THE FACTOR STRUCTURE AND RELIABILITY OF A SIX-ITEM SENSE OF COHERENCE MEASURE

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The study investigated the factor structure and reliability of a six-item sense of coherence (SOC) measure. Participants were a South African white collar employee sample (n=7185) purposively selected from over 300 different companies across various business sectors. The sample constituted 34% male and 66% female and 34% Black, 18% Coloured, 11% Indian and 37% White employees. Exploratory factor analysis (EFA) was used for the structural analysis. The reliability of the scores was also estimated. A one-dimensional structure seemed to best represent the six-item SOC measure. The internal reliability of the scores from the measure was high.

Keywords: Sense of coherence, orientation to life questionnaire, exploratory factor analysis, employee wellness

Employee wellness is imperative for productive organisational functioning and remains a vital research focus in optimising human talent (Rothmann & Ekkerd, 2007). Various positive psychology constructs are continuously researched as essential in understanding individual coping behaviour, strengths, a health promoting life orientation and the general wellness of employees. In particular SOC has been widely regarded as a core construct reflecting employee coping and wellness (Eriksson & Lindström, 2006; Feldt et al., 2011). Measurement issues remain to be resolved and particularly the factor structure and reliability of different SOC measure formats. Whilst the theoretical SOC model is widely accepted as useful in applied psychology, results differ on the structural equivalence of original and adjusted SOC measures with the underlying theoretical SOC construct (Van Schalkwyk & Rothmann, 2008). Moreover, Togari, Yamazaki, Nakayama and Shimizu (2007) argue that Antonovsky's original SOC-scales, the 29- and 13-item Orientation to Life Questionnaires (OLQ-29 and OLQ-13) are too extensive to be used in large multipurpose population surveys, high- lighting the need for developing shortened versions.

SOC is generally defined as a global life orientation reflecting confidence in one's ability to function meaningfully, with ad- equate resources in a manageable environment. As such SOC is conceptualised as the dynamic interplay between the three subcomponents of comprehensibility, manageability and meaningfulness (Eriksson & Lindström, 2005; Feldt et al. 2011). Comprehensibility constitutes the cognitive component of SOC through which one regards environmental stimuli to be structured, predictable, clear and explicable. Manageability is the instrumental or behavioural component of SOC and represents one's perception that there are sufficient, useful re- sources available and accessible in one's intrinsic and extrinsic environment to manage any confronting life demands. Lastly, meaningfulness is regarded as the motivational component of SOC denoting the belief that challenges and demands in life are worthy and meaningful to engage with and spend effort in.

The three SOC-subcomponents identified by Antonovsky do not consistently appear in factor analytic research (Feldt et al.2007; Jacobsson, 2011; Naaldenberg, Tobi, Van den Esker, & Vaandrager, 2011). Some studies establish a one factor structure (Bernabé et al., 2009; Hittner, 2007) and others a three factor structure, yet not necessarily in line with the original conceptualisation of SOC's three subcomponents (Naaldenberg et al., 2011). It seems that when confirmatory factor analysis methods are applied, a theoretically congruent three factor structure does emerge for the OLQ-13 (Feldt et al., 2007; Söderhamn & Holmgren, 2004). Yet, multi-factorial structures have also been found, including as many as two, three, five, six and 11 factor structures (Eriksson & Lindström, 2005; Van Schalkwyk & Rothmann, 2008). With regard to South African research a one dimensional structure mostly seem to explain the SOC construct (Barnard, Peters, & Muller, 2010; Fourie, Rothmann, & Van de Vijver 2008; Muller & Rothmann, 2009; Van Schalkwyk & Rothmann, 2008). In line with Antonovsky's (1993) warning against the empirical use of OLQ subscales, Muller and Rothmann (2009) do not anticipate SOC subcomponents to function independently because although the three subcomponents are conceptually distinguishable they are interrelated and form part of a unitary SOC construct.

Studies exploring the factorial structure of SOC measures mostly apply exploratory or confirmatory factor analysis. Ac- cording to Naaldenberg et al. (2011), studies applying confirmatory factor analysis present a better fit for models aligning with the three dimensional conceptualisation of the SOC construct. Bernabé et al. (2009) however regard these confirmatory factor analysis results as ambiguous due to model modifications made to achieve acceptable fit to the data. Moreover, due to the un- certainty about the factor structure of the SOC evident from varying construct validity results with the OLQ-13 and the OLQ-29, Jacobsson (2011) recommends the application of exploratory factor analysis as more appropriate in testing the SOC structure. The need for and potential efficiency value of a short SOC measure has been noted in this article (compare Togari et al. 2007). A variety of translated and shortened versions of the SOC have thus been applied worldwide in different populations (Naaldenberg et al., 2011) yet with varying results as to view SOC as a one or three factor model (Bernabé et al., 2009; Muller & Rothmann, 2009; Naaldenberg et al., 2011). This study therefore aimed at exploring and confirming the factor structure of a six-item Orientation to Life Questionnaire (OLQ-6) and at testing its reliability in a large scale South African employee sample. The results contribute to the current body of research and confirmed a six variable one factor solution for the OLQ-6.

METHOD

Participants and setting

The sample data (n=7185) were purposively drawn from over 300 companies across various business industries in South Africa, including finance, banking, construction, education, retail, mining, food and beverage, government departments, healthcare, travel and leisure, technology, telecommunications, professional services, chemical, utilities, automotive, real estate and manufacturing to represent white collar, sedentary employees with e-mail access. The demographic characteristics of the sample are depicted in table 1 below.

INSTRUMENTS AND MEASURES

The six items of the SOC, selected from the original OLQ-29, were items 8 and 28 (meaningfulness), 12 and 19 (Comprehensibility) as well as 9 and 29 (manageability) as identified in the study by Van Schalkwyk and Rothmann (2008). Items are scored on a 7-point ordinal rating scale varying from “very often” (1) to very seldom or never (7) for five of the items and one item’s rating scale varying from “no clear goals or purpose at all” (1) to “very clear goals and purpose” (7). Addition- ally, data on the participants’ demographics were also considered.

DATA ANALYSIS

Statistical analysis was performed with the Statistical Analysis System (SAS) software package. The dataset was randomly split into three subsets of n_i =2395, (i=1..3) each retaining a good representation of the same sample-population (see Friendly, 1995). It was hypothesized that if a common factor model of best fit is determined for the first subset that this is the model of best fit for the entire sample (n=7185). The models of best fit for the remaining two subsets were then compared against the hypothesized model to validate the model of best fit for the entire sample

Table 1
Sample Characteristics

	Category	Frequency	Percent
Age	<25	684	9.52
	26-35	3018	42.02
	36-45	1919	26.72
	46-55	1099	15.30
	55+	462	6.43
	missing = 3		
Gender	Male	2433	33.94
	Female	4726	66.06
	missing = 16		
Population group	Black	2428	33.83
	Coloured	1257	17.51
	Indian	823	11.47
	White	2670	37.20
	missing = 7		
Marital status	Single	2625	36.60
	Married	3823	53.30
	Divorced	725	10.11
	missing = 12		
Income level	< R5000	439	6.32
	R5001-R10000	2088	30.05
	R10001-R15000	1737	25.00
	R15001-R20000	1020	14.68
	R20001-R30000	925	13.31
	R30000+	740	10.65
	missing = 236		

Due to the large data subsets (n=2395 per set) multi-normal approximation could be assumed. Therefore maximum likely hood was applied as it leads to more accurate estimates when applied to larger samples, provides tests regarding the number of common factors underlying a data structure and readily tests for goodness of fit (SAS/STATS, 1999; Friendly, 1995). Oblique rather than orthogonal transformations to enhance the factor pattern of extracted factors through PROMAX rotation (SAS/STATS, 1999). With the Chi-square statistic (x^2) being sensitive to large sample size, further goodness of fit criteria were acquired and included calculation of Bartlett's chi-square test, Kaiser's mea- sure of sampling adequacy, Akaike Information Criterion (AIC), Schwartz's Bayesian Information criterion (BIC) and Tucker Lewis reliability coefficient (TLC). When several factor analytic models are compared, the model with the smallest BIC and AIC indicates the best fit (SAS/STATS, 1999) and TLC values greater than 0.9 indicates a model with good fit (Friendly, 1995). Scale reliability testing was finally conducted on the factor model of best fit calculating Split-half, Cronbach alpha and Spearman Brown internal consistency indexes.

RESULTS

Structure of the Six-Item SOC

Results of the factor analysis conducted on the first sample subset's OLQ-6 data applying principal axis and maximum likelihood extraction methods with PROMAX rotation are depicted in table 2. The number of factors to be extracted was deter- mined by the scree-plots' results, Kaiser's eigenvalue criterion (eigenvalues >1), the proportion of variance (communality <0.4) accounted for by a factor (Hatcher, 1994) and the various good- ness of fit criteria.

Principal axis analysis results from subset 1 initially show a 1-factor model of best fit with Kaiser's criterion indicating high common variance (MSA > 0.8) and justifying factor analysis of the data. Maximum likelihood with PROMAX rotation further demonstrate the overall and individual variables' Kaiser criterion are all greater than 0.8, confirming that the data is appropriate for a common factor analysis approach. Good fit statistics were demonstrated for a two-factor maxi- mum likelihood model with Chi-square statistic significant on the 0.1% level ($x^2 = 5638.76$) as the AIC and the BIC reached their smallest value for the two factor model. Similarly the TLC was closest to one for the two factor maximum likelihood model. Analysis of the scree-plot, eigenvalues, communalities and factor patterns however justifies a unifactorial structure above a two-factor structure. The interpretability of the two factors of the 6-variable model were not clearly fitting the theoretical subcomponents of the SOC construct, further favouring a one factor model as presenting the best underlying data structure.

On completion of the analysis of the first data subset it was hypothesized that one factor underlies the response data of a six variable factor analysis model and that this factor reliably measures a combined comprehensibility-manageability- meaningfulness SOC construct. Next this hypothesis was tested with the second and third data subsets applying the same exploratory factor analysis process. Tables 3 and 4 below depict the results of the factor analysis conducted on the second and third sample subset's OLQ-6 data applying principal axis and maximum likelihood extraction methods with PROMAX rotation. By following the same reasoning as followed for the first subset results, it can be deduced that for the six variables, one factor solution are again presented as the model of best fit for both the second and third data subsets. Although the criteria indicated in tables 3 and 4 potentially show that the two factor model might present as the best model (the AIC and the BIC reach their smallest value for the two maximum likelihood factor model and the TLC is closest to 1 for the two factor maximum likelihood model), the differences between the prior and final communalities for each variable in both subsets were again the smallest for the one factor model.

Scale Reliability Testing: Internal Consistency Reliability

Results (summarized in table 5 below) show that the reliability of the 6-item scale is higher (a=0.86) than for 3-item scales (a= 0.68, 0.74, 0.74 and 0.85 for 4 different 3-item permutations of the questionnaire).

CONCLUSION

This study contributes significantly to the body of SOC re- search in confirming the efficiency value of a short version SOC measure for more efficient use in online applications and in large scale employee surveys. Results support the notion that SOC-scale versions shorter than 12 items do not provide adequate scope to measure three related but distinct factors (compare Bernabé et al., 2009 and Togari et al., 2007).

Table 2

Summary of FA Models Evaluated for Goodness of Fit for Subset1 (As Determined With SAS Version 9.2)

Extraction method & rotation	No factors extracted	Scree plot inflection	Bartletts Chi-sq (unadj. Chi-square)	Kasier criterion MSA	Akaike criterion AIC	Schwarz Bayesian Criterion	Tucker Lewis Reliability	Original & (Final) Eigen-values & Communalities, MSA loadings/ q1-q6
Subset 1 (6 variables, q1-q6) (Kaiser's MSA per variable: 0.93 0.90 0.87 0.88 0.86 0.85)								
ML, promax	1	1	5638.76*** (192.25)	0.8770	174.25	123.31	0.9458	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 6.40 0.18 -0.27 -0.13 -0.25 -0.34 7.67 0.33 0.05 -0.02 -0.11 -0.25 Communalities Prior & Final 0.33 0.31 0.51 0.55 0.55 0.59 0.38 0.32 0.55 0.63 0.61 0.67 Factor pattern for I factor 82 79 78 74 62 57
	2	1	5638.76*** (23.28)	0.8770	15.29	-7.35	0.987	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 6.41 0.18 -0.03 -0.13 -0.25 -0.34 1.89 1.33 0.09 0.04 -0.04 -0.10 Communalities Prior & Final 0.33 0.31 0.51 0.55 0.55 0.59 0.37 0.33 0.83 0.61 0.67 0.71 Factor pattern for 2 factors 80 76 52 45 06 24 04 12 33 21 88 40
	3	1	minimum eigen value criterion not satisfied; no solution for number of factors to extract					
PA, promax	1	1	-0.8770	–	–	–		v1 v2 v3 v4 v5 v6 Prelim eigenvalues 3.11 0.10 -0.02 -0.07 -0.11 -0.17 Communalities Prior 0.34 0.31 0.51 0.54 0.55 0.59 Factor pattern for I factor 80 78 77 75 61 57
Subset 1 (5 variables, q1, q3-q6) (Kaiser's MSA per variable: 0.93 0.87 0.86 0.84 0.83)								
ML, promax	1		4845.69 (96.31)	0.8587	86.31	58.01	0.96	v1 v3 v4 v5 v6 Prelim & Final eigenvalues 5.78 0.04 -0.09 -0.26 -0.31 7.29 0.25 -0.00 -0.09 -0.15 Communalities Prior & Final 0.34 0.47 0.54 0.54 0.59 0.38 0.52 0.63 0.62 0.70 Factor pattern for I factor 83 79 79 72 62
	2		4845.69 (0.30)	0.8586	-1.70	-7.36	1.00	v1 v3 v4 v5 v6 Prelim & Final eigenvalues 5.78 0.04 -0.09 -0.26 -0.31 8.34 0.51 0.01 0.00 -0.01 Communalities Prior & Final 0.34 0.47 0.54 0.54 0.59 0.38 0.64 0.64 0.69 0.71 Factor pattern for 2 factors 78 67 07 32 31 07 22 75 54 35

Note. ML: Maximum Likelihood; PA: Principal axis; Promax: Oblique rotation; MSA: Kaiser's measure of sampling adequacy; *** Highly significant at the 0.1% level

Table 3

Summary of FA Models Evaluated for Goodness of Fit for Subset1 (As Determined With SAS Version 9.2)

Extraction method & rotation	No factors extracted	Scree plot inflection	Bartletts Chi-sq (unadj. Chi-square)	Kasier criterion MSA	Akaike criterion AIC	Schwarz Bayesian Criterion	Tucker Lewis Reliability	Original & (Final) Eigen-values & Communalities, MSA loadings/ q1-q6
Subset 2 [Kaiser's MSA per variable: 0.93 0.91 0.87 0.86 0.85 0.86]								
ML, Promax	1	1	5226.80*** (162.10)	0.8731	144.10	93.15	0.951	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 5.91 0.16 -0.05 -0.12 -0.24 -0.33 7.14 0.31 0.03 -0.02 -0.10 -0.22 Communalities Prior & Final 0.30 0.26 0.50 0.56 0.53 0.54 0.34 0.28 0.55 0.66 0.60 0.61 Factor pattern for I factor 81 78 77 74 58 53
	2	1	5226.80*** (9.239)	0.8731	1.24	-21.41	0.996	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 5.91 0.16 -0.05 -0.12 -0.24 -0.33 8.82 0.84 0.05 0.03 -0.03 -0.06 Communalities Prior & Final 0.30 0.26 0.50 0.56 0.53 0.54 0.33 0.30 0.74 0.64 0.71 0.63 Factor pattern for 2 factors 82 67 39 06 43 16 03 18 24 82 44 43
	3	minimum eigen value criterium overrules number factors to extract specification						
PA, Promax	1	1	-0.8731	–	–	–		v1 v2 v3 v4 v5 v6 Prelim eigennvalues 2.98 0.09 -0.03 -0.07 -0.11 -0.16 Communalities Prior 0.30 0.26 0.50 0.56 0.53 0.54 Factor pattern for I factor 80 77 76 7 4 58 54
Subset 2 (5 variables, q1, q3-q6) (Kaiser's MSA per variable: 0.92 0.86 0.84 0.84 0.84)								
ML, promax	1	1	4580.03*** (106.24)	0.8515	96.24	67.92	0.956	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 5.41 0.04 -0.07 -0.25 -0.32 6.76 0.26 0.01 -0.09 -0.18 Communalities Prior & Final 0.30 0.47 0.56 0.53 0.54 0.34 0.53 0.66 0.61 0.62 Factor pattern for I factor 81 79 78 73 59
	2	1	4580.03*** (0.0759)	0.8515	-1.924	-7.587	1.00	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 5.41 0.04 -0.07 -0.25 -0.32 9.58 0.94 0.00 0.00 -0.01 Communalities Prior & Final 0.30 0.47 0.56 0.53 0.54 0.34 0.61 0.68 0.83 0.60 Factor pattern for I factor 75 68 40 05 40 04 19 23 87 45

Note. ML: Maximum Likelihood; PA: Principal axis; Promax: Oblique rotation; MSA: Kaiser's measure of sampling adequacy; *** highly significant at the 0.1% level

Table 4

Summary of FA Models Evaluated for Goodness of Fit for Subset1 (As Determined With SAS Version 9.2)

Extraction method & rotation	No factors extracted	Scree plot inflection	Bartletts Chi-sq (unadj. Chi-square)	Kasier criterion MSA	Akaike criterion AIC	Schwarz Bayesian Criterion	Tucker Lewis Reliability	Original & (Final) Eigen-values & Communalities, MSA loadings/ q1-q6
Subset 3 (Kaiser's MSA per variable: 0.93 0.92 0.87 0.87 0.86 0.87)								
ML, Promax	1	1	5578.33*** (157.25)	0.8779	139.24	88.31	0.956	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 6.40 0.15 -0.05 -0.11 -0.23 -0.34 7.76 0.30 0.04 -0.01 -0.09 -0.23 Communalities Prior & Final 0.31 0.28 0.51 0.58 0.57 0.56 0.34 0.30 0.55 0.67 0.64 0.64 Factor pattern for I factor 82 80 80 74 59 55
	2		5578.33*** (5.82)	0.8779	-2.18	-24.82	0.998	v1 v2 v3 v4 v5 v6 Prelim & Final eigenvalues 6.40 0.15 -0.05 -0.11 -0.23 -0.34 10.83 1.30 0.06 0.01 -0.02 -0.04 Communalities Prior & Final 0.31 0.28 0.51 0.58 0.57 0.56 0.34 0.31 0.83 0.64 0.73 0.65 Factor pattern for 2 factors 84 69 53 46 06 25 02 16 35 18 87 37
PAF	1		–	0.8779	–	–	–	v1 v2 v3 v4 v5 v6 Prelim eigenvalues 3.08 0.08 -0.03 -0.06 -0.11 -0.16 Communalities Prior & Final 0.31 0.28 0.51 0.58 0.57 0.55 Factor pattern for I factor 80 79 78 75 58 55
Subset 3 (5 variables, q1, q3-q6) [Kaiser's MSA per variable 0.91 0.86 0.84 0.84 0.85]								
ML, promax	1		4873.37*** (104.65)	0.855	94.65	66.35	0.959	v1 v3 v4 v5 v6 Prelim & Final eigenvalues 5.85 0.03 -0.06 -0.24 -0.34 7.36 0.23 0.03 -0.05 -0.21 Communalities Prior & Final 0.31 0.48 0.57 0.56 0.55 0.35 0.53 0.67 0.65 0.65 Factor pattern for 1 factor 82 81 80 73 59
	2		4873.37*** ( )	MSA = 0.855, but process does not converge				v1 v3 v4 v5 v6 Prelim & Final eigenvalues 5.85 0.03 -0.06 -0.24 -0.34 Communalities Prior & Final 0.31 0.48 0.57 0.56 0.55 Factor pattern for 2 factors

Note. ML: Maximum Likelihood; PA: Principal axis; Promax: Oblique rotation; MSA: Kaiser's measure of sampling adequacy; *** Highly significant at the 0.1% level

Table 5

Scale Reliability Testing Results (Calculated with SAS Version 9.2 and SPSS Version 20)

Reliability coefficients	Reliability coefficients and variables on which coefficients were calculated subset 1		subset 2	q1-q6
Subset 1(q1 q3 q5) and subset 2 (q2 q4 q6) SAS version 9.2				
Half split (q1, q3l, q5 vs q2 q4 q6)	q1 q3 q5		q2 q4 q6	q1-q6
Cronbach alpha	0.740		0.744	0.861
Correlation between two halves of scale		0.790		
Spearman Brown				0.883
Subset 1 (q1-q3) and subset 2 (q4-q6) SPSS version 20. N=7185, missing=818				
Half split (q1, q3l, q5 vs q2 q4 q6)	q1-q3		q4-q6	
Cronbach alpha	0.680		0.845	0.861
Correlation between two halves of scale		0.719		
Spearman Brown				0.837
Guttman split half coeff (lambda 4)				0.829

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Author Notes

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