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JAMAICA, WEST INDIES

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THE RELATION OF EXTRAVERSION AND NEUROTICISM TO NON-VERBAL INTELLIGENCE

Gagindra Persaud

This study examined the relationships between extraversion, neuroticism, and non-verbal intelligence in a combined group of 159 West Indian college and university students of both sexes. The only significant correlation was that between extraversion and neuroticism, \( p < .05 \), which is negative. Partial correlation coefficients were low and negative. The \( F \) test for testing departure from linearity of the relationships between each of the personality dimensions, extraversion and neuroticism, and non-verbal intelligence did not reach statistical significance. The overall results do not support significant personality-intelligence relations, positive or negative, nor do they support significant curvilinearity of these relations. Furthermore, the results do not fully confirm the findings of an earlier study done elsewhere.

Can sizeable individual variations in performance on a wide variety of tasks be explained in terms of differences in ability level, where it is understood that ability level is a major contributing factor among a set of cognitive variables? Or can they be accounted for on the basis of differences in underlying personality structure as well? In a review by Lynn and Gordon [11] scholastic success and failure, for example, which are known to be significantly related to ability level, have been shown to have important connections with the personality traits extraversion (E), introversion (I), and neuroticism (N). Eysenck and White [7] in their re-analysis of Lienert's data [9], and on the basis of Shure and Roger's findings [15], conclude although tentatively, that personality and intelligence-test performance seem to be more closely interrelated than has until now been assumed.

Eysenck's personality dimensions E-I and N, ([2], [3], [5]) have been extensively investigated because of the claims made for them and because of their possible influence on time-consuming activities that call for sustained attention and concentration. According to this theory, extraverted individuals are characterized by lower levels of arousal and greater accumulation of reactive inhibition; introverted individuals by higher levels of arousal and less accumulation of reactive inhibition. Clearly if this distinction is valid, the former group is likely to encounter difficulty in maintaining optimal performance on tasks that are stretched over a relatively long period of time.

Eysenck [3] regards the performance on a typical intelligence test as an instance of massed practice in which very similar tasks are attempted repeatedly without the interposition of a programmed rest pause, a testing situation which is likely to put the extraverts at a disadvantage due to their susceptibility to build up greater reactive inhibition. On such tasks the extraverts will begin to work more efficiently than the introverts but, with the passage of time and increasing difficulty of test items, will experience greater work decrement so that their work curves will differ from those of the introverts (Eysenck & White, [7]). To ensure, therefore, the optimal performance of extraverts it would be necessary to introduce certain changes in the testing situation. This has been achieved by Lynn and Gordon [11] in their use of a shorter version of the Raven's Progressive Matrices [13], and by Mohan [12] who introduced a disinhibitor in his study on the pursuit rotor.

The factor of neuroticism is usually equated with autonomic drive and has been shown to correlate significantly with anxiety. Its influence on intelligence-test performance can be interpreted according to the Yerkes-Dodson Law [16], the "inverted U" principle, where both low and high neuroticism scores are equally inconsistent with high scores on intelligence tests. For efficient performance on tests like the Matrices, Lynn and Gordon [11] have suggested "a golden mean of N or anxiety, neither too much nor too little".

The relationships between E, I, N and intelligence-test scores have traditionally been investigated with the help of linear statistical parameters such as the product-moment correlations. But Lynn and Gordon [11], and Eysenck and White [7] have suggested the curvilinear approach which seems justified viewed from the position of the claims made for these dimensions, especially neuroticism. Lynn and Gordon [11] have indeed utilized this approach on a group of 60 male university students in an earlier study of the relations of E and N to scores on an abridged form of the Raven's Progressive Matrices [13], in which students worked on odd test items only. They found that whereas the correlation coefficients between E and N and Matrices scores were low and negative, the relationship between N and Matrices scores departed significantly from linearity. The present study aimed at examining these relationships among West Indian students.
METHOD

Subjects

182 West Indian students from three different tertiary institutions in Kingston, Jamaica participated willingly in this study. They came from:

1. The University of the West Indies. (Two groups were chosen, one made up of students in a course of the Use of English, (UOE), and the other, students in the Certificate of Education and the Bachelor of Education (C and BEds)).

2. The College of Arts, Science and Technology. (Three groups were selected, one in Medical Technology, (Med Tech), the other in Pharmacy, (Phar), and still another in Electrical Engineering (Elec Eng)).

3. The Mico Teachers' College. (Two groups of first year students were chosen, MTC-1 and MTC-2).

Tests

A shorter version (Borjeson et al, [1]) of the Raven's Standard Progressive Matrices [14], which consists of 4 sample items and 24 test items, was administered to the students. Of the test items 10 were taken from Set C, 8 from Set D, and 6 from Set E. Also administered was the Eysenck Personality Inventory, Form A [6]. The former test provides a measure of non-verbal intelligence, the latter measures of extraversion and neuroticism.

Procedure

The author met the lecturers of the courses in the first institution and the principals of the other two institutions and made arrangements for the students to be tested. They were tested in separate groups in the order in which they appear above. Testing was restricted to the morning hours only and all of it was completed during one week.

The students worked first on the Matrices test for 15 minutes. Following this they were given the Eysenck Personality Inventory which was not timed, but on which they were advised not to spend too much time.

Final Sample

The test scores of 23 students were not used in the final selection because they were either incomplete or invalid. Table 1 presents the relevant information regarding the remaining 159 students.

Table 1

<table>
<thead>
<tr>
<th>Groups</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Year</th>
<th>Month</th>
<th>Year</th>
<th>Month</th>
<th>Year</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>UOE</td>
<td>8</td>
<td>7</td>
<td>15</td>
<td>21</td>
<td>6</td>
<td>18</td>
<td>4</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>C and BEds</td>
<td>10</td>
<td>14</td>
<td>24</td>
<td>33</td>
<td>11</td>
<td>23</td>
<td>8</td>
<td>51</td>
<td>4</td>
</tr>
<tr>
<td>Med Tech</td>
<td>9</td>
<td>16</td>
<td>25</td>
<td>19</td>
<td>7</td>
<td>17</td>
<td>7</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Phar</td>
<td>5</td>
<td>16</td>
<td>21</td>
<td>21</td>
<td>3</td>
<td>18</td>
<td>2</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>Elec Eng</td>
<td>17</td>
<td>3</td>
<td>20</td>
<td>20</td>
<td>9</td>
<td>19</td>
<td>0</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>MTC-1</td>
<td>12</td>
<td>16</td>
<td>28</td>
<td>22</td>
<td>1</td>
<td>19</td>
<td>0</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>MTC-2</td>
<td>9</td>
<td>17</td>
<td>26</td>
<td>22</td>
<td>0</td>
<td>18</td>
<td>6</td>
<td>27</td>
<td>7</td>
</tr>
</tbody>
</table>

Total sample 70 89 159 23 2 17 7 51 4

As the range of ages for the total group listed in Table 1 is wide and can be misleading, it was decided to subdivide it into class-intervals in an attempt to give a clearer picture of the distribution of students at various points on the age-range. This information is provided in Table 2.

Table 2

| Class Intervals of Age and Frequency Distributions of Students (N = 159) |
|------------------------|------------------|------------------|------------------|------------------|
| Age in Years | 17-21 | 22-26 | 27-31 | 32-36 | 37-41 | 42-46 | 47-51 |
| Frequencies     | 86    | 46    | 17    | 2     | 3     | 3     | 2     |
RESULTS

Table 3 lists the descriptive statistics for all three measures:

<table>
<thead>
<tr>
<th>Measures</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-verbal intelligence</td>
<td>14.01</td>
<td>3.45</td>
</tr>
<tr>
<td>Extraversion</td>
<td>12.55</td>
<td>2.80</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>11.70</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Table 4 shows the intercorrelations between the three measures:

<table>
<thead>
<tr>
<th>Measures</th>
<th>Non-verbal IQ</th>
<th>Extraversion</th>
<th>Neuroticism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-verbal IQ</td>
<td>-</td>
<td>0.02</td>
<td>-0.06</td>
</tr>
<tr>
<td>Extraversion</td>
<td>-</td>
<td>-0.19*</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05

The negative correlation coefficient between extraversion and neuroticism in Table 4 is significant (p < .05, two-tailed test). Following these computations, first-order partial correlation coefficients were calculated and their values are -0.01 between extraversion and non-verbal intelligence (neuroticism held constant), and -0.06 between neuroticism and non-verbal intelligence (extraversion held constant).

The relationships between each of the two personality dimensions and non-verbal intelligence was examined for any departure from linearity. This was done by calculating the mean scores on the Matrices test for different levels of extraversion and neuroticism separately. The choice of class-intervals employed here was considered optimal in view of the relative distributions of students in each of them. The five-point class-interval, for example, did not prove satisfactory for meaningful statistical computations, because there was one student each at both extremes on extraversion and a few in the lowest class-interval and still fewer in the highest, on neuroticism.

In Tables 5 and 6 the performance of students on the Matrices test is given in the different class-intervals for extraversion and neuroticism respectively.

<table>
<thead>
<tr>
<th>Class Intervals</th>
<th>0-9</th>
<th>10-11</th>
<th>12-13</th>
<th>14-15</th>
<th>16-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>23</td>
<td>34</td>
<td>39</td>
<td>37</td>
<td>26</td>
</tr>
<tr>
<td>M</td>
<td>14.00</td>
<td>14.32</td>
<td>13.33</td>
<td>13.81</td>
<td>14.50</td>
</tr>
<tr>
<td>SD</td>
<td>2.66</td>
<td>3.33</td>
<td>3.52</td>
<td>4.24</td>
<td>3.08</td>
</tr>
</tbody>
</table>

Table 6

<table>
<thead>
<tr>
<th>Class Intervals</th>
<th>0-9</th>
<th>10-11</th>
<th>12-13</th>
<th>14-15</th>
<th>16-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>46</td>
<td>35</td>
<td>27</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>M</td>
<td>13.93</td>
<td>13.89</td>
<td>15.19</td>
<td>14.55</td>
<td>12.79</td>
</tr>
<tr>
<td>SD</td>
<td>3.46</td>
<td>3.86</td>
<td>2.02</td>
<td>3.05</td>
<td>3.99</td>
</tr>
</tbody>
</table>
The statistic computed in testing for a lack of linear relationship is the F test of linearity (Guilford, [8]), and as it uses the results of the one-way analysis of variance as well as the eta, (Linton and Gallo, Jr., [10]) all these values for extraversion and neuroticism are presented in Tables 7 and 8 respectively.

### Table 7

Summary of Analysis of Variance for Extraversion, ETA, and F Test Value

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>ETA</th>
<th>F Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion</td>
<td>4</td>
<td>28.28</td>
<td>7.07</td>
<td>.58</td>
<td>.12</td>
<td>.73</td>
</tr>
<tr>
<td>Error</td>
<td>154</td>
<td>1876.79</td>
<td>12.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>158</td>
<td>1905.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 8

Summary of Analysis of Variance for Neuroticism, ETA, and F Test Value

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>ETA</th>
<th>F Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>4</td>
<td>75.97</td>
<td>18.99</td>
<td>1.63</td>
<td>.20</td>
<td>1.95</td>
</tr>
<tr>
<td>Error</td>
<td>154</td>
<td>1792.51</td>
<td>11.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>158</td>
<td>1868.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Both of these F test values lie far below that required for significance ($F_{3, 154} = 2.67, p > .05$, two-tailed test). The statistical evidence here does not support any departure from linearity, either for extraversion or neuroticism, and this is also substantiated graphically in Figure 1.

![Figure 1](image)

**DISCUSSION**

The following results emerge as important from the present study. The significant negative correlation between extraversion and neuroticism implies that high scores on neuroticism are accompanied by high scores on introversion. This finding is consistent with that of Lynn and Gordon [11], and supports Eysenck's position [4] that extraversion-introversion is independent of neuroticism in normal groups of individuals but tends to be related in extreme groups.

Extraversion does not correlate in a significant way with non-verbal intelligence as measured by the Matrices test, nor does neuroticism. As a matter of fact, the relationships in both cases approach zero. The results remain unchanged when the effects of extraversion and neuroticism on non-verbal intelligence are each partialled out. These results also confirm earlier findings (Lynn and Gordon, [11]).
The graphs formed by plotting the mean scores on the Matrices test for different levels of extraversion and neuroticism (Fig. 1), seem to be mirror images of each other and are in keeping with the postulates made for these dimensions. And although a tendency to the "U" shape in extraversion and the "inverted U" shape in neuroticism is clearly visible, neither graph shows any significant departure from linearity. Thus the significant curvilinear relationship between neuroticism and matrices scores obtained by Lynn and Gordon [11] is not supported in this study. The results do, however, support their finding that an optimal mean of neuroticism is necessary for the most efficient performance on tasks like the Matrices.

The remaining part of the discussion will focus on the differences in the methodological approach employed by Lynn and Gordon and that employed in this study. It would be of interest to point them out in view of the importance attached to Eysenck's theory in explaining intellectual functioning and academic achievement as well as to compare results cross-culturally.

First of all, the Inventory and the Matrices test used in the two studies were not identical but were different versions of the same instruments. This being the case, there seems to be no reason to assume that they do not measure the same traits namely, extraversion-introversion and neuroticism on the one hand, and non-verbal intelligence on the other hand.

Secondly, the students in Lynn and Gordon's study worked for an average time of 8.9 minutes whereas those in the present study worked for 15 minutes. Thirdly, the students in their study worked on the odd items only in the Matrices test which gave a total of 30 items. The students in this study worked on 24 items which undoubtedly constituted a subset of harder items than the subset used by Lynn and Gordon [11]. Bearing in mind the basic differences between extraversion and neuroticism, and their differential effects on tasks that call for sustained concentration and attention, a longer testing-time coupled with more difficult test items should create somewhat ideal conditions under which the optimal relationships associated with these personality traits could be brought about. These optimal relationships have clearly not appeared here. On the strength of these two differences therefore, it does not seem unreasonable to assume that the traits were relatively more adequately tested in this study, yet failed to show the personality-intelligence relations among West Indian students which were obtained on male English students.

Finally, there are differences which are related to the samples. Lynn and Gordon's findings were obtained on a relatively homogeneous group in terms of number, sex, age, educational attainment and socio-cultural exposure. The students in this study, on the other hand, could be considered to be a relatively less homogeneous group as regards those variables. But, by the same token, it can be assumed that the latter group would have tapped a greater portion of the variance of those traits, thus possibly allowing a more meaningful establishment of the relationships between the different traits.

On the basis of the findings presented here, it is not possible to ascertain the relative influence of any or all of the variables mentioned above in determining the relationships between extraversion, neuroticism, and non-verbal intelligence. The sample reported in this study is considerably larger than that reported by Lynn and Gordon, but the results were not analyzed on the basis of sex. It would certainly be of interest to investigate sex-differences in the relationships of the traits studied here, and analyses have already been initiated to examine them.

The range of ages of the students in this study appears, at first sight, to be wide, but on closer examination reveals a different picture. Of the 159 students, 149 fall within the age-range of 17 to 31 years. It would be of interest to truncate the sample at this upper age-limit and re-examine the personality-intelligence relationships. But it must be pointed out that this exercise is likely to bias any relatively true relationships between these traits among West Indian students, seeing that almost all institutions of tertiary education, especially the University of the West Indies, do admit students whose ages normally fall within the range shown in Table 1.

The study appears to be the first of its kind done in the West Indies and approaches very closely the one carried out by Lynn and Gordon. It is not a strict replication as this author became aware of their study after he had carried out his. But the two studies are similar enough to suggest comparisons between findings in England and the West Indies. Despite the cross-cultural settings certain relationships have been confirmed, but the most important finding in this study is the lack of a significant curvilinear relationship between extraversion, neuroticism, and non-verbal intelligence. Confirmation of this, as well as of other relationships, will therefore have to be postponed until further studies have been done in the West Indies.
REFERENCES


