

How Introspections Concerning Cloninger's Concepts of Temperament and Character Influence Eysenckian Personality Structure

Chris J. Jackson · Luke D. Smillie

© Springer Science + Business Media, LLC 2008

Abstract Two studies examine the consequences of distinguishing between self-report responses on the Eysenck Personality Profiler (Eysenck et al. *The European Journal of Psychological Assessment* 8: 109–117, 1992) in terms of Cloninger's concepts of Temperament and Character (Cloninger et al. *Archives of General Psychiatry* 50: 975–990, 1993). Character is thought to reflect conscious, maturation-related influences on personality, while Temperament is thought to reflect instinctive, biologically-based influences. In Study one, one-hundred and thirty-three participants (76.6% female) classify primary scales of the Eysenck Personality Profiler as relating to Character or Temperament. Impulsiveness, Anxiety and Aggression are perceived as the most Temperament-based scales, while Responsibility, Manipulativeness and Assertiveness are perceived as the most Character-based scales. In Study two, one-hundred and seventy-seven participants (74.4% female) complete the Eysenck Personality Profiler using the standard response scale, while one-hundred and thirty-eight participants (62.3% female) complete the Eysenck Personality Profiler using a scale which distinguishes between Character and Temperament. Results demonstrate differences in the factor structure and concurrent validity of the Eysenck Personality Profiler when scoring distinguishes between Temperament and Character. We conclude that the concepts of Temperament and Character might usefully be applied to Eysenck's personality taxonomy.

Keywords Cloninger · Eysenck · Temperament · Character · Eysenck personality profiler · Conscious · Instinctive

C. J. Jackson (✉)
School of Organization and Management, University of New South Wales, Kensington, Sydney,
NSW 2052, Australia
e-mail: c.jackson@unsw.edu.au

L. D. Smillie
Goldsmiths, University of London, London, UK

Most major taxonomies of personality rely upon self-reports of behaviors, with multiple responses being grouped together according to theoretically or factor analytically derived constructs. These latent variables are often linked with putative causes of personality variation. For instance, in H. J. Eysenck's (1967, 1980) 'top-down' model of personality, Extraversion (composed of activity and sociability) is linked with variation in cortical arousal via the ascending reticular activating system. Neuroticism (composed of anxiety and depression) is linked with instability of the visceral brain. Psychoticism (composed of tough-mindedness and impulsiveness), is less-clearly understood.

Alternatively, in J. A. Gray's (1982) 'bottom-up' model of personality, sensitivity to reward is thought to manifest as Extraversion, while sensitivity to goal conflict is thought to manifest as Neuroticism (more specifically, the anxiety component of Neuroticism). However, as Pickering and others have pointed out elsewhere (for example, Pickering 2008; Smillie et al. 2006), it is unlikely that the introspections of a respondent completing a personality questionnaire directly relate to these potential underlying processes. A more plausible view is that such introspections may reflect *functional outcomes* of such brain-behavior systems (see Smillie et al. 2006, p. 327). Such functional outcomes may include estimates of the intensity or probability of a behavior in a given situation, or memories of the relevant behaviors actually occurring.

The view that self-reports reflect, at best, certain functional outcomes of personality processes, rather than the processes themselves, has potentially critical implications for models which posit interdependent or hierarchically-tiered causes of personality. The present study considers the distinction which has been made between distal, neurobiological causes known as *Temperament* and proximal, socio-cognitive causes of personality known as *Character* (Cloninger et al. 1993; Elliot and Thrash 2002; Jackson and Francis 2004; Jackson 2005, 2008). While major theorists such as Eysenck (1980, 1997) have long advocated multiple levels of causal influence on personality, the most detailed attempt to formalize this notion is provided by Cloninger and colleagues (Cloninger 1987; Cloninger et al. 1993) and more recently by Jackson (2005, 2008). Personality constructs reflecting automatic, sub-cortical, or *instinctive* behaviors are thought to relate to Temperament while those relating to controlled, pre-frontal, or *conscious* behaviors are thought to relate to Character.

The specific systems and structures that comprise the Temperament level are largely borrowed from Gray's theory, which consists of a Behavioural Approach System mediating reward reactivity, a Fight/Flight/Freezing System (FFFS) mediating punishment reactivity, and a Behavioral Inhibition System mediating sensitivity to goal conflict (such as approach-avoidance conflict; Gray and McNaughton 2000). These systems partially map onto Cloninger's Temperament dimensions of *Novelty Seeking*, *Harm Avoidance*, and *Reward Dependence*. Temperament is thought to be a biologically-based, instinctive cause of personality, grounded in phylogenetically-old learning systems (Cloninger 1987). Cloninger's Character dimensions—*Self-Directedness*, *Cooperativeness* and *Self-Transcendence*—then add a second tier to Gray's model, reflecting conscious aspects of personality.

Cloninger's model offers a potentially useful framework for conceptualizing the different levels of influence that may underlie self-report responses on personality questionnaires. Nevertheless, it is not known to what extent the subjective

introspections of respondents are partitioned in the way that Cloninger's model assumes. The notion that self-reported behaviors reflect *either* Temperament *or* Character is unconvincing, as functional outcomes which may be referenced by such self-reports (subjective memories or judgements, etc) may reflect the combined influence of biological and cognitive processes. Furthermore, specific functional outcomes may (to a greater or lesser extent) relate to *either* proximal *or* distal processes for different people. As a result, the complex behaviors typically surveyed using personality questionnaires may be attributed to the influence of Character, Temperament or both.

For example, an item on a personality questionnaire might ask if the respondent would use the stairs as opposed to waiting for an elevator if late for an appointment. Some people may respond that they would use the stairs because that course of action occurs to them intuitively and they can remember doing so automatically on previous occasions. For other people, the response may involve some conscious probability estimate that the goal of arriving for their appointment in good time would be best achieved by taking the stairs. It is possible that self-reports of behaviors which occur automatically or instinctively would be more relevant to the concept of Temperament, while those which are more conscious or deliberative would be more relevant to the concept of Character. To our knowledge there has been no previous attempt to determine if there are individual differences in the kinds of introspections (Temperament- versus Character-related) people make when completing self-report measures. If there are, this may have implications for the structure and validity of personality taxonomies based upon factor analysis of self-reported introspections.

In this paper, we explore the nature of self-reports that people provide when completing questionnaires based on H. J. Eysenck's personality taxonomy. While we use Cloninger's edification of Gray's theory as a conceptual framework, we do not use his Temperament–Character Inventory (Cloninger et al. 1993) or Tridimensional Personality Questionnaire (Cloninger 1987). This is firstly because of some minor unresolved issues relating to the these measures; while the factor structure of the Temperament–Character Inventory has been shown to be consistent with the proposed model (Parker et al. 1996), the same cannot be said for the Tridimensional Personality Questionnaire (Stewart et al. 2004). More importantly, we wanted to determine how the Temperament–Character distinction might influence the factor structure and validity of a major, broad-focus personality taxonomy which currently does not recognize this distinction. Most personality taxonomies include factors which are highly similar to those of Eysenck's Giant Three model (see Table 1). Eysenck's personality dimensions are represented as orthogonal factors and the causal processes attributed to them are typically treated as separable and independent. However, we might expect that the kinds of internal references made when responding to Eysenckian measures may nevertheless be quite distinct, depending upon whether these introspections access functional outcomes relating to Temperament or Character. It is therefore an intriguing research question to determine how this distinction might influence the structure of Eysenck's personality taxonomy.

Jackson and colleagues have previously explored Eysenck's personality measures in terms of the kind of distinctions that Cloninger makes between personality antecedents. Jackson and colleagues (Furnham et al. 2001; Jackson and Lawty-Jones 1996; Levine and Jackson 2004) identify primary scales of Eysenck's model of

Table 1 Relationship of Eysenck's giant three factors to key traits of other major models of personality

	Extraversion	Neuroticism	Psychoticism
Cloninger (1987)	Novelty Seeking	Harm Avoidance	Reward Dependence ^a
Fowles (1987)	Impulsivity/Positive Affect	Aversive Motivation	Non-specific Arousal
Goldberg (1982)	Extraversion	Neuroticism	(low) Agreeableness (low) Conscientiousness
Gray (1982)	Behavioral Activation	Behavioral Inhibition	Fight/Flight/Aggression ^a
Strelau (1987)	Strength of excitation	Strength of inhibition	Mobility of nervous processes ^a
Tellegen (1982)	Positive Affectivity	Negative Affectivity	Constraint
Zuckerman (1979)	Extraversion	Neuroticism	ImpUSS

^a Mapping to psychoticism is not clear

personality that are either learnt or non-learnt in origin. Jackson and Lawty-Jones (1996) reanalyze the Eysenck Personality Questionnaire-Revised to reveal underlying primary scales and classify them as either experientially learnt or non-learnt. Furnham et al. (2001) report a similar study with the Eysenck Personality Profiler, which is the only instrument to assess Eysenck's *primary* scales (that is, narrow-bandwidth *facets* of Extraversion, Psychoticism and Neuroticism). Experientially learnt traits were defined as those primary scales that relate to learning styles. Examples of these include Sociability (a component of Extraversion) and Disrespect for Rules (a component of Psychoticism). Primary scales such as Anxiety were unrelated to experiential learning. Levine and Jackson (2004) found that self-reported delinquency was better predicted by distinguishing between learnt and non-learnt components of the Eysenck Personality Profiler, which span all three of Eysenck's higher order factors. This line of reasoning led Jackson 2002a, 2002b, 2005, 2008) to develop a hybrid model of learning and personality which spans Temperament and Character.

This previous research by Jackson and colleagues demonstrates that distinguishing between learnt and non-learnt components of Eysenckian taxonomy has implications for the structure and predictive validity of Eysenck's personality questionnaires. Cloninger's model of personality argues that learnt components of personality have some conceptual similarity to cognitive, proximal Character-type influences, and while non-learnt components have conceptual similarity to biological, distal Temperament-type influences.

The present research builds upon this theme by examining the nature of the self-reports that people routinely provide when completing personality questionnaires. As stated earlier, it seems highly unlikely that such self-reports are based directly upon underlying biological or cognitive processes. Rather, respondents might introspect about various functional outcomes of these processes. In this study we consider two kinds of introspections; firstly, self-report assessments that are automatic or *instinctive*, which are possibly more relevant to Temperament, compared with those that are controlled or *conscious*, and possibly more relevant to Character. Our aim is to determine firstly, if individuals vary in terms of the extent to which they perceive scales from the Eysenck Personality Profiler as referencing conscious or instinctive behavior, and secondly, what the implications are of distinguishing between conscious and instinctive components of Eysenckian personality taxonomy.

Overview of Studies

Study one assesses whether respondents distinguish between personality scales, as measured by the Eysenck Personality Profiler (Eysenck and Wilson 2000), in terms of whether they are perceived as relating to instinctive or conscious behaviors. This draws upon Cloninger's notion of Temperament and Character, but contrary to the assumption inherent in Cloninger's model, we do not assume that all scale constructs neatly reside at a single level of analysis.

Study two asks respondents to indicate for each item of the Eysenck Personality Profiler whether they feel their response is conscious, instinctive, or a combination of such introspections. We then compare the standard scoring of this instrument with the scoring method that takes conscious/instinctive ratings into account, in terms of factor structure, convergent/divergent (concurrent) validity, and predictive validity. We anticipate that, as Levine and Jackson (2004) found when distinguishing between learnt and non-learnt personality facets, the Eysenck Personality Profiler will show enhanced validity when scored using the alternative method.

Study One

The aim of this study is to examine the extent to which each of Eysenck's primary scales of personality is perceived as being a component of Character or Temperament. Scale constructs which are putatively biologically-based were expected to be rated as Temperament by the majority of participants. Impulsiveness and Anxiety are predicted to be most unanimously rated as Temperament, as these tend to be linked with distal biological determinants of personality, such as Gray's Behavioral Approach System and Behavioral Inhibition Scale (Gray and McNaughton 2000) and Cloninger's Temperament dimensions of Novelty Seeking and Harm Avoidance (Cloninger 1987). Moreover, behavioral genetics suggests that impulsivity traits have particularly strong heritability (Eysenck 1993). Scales that tend not to be associated with biopsychological theory are predicted to be rated as Character-based by the majority of participants. An example here is Responsibility, which is similar to the Five Factor Model dimension of Conscientiousness (McCrae and Costa 1999), a trait which to date does not appear related to biological causes, and has been argued to appear relatively recently in evolutionary history (Gosling and John 1999). Overall, however, it is expected that there will not be a strong consensus between individuals—that is, that there will be marked individual differences—in terms of their perceptions of the nature of the Eysenck Personality Profiler scale constructs.

Method

Participants and Materials

Participants were a selection of undergraduate students studying psychology at an Australian University, and were aware of the basic ideas related to trait psychology

and the distinction between Temperament and Character processes, but had received no lectures on the theoretical basis of primary scales of personality. A total of one-hundred and thirty-three students (*Mean* = 21.11years; *Standard Deviation* = 4.88; 76.7% female) completed a short questionnaire that listed the twenty-one scales of the Eysenck Personality Profiler. The twenty-one traits are grouped into the three superfactors of Extraversion (Activity, Sociability, Expressiveness, Assertiveness, Ambition, Dogmatism and Aggressiveness); Neuroticism (Inferiority, Unhappiness, Anxiety, Dependence, Hypochondria, Guilt and Obsessiveness); and Psychoticism (Risk-taking, Impulsivity, Irresponsibility, Manipulativeness, Sensation-seeking, Tough-mindedness and Practicality). Further details of the Eysenck Personality Profiler are provided in the study two method section.

For each scale, participants were asked to indicate whether they thought the trait concept involved was (1) an *instinctive/automatic/immediate* behavior (one that is done without thinking) OR (2) a *conscious/thoughtful/considered* behavior (one that is not engaged in automatically); these descriptions were used to define Temperament and Character respectively. A short description of each scale from the Eysenck Personality Profiler manual (Eysenck and Wilson 2000) was provided to ensure participants had a clear interpretation of each construct.

Results and Discussion

The percentages of participants who reported the various primary scales of personality to be Character (as opposed to Temperament) are shown in Table 2

Table 2 EPP primary scales: percentage of raters stating that a scale is character in origin

Highly character	percent
Responsibility	62
Manipulativeness	56
Assertiveness	56
Risk-taking	56
Ambition	54
Activity	50
Sociability	47
Sensation seeking	44
Tough-mindedness	42
Hypochondria	41
Expressiveness	40
Practical	40
Unhappiness	37
Low confidence	36
Dependence	33
Dogmatism	33
Guilt	25
Obsessiveness	24
Impulsiveness	23
Aggression	20
Anxiety	14
Highly temperament	

in descending order. High scores therefore represent scales that were more widely rated as Character in origin, while low scores represent scales more widely rated as Temperament. A Chi-Square contingency test confirmed that the 21 scales were rated significantly differently in terms of being Character or Temperament: $\chi^2(20) = 276.36, p < .001$.

Consistent with expectations, Anxiety and Impulsiveness are considered to be the most oriented towards Temperament. These primary scales are most associated with systems thought to form the Character basis of personality (Cloninger et al. 1993; Gray and McNaughton 2000; Jackson 2002a, 2002b, 2003). The next most Temperament scales are those that seem to be generally related to other elements of Neuroticism (Obsessiveness, Guilt, Dependence, Low Confidence, Unhappiness, and Hypochondria). This might be consistent with the view that such constructs have very clear cognitive determinants (Eysenck et al. 1987; Gotlib and McCann 1984) in addition to their long phylogenetic history (Gray and McNaughton 2000). The most Character oriented primary scale was Responsibility, which has not been related to biological causes and is closely related to Five Factor Model Conscientiousness. Sociability is also strongly perceived as a Character scale (by forty-seven percent of participants). Unexpectedly, Sensation Seeking is viewed as Character by many participants (by forty-four percent of participants), yet this trait is central to one of the more comprehensive biological theories (Zuckerman 1991) and utilized as a biological component in Jackson's (2005) model of functional and dysfunctional learning. While a layperson rating of the basis of a trait is not evidence for the *actual* basis of that trait, it is interesting that the kinds of introspections a respondent may make while completing a Sensation Seeking scale are possibly unrelated to the antecedents with which this scale has been empirically and theoretically linked.

A general conclusion which can be drawn from Study one is that lay-people distinguish between trait concepts in terms of Character or Temperament in a way which is predicted from theoretical conceptualizations of those traits (with some important exceptions). It is particularly noteworthy that the consensus for rating a scale as Temperament reached eighty-six percent of raters (for Anxiety) whereas the consensus for rating a scale as Character reached only sixty-two percent of raters (for Responsibility). This suggests that lay people with basic training in psychology tend more often to identify personality constructs as Temperament rather than Character—mirroring the view that personality is predominantly a biological phenomenon (Eysenck 1967; Gray 1982; Zuckerman 1991).

Finally, the fact that agreements regarding the basis of any one scale never approached 100 percent suggests that introspections relevant to self reports on *any* personality scale may concern functional outcomes of both Temperament *and* Character. This is perhaps consistent with the suggestion that Character scales are re-expressions of Temperament scales, (Elliot and Thrash 2002; Jackson 2002b, 2005, 2008; Jackson and Francis 2004) as opposed to independent entities as argued by Cloninger et al. (1993). In addition, it has the interesting implication that there may be individual differences in responses to measures of individual differences. The implication this may have for factor structure and validity of the Eysenck Personality Profiler is investigated in Study two.

Study Two

Study one suggests that self-report responses to personality questionnaires may differ in terms of the introspections people make when responding to an item. Study two therefore asked respondents to classify the behavior referred to in each *item* of the Eysenck Personality Profiler as being either Temperament or Character in origin, thereby providing the means to compute Temperament and Character scales of personality *appropriate to each individual*. The structure and validity of the Eysenck Personality Profiler when scored in this way will then be compared with the standard solution (collected from a separate sample) in terms of factor structure and both concurrent and predictive validity.

Method

Participants

Sample A comprised one-hundred and seventy-seven first year undergraduate psychology students from an Australian University. The mean age was 19.45 (*STANDARD DEVIATION* = 4.44) and the sample comprised 74.4% females. Sample B involved a further one-hundred and thirty-eight first year undergraduate psychology students from an Australian University (*Mean* = 18.93years; *Standard Deviation* = 1.68; 62.3% females).

Materials

Participants from both samples completed the following questionnaires:

- (1) The *Eysenck Personality Profiler* (Eysenck et al. 1992; Eysenck and Wilson 2000) is a four-hundred and twenty item questionnaire measuring twenty-one primary scales underlying three Eysenckian super factors. Typically, each item is responded to on a ‘yes’, ‘no’ or ‘can’t decide’ scale. The structure of the Eysenck Personality Profiler has been widely examined (Eysenck et al. 1992; Costa and McCrae 1995; Jackson et al. 2000; Petrides et al. 2003).

Sample A participants completed the Eysenck Personality Profiler in the standard manner except that they used a four-point response scale (labeled from Strongly Agree to Strongly Disagree) instead of the usual trichotomous (Yes/No/Can’t decide) format. Sample B participants also completed the Eysenck Personality Profiler, however, each item was answered according to the following instructions to determine whether the person believed the item was based in Temperament or Character: “We are interested in whether you consider how true the statement is for you, in terms of whether (1) it is an *instinctive/automatic/immediate* behavior (i.e. one that you do instinctively without thinking) OR (2) it is a *conscious/thoughtful/considered* behavior (i.e. one that you do after putting some conscious thought into it) OR (3) potentially you might rate the behavior as *both* instinctive and conscious in which case please rate both scales. You might have *different* ratings for the same item depending on what you believe”. Two response scales were therefore supplied

for each question, each using a four-point Likert format with the same response format as Sample A.

- (2) *Core Academic Performance*. This is an eleven-item questionnaire measuring self-reported academic performance (for example, *To what extent have you ensured that your tasks were completed properly?*). Scoring is on a five-point rating scale (1 = *Very little* to 5 = *A great deal*). This measure was chosen to be a measure of performance of central relevance to our participants.
- (3) We use a range of single items questions to measure the frequencies of various every-day behaviors. These include questions concerning the extent to which the respondent drinks tea, coffee or alcohol; receives penalties or fines for traffic infringements; is interested in money; religious and engaged in religious behaviors; smokes cigarettes; is concerned with job security (and a range of other work-place preferences) and how well they perform academically. Samples A and B also differed slightly in terms of which specific single-items were open scales (in which case the respondent provided a precise figure) and which were rating scales (see Table 4 for information). These measures were chosen as providing a reasonably broad measure of behaviors which have been related to personality in various domains.

Participants in sample B also completed the following psychological instruments that have been related to Temperament (such as biologically-oriented personality scales):

- (4) *The Behavioral Inhibition System/Behavioral Activation System questionnaire* (Carver and White 1994) which provides three measures of behavioral approach (Drive, Reward Responsivity; Fun seeking) and a measures of behavioral inhibition. These two constructs form the Temperament basis of personality in Gray's (1982) biological theory.
- (5) *The Gray-Wilson Personality Questionnaire* (Wilson et al. 1990) which measures human equivalents of the animal behaviors upon which Gray's theory was based six scales; approach, active avoidance, passive avoidance, extinction, fight, flight).

Finally, sample B participants completed the following psychological questionnaires that have been related to Temperament (i.e. malleable, conscious or social-cognitive aspects of personality):

- (6) *Rotter's Internality-Externality scale* (Rotter 1966) is a measure of perceived internal versus external locus of control. According to Rotter, locus of control is a socially-learnt cognitive construct.
- (7) *General Self-efficacy* (Chen et al. 2001). This is a measure of general self-efficacy, which is designed to transcend situationally specific types of self-efficacy. According to Bandura (1999) self-efficacy is also socially-learnt.
- (8) *Goal orientation* (VandeWalle and Cummings 1997). Goal orientation has its basis in the conscious setting of, and commitment to, goals or objectives. VandeWalle and Cummings' (1997) instrument measures goal orientation in terms of *learning goals* (setting changeable goals, wanting to master the

situation), *performance goals* (comparing performance with others) and *avoidance goals* (wanting to avoid failure).

Statistical analyses

Sample A Eysenck Personality Profiler questionnaires were all scored in the standard manner (see Eysenck and Wilson 2000). For Sample B, the objective was to acknowledge that different people may perceive that they engage in the same behavior due to Temperament or Character influences. In this method of scoring, average primary scale scores for the Eysenck Personality Profiler rated as Temperament or Character by *each* person were computed. Thus if a person rated ten items from Anxiety as being Temperament then an average score across those ten items was taken as representing that person's Temperament Anxiety score. On the other hand if another person rated fifteen Anxiety items as being Temperament then the average score of those fifteen items was used to compute the person's Temperament Anxiety score.¹

Principal components analysis with varimax rotation was then separately performed on the Temperament and Character primary Eysenck Personality Profiler scales. This method of exploratory multivariate analysis was used to ensure a simple, widely acceptable and easily interpretable solution. The resultant Eysenck Personality Profiler superfactors were then correlated with the scales from the other questionnaires, and the self-reported behaviors.

Results and Discussion

In Table 3, means, standard deviations and alpha reliabilities of the Eysenck Personality Profiler primary scales are presented. Reliability estimates (internal consistency) are presented for just Sample A and for most scales $\alpha > 0.70$. Means, standard deviations and reliabilities of the dependent variables are shown in Table 4. Note that the alpha reliability of the dependent scale is high for most scales ($\alpha > .80$).

For sample A, superfactors of Extraversion, Neuroticism and Psychoticism were constructed in the standard manner explained by Eysenck and Wilson (2000) and Eysenck et al. (1992). Primary scales of Activity, Sociability, Expressiveness, Assertiveness, Ambition, Dogmatism and Aggression were averaged to provide a measure of Extraversion. Scales of low Self-esteem, Anxiety, low Happiness, Dependence, Hypochondriasis, Guilt and Obsessiveness were averaged to provide a measure of Neuroticism, and primary scales of Risk-taking, Impulsiveness, Irresponsibility, Manipulativeness, Sensation-seeking, Tough-mindedness and Practical were averaged to provide a measure of Psychoticism.

Exploratory principal components analysis with varimax rotation was used to determine the superfactor structure of the primary scales for sample B. Scree analysis suggested a two-factor structure for Temperament scales, and a three-factor structure for responses on the Character scales. The factor loading matrices from these results are shown in Table 5, with loadings $>.50$ in bold.

¹ As a mean value is used, this method does not introduce measurement bias—see [General Discussion](#).

Table 3 Means, standard deviations and alphas of the Eysenck Personality Profiler scales

	Sample A			Sample B			
	(N=177)			(N=138)			
	EPP			Temperament EPP		Character EPP	
	Mean	SD	Alpha	Mean	SD	Mean	SD
Activity	2.61	.34	.74	2.58	.47	2.49	.47
Sociability	2.78	.44	.85	2.81	.52	2.78	.51
Expressiveness	2.44	.28	.52	2.53	.44	2.32	.39
Assertiveness	2.43	.31	.71	2.49	.53	2.37	.47
Ambition	2.58	.33	.73	2.44	.49	2.49	.48
Dogmatism	2.42	.25	.48	2.46	.51	2.25	.41
Aggression	2.13	.39	.78	2.22	.48	2.12	.39
Low self-esteem	2.47	.52	.90	2.36	.60	2.28	.53
Unhappiness	2.24	.57	.92	2.21	.64	2.13	.52
Anxiety	2.51	.48	.89	2.56	.58	2.42	.53
Dependence	2.23	.38	.80	2.17	.50	2.13	.45
Hypochondriasis	1.90	.48	.88	1.85	.60	1.79	.52
Guilt	2.23	.45	.84	2.15	.62	2.04	.48
Obsessiveness	2.29	.40	.79	2.20	.55	2.20	.51
Risk-taking	2.45	.32	.67	2.49	.59	2.48	.45
Impulsiveness	2.58	.33	.75	2.58	.49	2.39	.43
Irresponsibility	2.51	.30	.62	2.57	.49	2.55	.44
Manipulativeness	2.28	.29	.68	2.12	.49	2.19	.40
Sensation-seeking	2.60	.44	.81	2.55	.57	2.54	.55
Tough-mindedness	2.32	.41	.76	2.30	.60	2.45	.57
Practical	2.38	.36	.75	2.47	.52	2.52	.44
Lie scale	2.73	.32	.73	2.72	.46	2.70	.45

EPP eysenck personality profiler, SD standard deviation

Table 4 Means, standard deviations and alphas of the dependent variables

	Sample A			Sample B		
	(N=177)			(N=138)		
	Mean	SD	Alpha	Mean	SD	Alpha
(i) Single items dependent variables						
Religious	2.11	1.02	–	2.03	1.02	–
Prayer	10.56 ^a	16.33	–	1.97	1.16	–
Worship	1.30 ^a	2.25	–	1.65	1.06	–
Alcohol consumption	1.06 ^a	1.78	–	2.00	0.83	–
Points on license	.32 ^a	1.02	–	0.68 ^a	1.46	–
Parking fines (\$)	16.91 ^a	37.83	–	37.12 ^a	79.93	–
Cigarette smoking	0.72 ^a	2.96	–	1.49	0.94	–
Cups of tea/coffee	1.51 ^a	2.38	–	2.03	1.04	–
Interest in money	2.87	0.75	–	2.98	0.71	–
Interest in secure job	3.49	0.76	–	3.55	0.82	–
Interest in rewarding job	3.72	0.53	–	3.79	0.49	–
Interest in strict job	1.87	0.72	–	1.87	0.71	–
Academic performance	2.68	0.59	–	2.67	0.59	–
(ii) Scale dependent variables						
Core academic performance ^b	4.14	0.59	0.90	3.46	0.52	0.79

^a These means are from open scales, all other scales are four point scales

^b Derived from an eleven item scale

Table 5 Sample B: Separate principal components analyses with varimax rotation of Temperament and Character primary scales of the Eysenck Personality Profiler

Name of component	Temperament		Character		
	I T-Avoidance	II T-Approach	I C-Neuroticism	II C-Psychoticism	III C-Extraversion
percent of variance	21.09	20.58	17.95	15.48	14.62
Cumulative percent of variance	21.09	42.18	17.95	33.42	48.04
Activity	-.37	.33	-.06	-.12	.60
Sociability	-.28	.50	-.17	.19	.47
Expressiveness	.08	.58	.24	.41	.29
Assertiveness	-.43	.58	-.04	.06	.81
Ambition	.11	.13	.40	-.58	.47
Dogmatism	.15	.58	.56	-.04	.04
Aggression	.10	.67	.37	.31	.47
Low self-esteem	.84	-.14	.65	.09	-.58
Unhappiness	.70	.15	.69	.23	-.34
Anxiety	.79	.02	.61	.10	-.41
Dependence	.73	.29	.58	.42	-.17
Hypochondriasis	.61	.15	.71	.02	.07
Guilt	.75	.08	.74	.22	-.20
Obsessiveness	.60	-.06	.69	-.36	.15
Risk-taking	-.12	.79	-.00	.67	.17
Impulsiveness	-.03	.68	-.05	.78	.03
Irresponsibility	.07	.52	.04	.79	-.02
Manipulativeness	.11	.42	.15	.36	.30
Sensation-seeking	-.11	.76	.14	.35	.52
Tough-mindedness	-.45	.48	-.13	.10	.56
Practical	-.27	.10	-.23	.10	-.13

T-Approach temperament approach, *T-Avoidance* temperament avoidance, *C-Neuroticism* character neuroticism, *C-Psychoticism* character psychoticism, *C-Extraversion* character extraversion

The first component of the Temperament scales consists of positive loadings by Eysenck Personality Profiler Neuroticism subscales (low self-esteem, unhappiness, anxiety, dependence, guilt, and obsessiveness) and some weaker negative loadings from Eysenck Personality Profiler Extraversion (activity, sociability and assertiveness).

The second Temperament component consists of positive loadings by Eysenck Personality Profiler Extraversion and Psychoticism subscales (sociability, expressiveness, assertiveness, dogmatism, aggression, risk-taking, impulsiveness, and sensation seeking). We name these two scales *Temperament-Avoidance* and *Temperament-Approach*, drawing upon the Approach/Avoidance labels used by Elliot and Thrash (2002) for trait concepts relating to Neuroticism and Behavioral Inhibition on the one hand, and to Extraversion and Behavioral Approach on the other.

Constructs reflected by the three Character components of the Eysenck Personality Profiler are broadly similar to typical solutions. Specifically, all of the Neuroticism primary scales load strongly on one component (low self-esteem, unhappiness, anxiety, dependence, hypochondriasis, guilt, obsessiveness), most of the Psychoticism primaries load on a second (risk-taking, impulsiveness, irresponsibility, with weaker loadings from manipulativeness and sensation seeking) and most of the Extraversion primaries load on a third (activity and assertiveness, with weaker

loadings from sociability, ambition, and aggression). The three components are termed *Character-Neuroticism*, *Character-Psychoticism* and *Character-Extraversion*.

Correlations between the superfactors from both samples are shown in Table 6. Unusually, in Sample A, Extraversion and Psychoticism are highly positively correlated ($r = .41, p < .01$). In sample B, correlations between Temperament-Approach and Temperament-Avoidance, and among the three Character factors, are of course zero since an orthogonal rotation was applied. As would be expected from their respective compositions, Temperament-Avoidance is strongly and significantly related to Character-Neuroticism ($r = .49, p < .01$) but negatively correlated with Character-Extraversion ($r = -.52, p < .01$), while Temperament-Approach is significantly correlated with Character-Psychoticism ($r = .55, p < .01$) and Character-Extraversion ($r = .42, p < .01$). Such relationships are consistent with the models of personality proposed by Elliot and Thrash (2002) and Jackson (2005), in which Character components of personality are seen as mediators of Temperament components. However, in the present case the reader is reminded that these relationships are somewhat tautological, given that the Character and Temperament scales are composed of the same items; only the response scales are different.

Convergent and divergent (concurrent) validity of the Temperament and Character superfactors was determined by examining their correlation with other scales that are commonly thought to have either a Temperament or Character origin (see Table 7). Evidence of convergent validity is provided if the Temperament scales tend to be highly correlated with other Temperament-based personality scales, and Character scales tend to be highly correlated with other Character personality scales. Evidence of divergent validity is provided if Temperament scales tend not to be correlated with Character personality scales and Character scales tend not to be correlated with Temperament personality scales.

Temperament-Avoidance is positively correlated with all measures of avoidance tendencies, including Passive-avoidance ($r = .55, p < .01$), Extinction ($r = .29, p < .01$), Flight ($r = .37, p < .01$) and Behavioral Inhibition System ($r = .48, p < .01$). There are also more modest correlations with some of the measures assumed to relate to Character processes. Temperament-Approach is correlated positively with both Behavioral Approach System scales of the Gray Wilson Personality Questionnaire: Approach ($r = .45, p < .01$) and Active-avoidance ($r = .27, p < .01$). It also

Table 6 Correlations between the Eysenck Personality Profiler scales

Overall Eysenck Personality Profiler scales (sample A)		Eysenck Personality Profiler scales divided into temperament and character scale (sample B)				
	N	P	T-AV	T-AP	C-N	C-P
P	-.18*		T-AP	.00		
E	-.12	.41**	C-N	.49**	.04	
			C-P	.01	.55**	.00
			C-E	-.52**	.42**	.00
						.00

P psychoticism, *E* extraversion, *N* neuroticism, *T-AV* temperament avoidance, *T-AP* temperament approach, *C-N* character neuroticism, *C-P* character psychoticism, *C-E* character extraversion

* $p < .05$, ** $p < .01$

Table 7 Study 3: Correlations between the temperament and character Eysenck Personality Profiler scales and other personality measures

	Temperament		Character		
	T-Avoidance	T-Approach	C-Neuroticism	C-Psychoticism	C-Extraversion
<i>(i) Temperament measures</i>					
GWPQ					
Approach	.14	.45**	.07	.31**	.09
Active-avoidance	.07	.27**	-.02	-.17	-.01
Passive-avoidance	.55**	-.17	.09	.01	-.49**
Extinction	.29**	-.31**	.04	-.10	-.40**
Fight	.14	.58**	.10	.26**	.27**
Flight	.37**	-.20*	-.00	-.01	-.24*
Carver & White's BIS/BAS scales					
BAS drive	-.26*	.34**	-.04	.23*	.46**
BAS fun seeking	-.19	.41**	-.10	.27*	.18
BAS reward responsiveness	.05	-.09	-.18	-.16	-.05
BIS	.48**	-.23*	.24*	-.08	-.32**
<i>(ii) Character measures</i>					
General self-efficacy	-.27*	-.10	-.08	-.21*	.41**
Learning goal orientation: Proving	.32**	.03	.22*	-.00	-.14
Learning goal orientation: Avoiding	.27*	-.01	.31**	.20	-.22*
Learning goal orientation: Learning	-.11	-.03	.01	-.24*	.15
Rotter's Internality Externality scale	.21*	.10	.32**	.21*	-.00

GWPQ Gray Wilson personality questionnaire, *BIS/BAS* behavioral inhibition system/behavioral approach system

* $p < .05$, ** $p < .01$

correlated positively with Carver and White's Behavioral Approach System Drive ($r = .34$, $p < .01$) and Fun-Seeking ($r = .41$, $p < .01$). A significant relationship with Fight ($r = .58$, $p < .01$) is not an a priori prediction of models concerned with behavioral approach (for example, Gray 1987a, 1987b), but is supported by empirical data elsewhere (see Jackson 2002a, 2003). Furthermore, Temperament Approach does not correlate with any of the Character measures. The lack of a relationship with Reward Responsiveness is unexpected, but this scale has been widely criticized for its poor psychometric properties (for example, Gomez et al. 2005).

As would be expected, the three Character scales show less overlap with the biologically inspired Gray Wilson Personality Questionnaire and Behavioral Inhibition System/Behavioral Approach System scales, and more overlap with the Character-related measures. Character-Extraversion is highly positively correlated with General Self-Efficacy ($r = .41$, $p < .001$), Character-Neuroticism is positively correlated with Proving and Avoiding goal orientations ($r = .22$, $p < .05$ and $r = .31$, $p < .001$ respectively) and both Character-Neuroticism and Character-Psychoticism predicted an External Locus of Control ($r = .32$, $p < .001$ and $r = .21$, $p < .05$ respectively). There is however, some unexpected overlap between these three scales and the Temperament-related measures. Most notably, Character-Extraversion

correlates negatively with Passive Avoidance, Extinction, Flight and Behavioral Inhibition System, and positively with Fight and Behavioral Approach System Drive. Character-Psychoticism has only a few modestly significant correlations with the Temperament scales and Character Neuroticism had no significant overlap with the Temperament scales.

Table 8 presents the correlations between the range of single item self-reported behaviors and the standard Eysenck Personality Profiler superfactors (sample A), as well as the Temperament and Character superfactors (sample B). There are almost no significant correlations between the scales of Neuroticism, Temperament-Avoidance and Character-Neuroticism and the dependent items and scales. Among the other personality scales, however, there are many significant correlations with the dependent variables. Generally, Character-Psychoticism and Character-Extraversion predict better than the standard versions of these scales. Temperament-Approach is also predictive of many of the dependent variables, and is generally better than any of the overall scales from the Eysenck Personality Profiler. In relation to all but two criterion items, the division of the Eysenck Personality Profiler into Character and Temperament scales provide at least one higher correlation than the standard scales.

To further assess validity, multiple regression was used to predict the scale of Core Academic Performance. Using the standard solution to the Eysenck Personality Profiler, and with Extraversion, Psychoticism and Neuroticism as the independent variables, Psychoticism is the only significant predictor ($\beta = -.30, p < .01$), and R^2 adjusted = .06. In contrast, using all the Character and Temperament scales of the Eysenck Personality Profiler, Character-Psychoticism ($\beta = -.27, p < .05$) and

Table 8 Correlations between Eysenck Personality Profiler scales (overall, character, temperament) and various criteria

	Standard scales			Temperament		Character		
	N	P	E	T-AV	T-AP	C-N	C-P	C-E
(a) Single items								
How religious	.13	-.20**	-.09	.18	-.24**	.00	-.27**	-.26**
Amount of praying	.04	-.19*	-.11	.21*	-.30**	.07	-.23*	-.30**
Amount of worshipping at a church	-.03	-.23**	-.13	.15	-.20*	.09	-.23*	-.24**
Amount of cigarettes smoked	-.01	.16*	.18*	.09	.20*	-.07	.22*	.01
Amount of alcohol consumed	.04	.26**	.21**	-.02	.40**	.00	.35**	.21*
Amount of tea and coffee drunk	-.01	-.03	.19*	.09	-.03	.16	-.10	.12
Points on license	.03	.10	.03	.01	.27**	-.06	.25**	.14
Fines from driving	-.04	.09	.05	.03	.16	-.05	.23*	.15
Interest in money	.14	.09	.19*	.07	.16	.06	.10	.22*
Interest in safe job	.13	-.10	.01	-.01	-.06	.14	-.07	.02
Interest in rewarding job	-.03	-.16*	.12	-.03	-.11	-.14	-.13	-.01
Interest in strict job	.08	-.16*	-.05	.01	-.05	.16	-.22*	.09
Academic performance	-.20*	-.18*	.07	.01	-.25**	.07	-.22*	.09
(b) Scale								
Core academic performance	-.07	-.20*	.12	.06	.22*	-.00	.17	.18

P psychoticism, *E* extraversion, *N* neuroticism, *T-AV* temperament avoidance, *T-AP* temperament approach, *C-N* character neuroticism, *C-P* character psychoticism, *C-E* character extraversion
 * $p < .05$, ** $p < .01$

Character-Extraversion ($\beta = .39, p < .01$) are both significant predictors, and R^2 adjusted = .18 of the variance in Core Academic Performance. The results therefore indicate that the description of personality provided by the Eysenck Personality Profiler explains 12 percent more variance in Academic Performance when scored in terms of Character and Temperament processes, which is three times the predictive power of the standard solution. This gain in predictive power may appear to be at the 'cost' of using more scales, however this merely reflects a more fragmented partitioning of the same questionnaire items. Possibly, by allowing respondents to conceptually distinguish their self-reported behavior in terms of Temperament and Character, we have extracted sharper personality constructs.

General Discussion

The central aim of this paper is to investigate how an attempt to distinguish between Temperament and Character concepts (Cloninger et al. 1993) in self-reports on personality measures might influence personality structure and validity. Study one demonstrates that respondents classify primary scales of the Eysenck Personality Profiler as having a basis in Temperament or Character. Our participants believe that the most Temperament-related primary scales of the Eysenck Personality Profiler are Anxiety, Impulsiveness and Aggression. Measures such as these are often regarded as having a potential biological basis (e.g. Cloninger et al. 1993; Elliot and Thrash 2002; Gray and McNaughton 2000; Jackson 2001, 2002a, 2002b, 2003; Jackson and Lawty-Jones 1996). In contrast, our participants believe that the most Character-related scales are Responsibility, Manipulativeness and Assertiveness. These trait concepts are typically thought to have a basis in socialization and learning rather than biological dispositions (such as Responsibility, which is similar in definition to Cloninger's Self-Directedness, or Conscientiousness from the Five Factor Model).

Study two shows that when Eysenck Personality Profiler items are responded to in terms of Character-related introspections a three-factor structure emerges (having some conceptual similarity to Eysenck's 'Giant Three' model), while when items are responded to in terms of Temperament-related introspections a two-factor structure emerges (bearing some resemblance approach/avoidance motivation frameworks; Elliot and Thrash 2002; Gray 1982). Regression indicated that Character factors are more strongly predictive of social-cognitive measures, while Temperament factors are generally more predictive of biologically-oriented measures. Concurrent and predictive validation then demonstrated that the Character and Temperament factors are more strongly predictive of a range of self-report behaviors, and of self-reported academic performance, than the standard solution of the Eysenck Personality Profiler.

We conclude that individuals vary in terms of the introspections they make when completing self-report personality measures (Study one) and that taking this into account when scoring such questionnaires can substantially influence factor structure and validity (Study two). The introspections we considered are based upon Cloninger's concept of Temperament and Character. From these findings, we suggest that distinguishing between self-report responses in terms of their

relatedness to these concepts improves the content validity of the resulting scales, and, as a result, concurrent predictive validity. Character aspects of personality putatively reside at a conscious level of abstraction, while Temperament aspects are thought to reflect ‘hard-wired’ biological processes (Cloninger et al. 1993; Elliot and Thrash 2002; Jackson 2005). Of course, it is highly unlikely that participant introspections examined in this research correspond *directly* to these levels of underlying influence; instead we take the view that these may relate to various functional outcomes of such processes (see Smillie et al. 2006). This possibility might be examined in future research using methods which partition variance in trait measures according to levels of influence, such as behavioral genetics (see Friedman et al. 2008, for example).

If distinguishing between Character and Temperament introspections is important, what is the advantage of the measurement approach we have used in this paper in comparison with that devised by Cloninger et al. (1993)? As noted, the conceptual specificity of Cloninger’s model of personality along with some unresolved theoretical and psychometric problems, led us to consider an alternative approach. Our solution was to explore the significance of incorporating Cloninger’s Temperament-Character distinction within the more widely established Eysenckian personality framework operationalized by the Eysenck Personality Profiler. The Eysenck Personality Profiler provides comprehensive all-round measurement of the ‘surface’ of personality—personality as we can readily perceive or describe it (Jackson et al. 2000). Therefore, in this study we explore the Character and Temperament aspects of personality in terms of an instrument which provides the latitude and longitude of the personality map. Not only does this overcome potential pragmatic limitations concerning reliability or validity, but it also enables a more generalized investigation of the issue at hand.

Some potential criticisms of the present research are worth discussing. First, respondents in Study one assess whether primary scales of the Eysenck Personality Profiler are Temperament or Character and in Study two participants rate whether each item of the Eysenck Personality Profiler is Temperament or Character. To what extent can we assume the validity of these lay-person judgments? We believe this is in fact the wrong question to ask, as we do not draw any conclusions regarding actual underlying personality influences based upon the introspections provided by our sample. Indeed, we specifically argue that such introspections do not directly index the causes of personality. The purpose of this research is to determine the significance of distinguishing self-reported behavior in terms of nature of the internal references people make to generate these. Any question regarding the objective validity of these subjective introspections is beyond the scope of this research, but would be a potentially important question for further investigation. Causal influences might be distinguished using psychogenomic methodologies (e.g. Eysenck 1990; Loehlin 1989; Plomin et al. 1990a, 1990b, 1997) as well as relevant experimental procedures (for example, assessments of individual differences in implicit social cognition (Greenwald et al. 1998).

A second potential criticism of this work concerns computation of scales representing Temperament and Character personality facets. In Study two, as an item was categorized by each individual as either Temperament or Character (or both), different items were used to calculate the Character and Temperament scales

for different people (because people vary in their classification of items, as shown by Study one). We anticipate some concerns with this methodology, but believe these are easily assuaged. Firstly, as the score for Character Extraversion, for instance, was computed as the average response to Extraversion items classified by that person as being Character in origin, the magnitude of a person's raw score is not unduly influenced by the number of Extraversion items classified as being Character (as it would be if a total score was used). Secondly, while it may seem irregular that different items contribute to the Character and Temperament scale scores, this scoring method is *identical* to that of most mainstream personality questionnaires. Consider the scoring of any questionnaire with a Yes/No format scored as '1' or '0' respectively, such as the Eysenck Personality Questionnaire or Cloninger's Temperament Character Inventory. In these questionnaires, 'Yes' responses are added to provide a total scale score, while 'No' responses are discarded. Therefore, two people completing the Eysenck Personality Questionnaire may receive the same Extraversion score despite responding 'Yes' to entirely different items. For two such people, their score will be composed of different items, as was the case for participants in the present research.

In summary, the current research suggests that distinguishing between Temperament and Character concepts in self-report behaviors, the building blocks of personality taxonomies, has striking implications for factor structure and validity. Of particular significance is the evidence we find for increased validity of a well-established personality questionnaire, the Eysenck Personality Profiler, when responses are distinguished at the respondent level in terms of conceptual relevance to Temperament and Character. It remains to be seen to what extent such distinctions in subjective introspections literally reflect distinct underlying causes of personality, however at present we conclude that the methodological approach we have explored might be examined further using other personality taxonomies.

References

- Bandura, A. (1999). Social cognitive theory of personality. In A. Pervin, & O. P. John (Eds.), *Handbook of personality: theory and research* (2nd ed.). New York: Guilford Press.
- Carver, C. S., & White, T. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology*, *67*, 319–333.
- Chen, G., Gully, S., & Eden, D. (2001). Validation of a new general self-efficacy scale. *Organizational Research Methods*, *4*, 62–83.
- Cloninger, C. R. (1987). A systematic method for clinical description and classification of personality variants. A proposal. *Archives of General Psychiatry*, *44*, 573–588.
- Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of General Psychiatry*, *50*, 975–990.
- Costa, P., & McCrae, R. (1995). Primary traits of Eysenck's P-E-N system: Three and five factor solutions. *Journal of Personality and Social Psychology*, *69*, 308–317.
- Elliot, A. J., & Thrash, T. M. (2002). Approach-avoidance motivation in personality: approach and avoidance temperaments and goals. *Journal of Personality and Social Psychology*, *82*, 804–818.
- Eysenck, H. J. (1967). *The biological basis of personality*. Springfield, IL: Thompson.
- Eysenck, H. J. (1980). The biosocial nature of man. *Journal of Social and Biological Structures*, *3*, 125–34.

- Eysenck, H. (1990). Genetic and environmental contributions to individual differences: the three major dimensions of personality. *Journal of Personality*, 58, 245–261.
- Eysenck, H. J. (1993). The nature of impulsivity. In W. G McCown, J. L. Johnson, & M. B. Shure (Eds.), *The impulsive client: Theory, research and treatment* (pp. 57–69). Washington, DC: American Psychological Association.
- Eysenck, H. J. (1997). Personality and experimental psychology: The unification of psychology and the possibility of a paradigm. *Journal of Personality and Social Psychology*, 73, 1224–1237.
- Eysenck, H. J., Barrett, P., Wilson, G. D., & Jackson, C. J. (1992). Primary trait measurement of the 21 components of the P-E-N System. *The European Journal of Psychological Assessment*, 8, 109–117.
- Eysenck, M. W., McLoud, C., & Matthews, A. (1987). Cognitive functioning in anxiety. *Psychological Research*, 49, 189–195.
- Eysenck, H. J., & Wilson, G. D. (2000). *Manual of the Eysenck Personality Profiler*. Australia: Cymeon.
- Fowles, D. C. (1987). Applications of a behavior-theory of motivation to the concepts of anxiety and impulsivity. *Journal of Research in Personality*, 21, 417–435.
- Friedman, N. P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology: General*, 137, 201–225.
- Furnham, A., Jackson, C., Forde, L., & Cotter, T. (2001). Correlates of the Eysenck Personality Profiler. *Personality and Individual Differences*, 30, 587–594.
- Goldberg, L. R. (1982). 'From ace to zombie: Some explorations in the language of personality'. In C. D. Spielberger, & J. N. Butcher (Eds.), *Advances in personality assessment*, 1 pp. 203–234. Hillsdale, NJ: Erlbaum.
- Gomez, R., Cooper, A., & Gomez, A. (2005). An item response theory analysis of the Carver and White (1994) BIS/BAS scales. *Personality and Individual Differences*, 39, 1093–1103.
- Gosling, S. D., & John, O. P. (1999). Personality dimensions in non-human animals: a cross-species review. *Current Directions in Psychological Science*, 8, 69–75.
- Gotlib, I. H., & McCann, C. D. (1984). Construct accessibility and depression: an examination of cognitive and affective factors. *Journal of Personality and Social Psychology*, 47, 427–429.
- Gray, J. A. (1982). *The neuropsychology of anxiety: An enquiry into the function of the septo-hippocampal system*. New York: Oxford University Press.
- Gray, J. A. (1987a). The neuropsychology of emotion and personality. In S. M. Stahl, S. D. Iverson, & E. C. Goodman (Eds.), *Cognitive neurochemistry*. Oxford: Oxford University Press.
- Gray, J. A. (1987b). *The psychology of fear and stress*. Cambridge: Cambridge University Press.
- Gray, J. A., & McNaughton, N. (2000). *The neuropsychology of anxiety*. Oxford: Oxford University Press.
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: the implicit association test. *Journal of Personality and Social Psychology*, 74, 1464–1480.
- Jackson, C. J. (2001). Comparison between Eysenck & Gray's models of personality in the prediction of motivational work criteria. *Personality and Individual Differences*, 31, 129–144.
- Jackson, C. J. (2002a). Mapping Gray's model of personality onto the Eysenck Personality Profiler (EPP). *Personality and Individual Differences*, 32, 495–507.
- Jackson, C. J. (2002b). *Learning Styles and its measurement: An applied neuropsychological model of learning for business and education*. Australia: Cymeon.
- Jackson, C. J. (2003). Gray's reinforcement sensitivity theory: a psychometric critique. *Personality and Individual Differences*, 34, 533–544.
- Jackson, C. J. (2005). *An applied neuropsychological model of functional and dysfunctional learning: Applications for business, education, training and clinical psychology*. Australia: Cymeon.
- Jackson, C. J. (2008). Measurement of functional and dysfunctional learning. In G. Boyle, G. Matthews, & D. Saklofske (Eds.), *Handbook of Personality and Testing* (p. 73–93). London: Sage.
- Jackson, C. J., & Francis, L. J. (2004). Are interactions in Gray's reinforcement sensitivity theory proximal or distal in the prediction of religiosity: a test of the joint subsystems hypothesis. *Personality and Individual Differences*, 36, 1197–1209.
- Jackson, C. J., Furnham, A. F., Forde, L. D., & Cotter, T. (2000). The dimensional structure of the Eysenck Personality Profiler. *British Journal of Psychology*, 91, 223–239.
- Jackson, C. J., & Lawty-Jones, M. (1996). Overlap between personality and learning style. *Personality and Individual Differences*, 20, 293–300.
- Levine, S. Z., & Jackson, C. J. (2004). Eysenck's theory of crime revisited: factors or primary scales? *Legal and Criminological Psychology*, 9, 1–18.

- Loehlin, J. (1989). Partitioning environmental and genetic contributions to behavioral development. *American Psychologist*, *44*, 1285–1292.
- McCrae, R. R. & Costa, P. T. (1999). A five-factor theory of personality. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (pp. 139–153). New York: Guilford.
- Parker, J. D. A., Bagby, R. M., & Joffe, R. T. (1996). Validation of the biosocial model of personality: confirmatory factor analysis of the tridimensional personality questionnaire. *Psychological Assessment*, *8*, 139–144.
- Petrides, K. V., Jackson, C. J., Furnham, A., & Levine, S. Z. (2003). Exploring issues of personality measurement and structure through the development of a revised short form of the Eysenck Personality Profiler. *Journal of Personality Assessment*, *81*, 272–281.
- Pickering, A. D. (2008). Formal and computational models of reinforcement sensitivity theory. In P. J. Corr (Ed.), *The reinforcement sensitivity theory of personality*. Cambridge: Cambridge University Press.
- Plomin, R., Chipuer, H., & Loehlin, J. (1990a). Behavioral genetics and personality. In L. Pervin (Ed.), *Handbook of personality theory and research*. New York: Guildford Press.
- Plomin, R., DeFries, J., & McClearn, G. (1990b). *Behavioral genetics: A primer*. New York: Freeman.
- Plomin, R., DeFries, J., McClearn, G., & Rutter, M. (1997). *Behavioral genetics*. New York: Freeman.
- Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, *80*, 1–28.
- Smillie, L. D., Pickering, A. D., & Jackson, C. J. (2006). The new reinforcement sensitivity theory: implications for psychometric measurement. *Personality and Social Psychology Review*, *10*, 320–335.
- Stewart, M. E., Ebmeier, K. P., & Dreary, I. J. (2004). The structure of Cloninger's tridimensional personality questionnaire in a British sample. *Personality and Individual Differences*, *36*, 1403–1418.
- Strelau, J. (1987). Emotion as a key concept in temperament research. *Journal of Research in Personality*, *21*, 510–428.
- Tellegen, A. (1982). Emotion as a key concept in temperament research. *Journal of Research in Personality*, *21*, 510–428.
- VandeWalle, D. M., & Cummings, L. (1997). A test of the influence of goal orientation on the feedback-seeking process. *Journal of Applied Psychology*, *82*, 390–400.
- Wilson, G. D., Gray, J. A., & Barrett, P. T. (1990). A factor analysis of the Gray–Wilson personality questionnaire. *Personality and Individual Differences*, *11*, 1037–1045.
- Zuckerman, M. (1979). *Sensation Seeking: Beyond the optimal level of arousal*. Hillsdale: Erlbaum.
- Zuckerman, M. (1991). *Psychobiology of personality*. Cambridge, UK: Cambridge University Press.