .05

Table 2 presents correlations for 16PF, HSPQ and SCII variables with VQDF for the various subgroups. All variables for both 16PF and HSPQ are arranged as columns, and subgroups as rows. At each intersection is the correlation of VQDF with the personality factor for the particular subgroup. Where a cell is crossed out (X), no factor score exists for that subgroup because of incomplete overlap between 16PF and HSPQ. Included in the table are those coefficients which are significant, which complete a column, or, in one instance, are close to significance and are generally consistent down the column (factor C). Significance values (.05) for both one- and two- tail tests are presented for each row, and the expected direction of results (based on earlier findings) is displayed below each column. One- tail tests are appropriate for columns for which there was an expected result.

Results are presented as correlations rather than, for example, *beta* weights, because the authors believe this form to be most potentially useful to practitioners. There appeared to be no practical way to simplify the results further without losing information from small but suggestive differences by sex and sample. However, there were four variables for which the  $X^2$  test for a combination of probabilities (Guilford, 1965, p. 248) was deemed appropriate. The problem was to ascertain the combined probability across samples, for the high school samples only, for variables I, Q<sub>4</sub>, Mth and Law. Each of these columns proved highly significant by this test, supporting the generalizability across sex and sample for the trends discussed below on these variables. Variable H approached significance at the .05 level by the same test.

Of results on the personality tests, then, significant (for at least one sample) and consistent in sign over sex and age are correlations of VQDF with factors I (tender-minded) and H (bold). Persons with excess of verbal score over quantitative (V persons) tend to be tender-minded and bold. Significant and generally consistent in sign over samples, but with at least one sample having sign reversed, are results for factors O (apprehensive, guilt prone) and Q<sub>4</sub> (tense, overwrought). Except for the high IQ high-school males (HSM3), persons with excess of quantitative score over verbal (Q persons) tend to be apprehensive. Except for the seminarians (CSM1), Q persons tend to be tense and overwrought.

Of results on the interest inventory, the occupational scale Lawyer, and the basic interest scale Mathematics both show results that are significant, consistent, and in the expected direction. Two other scales, the C-Theme (Conventional, liking order) and the Artist occupational scale have one significant correlation (for CSF) and consistent though negligible correlation in another sample (CSM2). V persons (female) resemble artists and dislike conventional tasks (housework, bookkeeping, etc.). Finally, on the Office Practices basic interest scale, there is a significant negative correlation for women, a modest positive correlation for men. V persons (female) tend to dislike office practices.

## DISCUSSION

There have been few studies of personality and interest correlates with VQDF below college age. This present study establishes the existence of some such relationships at the high school and junior high levels. At risk of doing an

injustice to subtleties of these relationships one might summarize as follows the findings among these younger groups:

- 1) V persons tend to be low anxious (O-, Q<sub>4</sub>-) [ $r \approx .20$ ].
- 2) V persons tend to be sensitive, cultured, turned inward (I-, J-)  $r \approx .20$ ].
- 3) V persons tend to be bold (H=) [ $r \approx .10$ ].
- 4) Sex differences in these relationships are salient only for dimension J, Individualism vs. Enthusiastic Participation. V girls are more pronounced in circumspect individualism than boys.

Two of these generalizations fit well with what is known of adults. V adults tend to be cultured, introspective and assertive. In adults, however, those trends appear on the 16PF as expressions of factors M (Imagination) and E (Dominance) rather than by I (Sensitivity) and H (Boldness) as in adolescents. Factors I and M are heavy contributors to a second stratum factor on the 16PF, Cortertia (Tough Poise), and a simple explanation of the shift from the I in adolescents to M in adults might be that V persons tend in general to be low on Cortertia. In adults, this tendency is expressed primarily as Imagination (M), in adolescents, as sensitivity (I). This interpretation is consistent with the tendency for M and I scores to change with age among males. The shift from Boldness (H) to Dominance (E) in adults may be explained similarly in terms of loading of both those primary factors on the second-stratum factor Extroversion.

There is no 16PF (adult) factor parallel to the HSPQ factor J to aid in understanding its relation to VQDF. Furthermore, results on this factor appear inconsistent: while V girls show significant tendency to be more individualistic (high J), and two groups of boys show slight tendencies in the same direction, one group of boys shows the opposite tendency. The relationships arrange themselves from significantly positive for girls of moderate to low intelligence to negative for boys of high intelligence. These data do not provide a compelling answer to whether the salient fact in the anomaly of factor J is that of sex difference, level of intelligence, or some other.

The finding of generally lower anxiety (O, guilt proneness; Q<sub>4</sub>, stress) among V persons, such as the lower guilt (O) for the seminarian sample, has not been anticipated from prior research. True, Altus (1952) did find that Q women tend to be anxious — the only such result among a great many studies with adult and young adult samples. In the present study, among the high school samples, only for HSM2 was one of the anxiety indicators found significantly related to V excess. In fact, it is the consistency of sign across samples that argues strongly for lower anxiety among V persons. It may be, then, that:

- 1) such low but consistent relationships are observed among adults but are unreported, or
- 2) there is something special about high school populations such that young Q persons are more anxious than V persons.

It is tempting to endorse the second of the two possibilities, particularly since the one exception (again) to the general rule is among the boys of high ability. Our reasoning is that these boys, more than any other sample, are like the young adults (college students) in terms of selection on general ability than the other high school samples. General ability level would then function as a moderator variable so that: 1) for persons of average-to-high-average general

ability, excess of V serves to lower anxiety by increasing ability to cope with social and internal stresses, and 2) for persons of high-to-very-high general ability, the manipulative advantage of high verbal ability is outweighed by increased sensitivity to the problems of living, and such persons experience more anxiety than Q persons. At any rate, a slight tendency for high school V persons to be less anxious can be considered probable, and this tendency stands in contrast to what is reported for young adults.

Among findings for the young adult samples in this study, two stand out across sexes in the expected direction:

- 1) V persons dislike math (SCII Math) [ $r \approx .30$ ].
- 2) V persons are artistic, cultured (SCII A, art, Artist 16PF) [ $r \approx .20$ ].

Some subtleties in the second conclusion are worth noting. Among V persons, the tendency to be high on the SCII-A theme crosses sexes, and neither sex expresses a strong tendency to be high on the basic interest in art — artistic, but not strongly interested in Art. Furthermore, V women (not men) show strong tendency to resemble artists, dislike office practices and score low on the Conventional Theme, and both male and female V persons tend to resemble lawyers.

In general, the similarity of the findings in this study to earlier results, and across ages in this study, is quite impressive, particularly considering the variety of sample characteristics and tests involved. One may, with some confidence, expect V persons to be cultured and sensitive, extroverted in the sense of bold or dominant, low anxious (high school).

The chief remaining question has to do with the size of V-Q difference. This question crosses the realms of technical scientific methodology and practical usefulness. With the great variety of methods and suggested cuts for defining a "difference," both continued programmatic research and every day usefulness are rendered difficult. The present authors present as a solution for both these realms the suggestion that further research be:

- 1) correlational over an entire sample.
- 2) on samples segregated by sex and age to adulthood, sex and educational level thereafter, and
- 3) that general ability level be entered as a moderator variable for at least three level: high, average, low.

The scientific advantages of these procedures seem obvious; the practical ones require some elaboration.

Given a reasonable estimate of the correlation between VQDF and some variable of interest it is possible to estimate the non-cognitive variable from VQDF. VQDF scores tend to distribute normally around zero, with standard deviation usually about the same as that of the associated verbal and quantitative variables. Observed differences can therefore be interpreted roughly in the original sigma units, with the VQDF sign indicating direction from the mean. A practitioner can take advantage of this fact together with the properties of the bivariate normal distribution (see Schrader, 1965; also Schuerger & Watterson, 1977) to ascertain the probability that a client is high on the noncognitive variable.

An example may illustrate the usefulness of this approach. Imagine a woman

client in her mid-twenties, graduate with master's degree, working as a social worker. She complains vaguely of dissatisfaction with her job. Her GRE Verbal is 550, Quantitative 750. She has a VQDF of -200, or in the original metric, about two sigma below the mean. What is the likelihood that she has some of the non-cognitive characteristics which were considered above?

The above discussions were in terms of characteristics of V persons, and must be reversed in direction since the client under consideration is a Q person. (An allowable step, since all variables are continuous and bipolar.) As a Q person, this client might be expected to be shy (16PF,  $r \approx .10$ ), tough-minded rather than sensitive (16PF,  $r \approx .20$ ), orderly (SCII C-Theme,  $r \approx .30$ ). Given the relational estimates in parentheses and her two-sigma differential, one can estimate the chances in 100 of her being in the top fifth on each of the three characteristics at about 28 for shy, 38 for tough-minded, 48 for orderly. If her VQDF were only -100 (one sigma in the direction of Quantitative), the chances in 100 of her being in the top fifth on the noncognitive characteristic would be 24 for shy, 28 for tough-minded, 33 for orderly. Given such odds, a practitioner could suspect a "poor fit" between this client's characteristics and those of social work and proceed accordingly.

As can be seen from the example, a "useful difference" is judged such according to the certainty one needs. With low (.10, .20, .30) correlations such as exist in this realm, one sigma would seem a minimum. A difference as large as two sigma would usually be strong evidence for the existence of the noncognitive characteristic. Such differences, given the typical correlations between verbal and quantitative scores, would be expected in about 5 percent of the population; differences of one sigma or more, about 35 percent. Such, in fact, has been verified empirically in the authors' experience over thousands of college students.

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