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A PSYCHOMETRIC EVALUATION OF THE SHORT INTERPERSONAL REACTIONS INVENTORY (SIRI) IN AN AUSTRALIAN TWIN SAMPLE

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Summary—The Short Interpersonal Reactions Inventory [SIRI (Grossarth-Maticek, Eysenck, Vetter & Schmidt, *Topics in Health*, 1988)] is a questionnaire designed to measure personality traits predisposing to disease, notably ischaemic heart disease and cancer. It has been criticized by several authors in terms of design, scoring and validity. In a sample of 762 Australian twins taking part in a genetic study of asthma, we have examined the psychometric properties of the SIRI, and its relationship with the Eysenck Personality Questionnaire. Asthma was not significantly associated with any of the items or subscales of the SIRI. Scores on the seven subscales as defined by the SIRI authors (Types 1–3, 4 + and 4 − , 5–6) were heavily skewed or truncated in six cases. Disturbingly, the two alternative forms of the Type 4 subscale were poorly intercorrelated ($r = 0.17$). A factor analysis using polychoric correlations partially replicated these subscales, but with important differences, similar to those found by other authors (Ranchor, Sanderman & Bouma, *Personality and Individual Differences*, *14*, 483–484 1992). Scores on the SIRI and EPQR/S personality types were found to correlate broadly, as predicted by Eysenck (*Perceptual and Motor skills*, *71*, 216–218, 1990). Attempts to assign each subject to a single major type were unsuccessful, whether by maximum subscale score, or membership of the upper quartile of a subscale distribution. Finally, we found that the questionnaire could be shortened from 70 to 25 items with little loss of internal reliability. We conclude that the SIRI has a number of shortcomings as currently formulated, but that it may serve as the basis for shorter instruments with superior internal and construct validity.

INTRODUCTION

In the past 25 years an abundance of research has focused on the role of personality as a contributory factor in the onset of disease (see Eysenck, 1991a for a review). The work of Friedman and Rosenman (1974) in identifying a behaviour pattern labelled 'Type A' which characterizes people who have heart attacks focused further attention on the relationship between personality and disease. The work of Spielberger, Jacobs, Russell and Crane (1983) has identified anger and hostility as a main source of coronary heart disease proneness and Greer and Morris (1978) showed a positive relationship between suppression of emotion and cancer.

More recent work by Grossarth-Maticek and Eysenck (Eysenck, 1989, 1990, 1991b, 1991c; Grossarth-Maticek & Eysenck 1990a; Grossarth-Maticek, Eysenck, Vetter & Schmidt, 1988) has led to the definition of putative disease-prone personality types, (based on several large scale, long-term prospective studies), which are purported to relate to the onset of cancer or coronary heart disease (CHD). Six personality types are proposed in the disease-prone typology of the Short Interpersonal Reactions Inventory (SIRI). The types are claimed by the authors to be internally highly consistent and show a satisfying retest-reliability (Grossarth-Maticek & Eysenck, 1990b). A description of these types is given in Table 1. Eysenck (1990) has proposed a model, relating three of the six types to the dimensions of Neuroticism (N) and Extraversion (E). The model states that the cancer prone personality (Type 1) is characterized by high Neuroticism coupled with low Extraversion; Type 2 (CHD prone) is related to high Neuroticism and high Extraversion; with Type 4 (Healthy) classified as a low Neurotic with high or low Extravert tendencies.

Grossarth-Maticek (1989) has suggested that each person can be assigned to a single type on the basis of scoring more points for that type than any other. Schmitz (1992) assigned *Ss* to their respective

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Table 1. Description of the six personality type of the Short Interpersonal Reactions Inventory

Types	Description and characterization
Type 1	Cancer-prone: characterized by (i) suppression of emotion (ii) failure to successfully cope with stress which leads to feelings of hopelessness, helplessness, and depression (iii) appeasing, unassertive, overcooperative, compliant and defensive
Type 2	Coronary heart disease: (CHD) prone: angry, hostile, aggressive, overaroused
Type 3	Alternating reaction type: psychopathic, characterised by amvivalence. Alternates between type 1 and type 2
Type 4	Autonomous, healthy type: able to show emotion, capable of controlling stress
Type 5	Rational—antiemotional type: related to rheumatoid arthritis and cancer
Type 6	Anti-social egocentric type: psychopathic, drug-addictive, possibly criminal

From H. J. Eysenck (1991), *Smoking, Personality and Stress: Psychosocial Factors in the Prevention of Cancer and Coronary Heart Disease*. London: Springer.

types based on whether their score fell into the highest quartile of that subscale and his findings provide empirical support for those of Grossarth-Maticek and Eysenck.

In a replication of the Schmitz study, Ranchor, Sanderman and Bouma (1993) administered the Dutch version of the SIRI to a sample of 2663 men from the northern part of the Netherlands. They found that only 30% of the *S*s fell in the highest quartile of one and only one of the six types, and that 30% had scores in the highest quartile of more than one scale. This reveals the inadequacy of the type scoring method adopted by previous researchers, and raises questions about the validity of their results. The findings are also inconsistent with the assumptions on disease specificity of the personality typology of Grossarth-Maticek and Eysenck.

In a further study, Ranchor, Sandeman and Bouma (1992) investigated the predictive validity of the Dutch version of the SIRI in a group of 151 diagnosed male patients who had suffered from a myocardial infarction, and a group of matched healthy controls. A significant proportion of their healthy control (31.1%) belonged to Type 4, offering partial support for the construct. With regard to the MI patients, there was no support for the coronary prone character of Type 2, with 21.3% of the patients being Type 2. Whereas support was found, this was weakened by the fact that the same pattern was observed for Type 6.

In a recent issue of Psychological Inquiry (1991), criticisms have been raised concerning the derivation of these six personality types by Eysenck and Grossarth-Maticek, and the lack of a theoretical and empirical basis for their personality typology. For the purposes of this paper we have tended to focus on the criticisms regarding the SIRI scale. Derogatis (1991) criticises the scale as being severely limited on the basis of assigning persons to 'types', stating that the items

> "....are not represented as homogenous sets of items measuring personality dimensions ...., the pattern of which form [*sic.*] the basis for assignment to type, but rather as cumulative (and often, highly redundant) measures of typeness *per se*".

He further points out that the personality features represented by the types are never fully dimensionalized and expressed but that

> "....this taxonomic system appears to reduce fundamentally to a unidimensional, criterion-determined typology".

Further to these criticisms, Amelang and Schmidt-Rathjens (1993) tested a German sample of 920 *S*s (aged between 17–76 yr) using the long version (277 items) of the SIRI. They suggest that Type 1 and Type 2 constitute the one pole of a *single* bipolar dimension, the other pole of which was defined by health and autonomy (Type 4). The SIRI failed in terms of both reliant validity (as measured against other well known scales using joint factor-analytic techniques), and in terms of discriminant validity. Persons in the sample who suffered from either cancer or CHD differed in their mean scores from healthy persons, but could not be discriminated from one another by their scores on the scales. So, while Type 1 and Type 2 do define a disease prone phenotype, they do not appear to be specific to cancer and CHD.

To test the relationship between the six SIRI types, somatic complaints and occurrence of physical disease, Sandin, Chorot, Jimenez and Santed (1993a) recruited a sample of 414 university students (153 men and 261 women), with ages ranging from 27 to 40 yr (mean age = 32.6 yr). They found an expected positive relationship between Type 1 (cancer) and immune-related problems ($r = 0.27$ males $P < 0.001$, $r = 0.21$ females $P < 0.01$). However, positive relationships were also observed for

cardiovascular, gastrointestinal, neurologic-sensorial, musculoskeletal, and genital-urinary complaints. Similar findings were also observed for Type 2 (CHD) and *all* somatic complaints (those above plus immunological and respiratory complaints). In discussing these findings, the authors state that Type 2 is a more undifferentiated type than Type 1. Using the Schmitz scoring criterion, they found that immune-related diseases (infectious diseases, influenza and allergies) were more frequently associated with Type 1, while a higher proportion of cardiovascular and gastrointestinal diseases were associated with Type 2. The authors conclude that the SIRI types may be related to diseases other than cancer and CHD, and that their findings generally support the differential psychosomatic model proposed by Eysenck and Grossarth-Maticek.

Similar findings were also found by Schmitz (1993) who found a significant relationship between Type 1 and physical exhaustion ($r = 0.31$ $P < 0.001$), muscular tension ($r = 0.32$ $P < 0.001$), gastro-intestinal complaints ($r = 0.26$ $P < 0.001$), proneness to infection ($r = 0.40$ $P < 0.001$), and allergies ($r = 0.34$ $P < 0.001$). Type 2, on the other hand was related to physical exhaustion ($r = 0.27$ $P < 0.001$), incapacity to detach ($r = 0.48$ $P < 0.001$), gastro-intestinal ($r = 0.36$ $P < 0.001$), and cardiovascular disease ($r = 0.25$ $P < 0.01$). Schmitz also points out the overlap between the two disease types (1 and 2), and suggests that more clear-cut results could probably be found using a sample of older persons.

In its initial construction, the SIRI was shown by Grossarth-Maticek and Eysenck to be useful for predicting disease outcomes in a European sample. The studies above highlight the inconsistent findings generated by this scale in different countries. Claims about the usefulness of the SIRI are now in question.

The present study is a preliminary to a large prospective twin cohort study, and examines the psychometric properties of the SIRI in a sample of Australian twins. The aim of the present paper is to test the claimed psychometric properties of the constructs using a large sample.

METHOD

Subjects

A sample of 1600 pairs of twins where one or both reported wheeze in an earlier study (Duffy, Martin, Battistutta, Hopper & Mathews 1990) was invited to take part in allergy and bronchial provocative testing. The clinical protocol was completed by 419 complete twin pairs [863 individuals, including 552 females (64%)] in seven cities throughout Australia. The age range for the sample was between 19–76 yr, with an average age of 36.4 yr. At the time of clinical testing, 781 of these *Ss* were given a copy of the SIRI to be self administered. *Ss* who had more than 14 items missing from the total of 70 items in the scale ($n = 14$) have been excluded from the analysis as well as five others from incomplete pairs, leaving 762 *Ss* (381 complete pairs). The sample comprised 125 monozygotic (MZ) and 78 dizygotic (DZ) female; 54 MZ and 36 DZ male, and 88 DZ opposite sex pairs. Zygosity was determined initially by self-report and later validated by typing 11 highly polymorphic genetic markers [short tandem repeats, polymorphism information content (PIC) > 0.6], which yields a probability for misclassification of less than 10^{-4} for each pair. The zygosity of only five pairs (0.9% of the total of same sex pairs) was changed from the self report after marker typing, (four MZF pairs were reclassified as DZF and one MZM pair to DZM). Approximately 50% of *Ss* were confirmed as asthmatic (Duffy, 1994).

Materials

Self-reports psychological measures. The psychometric instruments used were: The Eysenck Personality Questionnaire—Revised (Short Scale) (Eysenck, Eysenck & Barrett, 1985), and the Short Interpersonal Reactions Inventory (Grossarth-Maticek & Eysenck, 1990b). The SIRI (See Appendix A) consists of 70 items; 10 items for each of the six personality types. Type 4 is broken down into 10 positively worded and 10 negatively worded statements in order to control for acquiescence response bias. The items from each scale are presented in strict rotation in 10 blocks of seven. The inventory was translated by Grossarth-Maticek and Eysenck from German into English.

Methods of analysis. The programs used in the data analysis were SAS 6.07.02 (SAS Institute,

Table 2. Breakdown of number of Ss into SIRI type classification using the Schmitz (1992) uppre-quartile scoring method

No Type	(No score in upper quartile of any type)	74 (10%)
Single Type	(Upper-quartile score in one type only)	250 (33%)
Multiple Types	(Upper-quartile score in more than one type)	438 (57%)
		762

1991—PROC FACTOR, PROC CORR), LISREL 8.1 (Joreskog & Sorbom, 1993), PRELIS 2.1 (Scientific Software International), and SPSS/PC + Version 5 (Norusis, 1992).

Procedure

As part of the study of asthma risk factors a skin prick test was carried out with common antigens. While *S*s waited (between 20–40 min) for their skin test to be read, they were briefed (standard format) about the aims of the study and the rationale for the use of the SIRI in the clinical protocol. *S*s were then asked to complete a copy of the SIRI. A sample question was given to check that they fully understood the instructions. *S*s were told that if they did not fully understand a question, they were to ask the researcher present who would further explain it. The testing sessions spanned 29 weeks from May to December 1992, and were conducted in each State in mainland Australia (except the Northern Territory) by the same two investigators (second author and one assistant).

EPQR-S Data. In order to test the relationship between the Eysenckian dimensions of Extraversion, Neuroticism, Psychoticism, and Social Desirability (Lie) with the six-fold typology of the SIRI, we have used data collected in an earlier study. The EPQR-S (Eysenck, Eysenck & Barrett, 1985) was administered to these twins in mail-out surveys conducted in 1988–89, and it is these data that we have used in the present analysis. The relationship between the EPQR-S and SIRI scales is complicated by the question of the stability of the EPQR-S over time, since we are using EPQR/S responses collected four years before the present SIRI data. A sample of 1000 twin individuals (500 males, 500 females) from the 1988 survey, was tested two years later (1990) with the EPQR-S to assess the medium term stability (Heath, Cloninger & Martin, 1994). Test–retest reliability coefficients for males and females were in the range 0.75–0.87 (Extraversion), 0.72–0.86 (Neuroticism), 0.69–0.81 (Lie) and 0.62–0.72 (Psychoticism), suggesting good medium-term stability of these measures.

Scoring of types. In order to test alternate forms of scoring, *S*s were assigned to a type in two separate ways. The first was the Grossarth-Maticek and Eysenck (1990b) method in which *S*s were assigned to a type if they had a score of 10 on one of the types along with scores lower than the two on the other types. However, not one *S* could be classified using this method.

The second method we adopted was to use the Schmitz criterion with the assignment of *S*s into their respective types being based on whether their score fell into the highest quartile. The breakdown of the type scores is presented in Table 2. A high percentage had scores in the highest quartile of more than one scale (57%), with 90% falling into the highest quartile of any of the six types (10% unclassified). Only one third of the sample was able to be classified into a single type on the basis of this scoring method.

The 'type' concept adopted by Eysenck and Grossarth-Maticek has its roots in the diagnostic criteria of psychiatry, and assumes that individuals may be categorized into discrete, mutually exclusive categories. In contrast, the dimensional or scale concept flows naturally from biological and statistical theories of multifactorial causation and the Central Limit Theorem. Our findings (Table 2) replicate those found by Ranchor *et al.* (1993). The two findings show a lack of support for the type method used in the SIRI, as the majority of *S*s score in the upper-quartile of more than one type. It is therefore evident that the scores on the SIRI are *not* measuring six discrete and mutually independent scales, but are in essence measuring scale scores which are not independent of each other. We will therefore deal with what we correctly assume, and hereafter refer to, as scales when referring to our own analyses, and 'type scores' (quotation marks added to infer our disagreement with the terminology) when referring to the *original* typology of Eysenck and Grossarth-Maticek.

Table 3. Polychoric correlation matrix of the eight types of the SIRI (× 100)

	Type1	Type2	Type3	Type4 (combined)	Type4(+)	Type4(−)	Type5	Type6
Type1	100	45	33	− 39	− 8*	− 5	22	24
Type2		100	45	− 48	− 8*	− 7	28	37
Type3			100	− 27	6*	− 47	16	50
Type4 (Combined)				100	77	76	6	− 25
Type4(+)					100	17	23	3
Type4(−)						100	− 14	− 42
Type5							100	5
Type6								100

*r not significant for $P < 0.001$.

RESULTS

Distribution of SIRI 'type' scores

The frequency distribution of the scores on the six scales is given in Fig. 1. 'Types' 1, 2, 3 and 6 are positively skewed. In contrast 'types' 4a and 4b are negatively skewed with 'type' 5 showing a normal distribution. These results are as expected, with the majority of *S*s scoring at the lower end of the disease scales and the antisocial psychopathic 'type' 6, and at the upper end of the healthy scales. We then looked for significant effects of sex (male vs female) and age (young vs old, median split of 34 yr) on the distribution of the six 'type' scores, but no significant effects were detected.

Correlations between the scales

Correlations between the eight 'types' (1–6, 4 + , 4 −) are shown in Table 3. Because of the skewed distributions of five out of the six 'types', polychoric correlations were calculated using Prelis 2.1.

The cancer prone scale ('Type 1') is correlated significantly with 'Type 2' and 'Type 3', and negatively correlated with 'Type 4' combined. 'Type 2' is positively correlated with 'Type 3' and 'Type 6', and negatively correlated with 'Type 4' combined. 'Type 3' correlates positively with 'Type 6' and negatively with 'Type 4' negative. 'Type 4' (−) has a significant negative correlation with 'Type 6'. One disturbing finding is the very low correlation between ('Type 4' (−) and 'Type 4' (+). The 10 items for 'Type 4' (−) were reversed scored and correlated at .17 with 'Type 4' (+). These two scales are supposed to be measuring the same construct, but the analysis reveals that this may not be the case. This low correlation is further reflected in the quite different pattern of correlations of the 4(+) and 4(−) scales with the other scales. The two scales are not simply composed of the same items worded in different ways (positive vs negative), and clearly the item content is measuring two essentially different constructs.

Factor analysis

To test the factor structure of the 70 items from the SIRI, we subjected them to a principal-components-analysis. The polychoric correlation matrices of the 70 items derived from Prelis 2.1 were used in the factor analysis. 21 factors had eigen values greater than 1.00. The scree-plot of these 21 factors indicated a possible six factor solution explaining 42.1% of the variance. A varimax rotation, limited to six factors was then conducted. The six factor solution was specified because of both the scree plot result and the six defined personality 'types' of the scale. However, only the first five factors were conceptually meaningful, so a repeat of the varimax criterion specifying five factors was performed. The five factors extracted give a combined total of 40% of the variance explained. Only items with loadings equal to or greater than 0.3 and no significant cross-loadings were retained for further analysis (Table 4). Of the 51 statements retained, 15 loaded on Factor I, 12 loaded on Factor II, eight loaded on Factor III, seven loaded on Factor IV, and nine loaded on Factor V. To see if a reduced factor model could be supported, varimax rotations specifying 4,3,2 and 1 factor solutions were conducted, with the result that the factors became significantly cross-loaded and conceptually meaningless. To test for systematic group differences on the derived factor solution, varimax rotations specifying a five factor solution were then conducted with different subgroups of sex (male vs female), birthorder (twin1 vs twin2), disease status (asthma vs no asthma) and age (young vs old, median split

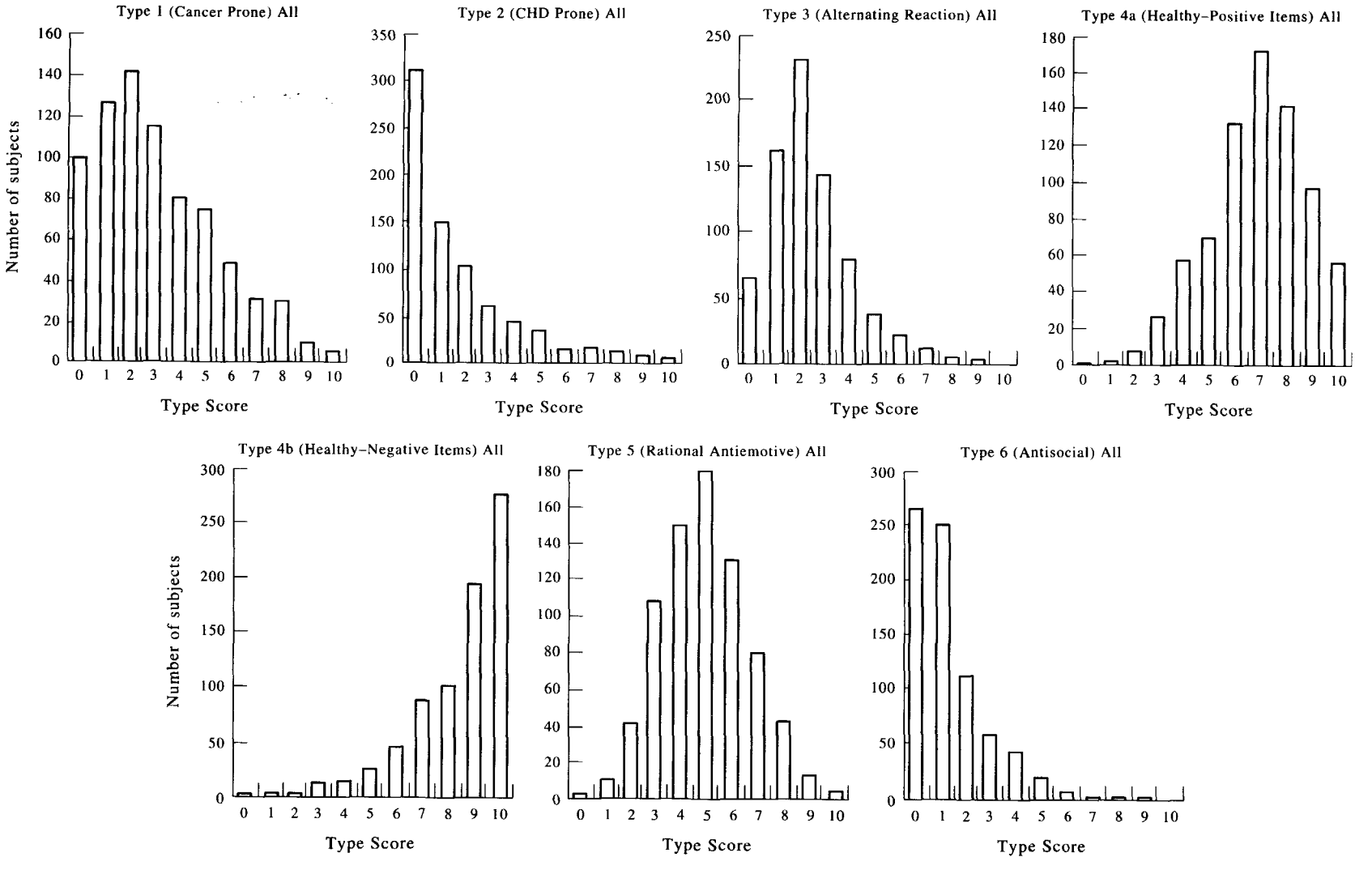
Type 1 (Cancer Prone) All
Type 2 (CHD Prone) All
Type 3 (Alternating Reaction) All
Type 4a (Healthy–Positive Items) All
Type 4b (Healthy–Negative Items) All
Type 5 (Rational Antiemotive) All
Type 6 (Antisocial) All
Number of subjects
Type Score

Fig. 1

Table 4. Short interpersonal reactions inventory items, factor pattern loadings (varimax rotation)-polychoric *r* in matrix

Item No.	Factor 1	2	3	4	5
Factor 1: (Eigen-value = 9.14) (Type2-CHD Prone)					
2	0.57				
9	0.44				
10*	0.43				
12*	0.36				
16	0.47				
17*	0.45				
23	0.57				
30	0.56				
37	0.56				
44	0.62				
51	0.48				
52*	0.42				
57*	0.44				
58	0.57				
65	0.54				
Factor 2: (Eigen-value = 2.98) (Type3/Type6-Alternating Reaction/Antisocial-Egocentric Combined)					
3		0.39			
13		0.44			
20		0.53			
31		0.34			
33*		0.41			
34		0.42			
38		0.47			
41		0.33			
45		0.52			
62		0.32			
66		0.41			
69		0.36			
Factor 3: (Eigen-value = 2.53) (Type1-Cancer Prone)					
1			0.56		
8			0.63		
15			0.48		
22			0.54		
29			0.38		
36			0.60		
43			0.56		
64			0.31		
Factor 4: (Eigen-value = 2.17) (Type5-Rational-Antiemotional)					
5				0.32	
19				0.61	
26				0.53	
40				0.36	
47				0.42	
50*				0.37	
68				0.36	
Factor 5: (Eigen-value = 1.75) (Type 4(+)-Autonomous Healthy)					
4					0.34
18					0.43
25					0.40
39					0.50
46					0.48
53					0.30
59*					0.39
60					0.40
67					0.35

*Items not matching original Short Interpersonal Reactions Inventory typology.

of 34 yr). We used Tucker's congruency coefficient (Derogatis & Serio, 1972) as a measure of factor loading similarity. No significant differences were found in all four subgroups.

On inspection of the statements that comprise the five factors, it was found that all 10 items of the scale that measured 'Type 2' (coronary-prone) were represented in the first factor extracted plus an additional 5 items. Factor II is a combination of 'Type 3' and 'Type 6' with five items and six items from each of these scale types respectively. Factor III is entirely represented by eight items from the 'Type 1' (cancer-prone) classification. Factor IV is clearly measuring the rational-antiemotional 'Type

Table 5. Cronbach αs for each of the eight original SIRI 'types' and five revised scales

	Full Scale (all 70 Items)	>0.33 Scale (Items < 0.33 rejected)	Shortened scale (top 5 items on each scale retained)	
8 SIRI 'Types'	SIRI		SIRI/S	Items
Type1 (cancer prone)	0.71	0.72	0.73	1,8,15,22,36
Type2 (CHD prone)	0.73	0.78	0.72	2,30,44,58,65
Type3 (alternating reaction)	0.61	0.67	0.62	10,17,45,52,66
Type4 (combined—healthy)	0.68	0.70	0.67	25,39,49,56,63
Type4 + (healthy)	0.54	0.53	0.53	25,39,46,53,67
Type4 − (healthy)	0.68	0.68	0.66	21,35,49,56,63
Type5 (rational—antiemotive)	0.52	0.48	0.50	5,19,26,47,68
Type6 (antisocial, egocentric)	0.57	0.53	0.56	13,20,34,55,69
5 revised Scales	SIRI-R		SIRI-R/S	Items
Scale1 (CHD prone)	0.82	0.80	0.84	2,23,30,44,58
Scale2 (alternating reaction/ antisocial/egocentric)	0.70	0.71	0.73	13,20,34,38,45
Scale3 (cancer prone)	0.80	0.79	0.85	1,8,22,36,43
Scale4 (rational-antiemotive)	0.64	0.66	0.70	19,26,40,47,68
Scale5 (healthy)	0.72	0.74	0.77	18,25,39,46,60

5', and Factor V is synonymous with 'Type 4 + ' (healthy). These *five* factors appear to closely parallel the 6-Type classification associated with the scale constructs; an important difference between these five revised scales (Scale1-R to Scale5-R) with the six original SIRI 'types' is that 'Type 3' and 'Type 6' were combined.

Reliability analysis

In order to assess the internal consistency (reliability) of both the 8 original SIRI 'types' (1–6 + Type 4-positive, Type 4-negative) and our five revised scales (Scale 1-R to Scale 5-R), the statements representing each scale were item-analysed. The polychoric correlation matrices of item responses derived from Prelis 2.1 were used in calculating Cronbach's α for each scale. The Cronbach Coefficient α for each scale (standardized) is given in the first column of Table 5. They range from 0.52 ('Type 5') to 0.73 ('Type 2') for the eight SIRI 'Types' (indicating fair internal consistency for four out of the eight types) and from 0.64 (Scale 4) to 0.82 (Scale 1) for the revised scales.

Retaining only those statements which showed item-total correlations of 0.33 or above; in the original scales, two statements from 'Type 1', one statement from 'Type 2', two from 'Type 3', six from 'Type 4' (combined), two from 'Type 4' (+), two from 'Type 4'(−), five from 'Type 5', four from 'Type 6'; in the revised scales, six from Scale 1, two from Scale 2, one from Scale 3, one from Scale 4, and two from Scale 5 were rejected. The Cronbach αs for four out of the eight scales of the original and three out of the five of the revised scale improved as a result, with the remainder showing diminished αs (see Table 5, column 2).

With a view to shortening the overall length of the instruments (original and revised), a third reliability analysis was performed retaining only the top five items from each scale that correlated the highest (item-total correlation). The Cronbach Coefficient αs for the shortened scales are given in Table 5 (column 3). The Cronbach αs of the shortened SIRI (SIRI/S—40 items—eight scales by five items) version of the scale do not differ significantly from the α scores of the full SIRI (70 item version). All five αs of the shortened revised scale (SIRI-R/S 25 items—five scales by five items) improved over the full revised scales (SIRI-R), as well as proving superior over their original 'Type' counterparts [e.g. Scale 3—cancer prone (0.85) and 'Type 1'—cancer prone (0.73)].

Relationship of SIRI types to asthma status

Since the SIRI is designed to measure proneness to certain diseases, we tested whether asthma status affects the pattern of scores by group *t*-test on all asthma cases vs non-cases for both the six 'types' (SIRI) and five revised scales (SIRI-R). We found no differences, however, confirming the earlier findings of Sandin *et al.* (1993a). As a further refinement, a paired *t*-test using MZ pairs discordant for asthma was performed, and again no significant relationship was found. The same analyses were

Table 6. Correlation matrix (× 100) of the EPQ and each of the SIRI scales (original and revised)

	Neuroticism	Extraversion	Psychoticism	Lie scale
		Eysenck Model (1990)		
Type1 (Cancer Prone)	High	Low		
Type2 (CHD prone)	High	High		
Type4 (Healthy)	Low	High/Low		
		Present study (N = 762) EPQR/S Scale (Polychoric r)		
SIRI				
Type1 (cancer prone)	25**	−34**	−7	7
Type2 (CHD prone)	43**	−9	4	2
Type3 (alternating reaction)	32**	1	13**	−5
Type4 + (healthy)	−16**	18**	16**	6
Type4 − (healthy)	−49**	19**	−1	−2
Type5 (rational—antiemotive)	−8	−13*	1	16**
Type6 (antisocial, egocentric)	28**	4	18**	−10*
SIRI/R				
Scale1 (CHD prone)	52**	−3	8	12
Scale2 (alternating reaction/ antisocial, Egocentric)	28**	4	33*	−18*
Scale3 (cancer prone)	44*	−11*	25	14
Scale4 (rational—antiemotive)	2	2	11	23*
Scale5 (healthy)	−71**	60**	27*	3
		Ranchor et al. (1992) (N = 1926) EPQR Scale (Pearson r)		
SIRI/R				
Type1 (cancer prone)	39**	−37**		1
Type2 (CHD prone)	49**	−7		−6
Type3 (alternating reaction/ antisocial, egocentric)	33**	3		−13**
Type4 (healthy)	−23**	25**		−4
Type5 (rational-antiemotive)	−3	−7		31**
		Schmitz (1992) (N = 92) EPQR/S Scale (Pearson r)		
SIRI				
Type1 (cancer prone)	43**	−30**	4	−9
Type2 (CHD prone)	68**	−25*	27*	−7
Type3 (alternating reaction)	48**	−22*	−10	−9
Type4 (healthy)	−57**	28**	−18	−14
Type5 (rational—antiemotive)	14**	−20	−34	26**
Type6 (Antisocial, egocentric)	59**	−9	33**	−12
		Sandin et al. (1993) (N = 270 Women) EPQ Scale (Pearson r)		
SIRI				
Type1 (Cancer prone)	43**	−36**	18	
Type2 (CHD prone)	45**	−12*	29**	
Type3 (alternating reaction)	38**	1	16	
Type4 (healthy)	−26**	28**	−5	
Type5 (rational—antiemotive)	5	−11	−2	
Type6 (antisocial, egocentric)	29**	16	26**	

**$P < 0.001$ *$P < 0.01$ (two tailed test)

then conducted on *all* twin pairs discordant for asthma (i.e. MZ plus DZ) and again no association between asthma and the SIRI traits was found.

EPQR/S and SIRI

In order to test the relationship between the Eysenckian dimensions of Extraversion, Neuroticism, Psychoticism, and Social Desirability (Lie) on the six-fold typology (SIRI) and the five revised scales (SIRI-R), we performed a polychoric correlational analysis between the EPQ/Revised (Short Form) and the scales. The correlational matrix between the EPQR/S and the two scales (SIRI and SIRI/R) is given in Table 6. The results show that moderate support is offered for Eysenck's (1990) model; the cancer prone 'Type 1' and Scale 3 are significantly positively correlated with Neuroticism and negatively with Extraversion; the CHD prone 'Type 2' and Scale 1 are positively correlated with Neuroticism and positively with Extraversion (Scale 1 only). The healthy personality 'Type 4'(+ / −) and Scale 5 are both negatively correlated with Neuroticism, and positively with Extraversion.

Table 6 also includes the findings of earlier studies, namely Ranchor *et al.* (1992), Schmitz (1992), and Sandin *et al.* (1993a). Ranchor *et al.*, revised the SIRI (with higher reliabilities and increased homogeneity), and similar to our study, combined 'Types' 3 and 6. It can be seen that these findings

offer some support to the Eysenck (1990) model for 'Types' 1 and 4 although they failed to find a relationship between 'Type 2' and high extraversion.

DISCUSSION

We have administered the SIRI to an Australian sample in order to test its psychometric properties. Eysenck (1991a) stated that 'types' (1 + 2 + 5) correlate together to define a disease-prone type, as opposed to a healthy type (3 + 4 + 6), and that an indicator of disease-proneness would be the difference between the two types (1 + 2 + 5) − (3 + 4 + 6). However, our results only offer partial support for this, since Types 1 and 2 (disease prone) correlate a lot higher with each other, and with Type 3, than with Type 5. Types 3 and 6 (assumedly healthy), correlate well with each other, but have no relationship to the major healthy 'Type 4'. From these results, it seems that the dichotomy between the disease-prone type and the healthy type is not as clear cut as Eysenck suggests, and that there exists an overlap between the measurements of healthy and disease-prone constructs.

It seems plausible then, as Derogatis (1991) and Amelang and Schmidt-Rathjens (1993) have pointed out, that the main problem with the Grossarth-Maticek and Eysenck studies lies in the fact that they adhere to the concept of strictly typing persons into categories rather than using a dimensional approach. In support of this statement, we tested the original scoring method of the scale [i.e. score of 10 on one type, and scores <2 on all other types (Grossarth-Maticek & Eysenck, 1990)], which resulted in no *S* being classified. The scoring method of Schmitz (1992) was then used (upper-quartile assignment); however 57% of the sample had scores in the highest quartile of more than one scale with only 33% being classified into a single 'type'. On the basis of these results which show the 'type' method as ineffective in assigning *S*s into discrete and mutually independent categories, and also on the grounds of biological implausibility, we have rejected the 'type' classification in favour of a dimensional approach (scale scores). The single bipolar dimension proposed by Amelang and Schmidt-Rathjens (1993) in which disease prone (Types 1 and 2) and healthy (Type 4) are at opposing ends of the continuum was not supported in a one factor solution of our data.

Exploratory factor analysis reveals that only five constructs are being measured in the SIRI with 'Types' 3 and 6 representing a combined alternating reaction/antisocial-egocentric type. In terms of reliability (internal consistency) in the current study, the original scale ranged from 0.52 (Type 5) to 0.73 (Type 2), indicating fair internal consistency. Based on these psychometric properties, 5 revised scales were constructed resulting in the original scale length being halved, with superior reliabilities (Cronbach's α). It is suggested that future research incorporating the SIRI, would be better served using a much shortened revised version (25 items), with five items representing Scales 1,2,3,4 and 5 (SIRI-R/S). This finding replicates earlier findings by Ranchor *et al.* (1992) who tested the construct validity of the Dutch version of the SIRI against the Dutch version of the Eysenck Personality Questionnaire (EPQ). Based on the psychometric properties of the SIRI, they constructed revised scales (Type 1-R to Type 5-R) with higher reliabilities and increased homogeneity (five Types as the original Type 3 and Type 6 were combined). They then assigned *S*s to a certain type based on the original scale and the revised scale. They used the Schmitz (1992) method of classification to assign a subject to a type when the subject's score fell into the highest quartile. The revised scale proved superior to the original on the basis of both predictive validity and internal reliability.

The overall relationship of the six 'types' and five scales (revised) to the Eysenckian constructs in the current study support earlier findings by Ranchor *et al.* (1992), Schmitz (1992), and Sandin *et al.* (1993a). The findings of these four studies clearly demonstrate that cancer proneness ('Type 1' and Scale 3) is clearly a highly neurotic and low extravert personality. CHD proneness ('Type 2' and Scale 1) is a high neurotic; alternating reaction and antisocial/egocentric (Scale 2 and 'Types' 3 and 6) is also a high neurotic with a moderate degree of psychoticism, while the healthy personality ('Type 4' and Scale 5) is a low neurotic, with medium to high extravert tendencies. The rational-antiemotive person ('Type 5' and Scale 4) is characterized by a moderate lie score, with a low extravert nature.

The disparity of results between numerous studies using the SIRI is a cause for concern. We believe that the reasons are numerous. Firstly, we consider the type method to be inappropriate for classifying persons into discrete and mutually exclusive categories. Until Schmitz began using the upper-quartile scoring method in 1992, previous studies used the original scoring method of Grossarth-Maticek. As

our study has shown, the use of different scoring strategies results in quite different type classifications. Secondly, the SIRI seems to be psychometrically problematic contributing to instability and unreliability of the instrument over different testing periods. As a result, some researchers have used revised versions of the instrument, contributing to conflicting findings (see Ranchor *et al.* 1992) with the original version. Other problems may arise from translation difficulties, since many of the items are complex and rather clumsily expressed (e.g. double negatives). This is a particular problem in the English version and may make its application to low or average IQ *S*s very limited.

Another reason for these inconsistencies in results has been offered by Grossarth-Maticek, Eysenck and Barrett (1993) whose research purports to show that different modes of administering the SIRI can result in quite different findings. The sample consisted of 1721 healthy males (aged between 55–57 yr) living in Heidelberg, Germany. In 1975, the sample was divided into four groups, each of whom received different levels of interviewer trust and rapport both prior to and during questionnaire administration. The entire sample was then followed up 13 years later in 1988. The accuracy of disease prediction was considered to be a test of the validity of the method of questionnaire administration. Best predictions were achieved when the interviewer gained the *S*'s trust and understanding prior to and during administration; worst results were achieved when the *S*s were merely given the questionnaire with no prior discussion or explanation of the meaning of the questions. Having the interviewer present to explain items that were not clear to the proband (understanding group) was as effective as spending 45–60 min with the proband, discussing their lives, prior to administration (trust group). The authors conclude that the success or failure of studies investigating the relationship between personality and disease depends crucially on the adopted method of interrogation. They suggest that failure to find differential predictive capacity in the Amelang and Schmidt-Rathjens (1992) study was due to lack of interviewer participation. We feel that it could equally be due to one of the problems highlighted above. Nevertheless, the authors concede that more simply worded items obviate the need for interviewer participation. We strongly agree with this last sentiment, since any protocol which depends on extensive interviewer participation, and indeed on the particular details of that participation, is quite impractical for the large scale epidemiological applications which will be necessary if the topic of personality and disease proneness is to be investigated in a replicable manner.

In conclusion, this study has revealed the many shortcomings of the SIRI in its psychometric properties. A superior shortened scale has been devised in order to overcome the shortcomings identified. Nevertheless, we feel much could be done to improve wording of the items and standardise administration of the instrument.

In order to test the validity of the shortened scale (Short Interpersonal Reactions Inventory/Revised) as well as to examine further the issues discussed above, a large prospective study has been started by the authors using volunteer twins over the age of 50 yr registered with the Australian National Health and Medical Research Council (NHMRC) Twin Registry. They will be initially assessed using the EPQR-S and the shortened version of the scale (SIRI-R/S), and traced periodically until death. This will enable us to test earlier findings as well as provide some further insight into the complex relationship between personality, genes, and disease.

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(For Appendix see opposite.)

APPENDIX A

Short Interpersonal Reactions Inventory (Yes/No Response)

1. I find it very difficult to stand up for myself.
2. I have been complaining for years about various unfavourable conditions but am not able to change them.
3. I am mainly concerned with my own well-being.
4. I am usually content and happy with my daily activities.
5. I can express my feelings only when there are good reasons for them.
6. I don't believe in social rules and don't pay much attention to other people's expectations or the obligations I may have toward them.
7. I cannot live happily and contentedly with nor without a particular person.
8. I prefer to agree with others, rather than assert my own views.
9. Certain people are the most important causes of my personal misfortunes.
10. I alternate to a great degree between the positive and negative evaluation of people and conditions.
11. When I cannot achieve closeness with someone who is emotionally important to me, I have no difficulties in letting them go.
12. I have difficulties in showing my emotions because for every positive emotion there is a negative one.
13. My behaviour toward other people alters from being very friendly and good-natured to being very hostile and aggressive.
14. I cannot live happily and contentedly in the presence or the absence of certain states or conditions; for example, I need my work but am unhappy doing it.
15. I tend to act more to fulfil the expectations of people close to me, rather than look after my own needs.
16. Certain conditions or situations are the most important causes of my personal misfortunes.
17. With people I love, I keep changing from keeping them at a great distance to stifling dependence, and from stifling dependence to excessive distancing.
18. I can usually arrange things so that people who are emotionally important to me are as close to or as distant from me as I wish.
19. Reason, rather than emotion, guides my behaviour.
20. I often expect others to fulfil agreements very strictly but do not believe in doing so myself.
21. I often have thoughts that terrify me and make me unhappy.
22. I tend to give in and abandon my own aims to achieve harmony with other people.
23. I feel helpless against people or conditions that cause great unhappiness for me, because I cannot change them.
24. When I am in a situation that I experience as threatening, I immediately try to get other people to help and support me.
25. When I fail to achieve my objectives, I can easily change tack.
26. When people make emotional demands on me, I usually react only rationally, never emotionally.
27. I usually act in a spontaneous manner, following my immediate feelings without considering the actual consequences.
28. Relations with certain people are always pretty unsatisfactory, but there is nothing I can do about it.
29. I am unable to express my feelings and needs openly to other people.
30. I always seem to be confronted with the undesirable aspects of people and conditions.
31. When someone who is emotionally important to me hurts me ever so slightly, I immediately dissociate myself from that person.
32. I can manage to live fairly contentedly with or without someone who is emotionally important to me.
33. I am quite unable to allow myself to be guided by emotional considerations.
34. I often feel like attacking other people and crushing them.
35. Certain situations and states (e.g. at my place of work) tend to make me unhappy, but there is nothing I can do to alter things.
36. I tend to accept conditions that work against my personal interests without being able to protest.
37. Certain people keep interfering with my personal development.
38. I expect others to live up to the highest moral standards but do not feel that these are binding on myself.
39. I can usually change my behaviour to suit conditions.
40. My actions are never influenced by emotions to the degree that they might appear irrational.
41. When my partner demonstrates love toward me, I sometimes become particularly aggressive.
42. Certain bodily conditions (e.g., being overweight) make me unhappy, but I feel unable to do anything about it.
43. I often feel inhibited when it comes to openly showing negative feelings such as hatred, aggression, or anger.
44. Certain conditions keep interfering with my personal development.
45. I seek satisfaction of my own needs and desires first, regardless of the needs and rights of others.
46. I am usually capable of finding new points of view and successful, sometimes surprising, solutions for problems.
47. I always try to do what is rational and logically correct.
48. When I feel like attacking someone physically, I have no inhibitions about doing this at all.
49. I can relax bodily and mentally only very rarely; most of the time I am very tense.
50. I am inclined not to be demonstrative when emotional shocks upset me.
51. I cannot control excitement or stress in my life because this is dependent on the actions of other people.
52. When I make emotional demands on another person, I require immediate satisfaction.
53. I am independent in what I do and do not depend on other people when this works to my disadvantage.
54. I always try to express my needs and desires in a rational and reasonable manner.

continued overleaf

55. I have no inhibitions in hurting myself physically if I feel like doing so.
56. I have great difficulties in entering into happy and contented relations with people.
57. When I feel emotionally let down I tend to be paralysed and inhibited.
58. I cannot control excitement or stress in my life because this depends on conditions over which I have no control.
59. I usually find fulfilment in everyday situations that are not subject to ordinary rules, regulations, and expectations.
60. When things don't work out, this does not make me give up but rather makes me change my way of doing things.
61. I try to solve my problems in the light of relevant and rational consideration.
62. I resent all moral obligations because they hamper and inhibit me.
63. I am helpless when confronted with emotional shocks, depression, or anxiety.
64. When something terrible happens to me, such as the death of a loved one, I am quite unable to express my emotions and desires.
65. I can express my aims and desires clearly but feel that it is quite impossible to achieve them.
66. As soon as someone becomes emotionally important for me, I tend to place contradictory demands on them, such as 'Don't ever leave me' or 'Get away from me.'
67. When things leads to harmful results for me, I have no trouble in changing my behaviour to make for success.
68. I only believe in things that can be proved scientifically and logically.
69. When it benefits me, I have no hesitation in lying and pretending.
70. I am seldom able to feel enthusiasm for anything.

Type 1 : Add 'Yes' answers to questions: 1,8,15,22,29,36,43,50,57,64.
Type 2 : Add 'Yes' answers to questions: 2,9,16,23,30,37,44,51,58,65.
Type 3 : Add 'Yes' answers to questions: 3,10,17,24,31,38,45,52,59,66.
Type 4a : Add 'Yes' answers to questions: 4,11,18,25,32,39,46,53,60,67.
Type 4b : Add 'No' answers to questions: 7,14,21,28,35,42,49,56,63,70.
Type 5 : Add 'Yes' answers to questions: 5,12,19,26,33,40,47,54,61,68.
Type 6 : Add 'Yes' answers to questions: 6,13,20,27,34,41,48,55,62,69.

From: Grossarth-Maticek, R. & Eysenck, H. J. (1990), Personality, stress and disease: Description and validation of a new inventory. *Psychological Reports*, *66*, 355–373.