Level 3 Practical – P. Burgess

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EYSENCK'S THREE DIMENSIONS:

AN INVESTIGATION OF

NORMALITY, ORTHOGONALITY

AND UNITY

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Abstract

Eysenck's "gigantic three" theory of personality is one of the most influential and controversial theories in psychology, hypothesising that personality can be grouped into three dimensions –extroversion/ introversion, neuroticism and psychotocism. Eysenck claimed that these three dimensions should satisfy three assumptions – they should be normally distributed, orthogonal and unitary. The purpose of this study is to determine how far data we collect will satisfy these assumptions. Results showed that the normality of the distribution was found to be partially supported - extroversion/ introversion and neuroticism were found to be normally distributed but psychotocism was not. Orthogonality was supported: correlations between psychotocism and extroversion/ introversion (rho = -0.02; n = 50; NS), neuroticism and psychotocism (rho = 0.22; n = 50; NS) and extroversion/ introversion and neuroticism (rho = -0.14; n = 50; NS) were all found to be non-significant. Extroversion/ introversion was also found to be unitary with sociability & impulsivity being significantly correlated (rho = 0.46; n = 50; p< 0.01), sociability & residual error being correlated (rho = 0.46; n = 50; p< 0.01), and also impulsivity and residual error being correlated (rho = 0.31; n= 50; p< 0.05). This led us to conclude that our data partially supported our first hypothesis of normality of distribution, and fully supported our second and third hypotheses concerning orthogonality and unity, which in turn concurred with Eysenck's assumptions about his three dimensions.

Introduction

As one of the most influential and controversial psychologists of all time, Hans Eysenck's theory of personality is one of the most important and widely studied theories amongst social psychologists. Eysenck was highly sceptical about Freudian theories and the concepts of psychoanalysis. He was a behaviourist and argued that behaviour is all we can use to understand people, and that any theory can only be accepted with solid empirical backup from scientific testing (Monte 1999). With this in mind, Eysenck attempted to take the classic personality theories of philosophers such as Wundt, Kant and Jung and turn their observations into scientifically testable hypotheses. After collecting and collating data from a sizeable sample of over 10,000 subjects, Eysenck and his colleagues carried out a factor analysis on this mass of data (Monte 1999). This statistical analysis breaks the information down into groups, and allowed Eysenck to identify several clusters of associated variables which appeared to make up different personality categories. Originally he identified 2 main dimensions; extroversion/introversion and neuroticism (Eysenck, M 2001). Extroversion is characterised by being outgoing, talkative, high on positive affect and in need of external stimulation, whereas introversion is characterised by a calmer, ever-tempered, thoughtful or passive personality. Individuals high on the neuroticism scale would be characterised by anxious and depressed feelings, low self-esteem and could be moody and tense (www.trans4mind.com/personality/EPQ). Further research showed the need for a third dimension, which Eysenck called psychotocism. Some have suggested this would be better described as emotionality because this dimension is associated not only with the susceptibility of having a psychotic episode but also with aggression and creativity (Monte 1999). He believed psychotocism was rooted in the characteristics of non-conformity, inconsideration and impulsiveness. These three dimensions were named "the Gigantic Three", and Eysenck made certain assumptions about them – he claimed they should be normally distributed among the population, unitary, i.e. have high correlations among their components and orthogonal, i.e. each dimension is independent.
This study is designed to determine whether the data collected from our PENSIL inventory will support Eysenck's assumptions about his three dimensions.

This study will therefore propose three hypotheses:

1. the dimensions of psychotocism, extroversion/introversion and neuroticism will be normally distributed among the population
2. the dimensions of psychotocism, extroversion/introversion and neuroticism will be independent i.e. not significantly correlated with each other
3. the extroversion/introversion dimension will be unitary[1]

Results from this study will show to what extent Eysenck's dimensions meet his assumptions of normal distribution, orthogonality and unity.

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[1] Without carrying out a factor analysis, it would be impossible to determine the unity of neuroticism of psychotocism, but because our inventory collects scores on three components of extroversion/introversion (sociability, impulsivity and residual extro version), we can determine through correlation analysis whether this dimension is unitary.

Method

Participants

50 participants took part in this experiment and all were students from the University of Dundee. All were in their third year studying Psychology and all were taking part due to a course requirement. The majority of participants were female and the majority were aged between 20 and 25.

Materials

Materials used in this experiment consisted of an instruction email detailing how participants were to submit their data (i.e. their scores on the PENSIL inventory) and a computerised version of the PENSIL inventory. This inventory was produced by combining Eysenck's PI and EPI inventories and allowed us to obtain scores on P (psychotocism), E (extroversion), N (neuroticism) S (sociability – a component of E), I (impulsivity – a component of E) and L (the lie scale).

Procedure

Each participant received the instruction email requesting that they complete the computerised PENSIL inventory by the specified date. Once they had completed the questionnaire they were requested to record their final scores for scales A-G and submit them to form a complete data set. This was then analysed by Philip Burgess and a copy of the data set and principle results supplied to each student/participant.

Results

Table 1: Mean, Standard Deviation and Normal Population Scores for the 3 Dimensions:

Dimension	Mean	Standard Deviation	Normal Population Scores (average)
Psychotocism	3.68	2.97	3
Extroversion/Introversion	13.42	4.22	12
Neuroticism	11.02	4.83	9

Examining the data in Table 1, it can be seen that the results from our experiment correspond well to the norms of the population on each of the measured dimensions, differing very slightly on psychotocism and extroversion/introversion, and perhaps slightly above the norm on neuroticism.

Our first hypothesis states that the dimensions of psychotocism, extroversion/introversion and neuroticism will be normally distributed. In order to assess this claim, th e scores on all three dimensions were plotted in bar charts which allowed the general shape of the distributions to be illustrated. Combined with these graphs, the descriptive statistics of skewness and kurtosis should also be used to assess whether the distributions are normal.

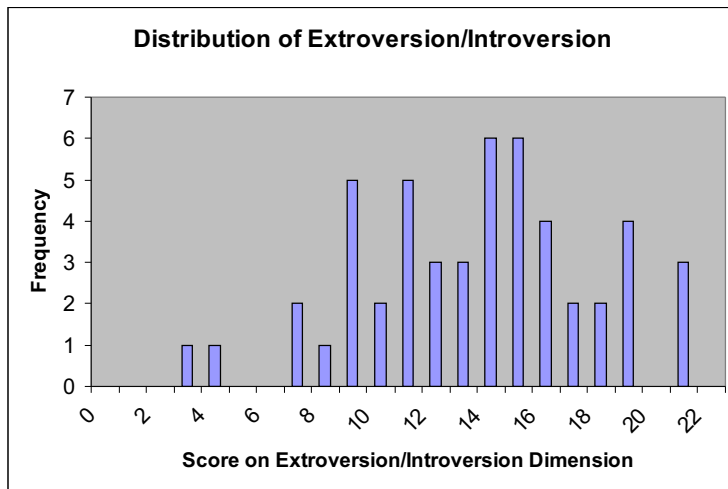**Graph 1: Distribution of Psychotocism**
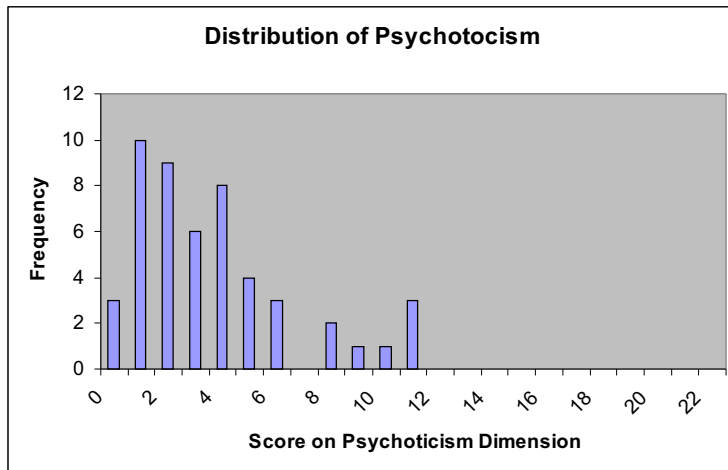
On first examination of Graph 1, the distribution of psychotocism does not appear to be normal as it is positively skewed and not the unimodal, symmetrical bell-shaped curve of a normal distribution. Looking at the skewness and kurtosis statistics for psychotocism (Table 2), it can be seen that this data supports the fact that the distribution is not normal as although the statistic for kurtosis is not more than two std. errors away from zero, the statistic for skewness is (kurtosis = 1.01; skewness = 3.39).

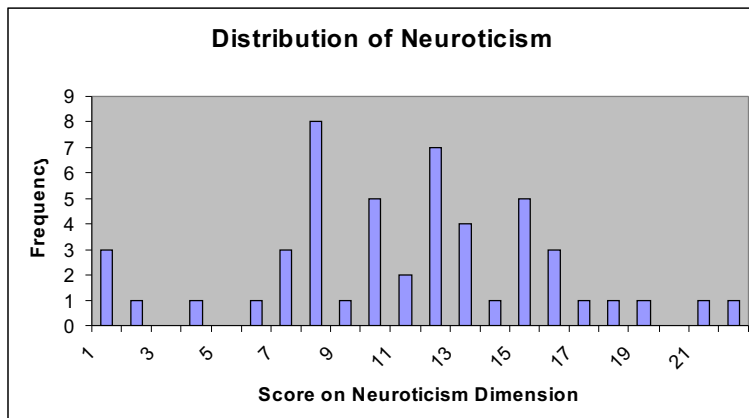**Table 2: Descriptive Statistics for Skewness and Kurtosis**

Dimension	Skewness		Kurtosis		Statistic divided by std error	
	Statistic	Std. Error	Statistic	Std. Error	Skewness	Kurtosis
Psychotocism	1.14	0.34	0.67	0.66	3.39	1.01
Extroversion/Introversion	-0.25	0.34	-0.18	0.66	-0.73	-0.28
Neuroticism	-0.10	0.34	0.07	0.66	-0.29	1.13

Graph 2: Distribution of Extroversion/Introversion:

Distribution of Extroversion/Introversion

[Histogram with y-axis labeled "Frequency" ranging from 0 to 7, and x-axis labeled "Score on Extroversion/Introversion Dimension" ranging from 0 to 22]

On first examination of Graph 2, the distribution of extroversion/introversion does appear to be normally distributed, as it generally shows the symmetrical bell-shaped curve of a normal distribution. Looking at the skewness and kurtosis statistics for extroversion/introversion (Table 2), it can be seen that this data supports the fact that the distribution is normal as both the statistic for kurtosis and skewness are not more than two std. errors away from zero (kurtosis = -0.28; skewness = -0.73).

Graph 3: Distribution of Neuroticism:

Distribution of Neuroticism

[Histogram with y-axis labeled "Frequency)" ranging from 0 to 9, and x-axis labeled "Score on Neuroticism Dimension" ranging from 1 to 21]

On first examination of Graph 3, the distribution of neuroticism does appear to be normally distributed, as it generally shows the symmetrical bell-shaped curve of a normal distribution. Looking at the skewness and kurtosis statistics for neuroticism (Table 2), it can be seen that this data supports the fact that the distribution is normal as both the statistic for kurtosis and skewness are not more than two std. errors away from zero (kurtosis = 1.13; skewness = -0.29).

The data from these graphs and kurtosis and skewness statistics supports our hypothesis to a certain extent, yet also casts doubt on it. It shows that although psychotocism is not normally distributed, extroversion/introversion and neuroticism do seem to be normally distributed.

Our second hypothesis states that the dimensions of psychotocism, extroversion/introversion and neuroticism will be orthogonal, i.e. not significantly correlated with each other. In order to assess this hypothesis, the correlations between the dimensions must be examined.

Firstly three scatterplots were produced in order to visually present the data – graph 4 shows psychotocism against extroversion/introversion, graph 5 shows neuroticism against psychotocism and graph 6 shows extroversion/introversion plotted against neuroticism. "Eyeballing" these scatterplots, it can be seen that there appears to be no relationship between any of the dimensions plotted as the pattern of dots generally quite circular and random without the presence of any elliptical shapes or clear positive or negative relationships.
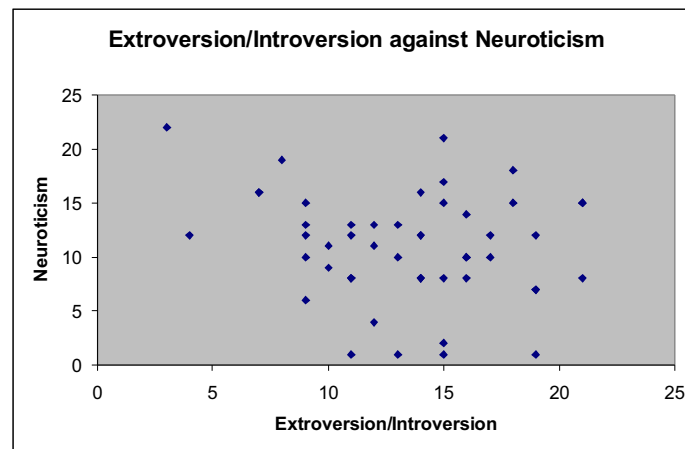
Graph 4: Scatterplot of Psychotocism against Extroversion/Introversion
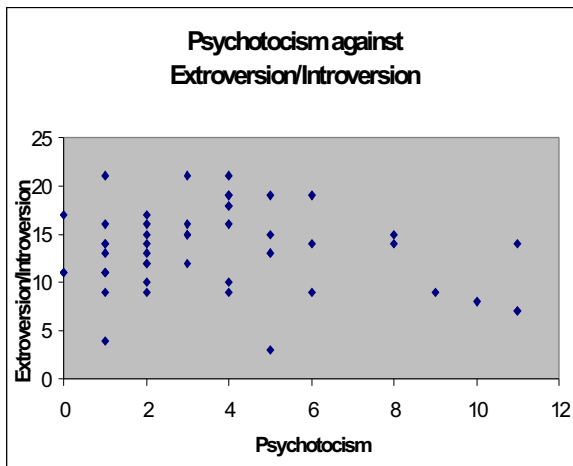
Graph 5: Scatterplot of Neuroticism against Psychotocism
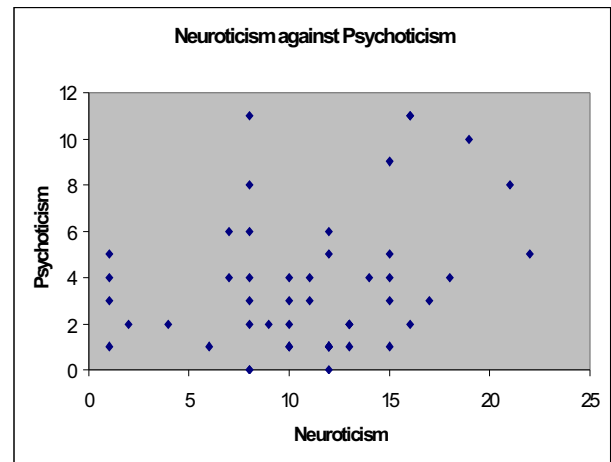
Graph 6: Scatterplot of Extroversion/Introversion against Neuroticism

Looking at the r and rho values obtained from the parametric and non-parametric correlation matrices, it can be seen that some discrepancies arise. Psychotocism against extroversion/introversion is shown to be non-significant whether we use r or rho (r = -0.17; n = 50; NS, rho = -0.02; n = 50; NS) as is extroversion/introversion against neuroticism (r = -0.17; n = 50; NS, rho = -0.14; n = 50; NS). However, looking at psychotocism against neuroticism there are far greater discrepancies between r and rho. Using the r value, the correlation is found to be significant (r = 0.29; n = 50; p< 0.05) whereas using the rho value the correlation is found to be non-significant (rho = 0.22; n = 50; NS).

Due to the conclusions of our first hypothesis which shows the data is not normally distributed for all three dimensions, it would be sensible to consult the non-parametric Spearman's rho correlations

matrix (see appendix) as these calculations do not rely on normally distributed data. As can be seen from this matrix psychotocism and extroversion/introversion are not significantly correlated (rho = -0.02; n = 50; NS), neither are psychotocism and neuroticism (rho = 0.22; n = 50; NS) and neither are extroversion/introversion and neuroticism (rho = -0.14; n = 50; NS).

These findings supports our hypothesis that the three dimensions are orthogonal and do not correlate with each other.

Our third hypothesis states that the extroversion/introversion dimension will be unitary. In order to assess this hypothesis, a scatterplot of sociability against impulsivity was created (graph 7). "Eyeballing" this graph shows that a positive linear relationship appears to be present, as the cloud of points plotted is generally elliptical, and x increases as y increases.

Graph 7: Sociability component of Extroversion/Introversion against the Impulsivity Component
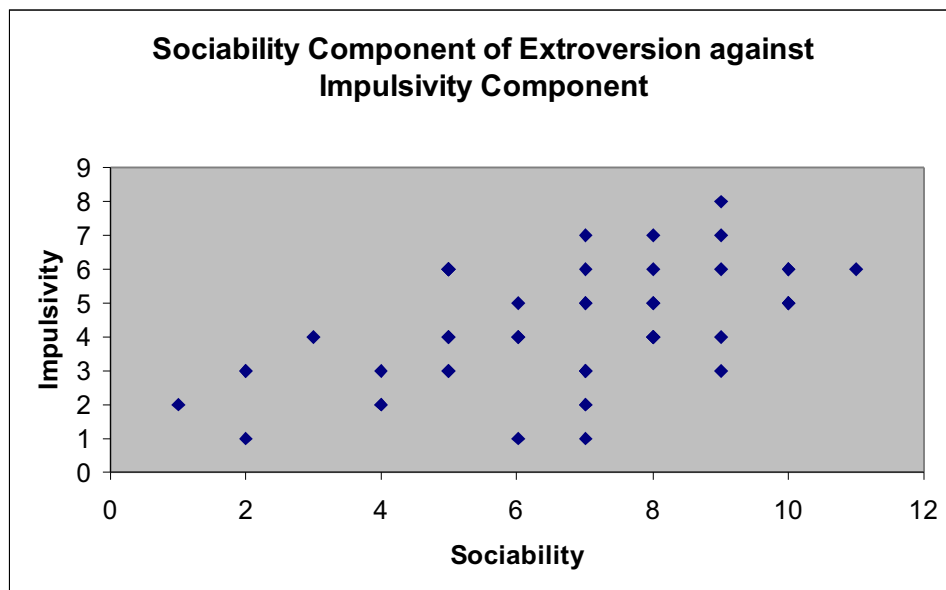
Although this scatterplot predicts a linear relationship between the two variables, this must be further investigated with the application of correlation coefficients. Pearson's r and Spearman's rho correlations were calculated by hand using the first 20 participants (see appendix for calculations and working), and revealed a positive correlation of +0.70 for Pearson's r and another positive correlation of +0.61 for Spearman's rho. Again, due to the conclusions of our first hypothesis that the distribution for all three dimensions was not normal, we shall rely on the Spearman's rho calculations. This rho value was then converted into a "t" value (see appendix for working) and was found to be significant (t (48) = 3.27; p<0.05). The non-parametric correlations matrices revealed that sociability & impulsivity are significantly correlated (rho = 0.46; n = 50; p< 0.01), as were sociability & residual error (rho = 0.46; n = 50; p< 0.01). Correlations between impulsivity and residual error were also found to be significant (rho = 0.31; n= 50; p< 0.05).

These findings support our final hypothesis that the dimension of extroversion/introversion is unitary as they show that the components are significantly correlated.

Discussion

Examining the results of this study it can be seen that they provide support for two of the original three hypotheses – orthogonality of the data and the unity of the dimension extroversion/introversion. Although we cannot say that the first hypothesis concerning the normality of the data is supported due to the finding that the dimension of psychotocism was skewed, we did find partial support for it as the other two dimensions of extroversion/introversion and neuroticism were found to be normally distributed. Although this finding initially appears to be in conflict with the claims of Eysenck's assumptions, his third dimension of psychotocism was never as fully understood as the first two dimensions – extroversion/introversion and neuroticism, even by him. Using his data this dimension was also found to be heavily skewed so although our findings do not support our hypothesis, they do appear to concur with Eysenck's data, if not his original hypothesis. The fact that this dimension appears so heavily skewed has given rise to several theories which attempt to explain it. It has been argued that the questionnaire related to psychotocism doesn't actually measure psychosis at all, rather psychotic individuals inconsistently respond which leads to elevated psychotocism sores.

Due to the nature of this study there may have been several methodological shortcomings which could possibly be addressed in order to strengthen the findings and conclusions of this paper. Firstly, there was a very small number of participants tested (n = 50). Eysenck's original attempt to break down personality into components pooled data from over 10,000 participants which undoubtedly increases the validity of his findings, (although the very fact that his theory can still be successfully illustrated with such a small number of participants could support the strength of his claims). The participants taking part in this experiment were also all in 3rd Year Honours Psychology at University, and therefore knew at least something about personality testing and Eysenck's theories before they completed the PENSIL inventory. This could lead to bias. They were also not representative of the whole population, as they were all at University, the majority were female and most were aged between 20 and 25. The unbalanced sex ratio could be of particular importance as there have been found to be sex differences between scores on the three dimensions, i.e. men tend to score higher on psychotocism as it is thought to be linked to aggression (Monte 1999). To improve these possible shortcomings, the range of participants tested could be looked into more carefully, ensuring a more random sample of the population in relation to age, gender, educational background and socio-economic status.

In conclusion, this study provides support for our second and third hypotheses of orthogonality and unity of extroversion/introversion, and partial support for our first hypothesis – normality of the distribution. These findings in turn partially support Eysenck's assumption that his three dimensions were normally distributed, and fully support his claims that they were orthogonal and unitary. There are many other aspects of Eysenck's personality theory to be explored and tested and perhaps by providing support for his theories and measures of personality his original purpose – to provide the basis for more rational and scientifically precise diagnosis and treatment of disordered behaviour, may be achieved.

References:

Textbooks:

Monte, C.F. (1999), Beneath the Mask: An Introduction to Theories of Personality (6th Edition). Harcourt Brace College Publishers

Eysenck, M (2001), Simply Psychology. Psychology Press Ltd

Websites:

www.trans4mind.com/personality/EPQ