



## EXPLAINING THE OVERLAP BETWEEN PERSONALITY AND LEARNING STYLE

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**Summary**—Each scale of the Eysenck Personality Questionnaire (EPQ) and the Learning Styles Questionnaire (LSQ) was factor analysed. Extraversion (E) and Psychoticism (P) were related to many components of the four learning styles. Neuroticism (N) was not related to components of learning styles. All elements of learning style were related to at least one of the elements of the personality traits. Furnham (*Personality and Individual Differences*, 13, 429–438, 1992) was therefore correct to suggest that learning style is a sub-set of personality and need not be measured independently, unless it is learning style that is of interest in its own right. Those components of personality that were unrelated to learning style appear to have been already identified as having a biological basis.

### INTRODUCTION

#### *Identification of the learning style components of personality*

Learning style questionnaires are used to measure individuals' preferred methods of learning and are increasingly used as an independent means of encouraging learning techniques in industry, training and teaching. Honey and Mumford (1992) advocated the use of learning style questionnaires in business, including tailoring learning situations towards peoples' learning style preferences and using learning logs. The emphasis of Honey and Mumford's work is to improve the ability of people to learn from work and training courses. Learning style is important in teaching because it helps teachers to understand how students learn (Butler, 1988). Atkinson, Murrell and Winters (1990) also reported correlations between learning style and career personality types while Green, Snell and Parimanath (1990) urged the use of learning style as part of a preassessment package for students.

Despite the emergence of questionnaires designed to measure only learning style, research suggests that such styles are closely linked to personality. Murray-Harvey (1994) noted that some formulations of learning style can be best classified in terms of personality. Shadbolt (1978) demonstrated that introverts and neurotics performed better with structured teaching methods compared with unstructured teaching methods. Eysenck (1978) noted that personality and learning are closely linked. Extraverts tend to socialize and lack concentration and are thus distracted from academic work. High neurotic scorers tend to let 'nerves' interfere with their work. Drummond and Stoddard (1992) noted the overlap between a learning style instrument and the Myers–Briggs Type Indicator. Judging individuals perceived themselves to be concrete sequential thinkers in contrast to perceptive individuals who were concrete random thinkers. Feeling types preferred random modes of thinking.

Furnham (1992) investigated the relationship between personality and learning style using the Eysenck Personality Questionnaire [EPQ (Eysenck & Eysenck, 1975)] and the Learning Styles Questionnaire [LSQ (Honey & Mumford, 1992)]. The EPQ measures personality in terms of Extraversion (E), Neuroticism (N), and Psychoticism (P). In contrast the LSQ measures an individual's preferred learning style based on a model developed from Kolb's learning cycle (Kolb, 1984). Learning is seen as a continuous cycle in which a person has a learning experience, reviews the experience, concludes from that experience and plans the next step. A person's preferences for one or more of the stages of the learning cycle translate into strengths and weaknesses of learning style.

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These are described in the LSQ as Activist (A), Theorist (T), Reflector (R) and Pragmatist (Pr) and correspond to the stages described above. The EPQ is widely used and psychometrically validated (Furnham, 1992). The factor structure of the LSQ was found to be satisfactory by Allinson and Hayes (1990).

Furnham (1992) reported that high E scorers were high in A and Pr and low E scorers were high in R. N was not highly correlated with learning styles and P was moderately correlated with A and T. As a result of the strong relationships found between Eysenck and Eysenck's personality variables and three learning style instruments, Furnham (1992) questioned whether learning style preferences needed to be measured at all. Parsimony suggested that personality tests could be used to examine learning preferences.

Since the greatest correlations between the EPQ and the LSQ were between E and A respectively it is useful to summarize the overlap. [For definitions, see Eysenck & Eysenck (1991) and Honey & Mumford (1992).] Components of E and A which overlap are liking to socialize, being impulsive, having energy and being lively. There is however a different emphasis in the definitions because A is less dominated by social interactions than E, although they both have a substantial impulsive element.

Furnham (1992) also reported that E was highly negatively correlated with R. Again, there is substantial overlap between these definitions in terms of the components of the scales which concern lack of socializing, lack of liveliness and lack of impulsiveness.

A high N scorer is described by Eysenck & Eysenck (1991) as a person who is anxious, worrying, moody, depressed, likely to suffer from psychosomatic illnesses and who reacts strongly to emotion arousing stimuli. High P scorers are described as solitary, uncaring, cruel, hostile and insensitive. According to Honey & Mumford (1992), high T scorers are people who can adapt and integrate observations into complex but logical theories and who are perfectionists with an objective perspective. High Pr scorers try out ideas, theories and techniques to see if they work in practice and are impatient with ruminating. From these definitions, there appears to be little overlap between the elements of these scales.

This paper had three aims. The first was to validate by factor analysis the dimensional structure of each of the scales of the EPQ and LSQ. With regard to the EPQ, these would correspond to the traits underlying each of the superfactors. We aimed to compare the operational definitions of each of the scales (i.e. the dimensional structure of the items) with the actual definitions found in the respective test manuals. This is an important first step when examining the overlap between two questionnaires because overlap may be due to poor item selection rather than genuine conceptual overlap.

The second was to determine the nature of the overlap between the dimensional structure of each of the scales used to measure personality and learning style. Unless all components of the learning style scales are correlated to personality, learning style could have a useful function above and beyond that provided by personality assessment. This is because the correlations between overall scales (e.g. E and A), as reported by Furnham (1992), may hide the possibility that components of each scale may be unrelated to each other. Furnham (1992) may than have been premature in his call for parsimony of measurement.

The third aim of the paper was to determine the nature of the elements of personality which are uncorrelated to learning style. Since learning style measures ability to learn, it is likely there will be components of personality that are unrelated to learning, because they have some other basis which is not learnt.

## METHOD

### *Subjects*

One-hundred and sixty-six *Ss* took part in this study of which 67% were female. All were unpaid volunteers and psychology students. Mean age was 27 yr old ( $SD = 7.8$  yr). The average scores of E, N and P were 15.0, 13.5 and 7.8, respectively.

### *Questionnaires*

(A) *The EPQ*. It is already known that E, N and P each have a dimensional structure (e.g. Eysenck, Barrett, Wilson & Jackson, 1992; Eysenck & Eysenck, 1991).  $\alpha$  reliabilities are reported to be all above 0.76 for E, N and P (Eysenck & Eysenck, 1991).

(B) *The LSQ*. This study reports  $\alpha$  reliabilities of the four LSQ scales to be all between 0.69 and 0.77, which suggests that each has a dimensional structure.

### Procedure

Ss completed both questionnaires as part of a test battery that also included a questionnaire on preferred learning methods. The time taken to complete all questionnaires was approx. 20–30 min.

## RESULTS

The correlation matrix between E, N, P, A, R, T and Pr is shown in Table 1. E is highly correlated with A ( $P < 0.01$ ), has some correlation with R ( $P < 0.01$ ) and Pr ( $P < 0.05$ ). N is not correlated with any learning style and P is correlated with A, R and T ( $P < 0.01$ ). This correlation matrix is very similar to that reported by Furnham (1992) because (a) the direction of all the correlations reported by Furnham is identical to those reported here, except for one, and (b) all the correlations reported as significant in Furnham's study are significant here, except for two.

To determine the elements which comprise E, N, P, A, R, T and Pr, principal component factor analyses were conducted on the items comprising each scale. The number of factors to be rotated was determined using Cattell's scree slope method which is one of the best solutions for selection of the correct number of factors (Kline, 1994). VARIMAX rotation was used because it is a very good method for obtaining simple structure (Kline, 1994). Factor loadings were sorted automatically. Orthogonal simple structure and automatic sorting means that results are likely to be replicable and relatively simple to interpret. These considerations are very important in exploratory factor analysis, even though it may be at the expense of logic since components of scales are likely to be correlated.

Another alternative approach would have been to perform just one single factor analysis over all the items from both the questionnaires. It was decided to perform a separate factor analysis on each scale of each questionnaire because the authors wished to identify and correlate the dimensional structure of each scale unaffected by its relationship to the other scales. Moreover, factor analysis of nearly 200 items from both the EPQ and LSQ all at the same time would produce ambiguous, complex and unreplicable results.

The total percentage of variance extracted from each scale was at least 30%, except for P (29.1%) and Pr (23.9%). The item communalities associated with each of the scales were rarely more than of medium size, and some were quite low. The signs of the factor loadings are all compatible with the standard scoring methods of the two questionnaires, except for item 26 of the LSQ. Oblique rotation methods were also used and tended to produce very similar results in those situations, where convergence to a solution was obtainable.

By examining how the items loaded on the factors, it was possible to name the components of E, N, P, A, R, T and Pr. The named factors and their coefficient  $\alpha$ s are listed in Table 2. Where it was felt that two words would better summarize an element, then two words were used. Coefficient alphas were all of a medium to high level which indicates that the components generally had at least reasonable internal consistency. Taking into account the direction of the items, the components of each of the scales were constructed using a simple additive model of the items.

The items of the EPQ and LSQ which comprised each of the components are as follows and are

Table 1. Correlation matrix of personality traits and learning styles

	E	N	P	L	A	R	T
N	-0.15						
P	0.01	0.06					
A	0.59**	0.05	0.36**	-0.29**			
R	-0.23**	-0.05	-0.29**	0.21**	-0.44**		
T	-0.10	0.04	-0.30**	0.23**	-0.29**	0.53**	
Pr	0.17*	-0.08	-0.13	0.08	0.08	0.21**	0.55**

$N = 167$ .

\* $P < 0.05$  (two tailed).

\*\* $P < 0.01$  (two tailed).

E, Extraversion; N, Neuroticism; P, Psychoticism; L, Lie scale; A, Activist; R, Reflector; T, Theorist; Pr, Pragmatist.

Table 2. Names assigned to rotated factors

	I	II	III
E	Sociable/Lively ( $\alpha = 0.88$ )	Impulsive ( $\alpha = 0.64$ )	Need for stimulation ( $\alpha = 0.52$ )
N	Nervous/Worrier ( $\alpha = 0.80$ )	Depressed ( $\alpha = 0.80$ )	
P	Disrespect rules ( $\alpha = 0.67$ )	Schizotypy ( $\alpha = 0.70$ )	Tough-minded ( $\alpha = 0.47$ )
A	Impulsive ( $\alpha = 0.59$ )	Informal ( $\alpha = 0.58$ )	Sociable/Lively ( $\alpha = 0.62$ )
R	Consider alternatives ( $\alpha = 0.71$ )	Distant/Detailed ( $\alpha = 0.65$ )	
T	Logical/Socially correct ( $\alpha = 0.74$ )	Objective/Perfectionist ( $\alpha = 0.51$ )	
Pr	Practical ( $\alpha = 0.63$ )	Direct/Blunt ( $\alpha = 0.58$ )	

Cronbach's  $\alpha$  for each scale is shown in parentheses. The range of values is between 0.47 and 0.88.

in descending order of their factor loadings. The Sociable/Lively component of E consisted of 47, 58, 20, 24, 33, 45, 11, 16, 36, 94, 6, 28, 90, 55 and 51. The Impulsive component of E consisted of 69, 61, 40, 63, 67 and 78. The Need for stimulation component of E consisted of 1 and 72. The Nervous/Worrier component of N consisted of 22, 38, 87, 43, 80, 13, 52, 31, 83, 97, 74 and 35. The Depressed component of N consisted of 26, 8, 70, 3, 65, 46, 17, 76, 84, 92, 60 and 100. The Disrespect rules component of P consisted of 18, 88, 25, 42, 21, 59, 48, 41, 14, 29, 7, 50 and 75. The Schizotypy component of P consisted of 34, 95, 2, 54, 12, 79, 5, 73, 91, 64, 81, 56 and 37. The Tough-minded component of P consisted of 96, 68, 30, 99, 85 and 9. The Impulsive component of A consisted of 10, 43, 23, 34, 40, 79, 64 and 24. The Informal component of A consisted of 71, 45, 2, 74, 6, 4 and 17. The Sociable/Lively component of A consisted of 48, 58, 38, 32 and 72. The Consider alternatives component of R consisted of 60, 46, 41, 29, 16, 7, 66, 13, 55, 39 and 76. The Distant/Detailed component of R consisted of 67, 62, 31, 15, 28, 25, 52, 36 and 33. The Logical/Socially correct component of T consisted of 51, 57, 18, 14, 77, 68, 1, 78, 22, 20, 63, 3 and 30. The Objective/Perfectionist component of T consisted of 42, 75, 47, 8, 26, 12 and 61. The Practical component of Pr consisted of 44, 56, 11, 37, 9, 73, 65, 35, 69, 53, 19 and 70. The Direct/Blunt component of Pr consisted of 27, 54, 21, 59, 5, 49, 50 and 80.

The components which underlie E, N, and P are highly correlated with their appropriate overall scale ( $P < 0.01$ ) and generally uncorrelated with the other overall scales. This is to be expected because the components (or traits) underlying each superfactor are likely to be intercorrelated, whilst not being correlated with the other superfactors. However the Impulsive element of E is related to both N and P ( $P < 0.01$ ); the Schizotypy element of P is related to N ( $P < 0.05$ ); the Disrespect rules element of P is related to E ( $P < 0.05$ ) and the Tough-minded element of P is also related to E ( $P < 0.05$ ).

The correlations of the components which underlie the scales of the LSQ are displayed in Table 3. All the components of A are correlated to E ( $P < 0.01$ ). The Impulsive and Informal components of A are correlated with P ( $P < 0.01$ ) and the Informal component is correlated with N ( $P < 0.01$ ). The two components that comprise R are both inversely correlated with P (at least  $P < 0.05$ ) but the Distant/Detailed component of R is inversely correlated with E ( $P < 0.01$ ). The Logical/Socially correct element of T and the Practical element of Pr are inversely correlated with P ( $P < 0.01$ ). The Practical element of Pr is slightly correlated with N ( $P < 0.05$ ) and the Direct/Blunt element of Pr is slightly correlated with E. Only the Objective/Perfectionist element of T is uncorrelated with the three overall personality scales. Whereas E and P are highly linked to learning style elements, N is generally independent.

The components of the personality scales which are, and which are not, linked to the components of the learning styles scales are also displayed in Table 3. The Impulsive component of A and the Objective/Perfectionist element of T are correlated with the Need for stimulation component of E ( $P < 0.01$ ). All the components of A and R, as well as the Direct/Blunt element of Pr, are linked to the Impulsive element of E ( $P < 0.01$ ). The Impulsive and Sociable elements of A and the Distant/Detailed element of R are linked to the Sociable element of E. The Impulsive and Informal

Table 3. Overlaps between the components of learning style and personality

	E	E Sociable/Lively	E Impulsive	E Need for stimulation
A Impulsive	0.56**	0.45**	0.50**	0.34**
A Informal	0.21**	0.14	0.32**	0.01
A Sociable/Lively	0.53**	0.53**	0.37**	0.03
R Consider alternatives	-0.11	-0.07	-0.20**	0.08
R Distant/Detailed	-0.30**	-0.27**	-0.32**	0.04
T Logical/Socially correct	-0.14	-0.14	-0.15	0.11
T Objective/Perfectionist	0.10	0.06	0.03	0.23**
Pr Practical	0.12	0.10	0.10	0.12
Pr Direct/Blunt	0.15*	0.08	0.24**	0.08
	N	N Nervous/Worrier	N Depressed	
A Impulsive	-0.11	-0.12	-0.07	
A Informal	0.20*	0.10	0.07**	
A Sociable/Lively	0.04	0.04	0.03	
R Consider alternatives	-0.02	0.08	-0.11	
R Distant/Detailed	-0.07	0.02	-0.14	
T Logical/Socially correct	-0.02	-0.02	-0.01	
T Objective/Perfectionist	0.03	0.04	0.01	
Pr Practical	-0.16*	-0.13	0.15	
Pr Direct/Blunt	0.07	-0.01	0.13	
	P	P Disrespect rules	P Schizotypy	P Tough-minded
A Impulsive	0.27**	0.37**	0.07	0.06
A Informal	0.38**	0.43**	0.25**	-0.08
A Sociable/Lively	0.08	0.09	0.09	0.01
R Consider alternatives	-0.31**	-0.27**	-0.29**	0.02
R Distant/Detailed	-0.17*	-0.19*	-0.08	-0.05
T Logical/Socially correct	-0.35**	-0.45**	-0.11	-0.03
T Objective/Perfectionist	0.00	0.00	-0.03	0.05
Pr Practical	-0.26**	-0.31**	-0.11	0.04
Pr Direct/Blunt	0.09	0.01	0.15	-0.01

\* $P < 0.05$ .

\*\* $P < 0.01$ .

$N = 167$ .

E, Extraversion; N, Neuroticism; P, Psychoticism; A, Activist; R, Reflector; T, Theorist; Pr, Pragmatist.

Correlations between components of personality superfactors and components of the four learning styles are shown.

components of A, all the elements of R, the Logical/Socially correct element of T and the Practical element of Pr are related to the Disrespect the rules element of P.

There are some components of E, N and P that appear to have virtually no relationship with learning style. The Schizotypy element of P is only related to the Informal component of A and the Consider alternatives element of R. These correlations are small but significant ( $P < 0.01$ ). The Depressed element of N is only related to the Informal element of A. The Nervous/Worrier element of N and the Tough-minded element of P have no significant relationship with any learning style element.

## DISCUSSION

### *Similarity of the operational concepts to those of the trait definitions*

By comparing the dimensional structure by factor analysis of E, N, P, A, R, T and Pr with the authors' trait definitions, it was possible to determine whether the authors of the tests have chosen items which are consistent with their definitions. It is important to note that this method is only as good as the percentage of the variance explained by the important factors and thus the conclusions drawn about P and Pr must be treated with some scepticism since the total percentage of extracted variance was less than 30% for these two traits.

The items of the EPQ would appear to mirror very well the trait definitions, although there is little evidence from the factor analysis of P that high P scorers are likely to be solitary. The operational definitions of the LSQ also have much similarity to the trait definitions, except the items of A suggest an Informal element, and T a Logical/socially correct element. These are missing from the trait definitions.

It is therefore reasonable to conclude that the items comprising the EPQ and the LSQ represent

a fairly good operationalisation of the trait definitions of the authors, although there is an inequality of items emphasizing Sociable/Lively and de-emphasizing Impulsive and Need for stimulation in E.

#### *Overlap between personality and learning style*

Correlations between the scales generally replicated the correlations reported by Furnham (1992) and suggested that there is a large overlap between personality and learning styles. By examining the correlations of the components of the scales with each other and with E, N and P, it was possible to determine the areas of overlap between personality and learning style as well as the areas of difference.

E is strongly related to all elements of A. This is not surprising since E and A have similar definitions and operational construction. The Sociable/Lively and Impulsive components of E and A are respectively highly correlated. Reasons why E and A are not more highly correlated include the fact that A has an Informal component whereas E has a Need for stimulation component and that E has an inequality of emphasis between its components. In short, people who crave excitement and centre activity around themselves also appear to have a preference for learning in these situations.

E also has an overlap with R, but only with the component called Distant/Detailed. Introverted people who are not impulsive and who are not sociable tend to be Distant/Detailed. E is not highly related to the Consider alternatives element of R. These two results suggest that Extraverts and Introverts consider similar numbers of alternatives when making a decision, but Introverts are more detailed in their evaluation of the alternatives.

P is related to at least one component of each of the learning style traits as well as some of the elements of E and N. P is related to A through its common links with being Impulsive and Informal. P is related to all components of R, the Logical/Socially correct element of T and the Practical element of Pr. When P is split into its components, it becomes clear that it is the Disrespect rules element which is responsible for these correlations. Schizotypy and Tough-minded components of P have little or no relationship with learning style respectively.

Since all elements of learning style have at least one significant correlation with one element of a personality trait there is substantial evidence that learning styles are fully measured by personality scales. In the interest of parsimony, Furnham (1992) is therefore indeed correct to suggest that there is no need to measure both personality and learning style. However it is also true that the emphasis of the LSQ on learning elements of personality suggests that the LSQ is useful in measuring the learning elements of personality whilst ignoring the elements which are not associated with learning.

Overall, the general picture suggests that it is only elements of E and the Disrespect rules element of P that are related to components of learning style. Since learning style is concerned with the way people learn, it is reasonable to conclude that these correlations reflect a learnt basis to these personality scales.

#### *Learnt and biological bases of personality*

It is also useful to note those elements of personality that have little or no relation to learning style. The Need for stimulation component of E is not strongly related to learning style and, in general, N and the Schizotypy and Tough-minded components of P are also not associated with learning styles. It is of great interest to note that the overall evidence from this study suggests that those elements of personality which are most related to learning style are generally those which are *not* associated with what is known of the biological basis of personality.

First, consider N and P. N was not related to learning and N is thought to be related to the lability of the autonomic nervous system. Schizotypy and Tough-minded were the two elements of P which were not related to learning. The biological basis for P is less well understood but there may be a basis for the Schizotypy component of P in terms of low platelet monamine oxydase (MAO), levels of serotonin, amount of HLA B27 (a subsystem of the human leucocyte antigen system) and/or dopaminergic activity. The Tough-minded element of P may result from differences in levels of sex hormone (Eysenck, 1990; Eysenck, 1992, Gray, Pickering & Gray, 1994; Stenberg, 1994). Taking this other evidence into account, it seems therefore reasonable to conclude that N, and Schizotypy and Tough-minded elements of P have a biological basis, whereas the Disrespect rules element of P is learnt.

Table 4. Components of personality that are learnt and not learnt

Superfactor	Trait	Learnt	Biological basis
E	Need for stimulation	Not learnt	Cortical arousal
E	Impulsive	Learnt	Cortical arousal
E	Sociable/Lively	Learnt	None
N	Depressed	Not learnt	Theory of lability of
N	Nervous/Worrier	Not learnt	ANS
P	Schizotypy	Not learnt	HLA B27, MAO, Serotonin Dopaminergic activity
P	Disrespect for rules	Learnt	None
P	Tough-minded	Not learnt	Male hormone levels

E, Extraversion; N, Neuroticism; P, Psychoticism.

This table summarizes the evidence derived from this study and relates it to what is presently known of the biological basis of personality. Those components of superfactors which are learnt are defined as those which have substantial overlap with one or more learning styles. Those components which are not learnt have little relationship with learning styles. Evidence from other studies suggests these have a biological basis. Note that only the Impulsive component of E is correlated with a learning style and is also thought to have a biological basis.

Second, consider the basis of E. The Need for stimulation component of E was not related to learning style, and excitation and inhibition of the central nervous system is known to be related to non-social elements of E (Eysenck & Levey, 1972) such as Need for stimulation (Sales, Guydosh & Iacono, 1974). Taking this extra information into account, it therefore seems reasonable to conclude that Need for stimulation has a biological basis. Results of this study indicate that the Impulsive element of E has a learnt basis but the evidence in favour of a biological basis is also reasonably well established (e.g. Eysenck & Levey, 1972; Stenberg, 1992). The importance of Impulsivity as a trait of personality is clear and the problems of its classification are known (e.g. Eysenck & Eysenck, 1991). A possible explanation of this is that Impulsivity has both a learnt and a biological basis.

It is therefore quite possible that the elements of personality which are learnt and those which have a biological basis are as in Table 4.

#### *Further points*

The components of E, N and P appear to be particularly useful in describing those aspects of personality which are learnt and those which are not. It is therefore important to remember that E, N and P may have elements which need independent investigation.

It should also be noted that this kind of study, in which scales are broken down into components, has many advantages over direct correlational studies between questionnaires. Many questionnaires that purport to measure different psychological dimensions have similar items. As such, it should not surprise investigators that scales are correlated. In general, the real question concerns which components of scales are correlated.

#### *Limitations of the study*

Two methodological limitations need to be noted. First, the percentage of variance which was explained by the components of the scales derived in this study was, on occasion, quite small. Second, also as noted in the results, some of the communalities of the items were relatively low and this indicates that some of the items were outliers when using the orthogonal factor analysis method used in this study. However the authors believe that the general robustness and interpretability of the results, in relation to the hypotheses, are sufficient to make these limitations relatively negligible.

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