A Psychometric Investigation of the Usefulness of the EASI-III Temperament Survey in the Australian General Population

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The psychometric properties of Buss and Plomin's EASI-III Temperament Survey were examined for a random sample of 290 respondents from the Australian general population. These data support the use of the emotionality, activity and sociability scales with some minor modifications, but cast doubt on the impulsivity scale. Not only did impulsivity emerge as a multidimensional construct, but its components related to other temperaments in markedly different ways. The preliminary analyses also suggested that the EASI-III could be used to measure other constructs, the most important of which are neuroticism and extraversion. The advantages offered by the EASI-III over currently available instruments are discussed: in particular, the simplicity and clarity of the items and the well-articulated sampling framework for their selection.

Multi-scale self-completion trait questionnaires such as the Eysenck Personality Inventory (EPI, Eysenck & Eysenck, 1964), the 16PF (Cattell, Eber, & Tatsuoka, 1970) and Guilford and Zimmerman's (1949) Temperament Survey continue to dominate the field of personality assessment. With these tests, items are sampled from the loosely and broadly defined domain of stable characteristics which describe the way in which people behave.

Recent developments in the field of personality, however, suggest that greater conceptual advances may be made if the content domain is defined more narrowly and systematically. Buss and Plomin (1975), for instance, point out that results on research into the heritability of personality is difficult to interpret when the instruments used contain a substantial cultural conditioning component. Furthermore, in view of Mischel's (1968) seminal work on the situational determinants of behaviour, considerable advantage may be gained by restricting traditional personality measures to traits which can reasonably be regarded as stable over time and across different situations.

The Buss and Plomin Model

One instrument which aims to restrict the content domain in relation to heritability and stability is Buss and Plomin's EASI-III Temperament Survey.

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Australian Journal of Psychology **Vol. 36, No. 1, 1984, pp. 85-95**

The authors postulate a model of personality based on four temperaments—emotionality (E), activity (A), sociability (S) and impulsivity (I). Temperaments are defined as rather broad stable personality dispositions, largely inherited, which describe the manner or style in which individuals act out their roles.

Buss and Plomin clearly delineate the content domain of each temperament by specifying sets of components. The first temperament, emotionality, is designed to measure level of affect or emotional reactivity. This is divided into three components, called fear, anger and general emotionality. Fear is defined as an escape reaction to noxious stimuli, whereas anger epitomizes attack or repulsion in comparable circumstances. General emotionality, on the other hand, represents undifferentiated emotion—a tendency to be easily aroused.

The second temperament, activity, refers to total energy output. Buss and Plomin postulate two components, tempo and vigour. Tempo describes the pace with which a person engages in activity, whereas vigour describes the forcefulness with which the actions are executed.

The third temperament, sociability, may be described as affiliativeness, a strong desire to be with others. Buss and Plomin claim two components for this, sociability (the need for the company of others) and warmth (the ability to attract others). They do not attempt to differentiate these components empirically, however, and have been content with one scale to measure this temperament.

The final temperament, impulsivity, is the one which provokes most reservations. The data relating to the hereditary factor are ambiguous and doubts are raised about the way the construct has been defined. Buss and Plomin conceptualize impulsivity as having a core component representing lack of inhibitory control, that is, an inability to delay responses to stimuli. In addition, they postulate three more specific facets—decision time (quickness to respond), lack of persistence (low tolerance to aversion), and sensation seeking (low resistance to temptation).

The Instrument—EASI-III

The EASI-III is thus composed of 10 scales—general emotionality, fear, anger, tempo, vigour, sociability (combining components of need for others and warmth), lack of inhibitory control, decision time, lack of persistence, and sensation seeking. Each scale has 5 Likert-type items.

The attractiveness of the instrument lies in the simplicity of the items, their face validity, and in the systematic way in which they have been sampled within a well defined framework. Its weaknesses are twofold. First, the simplicity of the items carries with it an imbalance of positive and negative wording. Secondly, the relative newness of the instrument results in a paucity of information about its psychometric properties and its construct validity.

The Psychometric Properties of the Instrument

Buss and Plomin imply that with the exception of sociability, the components of the temperaments can be empirically differentiated even though they may be interrelated. They do not, however, report data detailing the nature of relationships among components. On the other hand, analyses of the relationships among the temperaments have been published, but without significant gains in clarification. Buss and Plomin claim the four temperaments to be relatively independent, but, repeatedly, have found correlations of around 3 between impulsivity and emotionality.

In contrast to Buss and Plomin's conclusions, Costa and McCrae (1980) produce factor analytic solutions which fail to confirm the unitary and discrete nature of the temperaments. Using data from men of three different age groups, they factor analysed the component scales of the EASI-III, together with the EPI neuroticism and extraversion scales (Eysenck & Eysenck, 1964) and Coan's (1972) Experience Inventory. They conclude that underlying Buss and Plomin's instrument are 2 basic dimensions: (1) neuroticism, represented by the temperament components, general emotionality, fear, anger and inhibitory control; and (2) extraversion, by sociability, tempo, vigour and sensation seeking. The components not represented in their solution are decision time and persistence.

While these findings cast some doubt on Buss and Plomin's claims about the factorial structure of the EASI-III, Costa and McCrae's results should not be regarded as conclusive. First, the EASI-III was factor analysed in conjunction with other inventories. Thus, an instrument effect could be contributing to the common variance that has been factored. Second, Costa and McCrae chose to rotate their factors orthogonally. While this decision may have been justified in the context of their research, an oblique rotation is essential if the purpose is to test the validity of Buss and Plomin's model. Third, Costa and McCrae have based their analyses on scale scores, thereby assuming them to be reliable and valid measures of Buss and Plomin's components.

One problem common to the work of both Buss and Plomin and Costa and McCrae is that their data are based on non-random and non-representative samples, consisting of college students in the former case and an all-male sample of mainly war veterans in the latter. Consequently, the generalizability of findings of both groups of researchers is restricted.

In view of sampling shortcomings and ambiguity concerning the factorial structure of the EASI-III, the current paper seeks to provide answers to the following questions within a random sample from an Australian general population:

1. Do the component scales of the EASI-III measure unitary and discrete constructs?
2. Does the factorial structure of the EASI-III support Buss and Plomin's conceptualization of relatively independent temperaments each defined by its components?
3. Is there any evidence to suggest that the basic dimensions of neuroticism and extraversion underly the EASI-III?

Method

The data from 290 respondents, 119 males and 171 females, are used in this analysis. The sample was drawn randomly from the Canberra Division electoral roll. Where a selected elector was no longer resident at the address given in the roll, a substitute was selected from among the adults living at the address. Only one of the two electorates in Canberra was sampled for reasons of economy. Data from a recent survey of the whole of Canberra (Henderson, Byrne, & Duncan-Jones, 1981) have shown no difference between north and south Canberra in variables related to personality and neurotic illness. The project was designed to test instruments (such as the EASI-III Temperament Survey) and to examine certain methodological issues.

Six highly-trained and experienced interviewers contacted and interviewed the respondents in their own homes. The interview schedule consisted of a battery of

sixteen separate parts or questionnaires, some completed by the respondent, some administered orally. In this report, only three of those questionnaires will be discussed. They are the EASI-III Temperament Survey (Buss & Plomin, 1975), a short form of the EPI and some sociodemographic items. Of the 50 items in the EASI-III, three were re-worded slightly and one substantially so that they would be more easily understood by Australians. The items were provided with response scales running from 0 to 6, with "0" representing "very untrue for me" and "6" representing "very true for me". This instrument was self-completed. The short-form EPI (Duncan-Jones, in preparation) was developed from Form B of the EPI, using data from the Canberra general population. The items selected were those that were most highly correlated with the total score obtained on another occasion eight months later, while retaining a high degree of internal consistency. This instrument was administered orally. In the present study, neuroticism was represented by 7 items, extraversion by 8 items.

Results

A total of 374 names and addresses was issued to interviewers. Of these, 290 (77·5%) yielded successful interviews, 52 (13·9%) refused to take part and 32 (8·6%) were, for other reasons, not able to be interviewed.

With the items scored 0-6, the item means ranged from 1·45 to 5·24, the standard deviations from 1·10 to 2·23 and skewness from −1·78 to 1·05. This range of means, with the corresponding range of skewness, could lead to some problems in estimation of correlations.

Alpha reliability coefficients and interscale correlations for the 10 component scales are presented in Table 1. The internal consistencies of the scales ranged from unsatisfactory to moderate, the lowest being ·40, the highest ·69. The least satisfactory coefficients were obtained for the specific components of impulsivity—decision time (α = ·40), sensation seeking (α = ·46) and persistence (α = ·54). The unitary nature of these scales is questionable.

From the interscale correlations, doubts can be raised about whether the various scales are measuring empirically distinct constructs. A number of interscale correlations are not sufficiently lower than the corresponding internal consistency coefficients to imply empirical distinctiveness. This generally occurs with component scales representing the same temperament. Thus, fear and anger are both highly related to general emotionality, and tempo and vigour correlate substantially. It is of interest to note that the three with the weakest alpha

Table 1 Alpha reliability coefficients and interscale correlations for the EASI-III

Scale	1	2	3	4	5	6	7	8	9	10
1 General emotionality	·67	·53	·52	·14	−·06	−·04	−.37	·13	·12	−·09
2 Fear		·62	·34	−·03	−·28	−·27	−·39	·11	·03	−·26
3 Anger			·65	·20	−·05	−·10	−·44	·24	·12	−·12
4 Tempo				·56	·51	·14	−·10	·09	·27	·23
5 Vigour					·61	·35	·11	·05	21	·37
6 Sociability						·69	·12	·07	·20	·18
7 Inhibitory control							·61	−·24	−·32	·35
8 Decision time								·40	·28	−·17
9 Sensation seeking									·46	−·07
10 Persistence										·54

reliability coefficients—the specific components of impulsivity—appear to be just as highly related to other temperaments as to each other. Persistence, for instance, is most strongly related to vigour, sensation seeking has common variance with tempo, and decision time with anger.

The alpha reliabilities for temperament scales composed of all items from their component scales were ·80 for emotionality, ·72 for activity and ·69 for impulsivity. For sociability, which is measured by a single component scale of five items, the alpha reliability coefficient was ·69. Although these levels may appear satisfactory, any interpretation of them must be tempered by the fact that the alpha reliability coefficient tends to increase as the number of items in the scale increases. To gauge the degree of internal consistency among the items for each temperament, the item-total correlations were examined. The activity and emotionality scales produced the most favourable results with coefficients ranging from ·2 to ·5. The impulsivity scale, however, contained some items which were most unsatisfactory with correlations as low as −·3.

On the basis of these preliminary analyses, two conclusions can be reached. First, it is more meaningful to refer to the temperaments of emotionality, activity and sociability than it is to refer to their components. The interscale correlations are too high to consider the components as discrete constructs.

Second, these data lend little support to a unitary construct of impulsivity. Not only does the temperament lack cohesiveness, but so do three of the four components. Only inhibitory control, the core component of impulsivity, has an acceptable alpha reliability level.

While these conclusions are consistent with the data presented, the weakness of the methodology employed should be acknowledged. As Jackson and Paunonen (1980) have warned, reliability theory rests on the assumption that a single underlying dimension is of interest and all systematic variance is relevant to this dimension. If more than one dimension is present, alpha reliability coefficients can be misleading and findings should be tested against those obtained with other methodologies.

In order to provide a more rigorous test of the structure of Buss and Plomin's instrument, the EASI-III items were factor analysed. This procedure served two functions. Firstly, factor analysis may confirm the structure of temperaments and components identified by Buss and Plomin; or conversely, reveal an alternative and perhaps more parsomonious set of first order constructs underlying the domain. Secondly, the method highlights items that are multifactored, that is, items that are measuring more than one component of personality. Thus, at the item level, it should be possible to ascertain the degree of confounding in the measures. This is important if correlations among components are to be meaningfully interpreted.

A 50 × 50 Pearson product-moment correlation matrix was factor analysed using principal axes factor analysis with iterations. The factor matrix was rotated using the oblimin procedure (Nie, Hull, Steinbrenner, & Bent, 1975).

Rotated solutions in a number of dimensions were compared before accepting 10 factors as optimal. Solutions in alternative dimensionalities were dismissed on two grounds. Smaller numbers of factors (as suggested by the scree test) yielded an overly generalized solution accounting for too little variance. The higher dimensional solutions (indicated by the eigenvalue 1 cut off) were characterized by the addition of relatively specific or poorly defined uninterpretable factors.

Together the 10 factors accounted for 52·7% of the variance. They were labelled and defined as follows:[1]

1. General emotionality	Loading
(a) I frequently get upset.	·57
(b) I am almost always calm—nothing ever bothers me.	−·30
(c) I am somewhat emotional.	·46
(d) I often feel like crying.	·53
(e) I often feel insecure.	·62
(f) I often feel sluggish.	·40
(g) There are many things that annoy me.	·35

This factor is dominated by Buss and Plomin's scale of general emotionality (Items a to d).

2. Timidity	Loading
(a) I am easily frightened.	·36
(b) When I get scared I panic.	·40
(c) I tend to give up easily.	·68
(d) I often have trouble making up my mind.	·46

Timidity brings together items from the fear (a, b), persistence (c) and decision time (d) scales. It nevertheless epitomizes Buss and Plomin's notion of fearfulness—escape from aversive stimuli.

3. Anger	Loading
(a) When displeased, I let people know it right away.	·58
(b) I am known as hot-blooded and quick-tempered.	·37
(c) I yell and scream more than most people my age.	·35
(d) I usually prefer to do things alone.	·41

The dimension is dominated by items from Buss and Plomin's anger scale.

4. Tolerance	Loading
(a) I can tolerate frustration better than most.	·50
(b) Usually I can't stand waiting.	−·33
(c) It takes a lot to get me mad.	·70
(d) I am known as hot-blooded and quick-tempered.	−·30
(e) I am almost always calm—nothing ever bothers me.	·55

Tolerance combines items from the inhibitory control (a, b) and anger (c, d) scales. The essence of the factor is not so much control of frustration, but rather not feeling frustrated in the first place.

5. Activity	Loading
(a) I usually seem to be in a hurry.	·49
(b) I like to keep busy all the time.	·36
(c) My life is fast-paced.	·45
(d) I like to wear myself out with exertion.	·35
(e) I often feel sluggish.	−·35
(f) I often feel as if I'm bursting with energy.	·54
(g) When I do things, I do them energetically.	·39
(h) I get excited easily.	·30

Activity is defined largely by Buss and Plomin's tempo (a to c) and vigour scales (d to g).

6. Sociability	Loading
(a) I am very sociable.	·76

[1]The factors are presented in an order that facilitates comparison with Buss and Plomin's model (i.e. does not correspond either to order of extraction or to magnitude).

(b) I make friends very quickly.	·74
(c) I have many friends.	·61
(d) I usually prefer to do things alone.	−·35
(e) I tend to be shy.	−·31

This factor is defined by the five items that comprise Buss and Plomin's sociability scale.

7. Sensation seeking and impulsiveness	Loading
(a) I generally seek new and exciting experiences and sensations.	·47
(b) I'll try anything once.	·40
(c) I sometimes do "crazy" things just to be different.	·47
(d) I get bored easily.	·41
(e) I have trouble resisting my cravings.	·49
(f) I have trouble controlling my impulses.	·42
(g) I like to wear myself out with exertion.	·36
(h) My life is fast-paced.	·33
(i) I tend to hop from interest to interest quickly.	·43

Dominating this factor are items from the scales measuring sensation seeking (a to d) and inhibitory control (e, f).

8. Persistence	Loading
(a) I generally like to see things through to the end.	·40
(b) Once I get going on something I hate to stop.	·34
(c) Unfinished tasks really bother me.	·57
(d) I like to keep busy all the time.	·43
(e) I like to wear myself out with exertion.	·32

This factor conveys the same meaning as Buss and Plomin's persistence scale although only three of their items load significantly on the dimension (a to c).

9. Planfulness	Loading
(a) I like to make detailed plans before I do something.	·73
(b) I like to plan things way ahead of time.	·75

These two items from Buss and Plomin's decision time scale have very specific reference to planning. Not surprisingly, they correlate sufficiently with each other to define a separate factor.

10. Avoidance of stimulation	Loading
(a) For relaxation I like to slow down and take things easy.	·40
(b) I'm happiest in familiar surroundings.	·34
(c) I tend to be shy.	·37

Avoidance of stimulation is the weakest factor and is defined by items from different Buss and Plomin scales.

In this 10 factor solution, eight of the 50 items were multifactored, loading $\geqslant$ ·30 on more than one dimension. Six items did not load significantly on any factor.

These results support the conclusion from the previous analyses that the temperaments, sociability and activity, are discrete, unitary constructs. Again, impulsivity appears to be multidimensional, but so too does emotionality. When items are free to cluster with their highest covariates, as is the case with this methodology, some of the items do not behave as expected. Nevertheless, the factors of general emotionality, timidity, and anger are consistent with Buss and Plomin's concepts of general emotionality, fear, and anger. Similarly, the factor analytic solution reveals counterparts for Buss and Plomin's three specific components of impulsivity: sensation seeking (sensation seeking

and impulsiveness), persistence (persistence) and decision time (planfulness). The impulsivity component which does not emerge here, is the one which appeared most cohesive in the previous analysis: inhibitory control. Items from this scale combined with items representing anger to define a new construct, tolerance. The emergence of this factor is consistent with the correlation reported by Buss and Plomin between their emotionality and impulsivity temperaments.

Of particular note is the way in which this analysis provides stronger support for Buss and Plomin's component model of impulsivity and emotionality than the previous analysis. Obviously, some of the items in Buss and Plomin's scales are not valid indicators of the components in this population. The less valid items have probably lowered internal consistency measures and spuriously raised correlations between scales.

Having identified the components of the EASI-III that can be regarded as empirically distinct, questions concerning their inter-relatedness need to be addressed. More specifically, are the factors independent? Or do higher order factors of emotionality and impulsivity underly them? Alternatively, is there support for Costa and McCrae's notion of underlying dimensions of neuroticism and extraversion?

In order to answer these questions, a second order factor analysis with oblique rotation was performed on the factor intercorrelation matrix presented in Table 2. Two factors were extracted on the basis of the scree test. Together they accounted for 34·7% of the variance. The first was defined by the first order factors, general emotionality (·56), tolerance (−·38), timidity (·52) and sensation seeking and impulsiveness (·37). The second was defined by activity (·66), sociability (·35) and persistence (·35). The factors were orthogonal.

These findings do not support the proposition that the temperaments of emotionality and impulsivity are higher order factors. Indeed, the second order factors seem more akin to neuroticism and extraversion. The data behave similarly to those reported by Costa and McCrae with the difference that sensation seeking and impulsiveness have more in common with neuroticism than extraversion.

To test the interpretation of the second order analysis, scale scores were calculated for respondents on each of the first order factors. These scores, together with those on the shortened EPI extraversion and neuroticism scales were as before factor analysed and rotated obliquely.

As expected, two major factors emerged, accounting for 42·2% of the variance.

Table 2 Factor intercorrelations after an oblimin rotation of the principal axes factor solution

Factor	1	2	3	4	5	6	7	8	9	10
1 General emotionality	1·00	·27	·15	−·27	·09	−·03	·16	·04	−·07	·25
2 Timidity		1·00	·11	−·19	−·04	−·17	·20	−·08	−·14	·19
3 Anger			1·00	−·13	·14	·04	·18	·07	−·02	·01
4 Tolerance				1·00	−·06	·13	−·05	·09	·10	−·05
5 Activity					1·00	·-21	·16	·24	·02	−·15
6 Sociability						1·00	·04	·08	·03	−·13
7 Sensation seeking and impulsiveness							1·00	·06	−·21	·06
8 Persistence								1·00	·18	−·08
9 Planfulness									1·00	·02
10 Avoidance of stimulation										1·00

The first was defined by EPI neuroticism (·60), together with general emotionality (·74), tolerance (–·49), timidity (·56) and sensation seeking and impulsiveness (·50). In addition, anger loaded substantially on this dimension (·55). The second factor was defined by EPI extraversion (·71) with highly significant loadings for activity (·41) and sociability (·76). A significant negative loading appeared for avoidance of stimulation (–·48).

Discussion

The psychometric properties of Buss and Plomin's EASI-III were examined in a general population through two methodologies, one based on classical reliability theory, the other on factor analytic theory.

The analyses provided partial support for Buss and Plomin's model of personality. Two of the temperaments, activity and sociability, emerged as discrete, unitary constructs which are not reducible to empirically distinguishable components. Buss and Plomin appear to have assumed empirical distinctiveness for the components of activity, though not for sociability.

For the temperaments of emotionality and impulsivity, the findings were more complex. For neither of these did items group according to Buss and Plomin's model.

Factors did, however, emerge corresponding to the fear, anger, and general emotionality components of the emotionality temperament. Additionally, a new construct which may be termed "tolerance" emerged, incorporating aspects of emotionality and impulsivity. In contrast to these findings, the alpha reliability and interscale correlation analyses suggested a degree of cohesiveness in the emotionality construct. This inconsistency was reconciled through a second order factor analysis, which indicated the presence of a higher order factor defined by timidity, general emotionality, and tolerance.

The sensation seeking, decision time, and persistence components of impulsivity had counterparts in the factor solution, although the core component, inhibitory control, collapsed. Higher order analyses did not indicate any degree of cohesiveness among these factors to suggest an underlying impulsivity construct. In fact, factors relating to low resistance to temptation (sensation seeking and impulsiveness, and tolerance) shared variance with the components of emotionality; while the factor supposedly measuring resistance to aversion (persistence) had more in common with the activity temperament. The remaining impulsivity factor, planfulness, which reflects decision time, defined a separate and independent concept. All told, impulsivity does not emerge as a useful construct in that it seems to incorporate quite dissimilar personality dispositions.

Thus, from these data, the basic constructs measured by EASI-III are (1) activity, (2) sociability, (3) general emotionality, (4) timidity, (5) tolerance, (6) anger, (7) sensation seeking and impulsiveness, (8) persistence, and (9) planfulness. These constructs were not found to be independent and a second order factor analysis revealed the ubiquitous underlying constructs of neuroticism and extraversion. The former was defined most notably by general emotionality, timidity, tolerance, and sensation seeking and impulsiveness; the latter by activity and sociability.

Implications for Future Research

The EASI-III does provide reasonably reliable measures of the temperaments of emotionality, activity and sociability. It should not be used as a measure of impulsivity.

Having acknowledged the satisfactory nature of three of the temperament measures in the EASI-III, these preliminary analyses nevertheless suggest that there is scope for improvement. While Buss and Plomin's conceptualization of emotionality is basically sound, items did not factor as predicted. We therefore recommend the alternative measures of the components of emotionality given above, at least for Australian populations.

Contrary to Buss and Plomin's intentions and consistent with Costa and McCrae's findings, the emotionality and some impulsivity scales appear to be tapping a construct akin to Eysenck's neuroticism scale, while activity and sociability together are linked to the extraversion scale. As such, the EASI-III provides potential alternative measures of these traits. Advantages over Eysenck's scales have already been alluded to: The EASI-III employs simple and modern language and the items are derived through a clearly articulated sampling frame.

Furthermore, the systematic way in which items have been sampled may lead to greater clarification of the constructs of neuroticism and extraversion at a theoretical level. For instance, with the current data, anger was tangential to the higher order emotionality factor until Eysenck's neuroticism scale was added. The contribution of anger to the neuroticism construct needs to be examined more carefully.

With regard to extraversion, two issues arise. First, the correlation between activity and sociability is so weak that the component measures used separately may provide more insightful information than the global extraversion measure. Certainly, the two levels of measurement need to be compared in terms of their empirical usefulness. Second, these data shed some light on the debate as to whether impulsivity is part of extraversion or not (Eysenck, 1977; Guilford, 1975, 1977; Howarth, 1976). Impulsivity is clearly multidimensional, and while some aspects are linked with activity (e.g. persistence), not inconsequential facets (e.g. tolerance, sensation seeking and impulsiveness) are associated with emotionality.

The EASI-III has emerged as an instrument which should be regarded seriously by those adopting a trait approach to personality research. With further refinements, particularly the balancing of positively and negatively worded items, and with more knowledge derived from greater use, the EASI-III has the potential for providing new and superior measures of neuroticism and extraversion.

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Received 4 May 1983.