Mapping Gray's model of personality onto the Eysenck Personality Profiler (EPP)

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Abstract

The aim of this study was to determine how well Gray's model of personality [Gray, J.A. (1982). *The neuropsychology of anxiety: an enquiry into the functions of the septo-hippocampal system*. Oxford: Oxford University Press; Gray, J.A. (1987). *The psychology of fear and stress*. Cambridge: Cambridge University Press], as measured by the Gray–Wilson Personality Questionnaire (GWPQ), can provide a full description of personality as measured by the primary scales of the Eysenck Personality Profiler (EPP) and the type scales of the short version of the EPQ-R. Factor analysis of the GWPQ, the Anxiety and Impulsivity scales of the EPP and the Learning Styles Questionnaire (LSQ) showed that the GWPQ seemed to measure general activation and inhibition factors, but not the finer features of Gray's theory. When the GWPQ scales were regressed against each scale of the EPP, it was found that they generally provide only a reasonable explanation of the EPP primary scales. It is concluded that the GWPQ measures general properties of Gray's model, that the Impulsivity and Anxiety scales of the EPP also seem related to the GWPQ scales, and that Gray's model of personality provides only a partial explanation of personality in general. © 2002 Published by Elsevier Science Ltd. All rights reserved.

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1. Introduction

Eysenck's Giant three model is a widely respected trait theory based on factor analysis and psychobiological perspectives and has a wide international following (see Eysenck, 1967, 1997). The Eysenck Personality Profiler (EPP; Eysenck & Wilson, 2000) is a 420-item questionnaire measuring 21 primary scales that provide a reasonable fit to Eysenck's three factor model comprising of Extraversion (E); Neuroticism (N) and Psychoticism (P). The factor structure of the

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EPP has been investigated (Costa & McCrae, 1995; Eysenck, Barrett, Wilson, & Jackson, 1992; Jackson, Furnham, Forde, & Cotter, 2000); specific groups have been studied (Furnham, Jackson, Forde & Cotter, 2001; Jackson & Wilson, 1993, 1994; Wilson & Jackson, 1994), and the EPP has been the centre of theoretical work (Furnham, Forde, & Cotter, 1998,a,b; Jackson & Corr, 1998; Jackson, Furnham, & Lawty-Jones, 1999). Recently Jackson, et al. (2000) have suggested that the EPP provides a good all-round description of personality.

Gray's (1982, 1987) three scale theory of personality is a biological model, but has a clearer motivational basis than Eysenck's. This model is most often stated to be a 45 degree rotation of Eysenck's, but recent clarification suggests that Impulsivity is aligned at 30 degrees to Extraversion, and Anxiety is aligned at 30 degrees to Neuroticism (Pickering, Corr, & Gray, 1999). Impulsivity has a biological basis in the Behavioural Activation System (BAS), and anxiety has a basis in the Behavioural Inhibition System (BIS). The BAS is associated with pleasurable emotional states which are highly sensitive to reward. Gray's theory suggests that highly impulsive people learn best from, and are motivated by, reward. On the other hand, people with heightened reactivity to the BIS are sensitive to fear and punishment, and therefore high scorers on anxiety are thought to learn best from, and be motivated by, punishment. A third scale labelled Fight/flight is less well understood (Corr, 2001; Matthews & Gilliland, 1999).

The scales of Impulsiveness and Anxiety (primary scales of psychoticism and neuroticism, respectively) from the EPP seem very similar in definition and name to the scales that Gray (1982, 1987) advocates as major constructs of personality. They also seem to be a reasonable representation of the different levels of description and levels of physiological mechanisms between the two models. It should however be noted that the EPP places the Impulsivity scale in Psychoticism, whereas Gray would seem to place Impulsivity close to Extraversion.

Recently the GWPQ has been used as a measure of Gray's model of personality (Wilson, Barrett, & Gray, 1989; Wilson, Gray, & Barrett, 1990). The GWPQ measures the three main mechanisms of Gray's model, each with two scales: (1) the activation system which consists of response to reward (the Approach scale) and response to punishment (the Active avoidance scale); (2) the inhibition system which consists of reducing the risk of punishment by inactivity and submission (Passive avoidance) and abandoning behaviours that are not rewarded (Extinction); and (3) rapid escape from sources of punishment (Flight) and defensive aggression (Fight). Results of various studies tend to suggest that the GWPQ seems able to identify activation and inhibition systems but does not necessarily reflect the full depth of Gray's theory (Slobodskaya, Safronova, Knyazev, & Wilson, 2001; Wilson et al., 1989; Wilson et al., 1990; Wilson, Barrett, & Iwawaki, 1995).

Gray's model provides a behaviourally and physiologically based explanation of personality but as yet there have been no systematic attempts to determine how well Gray's model can be used to explain the causes of personality in general. This study corrects this state of affairs by determining how well Gray's scales explain each of the EPP primary scales, as well as the type scales of the short version of the EPQ-R (Eysenck & Eysenck, 1991). If Gray's model of personality provides a good all round explanation of personality then it could be regarded as a reasonably complete explanation of personality and possibly even a good description of personality. On the other hand, if Gray's model seems unable to explain the EPP and EPQ-R scales very well, then it would seem as though it is, at best, only a partial explanation of the whole domain of personality.

One possible way of developing Gray's physiological model is to take into account an experiential learning basis to personality (see Kolb, 1984). Honey and Mumford (1992) designed a

learning styles questionnaire (LSQ) that was specifically designed to measure Kolb's learning cycle: (1) activists who thrive on the challenge of new experiences; (2) reflectors who observe and ponder on what they have experienced; (3) theorists who enjoy the process of integrating these observations into a theoretical framework; and (4) pragmatists who are more interested in testing the theory through practical application. Furnham (1992) provides a fuller description of these terms. Honey and Mumford's learning styles questionnaire (LSQ; Honey and Mumford, 1992) has a wide following in training and occupational psychology across the whole world, but particularly in Europe. Validity of the LSQ seems good and has been reported in greater detail elsewhere (Furnham et al., 2001).

Three recent studies have reported the relationship between Eysenck's three factor personality structure, using the revised version of the Eysenck Personality Questionnaire (EPQ-R; Eysenck & Eysenck, 1991), the Eysenck Personality Profiler (EPP; Eysenck & Wilson, 2000) and the LSQ. Results suggest that quite a lot of the variance in extraversion and psychoticism can be explained by learning styles (Furnham, 1992; Furnham et al., 2001; Jackson & Lawty-Jones, 1996). However, none of these studies reported on what *additional* variance experiential learning may provide once a physiological model of personality has been taken into account.

It should, however, be noted that Gray's model could be expected to have some overlap with experiential learning models. This is because Gray's model of personality is not just a physiologically based model, but is also based in human equivalents of animal learning paradigms. Moreover, a physiological basis to personality is not necessarily unadaptive to learning. Quite what the overlap is between these two different approaches to learning remains to be seen.

The aims of the study are as follows:

1. If the Impulsivity and Anxiety scales of the EPP are similar to the appropriate Activation and Inhibition scales of the GWPQ, respectively.
2. The amount that the GWPQ scales explain each EPP scale
3. If scales of experiential learning add a significant extra amount of variance to that explained by Gray's model; and the amount of overlap between Gray's model and experiential learning.

2. Method

2.1. Participants

Two groups of participants took part in this study and received different questionnaires:

2.1.1. Group 1
A total of 70 participants took part in this study (51 males and 19 females). All were employees of a Graduate Development Programme of a highly successful 'blue-chip' company in the City of London. The ages of participants ranged from 21 to 28 years, the mean age being 23 years.

2.1.2. Group 2
One hundred participants from the University of Surrey and the surrounding area were used in this study. They comprised of 36 males and 64 females, and were from varied backgrounds including students, recruitment consultants and secretaries.

2.1.3. Measures

The following questionnaires were administered to Group 1:

1. Learning Styles Questionnaire (LSQ): The 80-item LSQ (Honey & Mumford, 1992) measures individuals' preferred methods of learning.
2. EPQ-R short scale: the short version of the EPQ-Revised (Eysenck & Eysenck, 1991) consists of scales which measure Eysenck's Giant three dimensions of personality.
3. Gray-Wilson Personality Questionnaire (GWPQ): The Gray-Wilson Personality Questionnaire GWPQ (Wilson et al., 1989), designed to represent Gray's (1987) theory of personality, measures the human behaviour equivalents of six animal behaviour paradigms which indicate a style of reaction to rewards and punishments in the environment. The GWPQ consists of 120 items to assess these behaviours.
4. Anxiety: The EPP scale of Anxiety (Eysenck & Wilson, 2000) is a 20-item questionnaire.
5. Impulsiveness: The EPP scale of Impulsiveness (Eysenck & Wilson, 2000) is also a 20-item questionnaire.

The battery of questionnaires administered to group 2 consisted of three different personality questionnaires:

1. LSQ
2. GWPQ and;
3. The EPP.

2.2. Procedure

Questionnaires were distributed by hand and participants completed each of the questionnaires as noted. Participants were fully debriefed on the aim of the study and offered individual feedback on their results. Participants in Study 1 were additionally told that the study was for survey purposes only.

3. Results

Means, standard deviations and alpha reliabilities for the scales are shown in Table 1. In general, alpha reliabilities are acceptable with the following scales having reliabilities less than 0.69: Active-avoidance, Expressive, Dogmatic, Dependence, Hypochondria, Obsessive, Impulsive, Irresponsive, Manipulative, Practical, Lie scale, Activist from the LSQ, and Psychoticism.

Table 2 presents a promax rotation of a maximum likelihood factor analysis of the scales common to both groups of subjects: GWPQ scales, LSQ scales, and Impulsiveness and Anxiety from the EPP. A scree slope analysis suggested three factors for extraction. Factor 1 includes Activation scales, factor 2 includes Inhibition scales and factor 3 comprises the two remaining scales of the LSQ. Impulsivity of the EPP loads on the activation scales and Anxiety of the EPP loads on the inhibition scales.

Tables 3–7 present the results of a series of hierarchical multiple regressions in which the GWPQ scales are entered as Step 1 variables and the LSQ scales are entered as Step 2 variables to

Table 1
Descriptive statistics

	Mean	S.D.	alpha
Gray-Wilson Questionnaire (n=170)			
Approach	17.21	6.53	0.69
Active-Avoidance	18.44	5.13	0.62
Passive-Avoidance	10.10	5.08	0.70
Extinction	11.69	5.14	0.67
Fight	12.74	6.04	0.75
Flight	15.54	6.49	0.74
Eysenck Personality Profiler (n=100, except for Impulsivity & Anxiety where n=170)			
Active/inactive	20.34	7.99	0.78
Sociable/unsociable	27.67	7.43	0.80
Expressive/inhibited	19.46	5.77	0.51
Assertive/submissive	19.83	6.87	0.71
Ambitious/unambitious	17.04	7.02	0.74
Dogmatic/flexible	14.23	5.47	0.38
Aggressive/peaceful	14.21	7.02	0.74
Inferiority/self-esteem	15.27	8.87	0.85
Unhappy/happy	11.90	7.53	0.80
Anxious/calm	13.21	8.44	0.77
Dependence/autonomy	11.02	6.20	0.67
Hypochondria/sense of health	7.22	5.13	0.63
Guilt/guilt freedom	10.72	6.57	0.73
Obsessive/casual	12.09	6.45	0.59
Risk taking/careful	21.64	7.00	0.69
Impulsive/careful	18.87	7.05	0.60
Irresponsible/responsible	22.20	6.30	0.67
Manipulation/empathy	16.08	5.91	0.60
Sensation seeking/unadventurous	22.64	7.47	0.75
Tough minded/tender minded	16.90	7.22	0.73
Practical/reflective	20.83	7.68	0.58
Lie scale	11.63	6.25	0.66
Learning styles questionnaire (n=170)			
Activity	10.54	3.45	0.69
Reflector	12.53	4.08	0.77
Theoretical	10.21	3.69	0.74
Practical	11.41	3.76	0.73
Eysenck Personality Questionnaire (revised; n=70)			
Extraversion	10.17	2.10	0.74
Neuroticism	2.56	2.46	0.74
Psychoticism	2.37	1.63	0.48
Lie	4.50	2.66	0.75

determine the amount of variance of EPQ-R (Table 3) and EPP scales which are explainable in terms of Gray's model and any remaining variance that is explainable in terms of experiential learning. The EPP primary scales are classified as Extraversion (Table 4), Neuroticism (Table 5), Psychoticism (Table 6) and Other scales (Table 7) according to the model proposed by Eysenck et al. (1992). Whilst the tables themselves present interesting information about how Gray's model

Table 2
Factor analysis of scales from the LSQ, GWPQ, Impulsivenss and Anxiety scales of the EPP ($n = 170$)[a]

	Factor			Communality
	I	II	III	
	Activation	Inhibition	Learning	
% var	28.7	23.1	11.3	
Cum% var	28.7	51.8	63.1	
Impulsive/careful	0.83	−0.08	−0.05	0.73
Activist (LSQ)	0.74	−0.05	0.01	0.54
Approach	0.69	0.26	0.06	0.50
Active-Avoidance	−.59	−0.02	0.00	0.34
Fight	0.52	0.24	0.18	0.27
Reflector	−0.50	0.25	0.31	0.48
Anxious/calm	0.14	0.77	−0.00	0.59
Extinction	−0.17	0.70	−0.02	0.53
Passive-Avoidance	0.02	0.69	−0.14	0.54
Flight	0.17	0.56	−0.04	0.34
Pragmatic	0.24	−0.23	0.77	0.68
Theorist	−0.20	0.00	0.75	0.68

[a] Pattern matrix shown after maximum likelihood factor analysis with promax rotation.

Table 3
Regression of GWPQ and LSQ scales on EPQ-R (short) scales

	GWPQ	EPQ-R		
		E	N	P
Activation	Approach		0.23*	0.30**
	Active-Avo			0.30**
	Fight			
Inhibition	Extinction			
	Passive-Av		0.34**	
	Flight		0.31**	
S1:R^2 (adj.)[a]			0.27	0.29
S2:R^2 (adj.)[a]		0.09		

[a] Adjusted values of R^2 are shown for Step 1 (S1) which includes the GWPQ scales and Step 2 (S2) which includes the additional four LSQ scales. Significant Beta weights are shown in the table and adjusted R^2 above 0.05 are presented.
*$P < 0.05$.
**$P < 0.01$.

and experiential learning explain each of the Eysenckian scales, the following are more general results:

1. If an adjusted R^2 of greater than or equal to 0.10 is taken as a reasonable level of explained variance, then N and P of the EPQ-R and 18 of the 21 primary scales of the EPP are explained by just the GWPQ scales.
2. With the same cut-off, but taking into account the extra variance explained by the LSQ scales, N and P of the EPQ-R, and 20 out of 21 primary scales of the EPP are satisfactorily explained.

Table 4
Regression of GWPQ and LSQ scales on EPP Extraversion primary scales

	GWPQ	E of EPP			
		Active	Sociable	Assertiveness	Ambition
Activation	Approach				
	Active-Avo				
	Fight		0.17*	0.41**	0.23*
Inhibition	Extinction				
	Passive-Avo	−0.38**	−0.30**	−0.37**	−0.21*
	Flight		0.21*		
S1:R^2 (adj.)[a]		0.15	0.19	0.41	0.10
S2:R^2 (adj.)[a]		0.19	0.31	0.44	0.25

   [a] Adjusted values of R^2 are shown for Step 1 (S1) which includes the GWPQ scales and Step 2 (S2) which includes the additional four LSQ scales. Significant Beta weights are shown in the table and adjusted R^2 above 0.05 are presented.
*$P < 0.05$.
**$P < 0.01$.

Table 5
Regression of GWPQ and LSQ scales on EPP Neuroticism primary scales

	GWPQ	N of EPP					
		Lo Esteem	Unhappiness	Anxiety	Dependence	Hypochondria	Guilt
Activation	Approach			0.24**			
	Active-Avo	−0.27**	−0.20*		−0.31**		
	Fight		−0.27**				
Inhibition	Extinction			0.23**	0.27**		
	Passive-Av	0.43**	0.26**	0.31**		0.23*	
	Flight			0.17*			
S1:R^2 (adj.)[a]		0.31	0.15	0.42	0.11	0.05	
S2:R^2 (adj.)[a]				0.43		0.08	0.26

   [a] Adjusted values of R^2 are shown for Step 1 (S1) which includes the GWPQ scales and Step 2 (S2) which includes the additional four LSQ scales. Significant Beta weights are shown in the table and adjusted R^2 above 0.05 are presented.
*$P < 0.05$.
**$P < 0.01$.

Table 6
Regression of GWPQ and LSQ scales on EPP Psychoticism primary scales

	GWPQ	P of EPP							
		Risk-taking	Impulsiveness	Irresponsibility	Manipulativeness	Sensation seeking	Aggression	Dogmatism	Expressivness
Activation	Approach	0.34**	0.21**	0.23*			0.28**	0.38**	0.20*
	Active-Avo		−0.16**	−0.33**	−0.30**				
	Fight				0.33**		0.59**		0.17*
Inhibition	Extinction	−0.34**				−0.38**			
	Passive-Av				−0.18*				
	Flight	−0.23**				−0.27**	−0.14*		
	S1:R^2 (adj.)[a]	0.40	0.39	0.21	0.25	0.30	0.63	0.11	0.21
	S2:R^2 (adj.)[a]	0.42	0.59		0.34		0.71	0.30	0.32

[a] Adjusted values of R^2 are shown for Step 1 (S1) which includes the GWPQ scales and Step 2 (S2) which includes the additional four LSQ scales. Significant Beta weights are shown in the table and adjusted R^2 above 0.05 are presented.
*$P < 0.05$.
**$P < 0.01$.

3. If an adjusted R^2 of greater than or equal to 0.30 is taken as a good level of explained variance, then no scales of the EPQ-R and just 6 of the 21 primary scales of the EPP are satisfactorily explained by the GWPQ scales on their own.
4. With the same cut-off, but taking into account the extra variance explained by the LSQ scales, no scales of the EPQ-R, and 9 of 21 primary scales of the EPP are satisfactorily explained.
5. Active, Sociable and Ambition components of the EPP are not satisfactorily explained by the GWPQ, whereas the Assertiveness primary scale is (Table 4).
6. Low self-esteem and Anxiety are well explained by the GWPQ but the other scales of Neuroticism are not (Table 5).
7. Risk-taking, Impulsivity and Aggressiveness are well explained by the GWPQ but the other scales of Psychoticism are not (Table 6).
8. The primary scales which are not easily classified into E, N or P of the EPP are not well explained by the GWPQ scales (Table 7).
9. There are also some consistencies in the GWPQ scales that predict the Extraversion scales suggesting some common basis: low Passive-avoidance (i.e. low inhibition) predicts all four primary extraversion scales of the EPP and high Fight (i.e. high activation) predicts Sociability, Assertiveness and Ambition.
10. The Neuroticism scales well predicted by the GWPQ seem to be commonly predicted by high Passive-avoidance (inhibition) and Active-avoidance (low activation) although Active-avoidance does not predict Anxiety.
11. Psychoticism scales are predicted by a diverse range of GWPQ scales including Approach (high activation) and Flight (low inhibition) but there is little discernible pattern, especially amongst the inhibition scales.

Table 7
Regression of GWPQ and LSQ scales on EPP primary scales not closely related to a three factor structure

Other	GWPQ	Other of EPP		
		Obsessiveness	Tough-mindedness	Practical
Activation	Approach			
	Active-Avo	0.47		−0.12**
	Fight			
Inhibition	Extinction		−0.27**	
	Passive-Av			
	Flight		−0.27**	0.29**
S1:R^2 (adj.)[a]		0.09	0.27	0.10
S2:R^2 (adj.)[a]		0.22	0.30	0.14

[a] Adjusted values of R^2 are shown for Step 1 (S1) which includes the GWPQ scales and Step 2 (S2) which includes the additional four LSQ scales. Significant Beta weights are shown in the table and adjusted R^2 above 0.05 are presented.
*$P < 0.05$.
**$P < 0.01$.

4. Discussion

The results of the factor analysis suggest that all the scales of the GWPQ can be explained by two factors which were labelled Activation and Inhibition. This confirms previous factor analytical research (Slobodskaya et al., 2001; Wilson et al., 1989, 1990, 1995) that suggests the GWPQ is not good at providing separate scales of the finer points of Gray's theory as originally intended by the authors.

Impulsivity of the EPP is strongly related to Activation and Anxiety of the EPP is strongly related to Inhibition suggesting that these two EPP scales provide similar measures to those in the GWPQ. Moreover, that a high Activist learning style and low Reflector learning style is associated with Activation supports the construct validity of the scales used in this study.

Results of the factor analysis suggest that a Pragmatic and Theorist learning style is unrelated to Activation and Inhibition, and forms a third factor unrelated to the human equivalents of animal learning paradigms represented by the GWPQ scales. This suggests that Kolb's ideas concerning experiential learning overlap with animal learning paradigms in terms of the Activist and Reflector scales (which seem generally related to the factor of activation) but that Pragmatic and Theorist scales are separate. One possible explanation is that putting ideas into action (Pragmatic learning) and developing models of how things work (Theorist learning) are higher intellectual activities than trying things out (Activist learning) and observing experiences (Reflector learning). This line of reasoning is supported by Furnham et al. (2001) and Jackson and Lawty-Jones (1996) whose results suggest that Activist and Reflector learning styles are more related to personality scales than Theorist and Pragmatist scales. It may be that Theorist and Pragmatist learning scales are more related to intelligence.

The study also aimed to determine the amount that Gray's model of personality, perhaps supplemented with an experiential learning model, provides a complete explanation of personality as measured by the primary scales of the EPP and the type scales of the EPQ-R. Results suggested that Gray's model provides at best only a reasonable explanation of two of the short EPQ-R scales and many of the EPP primary scales. *The majority of EPP scales were generally only reasonably explained by the GWPQ scales (with adjusted R^2 usually between 0.1 and 0.3, even when supplemented with scales of experiential learning).* It can be concluded that Gray's model of personality, as measured by the GWPQ, is not sufficient to be able to describe the whole domain of personality on its own or in conjunction with an experiential learning model, as measured by the LSQ. This is a relatively serious criticism of Gray's model of personality, since it seems to relegate the model to providing only a partial explanation of the personality domain. It remains to be seen if it is the important parts of personality which are effectively explained by Gray's model.

In general, experiential learning did not seem to add much extra variance to Gray's model in its explanation of the variance in the EPP and EPQ-R scales. This may be because a hierarchical model was imposed on the data such that all the variance attributable to Gray's model was partialled out prior to incorporating experiential learning. Such a statistical model makes sense because it is appropriate to explain variance from a physiological source prior to taking into account variance from an experiential learning source. However, this approach does not take into account that apparent covariance between some of the GWPQ and LSQ scales as clearly shown in Table 2. Such results suggest that Gray's model has overlap with experiential learning and reinforces the notion that physiological models are not necessarily unadaptive to experience.

Since this analysis probably underestimates the significance of the experiential learning model, it is therefore unsurprising that these results contradict the earlier work by Furnham (1992), Jackson and Lawty-Jones (1996) and Furnham et al. (2001) which all indicate that experiential learning has a large overlap with personality.

A further feature of the results is that a combination of Activation and Inhibition scales seem to be best predictors of many of the EPP scales. Superficially, this result is counter-intuitive since it seems sensible for Extraversion to be mainly related to Activation and Neuroticism to be related to Inhibition. Results of this study suggest that the primary scales of Extraversion seem to be mainly dictated by a balance between Fight and Passive-avoidance, and some of the primary scales of Neuroticism seem to be dictated by a balance between Active-avoidance and Passive-avoidance (and other Neuroticism scales seem to be outside of Gray's model). It may be that personality scales are best explained in terms of the combined effects of Activation and Inhibition scales — a proposal that bears a strong resemblance to Pavlov's theory of temperament and Gray's neuropsychological model (see Corr, 2001 for a discussion on hypothesized links between the BAS and BIS system).

The primary scales of Psychoticism have a diverse range of GWPQ predictors which suggest that the Psychoticism scales may have little commonality of origin. Some of the scales seem purely explainable in terms of Activation (Approach, low Active avoidance and Fight) whereas some also have an inhibitory influence from low Extinction, low Passive-avoidance and low Flight. This diverse range of predictors presents a general problem for the belief that Psychoticism primary scales should have a common underlying structure.

The scale of Practical is best explained in terms of *low* Activation and *high* Inhibition which seems to be the opposite of the Psychoticism scales. The poor fit of Practical to the rest of the Psychoticism scales supports the stance of Eysenck et al. (1992) and Costa and McCrae (1995) that the scale is not easily located in the Giant three model. Eysenck et al. (1992) maintain that Practical is not a personality scale, whereas Costa and McCrae (1995) believe that Practical represents their scale of Openness.

The analysis is designed to determine the amount of variance in primary and type scales which is attributable to Gray's model of personality. However, it must be noted that our analysis does not test for causality. It should also be noted that Eysenck (1967) also outlines a causal basis for the EPQ-R which is different to Gray's model. Another limitation to this study is the extent that Gray's model of personality is adequately represented by the GWPQ since the factor analytic results of this study and previous studies suggest that further development work on the GWPQ is needed. However, this potential limitation is probably not too serious since some of the scales of the EPP, which were explained best by the GWPQ, were Impulsiveness, Anxiety and Aggression. This is exactly as could be predicted, since they are likely to correspond best with the BAS, BIS and Fight/Flight systems, respectively, of Gray's model. Further work might determine how well Activation and Inhibition scales overall explain personality scales and might integrate such a model into Pavlov's theory of temperament.

In summary, the GWPQ scales and the Impulsivity and Anxiety scales of the EPP seem to provide good measures of Activation and Inhibition and therefore are likely to be good general measures of Gray's two scale model of personality. Nevertheless, Gray's model of personality seems to provide a relatively poor explanation of scales spanning the whole domain of personality. Both primary scales of Extraversion and Neuroticism seem to be best explained in terms of

the combined effects of Activation and Inhibition, whereas Psychoticism seems to have a more varied basis that has less consistency in terms of Gray's model.

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