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On the dimensional structure of emotional intelligence

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Abstract

The psychometric properties of the self-report emotional intelligence (EI) measured by Schutte et al. (1998) [Schutte, N. S., Malouff, J. M., Hall, L. E., Haggerty, D. J., Cooper, J. T., Golden, C. J., & Dornheim, L. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences, 25,* 167–177] are scrutinized and several weaknesses are identified. It is argued that by virtue of the construction strategy adopted by Schutte et al. (1998) the test cannot be measuring a general EI factor and furthermore that it has not been successfully mapped onto Salovey and Mayer's (1990) [Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition and Personality, 9,* 185–211] EI model. It is also shown via confirmatory factor analysis that the test is not unifactorial. A theoretical distinction between trait and information-processing EI is proposed. Trait EI appertains to the greater personality realm whereas information-processing EI is an attempt to chart new territory in the field of human mental ability.

Keywords: Emotional intelligence; Psychometrics; Test construction

1. Introduction

In 1990 Salovey and Mayer formulated a hierarchical model of emotional intelligence (EI), which they subsequently amended (Mayer & Salovey, 1997). The original model postulated that EI is an umbrella concept comprising three distinct components, viz., appraisal and expression of emotions, regulation of emotions and utilization of emotional information in thinking and acting.

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Salovey and Mayer's model was soon followed by a plethora of alternative conceptualizations of EI (e.g. Bar-On, 1997; Cooper & Sawaf, 1997; Goleman, 1995; Wessinger, 1998). The fact that early EI models were vague and paid little heed to those cognitive characteristics that are typical of the traditional definition of intelligence ultimately led to Mayer and Salovey's (1997) *ability* model of EI. On the basis of this theoretical development, Mayer, Salovey and Caruso (in press) differentiated between mixed and ability models of EI. According to Mayer et al. (in press), mixed models incorporate a wide range of personality variables as opposed to Mayer and Salovey's *ability* model, which is a strongly cognitive definition of EI.

A broader differentiation is that between *trait* EI and *information-processing* EI. This takes into account the different measurement approaches and operational definitions adopted by mixed and ability model theorists. In fact, we propose that it is the type of measurement rather than the theory per se that determines the nature of the model. Trait EI is concerned with cross-situational consistencies in behaviour (manifest in specific traits or behaviours such as empathy, assertiveness, optimism) as opposed to information-processing EI, which concerns abilities (e.g. able to identify, express and label emotions). Trait EI is embedded within the personality framework and is assessed via validated self-report inventories that measure typical behaviour (e.g. Bar-On, 1997; Salovey, Mayer, Goldman, Turvey & Palfai, 1995). This approach to EI research draws heavily on personality variables such as empathy, optimism and impulsivity, but often includes many other, somewhat vaguer, constructs that seem to be potential correlates (e.g. motivation, self-awareness, happiness) rather than essential elements of EI. By contrast, the information-processing approach is much more focused and explicit as to the constituent parts of EI and its relationship to traditional intelligence. Much like traditional intelligence, information-processing EI can be best assessed through measures of maximal (not typical) performance. Whilst there are a few trait EI inventories available (e.g. Bar-On, 1997; Salovey et al., 1995), the only measure of information-processing EI is the Multifactor Emotional Intelligence Scale (MEIS) developed by Mayer, Caruso and Salovey (in press). Research with this scale has provided promising evidence that EI might be embodied in the overall psychometric intelligence structure.

Schutte et al. (1998) developed and validated a self-report scale within the trait EI framework that allegedly measures 'a homogeneous construct of emotional intelligence' (p. 175). At various points in their paper, the authors implicitly claimed they had documented a general factor of EI and further conjectured that 'alternative items or an assessment technique other than self-report might show more specific factors' (p. 175). Our primary aim in this paper is to examine whether the scale by Schutte et al. (1998) measures a single general factor, which can be successfully mapped onto Salovey and Mayer's (1990) model. We will also discuss briefly the implications of the schism in EI research with reference to validation issues.

Schutte et al. (1998) used a principal components analysis followed by a varimax rotation (a 'Little Jiffy' procedure) to analyze an original pool of 62 items. They extracted four principal components, which they subsequently rotated orthogonally to a simple structure. Following a fruitless effort to interpret the emerged solution, they discarded three factors and retained only the first on the basis of its 'strength and conceptual parsimony' (p. 171). The strength of this factor, as measured by the variance it explains in the correlation matrix, is 17.4%. This value is

derived from dividing the first factor's eigenvalue by the total number of items in the original pool (10.79/62).

The first point to note is that the retained factor leaves 82.6% of the total variance unexplained. The second point is that a general factor is usually defined as one on which *all* of the items in the test have salient loadings. This is not the case with Schutte et al.'s (1998) factor as only 33 of the original 62 items loaded saliently on it.

To substantiate the existence of a general EI factor, it would be necessary to provide evidence of an empirically coherent domain of EI, i.e. a core construct shared by all the variables in a given EI scale. In a factor-analytic study, such a construct would normally take the form of a higher-order factor. The problem is that even if such factor existed in the 62 items of the test at issue, Schutte et al. (1998) eliminated it by rotating their factor matrix orthogonally. The varimax rotation is aimed at maximizing the sum of variances of squared structure elements in the columns of the factor structure matrix thereby distributing variance *away* from the general factor that is usually produced by the principal components analysis. As a rule, an orthogonal rotation is almost guaranteed to preclude the emergence of a general factor (Gorsuch, 1983, 1997; Nunnally & Bernstein, 1994). There is also a theoretical reason that may be levelled against the option of an orthogonal rotation. The three components of EI cannot be regarded as being independent. For example, it is difficult to imagine how one can regulate one's emotions without having appraised them first. That is not to say that these components will necessarily be correlated in self-report measures of EI; self-reported ability is markedly different from actual ability. Nevertheless, even in the case of self-report measures, it is more appropriate to start with an oblique rotation.

In light of the foregoing points, it seems unsuitable to impose orthogonality on the data by using a varimax rotation. The authors should have tried an oblique rotation that would have also allowed them (provided it produced substantial factor inter-correlations) to analyze the inter-cosine matrix of the primary solution in order to seek a broader, higher-order factor underlying all the items in the test. Alternatively, a confirmatory factor analysis could have been performed to assess whether a three-factor model with one higher-order factor fits the data well.

Schutte et al. (1998) also contended that their measure is conceptually parsimonious because 'in the set of 33 items, representation of different categories of the model is roughly proportionate to the model' (p. 171). That is, the 33 items of the final version of the test ostensibly came from all three subcategories of Salovey and Mayer's original EI model. However, by arguing that this 'conceptual parsimony' constitutes evidence that the test measures general EI, the authors took for granted the very thing they failed to demonstrate in their analysis, namely, that their items had been sampled from three conceptually distinct subdomains of EI. Had these subdomains been successfully sampled, one would have expected them to form clear factors in the analysis, which they did not. Since the authors failed to find factors corresponding to the three subdomains there was little basis for arguing that these are represented in the test.

The high reliability coefficient ($\alpha = 0.9$) suggests that perhaps the test measures something coherent and internally consistent, but it is difficult to surmise precisely what because, in addition to the aforementioned problems, the scale is most likely to be confounded with

individual differences in acquiescence due to highly homogenized item-keying (91% of the items are keyed in the same direction).

An important issue is whether this scale can be used in research as a face-valid, unidimensional measure of trait EI. The primary concern in this case is the underlying dimensionality of the scale. Accordingly, we performed a confirmatory factor analysis on British data to investigate whether there is any evidence in support of the authors' claims that the scale is unifactorial.

2. Method

2.1. Participants

In total, 260 university students (175 females and 85 males) participated in the study. The mean age for the sample was 22.21 years (S.D. = 5.9).

2.2. Questionnaire

The questionnaire by Schutte et al. (1998) comprises 33 items, three of which (5, 28 and 33) are reverse-scored. Participants reply on a Likert scale and a total score is derived by summing up the item responses. Validation studies included correlations with theoretically related constructs (e.g. alexythimia, pessimism, depression), *t*-tests between various groups (e.g. therapists, prisoners, clients in a substance abuse program) and correlations with each of the Big 5 higher-order factors.

2.3. Procedure

Participants from three British universities completed the questionnaire in classroom time. There was a response rate of over 95%. They were debriefed afterwards where possible.

3. Results

3.1. The confirmatory stage

A confirmatory factor analysis with maximum likelihood estimation, using LISREL 8.2 (Jöreskog & Sörbom, 1993) was performed to test the fit of a one-factor model to the data. The 33 items in the questionnaire were the indicators of the latent variable, which represented the general factor of emotional intelligence. The data were collected on a seven-point[1] Likert

[1] It should be mentioned that Schutte et al. (1998) collected their data on a five-point Likert scale. Colman, Norris and Preston (1997) demonstrated that scores from five-point and seven-point Likert scales are virtually equivalent and it is unlikely that a five-point scale will produce unidimensional data.

scale and were treated as continuous so as to avoid the use of weighted least squares estimation, which requires very large sample sizes. The analysis was carried out both on raw-score and on standardized units. There were no discrepancies between the two solutions with respect to the values of the fit indices. The results from the raw-score unit analysis are not reported, but are available upon request from the authors. The values of a series of criteria for the assessment of model fit are presented in Table 1.

Most fit indices were wide of their respective recommended values thereby indicating a lack of fit for the one-factor model in question. The χ^2 test of global fit was highly significant. Steiger's root mean square error of approximation (RMSEA) exceeded 0.08. Jöreskog's goodness-of-fit indices (GFI and AGFI) were both far below 0.9. Bentler's comparative fit index (CFI) was also much below 0.9. Bentler and Bonnet's normed (NFI) and nonnormed (NNFI) fit indices were both below 0.9. Finally, the root mean square residual (RMR) exceeded 0.08.

3.2. The exploratory stage

Following the rejection of the unifactorial model the data were subjected to an exploratory factor analysis in order to seek a more appropriate solution. The Kaiser–Guttman rule indicated a ten-factor model whereas the scree test indicated a two-factor model. We decided on a four-factor, varimax-rotated solution, as it was interpretable, clear, and accounted for a reasonable amount of the total variance. An oblique rotation was also conducted, but all factor correlations were below |0.3|. Furthermore, the two rotations produced highly similar results. Table 2 presents the results of the exploratory factor analysis.

The four factors accounted for 40.4% of the total variance and were labelled: 'optimism/mood regulation', 'appraisal of emotions', 'social skills' and 'utilization of emotions'.

4. Conclusion

Schutte et al.'s (1998) questionnaire has many psychometric problems, perhaps the most important of which being the application of 'Little Jiffy' in an analysis that sought to

Table 1
Summary statistics for fit of a one-factor model to data

χ^2 (df = 495)	1662.36[a]
RMSEA Index	0.105[b]
GFI Index	0.69
AGFI Index	0.65
NFI	0.43
NNFI	0.48
CFI	0.51
RMR	0.093

[a] $p < 0.001$.
[b] The upper and lower 90% confidence bounds for the RMSEA were 0.110 and 0.101 respectively.

demonstrate a general EI factor. On a more positive note, the scale has face validity as well as some evidence of construct, predictive and discriminant validities. Although we have used the scale in two exploratory studies that investigated the correlates of trait EI (Furnham & Petrides, (1999); Furnham, Petrides, Sisterson, & Baluch, (1999)) we would caution further research with it. In our studies we have used factor scores as well as a total score because of the clear evidence of the scale's multidimensionality. We urge researchers to factor-analyse the scale before using it because the alternative solution we have presented could be unstable. It is possible that we may have overestimated the number of factors, which means that some of

Table 2
Factor loadings of varimax-rotated factors from the emotional intelligence questionnaire[a]

Item number	Factor 1	Factor 2	Factor 3	Factor 4
10	**0.729**	−0.052	0.231	0.091
3	**0.689**	−0.041	0.068	0.159
23	**0.660**	0.128	0.181	0.237
14	**0.537**	0.125	0.238	0.078
21	**0.527**	0.296	−0.208	−0.055
12	**0.515**	0.241	**0.329**	−0.004
28	**0.492**	0.014	0.037	0.094
2	**0.430**	0.088	0.177	0.296
31	**0.399**	0.182	**0.351**	**0.325**
18	0.063	**0.720**	0.158	0.138
25	0.083	**0.715**	0.204	−0.021
29	−0.090	**0.668**	0.143	0.197
19	0.337	**0.581**	−0.108	0.141
5	0.011	**0.570**	0.106	−0.102
32	−0.071	**0.549**	0.243	0.273
22	**0.412**	**0.545**	0.041	0.105
15	0.178	**0.510**	0.179	−0.194
9	0.201	**0.409**	0.196	0.150
11	0.165	−0.047	**0.642**	−0.021
4	0.078	0.203	**0.528**	0.005
13	0.192	0.127	**0.527**	−0.157
30	−0.056	0.238	**0.513**	0.189
26	0.056	0.205	**0.499**	0.103
6	0.100	0.138	**0.473**	**0.333**
24	0.095	0.073	**0.470**	0.157
16	**0.377**	0.116	**0.451**	0.104
1	0.270	0.056	**0.361**	0.036
8	0.228	−0.017	**0.328**	0.274
33	−0.201	0.244	**0.315**	−0.033
20	**0.316**	0.050	0.015	**0.739**
7	0.013	−0.024	0.143	**0.715**
27	0.099	0.084	0.027	**0.623**
17	**0.315**	0.166	0.074	**0.577**

[a] Factor loadings greater than |0.3| are shown in boldface. The items along with their numbers are presented in Schutte et al. (1998).

them (especially the fourth) might not emerge in other data sets. As one anonymous reviewer pointed out, the scale is inherently biased in favour of a unifactorial interpretation. Thus, some of the factors cannot emerge clearly simply because they are represented by an inadequate number of items. Another reason why the solution might be unstable is that even after the extraction of four factors, there still remains a substantial proportion of error variance. Given the theoretical and empirical shortcomings of the scale, we believe that researchers should use it in the future only as a tentative, face-valid measure of EI.

The validation of any EI measure must be pursued primarily within the framework in which the measure was developed. The discriminant validity of a trait EI measure has to be demonstrated vis-à-vis the established personality factors whereas that of information-processing EI must be demonstrated against the intelligence factors (particularly verbal intelligence). Furthermore, the validity of EI measures must be predicated on experimental rather than correlational studies. The trend of validating one tentative measure of EI against another (e.g. the EI questionnaire examined in this paper against the Trait Meta-Mood Scale) does not help clarify what the questionnaires really measure not least because these inventories often have items with very similar semantic content that spuriously inflate their correlations.

Finally, it should be stressed that the existence of a coherent domain of EI has not yet been demonstrated. It remains uncertain whether either the concept of trait EI or measures of it provide any *incremental* validity over the sum of its parts such as empathy, assertiveness, optimistic attributional style, trait happiness, etc. This is also true for information-processing EI and its measures. Questions that pertain to the concept's trainability or to its application in work, educational and clinical environments are therefore premature. First we must forge a scientific theory of the origin and nature of emotional intelligence, then devise subtle, parsimonious and valid measures and only then will we be able to explore the concept's potential benefits.

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