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Are Self-disorders in Schizophrenia Expressive of a Unifying Disturbance of Subjectivity: A Factor Analytic Approach

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***Background and Hypothesis*: The idea that a disorder of the basic self is a central feature in schizophrenia has recently been corroborated in a meta-analysis and a systematic review. Manifestations of the self-disorder can be systematically explored with the Examination of Anomalous Self-Experience (EASE). In this study, we examined the factorial structure of EASE, and diagnostic efficacy of EASE. We hypothesized that EASE will have a monofactorial structure as an instability of the basic self will result in multiple deformations of self-experience which would be meaningfully interrelated as aspects of a unifying Gestalt. *Design*: EASE data for 226 patients suffering from various mental disorders were analyzed under a confirmatory factor analysis framework (CFA). Area under the receiver operating characteristic curve (AUC) was calculated for the total EASE sums, and sensitivity and specificity values for prediction of schizophrenia spectrum disorders based on different cut-offs were obtained. *Results*: Fit indices for the CFA model: RMSEA = 0.036, SRMR = 0.100, CFI = 0.983, TLI = 0.981. The AUC value was 0.946 (95% confidence interval: 0.919–0.974). Sensitivity as well as specificity for schizophrenia spectrum disorders were high. *Conclusion*: Our results lend support for EASE exhibiting a monofactorial structure and the notion of self-disorders as a central phenotypic feature of schizophrenia spectrum disorders.**

Key words: self-disorders/selfhood/basic self/sensitivity/specificity/cut-off/schizophrenia/monofactorial

Introduction

Disorders of selfhood (or self-disorders, SD) were emphasized as central to the schizophrenia spectrum already in the foundational texts on this illness.[1,2] However, SD only reappeared in mainstream psychiatry at the turn of the millennium. A publication in 2005 of a psychometric instrument "Examination of Anomalous Self Experience" (EASE) to explore SD facilitated empirical research in this domain[3] and numerous empirical studies have subsequently been conducted worldwide. A recent systematic review and a meta-analysis have demonstrated that SD selectively hyper aggregate among patients suffering from schizophrenia spectrum disorders compared to patients with other diagnoses.[4,5]

EASE contains 57 items, which are prototypically described, and presupposes a narrative interview aiming at spontaneous verbalization of anomalies of self-experience. The interview is time consuming and requires that the interviewer is familiar with the concept of SD and their potential manifestations.[6]

The creation of EASE was based on empirical psychopathological research in schizophrenia and clinical work with first admission schizophrenia spectrum patients over many years.[7,8] This empirical approach was conceptually framed by a phenomenological perspective.[9–12] In this particular perspective, we considered the single manifestations of the SD as being reflective of a core disturbance of the minimal self (aka ipseity or basic self). The minimal self equals the first personal givenness of all experience: in other words, when I think or perceive I am tacitly aware that it is *me* who is thinking or perceiving. It is a sort of tacit self-presence that permeates all conscious acts. We hypothesized that an instability in the sense of self-presence will result in multiple deformations of self-experience which would overlap each other, imply each other, or interpenetrate each other. One way to entertain such view could be based on a purely clinical-phenomenological perspective

based on the interview experience with schizophrenia patients.[9,12,13] Another approach is psychometric, trying to determine whether the internal structure of the EASE items is monofactorial.

Previously, we have published two preliminary factor analyses equally suggesting a monofactorial distribution of EASE items.[14,15] However, these results were based on insufficient sample size and therefore limited in their validity.

In Copenhagen, several psychopathological studies have been conducted with EASE by members of our research group. Thus, we had an opportunity to pool data from several studies in order to arrive at a larger sample size than previous studies. The main objective of this study is to test the hypothesis that EASE is monofactorial by using confirmatory factor analysis (CFA). The secondary aim is to assess the performance of EASE on prediction of schizophrenia spectrum disorders by calculating the area under the receiver operating characteristic curve, thereby obtaining sensitivity and specificity values for different cut-off levels of EASE.

Methods

Sample

We pooled EASE data from four different samples totaling 226 patients. The methods used to examine the patients were the same in the four studies that only differentiated from each other in their sampling. The patients were between 18 and 65 years old, except from sample 4 in which the age at inclusion had to be between 18 and 40 years. See table 1 for information on age and sex. The patients had to be considered capable of participating in lengthy interviews. This naturally excluded agitated and severely psychotic patients. Additional exclusion criteria were primary or clinically dominating alcohol or substance abuse, organic brain disorder, intellectual disability, and involuntary admission or legal status. All individuals participated upon written consent. The study was approved by the Danish Data Protection Agency and adhered to the ethical principles laid down by the Helsinki Declaration. According to Danish legislation approval from The Danish National Committee on Health Research Ethics is not required for interview studies of this kind. In all four studies the patients were assessed comprehensively for psychopathology and diagnosed according to ICD-10 and DSM-IV or -5[14,16–19]

Sample 1. The sample comprised 63 patients referred by clinicians from out- and in-patient facilities at the Mental Health Services in the Capital Region of Denmark, Copenhagen University Hospital between February 2016 and February 2017. Inclusion criteria were a clinical ICD-10 diagnosis within the schizophrenia-spectrum (schizophrenia, other nonaffective psychosis, and schizotypal disorder) or a clinical diagnosis of obsessive-compulsive disorder (OCD). For details see Ref.[19]

Sample 2. The sample comprised 100 first admission patients from a general psychiatric hospital in Copenhagen, Denmark, Copenhagen University Hospital. The patients were included from June 2009 to December 2010, independently of their clinical diagnosis at admission as long as they did not meet the exclusion criteria.[14] Years later, two participants withdraw their consent leaving the sample with 98 participants. For details see Refs.[14,20]

Sample 3. The sample comprised 30 patients with a main clinical diagnosis of borderline personality disorder (BPD). Patients were recruited from three different outpatient clinics in Mental Health Services, Capital Region of Denmark specifically dedicated to the treatment of BPD. Patients were included between December 2014 and March 2017. For details see Ref.[17]

Sample 4. The sample comprised 35 patients diagnosed with schizophrenia within the last year prior to inclusion. The patients were recruited from three psychiatric outpatient clinics in Region Zealand in Denmark between May 2017 and February 2019. For details see Ref.[18]

Assessment

All interviews were semistructured and conducted with a phenomenological approach.[6]

Table 1. Characteristics of the 4 Samples

	Sample 1	Sample 2	Sample 3	Sample 4	Total
N	63	98	30	35	226
Age (mean)	29.9 (SD = 6.7809)	28.1 (SD = 9.020)	30 (SD = 7.998)	22.1 (SD = 3.932)	27.9 (SD = 8.074)
Sex (M/F)	19/44	33/65	2/28	14/21	68/158
Whole sample EASE score (mean)	14.63 (SD = 7.899)	15.53 (SD = 9.083)	13.90 (SD = 7.680)	25.20 (SD = 9.523)	16.56 (SD = 9.387)
Diagnostic group and mean score for self-disorders					
Nonaffective psychosis	36	45	7	35	123
EASE score (mean)	17.75 (SD = 7.725)	19.53 (SD = 8.751)	16.57 (SD = 8.541)	25.20 (SD = 9.523)	20.46 (SD = 9.132)
Schizotypy	14	29	17	0	60
Self-disorder (mean)	15.14 (SD = 4.167)	17.52 (SD = 6.462)	16.12 (SD = 5.988)	N/A	16.57 (SD = 5.861)
Other mental illness	13	24	6	0	43
Self-disorder (mean)	5.46 (SD = 2.989)	5.63 (SD = 3.449)	4.5 (SD = 2.665)	N/A	5.42 (SD = 3.172)

In the four samples the patients were assessed comprehensively for psychopathology using a checklist consisting of the OPCRIT,[21] items from SADS-L,[22] perceptual disturbances from the BSABS (Bonner Skala Für die Beurteilung von Basissymptomen),[23] and EASE.[3] All patients were diagnosed according to the ICD-10 using a best consensus lifetime diagnosis. For the purpose of the analyses in the present study we divided the diagnoses into 3 groups: (1) schizophrenia and other nonaffective psychosis (jointly called "nonaffective psychosis"), (2) schizotypal disorder, and (3) all other diagnoses combined. For the AUC analyses, groups (1) and (2) were then further combined into *schizophrenia spectrum disorders*. All were assessed for SD using EASE by 4 trained and experienced clinicians and researchers (authors J.N., A.R.R., K.E.S., M.Z.) supervised by the last author (J.P.), whom is the first author of EASE. All raters were reliability trained and experienced in the use of EASE (kappas ranging from 0.74 to 0.94)[16,17,24]

Statistical Analyses

In order to assess the hypothesized monofactorial structure of EASE, we analyzed the data under a confirmatory factor analysis framework (CFA) specified with one latent factor and the individual EASE items as indicator variables.

To the best of our knowledge, the literature does not provide a clear method for determining sample size. In comparison with some source which recommend 3–10 study subjects per variable included in the model or consider a sample size of 200 as *fair*,[25] our sample size of 226 subjects for 57 items is clearly insufficient. We therefore chose to limit the number of variables in the model to approx. 20, yielding a ratio of 11.3 subjects per indicator variable, which seems to be on the conservative side. We adopted two approaches: a clinical and a psychometric. Based on a group discussion, we selected a priori 23 EASE items which we considered to be most reflective of the core disturbance of first-person perspective. This selection was motivated by our clinical and research experience and theoretical phenomenological perspective. Next, we performed a CFA with all the 57 items and selected the 20 items which displayed the highest factor loadings (see Results for details). All these 20 items were among the 23 selected on a rational basis. After performing the main analysis, we performed two sensitivity analyses with 15 and 25 items, respectively, included in the CFA model. The sensitivity analysis models were compared to the main model on indices of model fit as well as on factor loadings for individual items. The goodness of fit indices and their putative thresholds for indicating a good model fit were RMSEA (<0.08), SRMR (<0.08), TLI (≥0.95), and CFI (≥0.95).[26]

Area under the receiver operating characteristic curve (AUC in ROC curve) was calculated for the total EASE sums, and sensitivity and specificity values for prediction of schizophrenia spectrum disorders based on different cut-offs were thus obtained. Because the final CFA model required a truncated version of EASE, containing only 20 of the 57 original items, we repeated the AUC analyses for this shortened version of the scale, in order to assess how this version of EASE compared to the full version.

Two sets of auxiliary analyses were performed. The first was the calculation of *scree plots* using an exploratory factor analysis method (EFA) in order to assess the eigenvalues for different number of potential factors. Scree plots were obtained for the full 57-item EASE and the shortened 20-item version used for the main CFA analysis in the paper. The second set of analyses was additional CFA models using 15 or 25 items, respectively, from EASE scale in order to assess whether the results differed substantially from the main CFA with the 20-item version of EASE scale.

All statistical analysis was performed in R 4.0.2[27] with the package *lavaan* 0.6-7 for CFA modeling[28] and *pROC* for AUC analyses.[27]

Results

A total of 226 participants were included in study. See table 1 for descriptive characteristics and EASE scores of the four contributing samples (note that Sample 4 consists only of patients diagnosed with schizophrenia), and for the whole (pooled) sample. In total 30% were men, 123 were diagnosed with a nonaffective psychosis, 60 with schizotypy and 43 with other mental disorders (including personality disorders, OCD, depression, anxiety). All diagnoses were made according to the ICD-10.

In preparation for the main CFA model, 20 items needed to be selected from the full 57 item EASE because of sample size considerations as outlined in the methods section. We performed a CFA on the full 57 item scale specified as having a single latent variable which all 57 items loaded on. This model did not show a good model fit (RMSEA = 0.028, SRMR = 0.139, CFI = 0.916, TLI = 0.913,), though considering that the sample size is much too small given the number of items in the model, the results are difficult to interpret. We then selected the 20 items with the highest factor loadings from this preliminary CFA and specified the main CFA model with those 20 items, again with one single latent variable which all the items loaded on. This model performed much better in terms of model fit indices (RMSEA = 0.036, SRMR = 0.100, CFI = 0.983, TLI = 0.981), with all fit indices except for SRMR indicating an excellent model fit. The loadings for the 20 items on the latent variable are shown in table 2.

The AUC value for the full 57 item EASE scale was 0.946 (95% confidence interval: 0.919–0.974) which has been considered as *outstanding* performance according to Hosmer and Lemeshow.[29] The sensitivity and specificity

for different cut-off values of the total EASE scale sums are shown in table 3. For the shortened 20 item EASE scale, the AUC was 0.943 (95% confidence interval: 0.914–0.972) and sensitivity and specificity at different cut-off values are shown in table 4. As illustrative examples for the performance of EASE, a score of 10 or more on the full EASE scale indicated 86.9% sensitivity and 86.0% specificity for schizophrenia spectrum disorders, and a score of 3 or more on the 20 item EASE scale indicated 90.7% sensitivity and 90.7% specificity for schizophrenia spectrum disorders.

The scree plots obtained from EFA are shown in figure 1. In the 57-item version of EASE, there is a clearly dominating factor with an eigenvalue of over 8, and three factors with eigenvalues above the traditional cut-off of 1. In the shortened 20-item version, the scree plot indicates a single dominant factor with an eigenvalue of over 5, and no other factors with eigenvalues at 1 or above. These results indicate that the full 57-item EASE scale is characterized by one clearly dominant factor, though a monofactorial structure cannot be ascertained. In contrast, the results from the scree plot support the monofactorial structure of the 20-item EASE scale.

In the sensitivity analysis using CFA models for 15 and 25 items, respectively, the fit measures for the 15-item version were slightly superior to the 20-item version (RMSEA = 0.036, SRMR = 0.088, CFI = 0.990, TLI = 0.989), and the fit measures for the 25-item version were slightly inferior (RMSEA = 0.037, SRMR = 0.105, CFI = 0.973, TLI = 0.971).

Table 2. 20 EASE Items and Their Loadings

EASE Item	Loadings
2.2 Disturbed first person perspective	0.9851
1.2 Loss of thought ipseity	0.9194
2.1 Diminished sense of basic self	0.8024
1.7 Perceptualization of inner thought	0.7775
1.3 Thought pressure	0.7313
2.6 Hyperreflectivity	0.7304
1.1 Thought interference	0.6949
3.2 Mirror-related phenomena	0.6939
4.2 Confusion with one's own specular image	0.6855
1.8 Spatialization of experience	0.6699
2.7 I-Split	0.6675
2.12 Loss of common sense/perplexity/lack of natural evidence	0.6372
3.8 Motor disturbances	0.6177
5.5 "As if" Feeling that the experienced world is not truly real, existing, as if It was only somehow apparent, illusory, or deceptive	0.6205
2.9 Identity confusion	0.6026
2.4 Diminished presence	0.5967
5.2 Feeling of centrality	0.5503
1.4 Thought block	0.5321
4.1 Confusion with the other	0.5268
2.3 Other states of depersonalizations	0.5108

Discussion

The results of the study lend support to the hypothesis that the EASE has a monofactorial structure, or at least one clearly dominant factor, and thus reinforces a notion of SD as facets or aspects of a common disturbance, namely that of the first-person perspective.[13]

As already stated in the introduction, the single EASE items are conceptualized as meaningful clinical phenomena mutually linked by an underlying disturbance. For example, a patient who complains of not being present or truly alive will typically manifest other forms of self-alienation such as hyperreflectivity and a feeling that their thoughts are not fully under their control.

In our analysis, the SD appear highly specific to schizophrenia spectrum disorders. The discussion of the specificity of the SD to the diagnosis of schizophrenia is somehow tautological because the very concept of schizophrenia was originally anchored in the descriptions of self-dissolution or SD. However, present-day definitions of schizophrenia in the diagnostic manuals don't include SD.[1,30–33]

Although we use a 20-item version of EASE in the present statistical analysis, we will be cautious in advocating a reduction of the EASE to 20 items in the exploration of SD. First, there are methodological limitations to this study (see below). Second, the selected 20 items were scored in the context of a performance of the full EASE. It is our consistent experience that exploration of one particular experience (item) very often elicits

Table 3. Results From ROC Analysis on the Full 57 Item EASE Scale

Cut-off	Specificity	Sensitivity
≥2	0.047 (0–0.116)	1 (1–1)
≥3	0.256 (0.14–0.395)	0.989 (0.973–1)
≥4	0.326 (0.186–0.465)	0.978 (0.956–0.995)
≥5	0.442 (0.302–0.605)	0.973 (0.945–0.995)
≥6	0.605 (0.465–0.744)	0.956 (0.923–0.984)
≥7	0.651 (0.512–0.791)	0.951 (0.918–0.978)
≥8	0.698 (0.558–0.837)	0.94 (0.902–0.973)
≥9	0.791 (0.674–0.907)	0.923 (0.885–0.962)
≥10	0.86 (0.744–0.953)	0.869 (0.814–0.918)
≥11	0.977 (0.93–1)	0.814 (0.754–0.869)
≥15	1 (1–1)	0.732 (0.667–0.798)

Table 4. Results From ROC Analysis on the Shortened 20 Item EASE Scale

Total Score	Specificity	Sensitivity
≥1	0.419 (0.279–0.558)	0.973 (0.951–0.995)
≥2	0.698 (0.558–0.837)	0.934 (0.902–0.967)
≥3	0.907 (0.814–0.977)	0.907 (0.863–0.945)
≥5	0.953 (0.884–1)	0.77 (0.71–0.831)
≥6	1 (1–1)	0.699 (0.634–0.765)

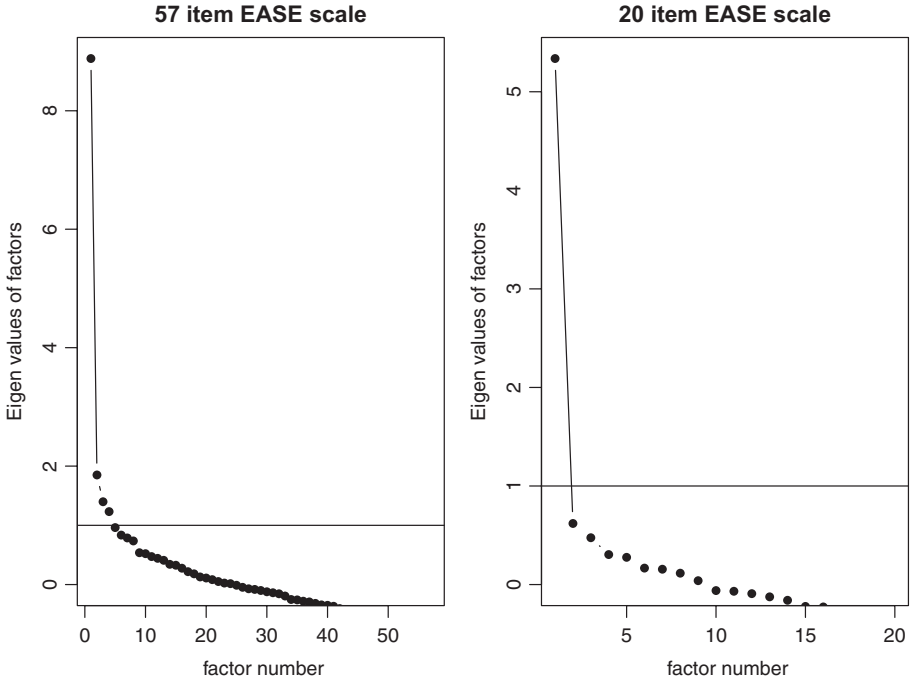

Fig. 1. Screeplots of the 20-item and 57-item EASE.

a description classified under another item. The present results are obtained from the full EASE interview and the results only using 20 items might be different. The interviewer must be familiar with the phenomenological structures of subjectivity and the profound varieties of disorders of these structures. Moreover, the interview must be conducted in a conversational, semistructured way since the experiences in question are often nearly ineffable or only communicable using metaphors in spontaneous self-descriptions. Phenomena of SD are not thing-like entities akin to ripe fruits in the patient's mental life only waiting to be picked by a preformed question in order to come into a full view.[6,20,34] These characteristics of SD necessitate a certain kind of dialogue which allows for such experiences to be expressed and examined. Moreover, the nonused 37 items contribute to descriptions which may be relevant in clinical or therapeutic contexts.

The results generally support a monofactorial structure in the 20-item version because even though the SRMR is above the proposed cut-off, the scree plot indicates that a one-factor solution is adequate. However, the sensitivity and specificity obtained in this study may not be directly applicable to other settings. All interviewers in the component studies were experienced psychiatrists or psychologists trained in same research environment focusing on the pathology of schizophrenia.

Limitations

A major limitation in the present study is the small sample size relative to the number of items in the full EASE instrument. While we were unable to find any clear guidelines regarding sample size and number of items for monofactorial CFA models, it seems clear that a much larger sample size would be needed for a model including all the 57 items. The results indicate that there is indeed one major, clearly dominating factor, but the presence of less pronounced factors cannot be ruled out.

In order to address the aforementioned limitation, we performed a data reduction procedure selecting 20 items (along with 15 and 25, respectively, in the sensitivity analyses). While these models did indeed present a reasonable model fit for a monofactorial factor structure, the items were selected for higher factor loadings in the full model which means that the results can only confirm the presence of the major factor, not rule out the presence of less pronounced factors.

Some of the items in the EASE instrument is also found in nonspectrum patients, such as anxiety, ruminations, hypohedonia, or may be difficult to assess (eg, diminished vitality or passivity mood). Thus, some degree of "noise" in the data is fully expected, and in an exploratory factor analysis paradigm, this might well result in other factors, while in a CFA paradigm, this might result in worse model fit. In sum, the presence of lesser factors cannot be excluded, especially in the 37 items that weren't selected for the 20 item CFA model.

Another limitation is the dominance of schizophrenia spectrum patients (183 out of 226 patients) in the sample. This might affect the factor structure as assessed in this study as well as the results from the AUC analyses. This limits the generalizability of the results and highlights the need to run the same analyses in larger data sets including more patients with nonspectrum diagnoses as well as

healthy controls. However, this is difficult to achieve given the resource demands of assessing SD with EASE.

In conclusion, in this sample of 226 patients we performed a CFA. To ensure enough power for the analysis we tested both a reduced version of EASE (20 items) and the full EASE (57 items). The results point to a monofactorial structure of EASE, or at least one clearly dominating factor. Moreover, we found an excellent performance of the EASE in distinguishing between schizophrenia spectrum patients and nonschizophrenia spectrum patients. Analyses of sensitivity and specificity showed that an EASE score of 10 or more resulted in a sensitivity of 86.9% and 86.0% specificity for schizophrenia spectrum disorders. Our findings are consistent with the overall hypothesis that the different items all articulate a unifying underlying and profound disturbance of subjectivity, though some degree of measurement error that possibly results in the presence of lesser factors cannot be ruled out. Thus, the present study corroborates the notion of SD as a central phenotypic feature of schizophrenia spectrum disorders.

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