

## Self-assessment of negative symptoms – Critical appraisal of the motivation and pleasure – Self-report's (MAP-SR) validity and reliability

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### ABSTRACT

**Objective:** The negative symptom domain remains a major challenge concerning treatment. A valid self-report measure could assist clinicians and researchers in identifying patients with a relevant subjective burden. The Motivation and Pleasure – Self Report (MAP-SR) derives from the CAINS and is supposed to reflect the “amotivation” factor of negative symptoms. We evaluated different aspects of the scale's reliability and validity. This is the first factorial analysis as well as the first analysis of test-retest reliability.

**Methods:** We assessed three samples of subjects with schizophrenia or schizoaffective disorder ( $n = 93$ ) and a broad spectrum of related domains.

**Results:** We explored a 3-, 2- and 1-factor solution (explaining 50.93, 44.85 and 36.18% of variance, respectively). The factor “pleasure and hedonic activity” consists of eight items and was most robust; the factors “social motivation” and “motivation for work” were problematic. Test-retest reliability of the scale was adequate ( $r_5 = 0.63$ ,  $p = .005$ ). Neither the MAP-SR nor the “pleasure and hedonic activities” factor are associated with the PANSS negative symptom scale. There are significant associations with the observer-rated CAINS-MAP scale, experiences of pleasure, and social cognition but none with functional outcome. Discriminant validity could not be established with regards to depression and extrapyramidal symptoms.

**Conclusions:** We found that the MAP-SR is adequate to assess anhedonia but is less suitable when assessing motivation. Therefore, we propose using the “pleasure and hedonic activity scale” to cover the “anhedonia” subdomain. We think the “motivation” part of the instrument requires reconstruction.

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### 1. Introduction

Negative symptoms remain a major challenge in the treatment of schizophrenia [1]. It seems critically important to further our understanding of the symptom complex, try to develop specific treatment strategies for different aspects of negative symptoms, and precisely assess these treatments. To establish negative symptoms as primary endpoint in treatment studies, clear operationalization and construct validation of measuring instruments is needed [e.g. 2].

The first factorial conceptualization of negative symptoms comprised emotional blunting, alogia, avolition, anhedonia, social withdrawal and attention deficits [3]. Most diagnostic instruments aiming to measure negative symptoms inquire these symptom domains. However, recent studies on the factorial structure of negative symptoms suggest that some of the subdomains overlap, while others can be distinguished from each other. Overall, the models converge towards a two-factorial structure with a) “diminished expression” which covers emotional blunting and alogia and b) “amotivation” which contains avolition, anhedonia and social withdrawal. Inappropriate affect, poverty of content of speech, and reduced attention load on a third factor which isn't considered part of the negative symptom domain anymore and seems to correspond to cognitive dysfunction and disorganization [e.g. 2]. “Diminished expression” and “amotivation” correlate moderately (0.47–0.57) [e.g. 2]. A recent factorial analysis of Ahmed, Kirkpatrick [4] found a hierarchical 5-factor model for the Brief Negative Symptom Scale (BNSS) with two second-order factors reflecting “expression” and “amotivation” as well as 5 first-order factors reflecting blunted affect, alogia, anhedonia, avolition, and asociality. The factors

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might respond differently to treatment [e.g. 5,6]: for instance, amotivation seems to improve more with CBT and social skills training, blunted affect with nonverbal treatments (i.e. body-oriented psychotherapy).

The National Institute of Mental Health consensus document [7] called for the development of rationally constructed scales that refer to the two-factorial structure of negative symptoms. Subsequently, the BNSS [8] and the Clinical Assessment Interview for Negative Symptoms (CAINS, Kring, Gur [9]) were developed with this in mind. Both measures have good internal consistency, convergent validity, and discriminant validity [10]. The CAINS consists of two scales: the “motivation and pleasure” scale (CAINS-MAP) strives to measure attitudes, intrinsic motivation and subjective experience of pleasure, the “expression” subscale (CAINS-EXP) asks the rater to assess vocal prosody, gestures, facial expression and quantity of speech [9].

Interestingly, there are only few established self-rating measures in the field of psychosis – the majority of endpoints in clinical studies are derived from interview-based rating scales. However, there are findings indicating that patients with schizophrenia can adequately assess at least parts of the negative symptom complex [11–13]. A valid self-report measure could assess subjective aspects of negative symptoms and assist clinicians and researchers in time-savings identifying patients with a relevant subjective burden. Furthermore, it could enable online research and large scale panel studies with community samples.

As far as we are aware, there are only three specific self-rating negative symptom measures [11]: the Subjective Experience of Negative Symptoms (SENS, Selten, Sijben [14]), the Self-Evaluation of Negative Symptoms (SNS, Dollfus, Mach [13]), and the Motivation and Pleasure - Self Report (MAP-SR, Llerena, Park [12]). The SENS derives from the SANS and is interview-based. Thus, it is quite time-consuming, might be influenced by the interviewer, and also includes items outside the amotivation and expression domains. So far, there is no data on its convergent or discriminant validity. The SNS could be the most up-to-date instrument, since it evaluates emotional range and avolition as well as amotivation and thus covers the five domains of negative symptoms. Factor analysis extracted two factors (“apathy” and “emotional”) that accounted for 75.2% of the variance, but did not clearly differentiate amotivation and expression. Furthermore, its convergent as well as discriminant validity have not yet been evaluated comprehensively. The MAP-SR derives from the “motivation and pleasure” subscale of the CAINS and was developed as a self-rating instrument for avolition in schizophrenia. Its precursor, the Clinical Assessment Interview for Negative Symptoms – Self Report (CAINS-SR, Park, Llerena [15]) also tried to assess expressive deficits but found poor psychometric properties for this subscale. They concluded that self-reports of negative symptoms should focus on the experiential domain. Six of the MAP-SR's items tap social pleasure, recreational pleasure and work pleasure, six feelings and motivations about close, caring relationships, and six motivation and effort to engage in activities (social, recreational and occupational). Looking at the usual procedure in validating new measures, the MAP-SR is still at an early stage. For the original version of the scale, Llerena, Park [12] found good internal consistency (Cronbach's  $\alpha = 0.9$ ) after a scale reduction (18 to 15 items,  $n = 37$ ). Convergent validity to the “motivation and pleasure” scale of the CAINS ( $r = 0.65$ ), social anhedonia ( $r = 0.48$ ) and social engagement ( $r = 0.57$ ) was established. No significant correlations were found for positive symptoms and depression/anxiety as well as general cognitive abilities signifying adequate discriminant validity. Further validation studies were undertaken by Engel and Lincoln [16] for the German version of the MAP-SR ( $n = 50$ ) and Kim, Jang [17] for the Korean MAP-SR ( $n = 137$ ). Both found good internal consistency, strong to moderate convergent validity regarding correlations to the “motivation and pleasure” scale of the CAINS as well as other measures for negative symptoms. No significant correlation with the “expression” subscale of the CAINS was observed in the German study [16], whereas a weak correlation was observed in the Korean study [17]. This partially supports the distinction between these

subdomains; however, Engel and Lincoln [16] discussed a possible lack of commonality between the avolition and expression aspects of negative symptoms. Discriminant validity was established finding no significant correlation with positive symptoms and rater-assessed depression/anxiety; Kim, Jang [17] also found no significant link to neurocognition. Engel and Lincoln [16] found a moderate but significant correlation with the BDI-II. The authors of previous validations called for investigation of temporal stability [12,16]. The MAP-SR was constructed to represent the “amotivation” factor of negative symptoms, but so far there was no empirical analysis of its factorial structure.

The objective of this paper is to evaluate the German version of the MAP-SR regarding factorial structure, validity, and reliability.

## 2. Methods

### 2.1. Participants

Three independently collected samples were used: a “convergent and discriminant validity” sample (sample V), a “test-retest and interrater reliability” sample (sample R) and an additional sample to increase the sample size of the pooled “exploratory factor analysis” sample (EFA sample). Inclusion criteria across all samples were diagnosis of a psychotic disorder according to DSM-IV, age 18 to 65 years, sufficient German language skills, normal or corrected to normal vision and hearing as well as capability to give consent. Exclusion criteria were substance dependence as the leading clinical problem and intellectual disability ( $IQ < 70$ , approximated by level of education). In addition to these common inclusion and exclusion criteria, there were sample-specific differences.

Sample V was used to assess the MAP-SR's convergent and discriminant validity and included 55 outpatients in a stable phase. Since sample V was the baseline examination of a study that aimed to improve negative symptoms using individual and group CBT, the participants had to have relevant negative symptoms (PANSS items N1 to N4, N6, G7 und G16  $\geq 10$ ) and to be in outpatient treatment to be included. Sample V's additional exclusion criteria were severe depressive symptoms (PANSS, G6  $> 4$ ), structural brain lesions, severe extrapyramidal side effects (Modified Simpson-Angus Rating Scale (MSAS)  $> 11$ ), and current psychotherapeutic treatment. The diagnosis of a psychotic disorder according to DSM-IV was established using the Structured Clinical Interview for DSM-IV (SCID-I) for sample V. Sample V's participants received a monetary compensation for their assessment, the other samples did not.

Sample R was primarily used to assess the scale's interrater- and test-retest reliability and comprised 25 patients in the stabilization phase; 19 of whom were still available for the second assessment. In sample R, further assessment was videotaped, so the participants had to agree to this.

The additional sample comprised 15 inpatients and outpatients used to increase the cumulated sample size for the EFA. Sample R and the additional sample were diagnosed with the German Brief Diagnostic Interview of Mental Disorders (Mini-DIPS).

Both sample V and R as well as the additional sample ( $n = 93$  because two subjects partook in sample V and R) were used for exploratory factorial analysis and to assess the internal consistency of the measure. The samples were also used to further assess the CAINS; publication is planned. Demographic and clinical characteristics of the samples can be found in Table 1.

### 2.2. Procedures and measures

The study protocol was approved by the ethics committee of the University of Tuebingen's medical faculty. After giving informed consent, all screened participants that met inclusion criteria were interviewed using the following measures: 1) a structured interview to obtain basic demographic data, 2) the MAP-SR, 3) the PANSS (30-

**Table 1**  
Demographics of sample V, sample R and the EFA-sample.

|                                  | Sample V<br>(n = 55) | Sample R<br>(n = 19) | EFA-sample<br>(n = 93)    |
|----------------------------------|----------------------|----------------------|---------------------------|
| Age (yrs)                        | 40.56 (10.96)        | 36.26 (10.86)        | 38.99 (10.99)             |
| Male (%)                         | 67.3                 | 53                   | 66.7                      |
| Age at 1st hospitalization (yrs) | 25.55 (8.70)         | 22.78 (7.22)         | 25.33 (8.08)              |
| Diagnosis (%)                    |                      |                      |                           |
| Schizophrenia                    | 85.5                 | 74                   | 85                        |
| Schizoaffective disorder         | 14.5                 | 26                   | 15                        |
| PANSS total score                | 64.38 (12.42)        | 64.26 (22.41)        | 64.83 (15.63)<br>(n = 81) |
| CDSS total score                 | 3.67 (3.79)          |                      |                           |
| PSP                              | 59.27 (13.34)        |                      |                           |

Notes. PANSS = Positive and Negative Syndrome Scale; CDSS = Calgary Depression Scale for Schizophrenia; PSP = Personal and Social Performance Scale.

item clinician-rated measure of psychosis symptoms, scored 1 (absent) to 7 (extreme); Cronbach's  $\alpha = 0.74$  to  $0.83$ ) as well as 4) the CAINS (13-item semi-structured interview scored 0 (no impairment) to 4 (severe deficit), Cronbach's  $\alpha = 0.76$ ).

Sample V's assessment took approximately 4 h and included the following additional measures: 1) the Time Budget Measure (TBM; 28-item semi-structured interview, scored 0 (nothing) to 4 (variety of demanding independent activities)) whose structured retrospective assessment of the past week is intended to reflect the actual level of activity, 2) the Calgary Depression Scale for Schizophrenia (CDSS; nine-item structured interview of depressive symptoms in schizophrenia scored 0 (absence) to 3 (highest severity); Cronbach's  $\alpha = 0.79$ ), 3) the Personal and Social Performance Scale (PSP; 100-point single-item rating scale) as a rating of psychosocial functioning as well as 4) the Modified Simpson-Angus Scale (MSAS; 10 items scored 0 (normal) to 4 (severe); Cronbach's  $\alpha = 0.79$ ) assessing extrapyramidal side effects. Additionally, there was a performance assessment of social skills using role play, the Social Skills Performance Assessment (SSPA; two 3-min role-plays (greeting a new neighbor and lodging a complaint with the landlord); performance scored 1 (poor) to 5 (excellent)), which was audio recorded. Furthermore, we assessed cognitive functioning employing 1) the Trail Making Test A and B (TMT-A, TMT-B), 2) the German version of the auditory verbal learning test (VLMT), 3) the Tower of London (ToL) as well as 4) the Wechsler Adult Intelligence Scale's Digit Span task (WAIS-IV-DS). Lastly, the participants were asked to fill in additional questionnaires: 1) the Frankfurt Self-Concept Scales (FSKN; 48 items scored 1 (I strongly agree) to 6 (I strongly disagree); Cronbach's  $\alpha = 0.93$  to  $0.97$ ), assessing components of self-concept including the subscale "appreciation by others" (FSWA) as a measure of social cognition and 2) the Temporal Experience of Pleasure Scale (TEPS; ten items assessing anticipatory, eight consummatory pleasure scored 1 (very false for me) to 6 (very true for me); Cronbach's  $\alpha 0.71$  to  $0.79$ ).

Sample R's initial assessment lasted approximately 1 h during which the CAINS interview was videotaped. 14 (+/−5) days after the first assessment, participants were evaluated again, which took about 25 min.

The additional sample's assessment included further measures and took approximately 1.5 h.

The German versions of the CAINS and TEPS were kindly made available to us by the research group led by Tania Lincoln, Department of Clinical Psychology and Psychotherapy, University of Hamburg. The English versions of the MAP-SR, TBM and SSPA were translated into German by our research group and retranslated by an English native speaker. Differences to the original English versions were discussed among the translators and a consensus was agreed on.

### 2.3. Data analysis

Using SPSS 25.0, we first assessed 1) the MAP-SRs factorial structure, 2) internal consistency including item-level descriptives "α if item deleted", 3) stability of items using test-retest correlations as well as

4) the items' convergent validity with corresponding CAINS items. We tested for normal distribution and homoscedasticity. Pearson or Spearman correlations respectively were used for these correlational analysis and we used Holm-Bonferroni sequential correction to deal with the multiple testing problem. For demographic data a rate of missings  $\leq 10\%$  was not reported. When calculating the scale composites, up to 5% and 10% missing values for assessments and self-ratings respectively were replaced by the scale's mean. Measures with more missing data were excluded from the analysis.

The EFA sample (n = 93) was used for the exploratory factor analysis. Kass and Tinsley [18] recommend  $\geq 5$  participants per variable (here: 15 items,  $n \geq 75$ ); therefore our sample size (n = 93) could be adequate. According to Fabrigar, Wegener [19] communalities  $>0.6$  suggest a sample size  $<100$  may be adequate. The communalities of items 3, 6, 7, 8, 9 and 13 are  $<0.6$ ,  $>0.20$ . Kolmogorov-Smirnov tests indicated non-normally distributed data, but skewness and kurtosis values were all  $<|2|$  and  $<7$  respectively. Visual inspection of inter-item scatter plots suggests sufficient linearity. There were two multivariate outliers identified via Mahalanobis distance at  $\alpha = 0.001$  and 11 at  $\alpha = 0.05$ ; there was no theoretical justification for the exclusion of any outliers. The KMO measure of sampling adequacy was 0.80 suggesting 'great' common variance for factor analysis. The diagonals of the anti-image correlation matrix (Measures of Sampling Adequacy) were all  $>0.5$ . Bartlett's test of sphericity was significant ( $\chi^2(105) = 618.64$ ;  $p < .001$ ), pointing to large enough item correlations for analysis. Concerning multicollinearity, tolerance values were well above 0.10, VIFs  $<3.7$ . However, the determinant of the correlation matrix as well as Haitovsky's test suggests multicollinearity. The greatest inter-item correlation was 0.81 for items 4 and 5; we do not consider this high enough for elimination. Hence, the possible multicollinearity is a limitation of the statistic method.

Initial analysis yielded four eigenvalues  $>1$  (Kaiser criterion), explaining 66.99% of the variance; 40.23% thereof explained by factor 1, 10.44 by factor 2, and 8.40% by factor 3. The scree plot can be found in Fig. 1. Verlicers' Minimum-Average-Partial-Test (1976) suggests one, the 2000-version three factors| for extraction. The theoretical framework for the scales' initial construction suggests one factor - supposedly the "amotivation" or "motivation and pleasure" factor of negative symptoms. Ahmed et al. [4]'s hierarchical model of negative symptoms found three sub factors for amotivation: anhedonia, asociality and avolition. We decided to present the 1-, 2-, and 3-factor-solution to see how MAP-SR fits with those considerations.

The maximum likelihood method is thought to be adequately robust given the preconditions [e.g. 20]. We performed a maximum likelihood factor analysis for one, two and three factors (the two latter with oblique rotation (direct oblimin)). Stevens [21] suggests 0.57 as critical

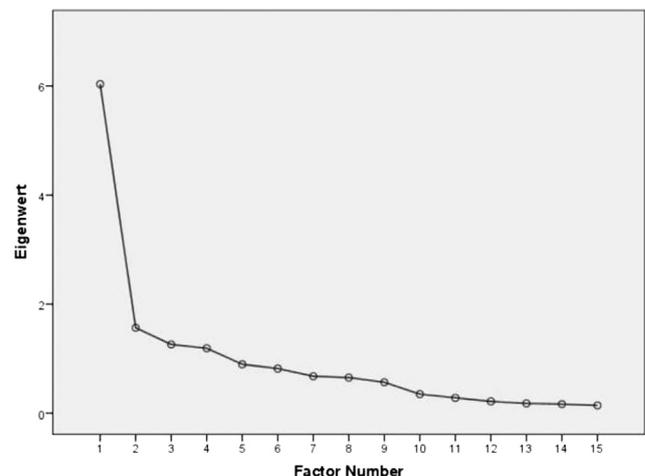


Fig. 1. Scree plot of the exploratory factor analysis.

**Table 2**  
Relevant factor loadings and explained variance for the 1-, 2- and 3-factor solutions.

| Item | 1-factor solution           |                             |                   | 2-factor solution           |                   |                     | 3-factor solution           |                   |                     | Item domain            |
|------|-----------------------------|-----------------------------|-------------------|-----------------------------|-------------------|---------------------|-----------------------------|-------------------|---------------------|------------------------|
|      | Pleasure & hedonic activity | Pleasure & hedonic activity | Social motivation | Pleasure & hedonic activity | Social motivation | Motivation for work | Pleasure & hedonic activity | Social motivation | Motivation for work |                        |
| 1    | <b>0.69</b>                 | <b>0.77</b>                 | −0.21             | <b>0.74</b>                 | 0.23              | 0.39                |                             |                   |                     | Pleasure: social       |
| 2    | <b>0.70</b>                 | <b>0.77</b>                 | −0.25             | <b>0.72</b>                 | 0.26              | 0.41                |                             |                   |                     | Pleasure: social       |
| 3    | <b>0.64</b>                 | <b>0.68</b>                 | −0.25             | <b>0.65</b>                 | 0.26              | 0.33                |                             |                   |                     | Pleasure: social       |
| 4    | <b>0.80</b>                 | <b>0.75</b>                 | −0.51             | <b>0.80</b>                 | 0.51              | 0.38                |                             |                   |                     | Pleasure: hobbies&work |
| 5    | <b>0.83</b>                 | <b>0.80</b>                 | −0.44             | <b>0.86</b>                 | 0.44              | 0.33                |                             |                   |                     | Pleasure: hobbies&work |
| 6    | <b>0.67</b>                 | <b>0.64</b>                 | −0.35             | <b>0.67</b>                 | 0.35              | 0.33                |                             |                   |                     | Pleasure: hobbies&work |
| 7    | 0.24                        | 0.28                        | −0.03             | 0.26                        | 0.04              | 0.13                |                             |                   |                     | Motivation: family     |
| 8    | 0.29                        | 0.31                        | −0.14             | 0.28                        | 0.15              | 0.24                |                             |                   |                     | Motivation: partner    |
| 9    | 0.50                        | 0.47                        | −0.43             | 0.44                        | 0.43              | 0.31                |                             |                   |                     | Motivation: friends    |
| 10   | 0.53                        | 0.39                        | <b>−0.97</b>      | 0.38                        | <b>0.99</b>       | 0.28                |                             |                   |                     | Motivation: social     |
| 11   | 0.51                        | 0.49                        | <b>−0.77</b>      | 0.38                        | <b>0.76</b>       | 0.29                |                             |                   |                     | Motivation: social     |
| 12   | 0.52                        | 0.49                        | −0.38             | 0.45                        | 0.37              | <b>0.83</b>         |                             |                   |                     | Motivation: work       |
| 13   | 0.47                        | 0.48                        | −0.17             | 0.44                        | 0.16              | <b>0.83</b>         |                             |                   |                     | Motivation: work       |
| 14   | <b>0.67</b>                 | <b>0.63</b>                 | −0.42             | <b>0.62</b>                 | 0.42              | 0.46                |                             |                   |                     | Motivation: hobbies    |
| 15   | <b>0.63</b>                 | <b>0.59</b>                 | −0.39             | <b>0.58</b>                 | 0.38              | 0.42                |                             |                   |                     | Motivation: hobbies    |
| PEV  | 36.18                       | 29.04                       | 15.54             | 25.55                       | 19.39             | 5.99                |                             |                   |                     |                        |

Note. PEV: percentage of explained variance; 2- and 3-factor-solution oblique rotation (direct oblimin); bold: relevant factor loadings (≥0.55); cursive: part of factor (for the 2- and 3-factor solution).

value for relevant loadings in sample sizes around 80 and 0.51 for a sample size of 100. Guadagnoli and Velicer [22] consider factors with four or more loadings >0.6 reliable regardless of sample size. We decided to consider loadings ≥0.55 adequately reliable.

Pearson or Spearman correlations respectively were used to evaluate convergent and discriminant validity of the scale and found subscales. Since we consider this part of the analysis exploratory, we did not account for multiple testing.

### 3. Results

#### 3.1. Scale construction/item analysis

##### 3.1.1. Factorial validity

Table 2 highlights the loadings of the 1-, 2- and 3-factor-solutions as well as the percentage of explained variance for each factor (EFA sample, n = 93). The 3-factor-version explains 50.93% of the variation, the 2-factor 44.85% and the 1-factor-solution 36.18%. The factors of the 2-

factor solution correlated with r = −0.41. For the 3-factor solution, “pleasure and hedonic activity” and “social motivation” correlated with r = 0.32, “pleasure and hedonic activity” and “motivation for work” with r = 0.37, and “social motivation” and “motivation for work” with r = 0.45.

##### 3.1.2. Internal consistency of the MAP-SR and subscales

Cronbach’s α for the MAP-SR was 0.87 (EFA sample, n = 81) with no relevant gain in discarding any item (no “α if item deleted” >0.88).

For the subscale “pleasure and hedonic activity” (items 1 to 6, 14 and 15) Cronbach’s α was 0.89 (n = 91) with no “α if item deleted” >0.88, for “social motivation” (items 10 and 11; n = 93) 0.86 and for “motivation for work” (items 12 and 13; n 0 91) 0.82.

##### 3.1.3. Stability

Table 3 shows sub-sample R’s test-retest reliability correlations (n = 19) for the items as well as the MAP-SR composite score (r<sub>s</sub> = 0.63, p = .005). The subscales “pleasure and hedonic activity” had a test-

**Table 3**  
Relevant results of item analysis.

| Item   | Factor loadings ‘1’ | Factor loadings ‘2’    | Factor loadings ‘3’   | Stability | CAINS items/constructs | CAINS-MAP | Missings | Item domain |                        |
|--------|---------------------|------------------------|-----------------------|-----------|------------------------|-----------|----------|-------------|------------------------|
| 1      | <b>0.69</b>         | <b>Factor 1: 0.77</b>  | <b>Factor 1: 0.74</b> | .38       | −.30*                  | a         | −.34*    | 1.1         | Pleasure: social       |
| 2      | <b>0.70</b>         | <b>Factor 1: 0.77</b>  | <b>Factor 1: 0.72</b> | .64*      | −.36***                | a         | −.33*    | 1.1         | Pleasure: social       |
| 3      | <b>0.64</b>         | <b>Factor 1: 0.68</b>  | <b>Factor 1: 0.65</b> | .54*      | −.26                   | b         | −.23     | 2.2         | Pleasure: social       |
| 4      | <b>0.80</b>         | <b>Factor 1: 0.75</b>  | <b>Factor 1: 0.80</b> | .55       | −.16                   | c         | −.22     | 0.0         | Pleasure: hobbies&work |
| 5      | <b>0.83</b>         | <b>Factor 1: 0.80</b>  | <b>Factor 1: 0.86</b> | .29       | −.19                   | c         | −.21     | 0.0         | Pleasure: hobbies&work |
| 6      | <b>0.67</b>         | <b>Factor 1: 0.64</b>  | <b>Factor 1: 0.67</b> | .78***    | −.18                   | d         | −.17     | 1.1         | Pleasure: hobbies&work |
| 7      | 0.24                | Factor 1: 0.28         | Factor 1: 0.26        | .06       | −.45***                | e         | −.34*    | 0.0         | Motivation: family     |
| 8†     | 0.29                | Factor 1: 0.31         | Factor 1: 0.28        | .89***    | −.29                   | f         | −.14     | 10.8        | Motivation: partner    |
| 9      | 0.50                | Factor 1: 0.47         | Factor 1: 0.44        | .48       | −.26                   | f         | −.15     | 1.1         | Motivation: friends    |
| 10     | 0.53                | <b>Factor 2: −0.97</b> | <b>Factor 2: 0.99</b> | .00       | −.02                   | g         | −.05     | 0.0         | Motivation: social     |
| 11     | 0.51                | <b>Factor 2: −0.77</b> | <b>Factor 2: 0.76</b> | .00       | −.09                   | g         | −.11     | 0.0         | Motivation: social     |
| 12     | 0.52                | Factor 1: 0.49         | <b>Factor 3: 0.90</b> | .66*      | −.38***                | h         | −.22     | 2.2         | Motivation: work       |
| 13     | 0.47                | Factor 1: 0.48         | <b>Factor 3: 0.83</b> | .58       | −.42***                | h         | −.18     | 1.1         | Motivation: work       |
| 14     | <b>0.67</b>         | <b>Factor 1: 0.63</b>  | <b>Factor 1: 0.62</b> | .49       | −.27                   | i         | −.26     | 0.0         | Motivation: hobbies    |
| 15     | <b>0.63</b>         | <b>Factor 1: 0.59</b>  | <b>Factor 1: 0.58</b> | .00       | −.26                   | i         | −.21     | 0.0         | Motivation: hobbies    |
| MAP-SR |                     |                        |                       | .63**     |                        |           | −.35**   | 1.1         |                        |

Note. Holm-Bonferroni Sequential Correction was used for correlations per columns excluding the MAP-SR total score. Bold: factor loadings ≥ 0.55. a = CAINS item 3: past week social pleasure; b = CAINS item 4: expected social pleasure; c = CAINS item 8: past week pleasure from hobbies; d = mean of CAINS items 6&9: expected pleasure work, school&hobbies; e = CAINS item 1: family relationships; f = CAINS item 2: friendships; g = mean of CAINS items 1&2: family relationships&friendships; h = CAINS item 5: motivation for work&school; i = 7: motivation for hobbies.

† = possibly inadequate question.

\* = p < .05.

\*\* = p < .01.

\*\*\* = p < .001

**Table 4**  
Convergent and discriminant validity of the MAP-SR and subscales.

| Domain             | Measuring instrument                              | MAP-SR                             | PHA                             | Social motivation                 | Motivation work                 |                                      |                              |               |            |
|--------------------|---|------------------------------------|---------------------------------|-----------------------------------|---------------------------------|--------------------------------------|------------------------------|---------------|------------|
| Negative symptoms  | PANSS Marder Negative                             | $r = -0.12$                        | $p = .385$                      | $r = -0.19$                       | $p = .173$                      | $r_s = -0.03$                        | $p = .837$                   | $r_s = -0.04$ | $p = .758$ |
|                    | CAINS   | $r = -0.26$                        | $p = .065$                      | $r = -0.25$                       | $p = .071$                      | $r_s = -0.04$                        | $p = .749$                   | $r_s = -0.06$ | $p = .647$ |
|                    | CAINS - motivation&pleasure subscale              | <b><math>r = -0.34^*</math></b>    | <b><math>p = .013</math></b>    | <b><math>r = -0.30^*</math></b>   | <b><math>p = .028</math></b>    | $r_s = -0.11$                        | $p = .440$                   | $r_s = -0.19$ | $p = .163$ |
|                    | CAINS - expression subscale                       | $r_s = -0.01$                      | $p = .922$                      | $r_s = -0.07$                     | $p = .600$                      | $r_s = -0.03$                        | $p = .842$                   | $r_s = 0.08$  | $p = .546$ |
| Functional outcome | Temporal Experience of Pleasure Scale (TEPS)      | <b><math>r = 0.46^{**}</math></b>  | <b><math>p &lt; .001</math></b> | <b><math>r = 0.55^{**}</math></b> | <b><math>p &lt; .001</math></b> | $r_s = 0.09$                         | $p = .509$                   | $r_s = 0.22$  | $p = .112$ |
|                    | Psychosocial functioning (PSP)                    | $r_s = 0.13$                       | $p = .131$                      | $r_s = 0.04$                      | $p = .801$                      | $r_s = 0.12$                         | $p = .405$                   | $r_s = 0.16$  | $p = .252$ |
|                    | Level of activity (time budget measure)           | $r_s = 0.10$                       | $p = .467$                      | $r_s = -0.01$                     | $p = .958$                      | $r_s = 0.14$                         | $p = .322$                   | $r_s = 0.15$  | $p = .276$ |
| Social cognition   | Social competence (SSPA)                          | $r_s = 0.16$                       | $p = .245$                      | $r_s = 0.12$                      | $p = .376$                      | $r_s = 0.14$                         | $p = .298$                   | $r_s = 0.11$  | $p = .430$ |
|                    | Appreciation by others (FSKN-WA)                  | <b><math>r = 0.51^{***}</math></b> | <b><math>p &lt; .001</math></b> | <b><math>r = 0.35^{**}</math></b> | <b><math>p = .010</math></b>    | <b><math>r_s = 0.28^*</math></b>     | <b><math>p = .035</math></b> | $r_s = 0.23$  | $p = .092$ |
| Neurocognition     | Index of VLMT, Digit Span, TMT, Tower of London   | $r = -0.05$                        | $p = .744$                      | $r = -0.02$                       | $p = .868$                      | $r_s = -0.03$                        | $p = .822$                   | $r_s = -0.04$ | $p = .787$ |
| Positive symptoms  | PANSS Positive Symptom Scale                      | $r_s = -0.04$                      | $p = .773$                      | $r_s = 0.07$                      | $p = .615$                      | $r_s = -0.21$                        | $p = .128$                   | $r_s = -0.05$ | $p = .712$ |
| Depression         | Calgary Depression Scale for Schizophrenia (CDSS) | <b><math>r_s = -0.34^*</math></b>  | <b><math>p = .014</math></b>    | <b><math>r_s = -0.27^*</math></b> | <b><math>p = .044</math></b>    | <b><math>r_s = -0.37^{**}</math></b> | <b><math>p = .006</math></b> | $r_s = -0.11$ | $p = .436$ |
|                    | PANSS Dysphoric Mood                              | $r = 0.04$                         | $p = .761$                      | $r = 0.09$                        | $p = .539$                      | $r_s = -0.14$                        | $p = .299$                   | $r_s = -0.01$ | $p = .941$ |
| EPS                | Modified Simpson Angus Rating Scale (MSAS)        | <b><math>r_s = 0.30^*</math></b>   | <b><math>p = .029</math></b>    | <b><math>r_s = 0.33^*</math></b>  | <b><math>p = .014</math></b>    | $r_s = 0.21$                         | $p = .126$                   | $r_s = 0.08$  | $p = .556$ |

Note. PHA = pleasure and hedonic activity; PANSS Marder Negative = sum of PANSS items N1 to N4, N6, G7, and G16; PANSS Dysphoric Mood = sum of PANSS items G1 to G4, and G6; EPS = extrapyramidal symptoms;  $r$  = Pearson correlation;  $r_s$  = Spearman correlation; bold = significant p-values; not Holm-Bonferroni sequential corrected.

\* =  $p < .05$ .

\*\* =  $p < .01$ .

\*\*\* =  $p < .001$ .

retest reliability of  $r = 0.57$ ,  $p = .011$ , “social motivation” of  $r = 0.03$ ,  $p = .906$ , and “motivation for work” of  $r_s = 0.75$ ,  $p < .001$ .

#### 3.1.4. Correlation with corresponding CAINS items/constructs

The correlations with corresponding CAINS items or constructs can be found in Table 3 (EFA sample,  $n = 93$ ).

#### 3.1.5. Missings

Analysis of data showed 10.8% of item 8 missing; all other items were missing  $\leq 2.2\%$ ; see Table 3 (EFA sample,  $n = 93$ ).

### 3.2. Convergent and discriminant validity of the MAP-SR

Table 4 shows the MAP-SR's as well as the subscales “pleasure and hedonic activity” “social motivation” and “motivation for work”'s convergent and discriminant validity (sample V,  $n = 55$ ).

## 4. Discussion

This is a comprehensive analysis of the psychometric properties of the MAP-SR and its items. The sample size met methodological requirements for analysis. We assessed a broad spectrum of related domains and – to our knowledge – this is the first factorial analysis as well as the first analysis of test-retest reliability.

#### 4.1. Item analysis and scale construction

Concerning the items, the six MAP-SR items designed to tap “pleasure” seem to be robust: with reliable factor loadings on all factor solutions, hinting at adequate test-retest reliability and convergent validity and with no relevant missing data. For the nine-item “motivation”-part of the scale, there are less sound findings. For the 1-factor-solution, there are two relevant item loadings assessing motivation for hobbies (i.e. hedonic activities which seems close to the pleasure construct) with no significant test-retest correlations as well as no significant correlation with corresponding CAINS items/constructs. For the 2- and 3-factor-solutions, the items tapping motivation for social activities load on a common factor but show less than satisfactory item stability and convergent validity. The items assessing motivation for work constitute one factor of the 3-factor-solution, show good convergent validity with CAINS items/constructs as well as sufficient stability. Three items (7, 8 and 9) do not load reliably on any of the factors. Item 9 does not correspond significantly to the CAINS as well. Item 7 corresponds well to the CAINS and has no missings but is not stable over time. Item 8 has good test-retest reliability but a lot of missing data –

presumably because it asks about partners and could be difficult to answer for those participants not in a romantic relationship.

The MAP-SR set out to represent one of the two subdomains of negative symptoms, the “amotivation” factor. The 1-factor-solution, however, mainly seems to encompass items designed to measure pleasure or anhedonia. The results of the factorial analysis could be interpreted in light of a recent factorial analysis on the rater-assessed Brief Negative Symptom Scale: Ahmed, Kirkpatrick [4] found the best fit for two second-order factors reflecting “expression” and “amotivation” as well as 5 first-order factors reflecting blunted affect and alogia as well as anhedonia, avolition and asociality. For the three-factor-solution Ahmed, Kirkpatrick [4]'s anhedonia could overlap with our “pleasure and hedonic activity”, their avolition with our “motivation for work” and asociality with our “social motivation”. It should be kept in mind, however, that both additional factors only consist of two items, and that those items with rather poor stability and relatively low factor loadings have the greatest loadings on the “pleasure and hedonic activities” factor.

Concerning test-retest reliability, the MAP-SR as well as the “pleasure and hedonic activities” and “motivation for work” factor seem promising. It should be kept in mind that our sample R is small ( $n = 19$ ), and featured in-patients in the stabilization phase.

Overall, we think of the three factors the “pleasure and hedonic activities” factor shows the most promise. Thus, we will discuss the MAP-SR in its entirety and this factor with regards to convergent and discriminant validity.

#### 4.2. Validity analysis

There are interesting results for the validity analysis. Concerning convergent validity, neither the MAP-SR nor the “pleasure and hedonic activities” factor are associated with the PANSS negative symptom scale. It has to be stated, however, that there is criticism on this specific PANSS scale: its seven items include “abstract thinking” and “stereotyped thinking”; both are not considered part of the negative symptom domain anymore. There are significant associations with the observer-rated CAINS-MAP scale, the TEPS (sampling experiences of pleasure) and social cognition but none with functional outcome. This might point to a possible benefit of the instrument: It could measure aspects of the negative symptom domain, which might not be picked up reliably by the observer ratings, namely the area that is far from functional outcome but close to subjective experience: e.g. inner need for company/engagement/activities vs. mere attendance, experienced pleasure vs. observed expression of emotion. It should be mentioned, though, that

there could be some common-method bias, since mainly the other self-rating instruments correlate highly.

Furthermore, there is evidence for overestimation by patients and/or underestimation by therapists when assessing e.g. quality of life (rated more poorly by mental health workers than their clients [23]) or medication side effects (reported more frequently and rated more severe by patients than clinicians [24]). With regard to functional status, Bowie, Twamley [25] compared underestimating, accurate and overestimating patients. Underestimators performed better cognitively and reported more depressive symptoms than overestimators. Accurate raters had better social skills than both other groups. Overestimators were most cognitively and functionally impaired. Over-/underestimation also could play a role when reporting or observing negative symptoms; this may be moderated by factors such as depression, positive symptoms, cognitive functioning, and insight. Selten, Wiersma [26] looked for predictors for discrepancy between patients and psychiatrists concerning negative symptoms. They found that depression impacts discrepancy scores negatively and anxiety positively; there was no association for insight into positive symptoms. Even still, small-scale studies show that patients can correctly self-assess some symptoms of psychosis: Liraud, Droulout [27] found this for individual positive and negative symptoms, except for persecutory delusion and alogia. Hamera, Schneider [28] report that self-report of positive and nonpsychotic symptoms may be more congruent to rater assessment than self-report of negative or deficit symptoms; however, those were only assessed with two items, i.e. emotional withdrawal and motor retardation. Considering all known rater biases in clinical assessments [29], it seems sensible to complement them with self-reports. We consider this even more important in this specific area of research: In patients with difficulties in expressing emotions, self-reports could reflect the inner experience of patients more validly.

Concerning discriminant validity there are problems with regards to depression and extrapyramidal symptoms. The validity sample V comprised outpatients with relevant negative symptoms, but with depressive symptoms below “severe”. There was a very low rate of extrapyramidal symptoms; hence correlation of the MAP-SR and of the “pleasure and hedonic activity” factor and the measure of extrapyramidal symptoms could be due to the low variance in the latter measure. The correlation of the MAP-SR, the “pleasure and hedonic activity” factor and the “social motivation” factor with the CDSS could also be due to the fact that depression and mainly the “amotivation” factor of negative symptoms overlap (loss of interest, anhedonia, and reduced energy) and thus are not trivial to differentiate. In their validation study of the German MAP-SR Engel and Lincoln [16] also found significant correlations with the BDI-II; they contemplated problems in differentiating negative and depressive symptoms when exclusively self-report are utilized. Papsuev, Movina [30] investigated the association between self-rated and clinician-rated motivation, and (i.a.) depression. They also found correlations for self-rated motivational deficits and observer-rated depression and speculate that patients could be less aware of primary negative symptoms, and instead rate secondary negative symptoms caused by depression.

#### 4.3. Conclusion

There are only few self-rated specific negative symptom measures, the MAP-SR being one of them. Other authors already mentioned shortcomings like absence of an expression subscale (thus no coverage of alogia and affective blunting) as well as the challenge to self-evaluate consummatory and anticipatory pleasure [11]. We found that the MAP-SR is adequate to assess anhedonia but is less suitable when assessing motivation. Therefore, we propose to use items 1 to 6 and item 14 and 15 as a “pleasure and hedonic activity scale” covering the “anhedonia” sub domain of the “amotivation” factor of negative symptoms. We think the “motivation” part of the instrument requires reconstruction. It might benefit from new and more items covering different

aspects of motivation. Motivation for social relations and motivation/drive for (work) activities could be surveyed more in detail and might benefit from more straightforward questions. They could try to cover Ahmed, Kirkpatrick [4]’s “asociality” and “avolition”. Pointers to possible item content could be taken from the CAINS’ and the BNSS’ related items and their probe questions. For “sociability” in addition to the two items assessing motivation to be around others and effort to do things with others, the amount and intensity of contact with family and friends, who mainly initiated contact, feelings of closeness to other people and desire for contact could be inquired. For “avolition” items assessing the amount of time spent doing something vs doing nothing and personal initiative and perseverance when doing projects, could complement the two items inquiring motivation for and effort to do things at work or school. The validity and reliability of this resulting scale should be evaluated in further studies.

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