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Distinguishing schizophrenia spectrum from non-spectrum disorders among young patients with first episode psychosis and at high clinical risk: The role of basic self-disturbance and neurocognition

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ABSTRACT

Introduction: The distinction between the schizophrenia spectrum and other types of disorders may be clinically relevant in terms of its predictive validity as suggested by studies showing schizophrenia spectrum patients have more unfavourable outcomes compared to other psychotic disorders. The present study aimed to investigate whether basic self-disturbances and neurocognitive processes that have been linked to psychosis risk have discriminative power for schizophrenia spectrum disorders in patients presenting with first episode psychosis (FEP) and at ultra-high risk for psychosis (UHR).
Methods: 38 FEP patients, 48 UHR patients, and 33 healthy controls were assessed for basic self-disturbances (using the Examination of Anomalous Self-Experience, EASE, interview), source monitoring and aberrant salience (behavioural tasks to measure neurocognitive constructs). Clinical groups were divided into patients with schizophrenia spectrum disorders and those with other non-spectrum disorders and were further compared on measures controlling for symptom severity and age.
Results: Basic self-disturbances distinguished schizophrenia spectrum from non-spectrum disorders in the 'FEP only' sample, $F = 19.76$, $p < 0.001$, $\eta^2_{partial} = 0.37$, and also in the combined UHR/FEP sample, $F = 23.56$, $p < 0.001$, $\eta^2_{partial} = 0.22$. Additionally, some processes related to source monitoring deficits were elevated in schizophrenia spectrum disorders. In contrast, the two groups (schizophrenia spectrum vs other diagnoses) performed similarly in aberrant salience tasks. Comparable results were obtained for analyses performed with an FEP/UHR combined sample and the 'FEP only' sample.
Discussion: Basic self-disturbances at the phenomenological level and source monitoring deficits on the neurocognitive level may be useful in identifying risk of schizophrenia spectrum disorders at the earliest clinical presentation.

1. Introduction

Psychotic disorders are a heterogeneous group of disorders with different aetiological and developmental trajectories (Knoll et al., 1998; Fusar-Poli et al., 2016). Nosological distinctions have been made between affective and non-affective, as well as between schizophrenia spectrum and other psychoses (Walterfang et al., 2009; Raballo et al., 2011; Fusar-Poli et al., 2017; Raballo et al., 2018). However, there is ongoing debate regarding the very early concept of 'unitary psychosis' (Craddock and Owen, 2007), which posits that psychosis, even if it has different clinical presentations, is an expression of the same (brain) disease. Some authors have found this argument to be at least partially

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supported by research showing genetic overlap between schizophrenia and affective psychosis (e.g., bipolar disorder) (Schulze et al., 2014). To date, however, there is no general consensus regarding this hypothesis. In general, it has been shown that patients with schizophrenia spectrum psychoses have poorer functional outcomes (Velthorst et al., 2017), more persistent psychotic symptoms and a greater likelihood of relapse (Pelayo-Terán et al., 2017) compared to patients diagnosed with other psychoses. Given these less favourable outcomes, it is important to better understand potential early markers of a schizophrenia spectrum diagnosis that may be clinically investigated when patients present with a first episode of psychosis or are at high clinical risk of developing psychosis. Differences in phenomenological characteristics of early stages of schizophrenia spectrum disorders may not only have pragmatic value for clinicians, but may also inform neurobiological studies. Indeed, subtle experiences investigated at the phenomenological level may reflect differences in mental states that mirror early neurobiological disruptions that are specific to the schizophrenia spectrum (Schultze-Lutter et al., 2016; Schultze-Lutter et al., 2018). Therefore, investigation of early indicators of schizophrenia spectrum disorders may be informative for further studies of aetiological and nosological aspects of psychotic disorders.

Arising from empirical research and philosophical concepts, phenomenologically-oriented researchers have suggested basic self-disturbance as a core phenotypic marker of schizophrenia spectrum disorders (Nelson et al., 2013; Nelson et al., 2014a, 2014b; Noorgaard and Parnas, 2014; Parnas and Henrikson, 2014). The 'basic' self refers to an automatic, pre-reflective awareness of selfhood, of experiences being one's own without need for introspection/reflection and of an implicit sense of immersion in the shared social world (Nelson et al., 2012; Nelson et al., 2013; Noorgaard and Parnas, 2014). Also referred to as the 'minimal' self or 'ipseity', the basic self is the first-person quality, the sense of "I-me-mineness" that underlies all experience (Nelson et al., 2014a, 2014b; Noorgaard and Parnas, 2014). Basic self-disturbance, which typically emerges in late childhood and early adolescence (Moller and Husby, 2000; Parnas and Henrikson, 2014; Raballo et al., 2018) is an instability or disruption of this "ground level" of self-experience. It is characterised by a number of experiential anomalies including states of dissociation and depersonalisation, diminished transparency of conscious life, hyper-reflexivity, unstable or ill-defined perceptual and cognitive experience, and perceived sense of alienation from the shared social world (Parnas et al., 2005; Raballo, 2012; Henrikson and Parnas, 2014; Noorgaard and Parnas, 2014; Raballo et al., 2018).

Empirical studies indicate that basic self-disturbances, generally assessed using the Examination of Anomalous Self-Experience (EASE) instrument (Parnas et al., 2005), aggregate in the schizophrenia spectrum (Parnas and Henrikson, 2014) compared to other diagnostic groups such as obsessive-compulsive disorder (Rasmussen et al., 2019), Asperger syndrome (Nilsson et al., 2019), and borderline personality disorder (Zandersen and Parnas, 2019)). Studies have tended to identify basic self-disturbances as being temporally stable, indicating a trait-like status (Nordgaard et al., 2017) as well as correlating with schizophrenia psychopathology dimensions, and longitudinally predicting onset of schizophrenia-spectrum disorders.

Basic self-disturbances have also been found to discriminate schizophrenia spectrum disorders from bipolar disorder and other psychotic disorders (Haug et al., 2012). Raballo (Raballo, 2012) found that participants diagnosed with non-schizophrenia spectrum psychotic disorders exhibited lower levels of basic self-disturbance compared with schizophrenia and schizotypal patients. These data also showed that basic self-disturbances aggregated in patients with schizophrenia spectrum disorders, with no differences between schizophrenia and schizotypal disorders (Nelson et al., 2008). These findings suggest that basic self-disturbances are experiential features of schizophrenia spectrum disorders irrespective of psychotic status, i.e., are present in those without diagnostic-level psychotic symptoms.

A previous study conducted by our group (Nelson et al., 2013) on a small sample of eighteen first episode psychosis (FEP) patients found that basic self-disturbance, as assessed using the EASE, was significantly more pronounced in patients with a schizophrenia spectrum diagnosis compared with first episode patients with other psychoses. The findings were consistent with the studies outlined above (Nelson et al., 2008; Raballo et al., 2011; Raballo, 2012; Noorgaard and Parnas, 2014) and complemented the findings of our earlier study (Nelson et al., 2012) in which basic self-disturbance was found to predict the onset of psychotic disorder over a 1.5 year follow up period in an ultra-high risk (UHR) for psychosis sample. In this study, data also indicated that basic self–disturbance was higher in UHR patients with schizotypal or schizoid personality disorder, without threshold-level psychotic symptoms, compared to the rest of the UHR sample.

Although there has been some indication that aspects of basic self-disturbance may also be present in other disorders (e.g., panic disorder (Madeira et al., 2017) and depersonalisation disorder (Sass et al., 2013)), the empirical literature to date indicates that it is especially characteristic of schizophrenia spectrum disorders. Therefore, detecting basic self-disturbance may be of value in early detection and diagnostic clarification, as well as for predicting clinical and functional outcomes (Nelson et al., 2012). Importantly, in light of recent research showing neural correlates of these self-disturbances (Bonoldi et al., 2019), it is possible that the observed differences in clinical profile may potentially pinpoint characteristic brain mechanisms involved in different disorders.

Nelson and colleagues hypothesized that neurocognitive disturbances, in particular source monitoring deficits (Nelson et al., 2014a) and aberrant salience (Nelson et al., 2014a), may be potential mechanisms associated with basic self-disturbances. Source monitoring deficits refer to difficulties distinguishing between the origins of endogenous (i.e., internally or self-generated) and exogenous (i.e., externally or other generated) stimuli (Nelson et al., 2014a). Aberrant salience refers to failed suppression of attention to irrelevant or familiar information or environmental stimuli (or, to reverse the terminology, excessive attention to information that is irrelevant or highly familiar), leading to unusual salience or prominence of objects and associations (Nelson et al., 2014a). Source monitoring deficits and aberrant salience are two neurocognitive processes consistently linked to psychosis and its risk states (Gawęda et al., 2018). If basic self-disturbance is characteristic of schizophrenia spectrum disorders, and source monitoring deficits and aberrant salience are associated with basic self-disturbance, then we would expect source monitoring deficits and aberrant salience to aggregate in schizophrenia spectrum disorders.

The primary aim of the current study was to assess whether basic self-disturbance is more prominent in first episode psychosis (FEP) patients with schizophrenia spectrum diagnoses compared with FEP patients with other psychotic disorders, which would replicate our previous findings in an independent sample (Nelson et al., 2013). A secondary aim was to determine whether early psychosis patients with schizophrenia spectrum diagnoses, irrespective of severity of psychotic symptoms (i.e. UHR and FEP combined), display higher levels of basic self-disturbance compared with early psychosis patients without schizophrenia spectrum diagnoses. As a tertiary aim, we tested whether source monitoring and aberrant salience measures discriminated schizophrenia spectrum disorders from non-schizophrenia spectrum disorders.

2. Method

2.1. Setting and sample

The study was conducted at Orygen Youth Health (OYH), a public mental health service for young people aged between 15 and 25 years living in north-western metropolitan Melbourne, Australia. The sample consisted of FEP and UHR patients, and a community sample of

participants with no diagnosed mental illness (healthy controls). FEP participants were recruited from the Early Psychosis Prevention and Intervention Centre (EPPIC) continuing care team. Inclusion criteria for the FEP group consisted of daily positive psychotic symptoms for longer than a week, as per previous research (Breitborde et al., 2009). UHR participants were recruited from the Personal Assessment and Crisis Evaluation (PACE) clinic. Inclusion in the UHR group required the young person to meet criteria for at least one of the three UHR groups (Yung et al., 1996): Attenuated Positive Psychotic Symptoms (APS), Brief Limited Intermittent Psychotic Symptoms (BLIPS) and/or trait vulnerability groups (schizotypal personality disorders or a first degree relative with a psychotic disorder). All groups must have experienced a significant decline in functioning or have had chronic low functioning over the year prior to referral. Exclusion criteria for both groups consisted of an organic cause of the clinical presentation, presence of an intellectual disability (IQ < 70) as documented in the individual's medical history, and lack of proficiency in English. An additional exclusion criterion for the UHR group was a past or current diagnosis of a psychotic disorder. The healthy control participants were matched for sex and age to the clinical groups and were recruited using online advertisements. The sample was recruited between March 2014 and January 2018. The study was reviewed and approved by the local research and ethics committee and participants provided written informed consent. Other data and analyses from this sample have previously been published by this group (Nelson et al., 2019a; Nelson et al., 2019b; Nelson et al., 2020).

2.2. Measures

All measures were administered by Honours-level, psychology-trained Research Assistants supervised by BN.

2.2.1. Demographics

Demographic information was collected using an interviewer-administered questionnaire.

2.2.2. Basic self-disturbance

Basic self-disturbance was assessed using the Examination of Anomalous Self-Experience (EASE) (Parnas et al., 2005). The EASE is a symptom checklist for semi-structured phenomenological exploration of subjective anomalies associated with basic self-disturbance. It consists of 57 items in 5 domains: (1) cognition and stream of consciousness (17 items); (2) self-awareness and presence (18 items); (3) bodily experiences (9 items); (4) demarcation/transitivism (5 items); and (5) existential reorientation (8 items). The EASE has been found to have good to excellent internal consistency (Cronbach's alpha above 0.87) and an overall interrater correlation above 0.80 (Spearman's rho, $P < 0.001$) (Moller et al., 2011).

2.2.3. Source monitoring

Source monitoring was assessed using three tasks:

Action Memory Task (AMT) (Moritz et al., 2009). During the learning phase, participants are presented with either verbal instructions or nonverbal pictograms cuing actions. Instructions set in a green frame have to be performed, whereas action instructions set in a red frame have to be imagined but not performed. Eighteen verbal and 18 nonverbal action instructions are presented, requiring the participant to either perform or imagine each item (9 items each). Before the recognition phase, a filler task is administered for about 10 min. Then, participants are required to indicate whether the corresponding instruction had appeared either as text (verbal), pictogram (nonverbal), or was new (presentation type differentiation), whether or not the action was performed or imagined (self-monitoring), and graded for confidence (unsure or sure). All items are randomized both in the learning and recognition phase. The experiment was programmed in MATLAB (MathWorks, Natick, MA).

Word Recognition Test (Giráldez et al., 2000). A series of 30 words are presented to participants on a computer screen. For each word, participants are required to type a single word on the keyboard that is conceptually related to the word displayed on the screen. In the second phase of the task, participants are presented with all the words (those generated by the computer and those generated by the participant) in a random order, and participants are asked to identify whether each word was generated from the computer (external origin) or generated by themselves (internal origin). Source monitoring deficits are measured by two types of errors: 1) Internal Attribution Errors (when participants inaccurately identify self-generated words to be computer-generated) and 2) External Attribution Errors (when participants inaccurately identify computer-generated words to be self-generated). Higher scores indicate greater source monitoring deficits.

Temporal Binding Task (Haggard et al., 2002; Moore and Haggard, 2008). This task requires participants to view a Libet clock hand rotating (one rotation = 2560 ms) on a computer screen. The clock face is marked with conventional intervals (5, 10, 15, etc.). The initial position of the clock hand is randomly placed. Participants are asked to press a key while the clock hand is rotating and then estimate at what time on the clock face they pressed the key. 50% of keypresses result in an audible tone. Previous research (Haggard et al., 2002) indicates that when the keypress results in a tone there is a tendency among healthy participants to estimate the timing of the keypress closer to the tone than actually occurred, referred to as an "intentional binding" of actions and their effects in conscious awareness. This provides an index of implicit control over one's actions (i.e., agency), which we take to be dependent on source monitoring because agency assumes a sense of the origin of actions. The score used for analysis was the difference between the estimated time of the keypress and actual time of the keypress for trial type 1 (keypress followed by beep) and trial type 2 (keypress not followed by a beep). Positive scores indicate that participants estimated their action (keypress) to occur later when it was followed by a sensory consequence (beep) compared to when it was not – this was taken as evidence of temporal binding. Conversely, negative scores indicate that participants estimated their action to occur earlier when it was followed by a sensory consequence compared to when it was not – this was taken as the inverse of sensory binding.

2.2.4. Aberrant salience

Aberrant salience was measured using two tasks:

Salience Attribution Test (SAT) (Roiser et al., 2009; Roiser et al., 2010). The SAT is a reward-based speed-response game, which measures responses to task-relevant and task-irrelevant cue features. The SAT provides measures of adaptive (relevant) and aberrant (irrelevant) motivational salience on the basis of visual analogue scale ratings (explicit salience) and reaction times (implicit salience). The test has been used in a number of previous studies to measure aberrant salience (Roiser et al., 2009; Roiser et al., 2010; Roiser et al., 2012).

Babble Task (Hoffman et al., 2007). In this task participants are presented with verbal babble (meaningless syllables) via headphones and asked to repeat any words or phrases that they perceive. The extent to which spurious messages are extracted from meaningless noise (i.e., meaningless stimuli being endowed with significance) is thought to index aberrant salience and has previously been found to predict onset of psychosis in a UHR sample (Hoffman et al., 2007). The task measures both number of words/phrases heard and length of phrases heard (higher scores corresponding to greater aberrant salience).

2.2.5. DSM-IV diagnoses

DSM-IV diagnoses were established using the Structured Clinical Interview for DSM-IV (SCID) [25], a structured interview based on the DSM-IV. The full axis I instrument was used, as well as the schizotypal, paranoid and schizoid sections of the SCID-II. Schizophrenia,

schizophreniform, schizoaffective disorder, schizotypal, paranoid and schizoid personality disorders were categorised as schizophrenia spectrum disorders.

2.2.6. UHR status

The Comprehensive Assessment of At-Risk Mental States (CAARMS) (Yung et al., 2005) was used to assess UHR status (Yung et al., 2003). The CAARMS is a comprehensive semi-structured interview designed to assess a wide range of psychiatric symptoms associated with the prodromal phase of psychotic disorders.

2.2.7. Functioning

Psychosocial functioning was assessed using the Social and Occupational Functioning Scale (SOFAS) (Goldman et al., 1992).

2.2.8. General psychopathology

The Brief Psychiatric Rating Scale (BPRS) was used to assess general psychopathology in both UHR and FEP groups. The 24-item BPRS is a clinical measure in which items are rated on a 7-point Likert scale from "not present" to "extremely severe" (Ventura et al., 1993).

2.3. Statistical analysis

All analyses were conducted for the FEP group alone and for the FEP and UHR groups combined. The purpose of this second analysis (FEP and UHR combined) was to test whether the pattern of findings found in FEP held irrespective of psychotic symptom status, i.e., including schizophrenia spectrum cases who do not have threshold-level psychotic symptoms, such as schizotypal and schizoid personality disorders. Analyses consisted of comparing participants with schizophrenia spectrum diagnoses versus other diagnoses.

ANCOVAs were conducted to assess group differences (HC, schizophrenia spectrum cases, non-schizophrenia spectrum cases) on basic self-disturbance and on the neurocognitive measures, controlling for differences in symptom severity and age. When a significant overall group effect was observed, post-hoc analyses were used to compare each clinical group (schizophrenia spectrum and other) to healthy controls, as well as to compare schizophrenia spectrum with non-spectrum cases.

3. Results

3.1. Participants

The total sample comprised 120 participants. For the FEP-only group, 39 were included: 17 with schizophrenia spectrum diagnoses and 22 with other, non-schizophrenia spectrum disorders. The UHR/FEP combined group consisted of 86 participants: 21 with schizophrenia spectrum diagnoses (4 of which were in the UHR group) and 65 with non-schizophrenia spectrum disorders. Diagnoses are presented in Table 1. 34 healthy individuals served as a non-clinical control group.

Table 1
Schizophrenia spectrum and non-schizophrenia spectrum primary diagnoses in the UHR and FEP groups.

	FEP	UHR
Schizophrenia spectrum	Schizophrenia ($n = 8$) Schizophreniform ($n = 9$)	Paranoid personality disorder ($n = 2$) Schizotypal personality disorder (n = 2)
Non-schizophrenia spectrum	Mood disorder with psychotic features (n = 9) Psychosis not otherwise specified ($n = 13$)	Anxiety disorder (n = 9) Mood disorder ($n = 30$) Substance use disorder (n = 2) No SCID diagnosis (n = 2)

Table 2
Sample demographics (age and sex) and clinical features (FEP group alone).

	Whole sample ($n = 39$)	Schizophrenia spectrum ($n = 17$)	Non-spectrum disorders ($n = 22$)
Mean age (years)	19.87 (SD = 3.25)	18.41 (SD = 2.92)	21.00 (SD = 3.09)
Sex			
Male	17 (43.6%)	5 (29.4%)	12 (54.5%)
Female	21 (53.8%)	11 (64.7%)	10 (45.5%)
Missing		1 (5.9%)	
BPRS total scores	51.81 (SD = 13.50)	58.31 (SD = 10.46)	46.86 (SD = 13.65)

Demographic and clinical data (age, sex and BPRS total scores) for the five groups of interest (FEP schizophrenia spectrum participants, FEP non-spectrum, UHR/FEP combined schizophrenia spectrum, UHR/FEP combined non-spectrum and HC) are presented in Tables 2, 3 and 4. Further demographics and clinical information, as well as correlations between self-disturbance scores (EASE) and neuro-measures, have been reported in a previous publication based on this dataset (Nelson et al., 2020). Group differences on symptom severity and age were analysed between individuals with schizophrenia spectrum and non-spectrum disorders from a combined sample including all three cohorts - UHR, FEP and healthy controls. The groups (spectrum, non-spectrum and HC) differed on BPRS, $F_{(2,120)} = 103.948$, $p < 0.001$, $\eta^2_{partial} = 0.64$. Bonferroni post-hoc analyses indicated that the schizophrenia spectrum disorders group had significantly more severe symptoms compared with the non-spectrum group in a combined UHR/FEP cohort ($p = 0.001$). Both schizophrenia spectrum and non-schizophrenia spectrum clinical groups differed from healthy controls on BPRS ($p < 0.001$). Groups also differed on age, $F_{(1,120)} = 6.77$, $p = 0.002$, $\eta^2_{partial} = 0.104$. Bonferroni post-hoc comparisons revealed that the schizophrenia spectrum group were younger than the non-spectrum psychosis group ($p = 0.06$) and controls ($p = 0.001$). No differences between the non-spectrum psychosis group and healthy controls emerged ($p = 0.15$).

3.2. Aims

3.2.1. Aim 1: Schizophrenia spectrum vs other disorders on basic self-disturbance (FEP-only analysis)

For the FEP-only sample an ANCOVA was performed controlling for BPRS total score and age (Table 5). FEP patients with and without schizophrenia spectrum disorders had significantly higher EASE scores than healthy controls (EASE Total score, $F_{(2,66)} = 47.78$, $p < 0.001$,

Table 3
Sample demographics (age and sex) and clinical features (UHR and FEP combined sample).

	Whole sample ($n = 86$)	Schizophrenia spectrum ($n = 21$)	Non-spectrum disorders ($n = 65$)
Mean age (years)	19.56 (SD = 3.03)	18.33 (SD = 2.78)	19.95 (SD = 3.02)
Sex			
Male	35 (40.7%)	8 (38.1%)	27 (41.5%)
Female	49 (57.0%)	13 (61.9%)	36 (55.4%)
Missing	2 (2.3%)		2 (3.1%)
BPRS total scores	50.45 (SD = 10.77)	56.48 (10.88)	48.51 (SD = 10.06)

Table 4
Sample demographics (age and sex) and clinical features (Healthy Controls).

	Healthy control sample ($n = 34$)
Mean age (years)	21.09 (SD = 1.85)
Sex	
Male	9 (26.5%)
Female	25 (73.5%)
BPRS total scores	25.59 (SD = 2.46)

Table 5
Group differences on self-disturbances (FEP group alone).

	HC - healthy controls ($n = 34$)	SS - schizophrenia spectrum ($n = 16$)	NS – non spectrum Disorders ($n = 21$)	ANCOVA[a] $F(2, 66) =$	Post-hoc test[a]
Self-disturbances (EASE domains)					
Cognition and streaming of consciousness	3.85 (3.67)	40.94 (4.42)	27.05 (11.27)	36.07, $p < 0.001$, $\eta^2_{partial} = 0.52$	SS > NS, $F = 12.04$, $p = 0.001$, $\eta^2_{partial} = 0.26$ SS > HC, $F = 109.40$, $p < 0.001$, $\eta^2_{partial} = 0.70$ NS > HC, $F = 29.82$, $p < 0.001$, $\eta^2_{partial} = 0.24$
Self-awareness and presence	1.12 (1.47)	32.63 (9.07)	18.10 (11.16)	21.30, $p < 0.001$, $\eta^2_{partial} = 0.39$	SS > NS, $F = 9.11$, $p = 0.005$, $\eta^2_{partial} = 0.22$ SS > HC, $F = 54.99$, $p < 0.001$, $\eta^2_{partial} = 0.54$ NS > HC, $F = 16.18$, $p = 0.001$, $\eta^2_{partial} = 0.24$
Bodily experiences	0.21 (0.72)	13.50 (5.38)	6.48 (5.36)	14.33, $p < 0.001$, $\eta^2_{partial} = 0.30$	SS > NS, $F = 8.32$, $p = 0.007$, $\eta^2_{partial} = 0.20$ SS > HC, $F = 18.43$, $p < 0.001$, $\eta^2_{partial} = 0.29$ NS > HC, $F = 11.63$, $p = 0.001$, $\eta^2_{partial} = 0.19$
Demarcation/transitivism	0.03 (0.17)	5.31 (5.07)	3.00 (4.13)	7.72, $p = 0.001$, $\eta^2_{partial} = 0.19$	SS > NS, F = 4.30, $p = 0.046$, $\eta^2_{partial} = 0.11$ SS > HC, $F = 10.37$, $p = 0.002$, $\eta^2_{partial} = 0.18$ NS > HC, $F = 8.66$, $p = 0.005$, $\eta^2_{partial} = 0.14$
Existential reorientation	0.12 (0.41)	10.56 (4.97)	6.29 (4.69)	14.92, $p < 0.001$, $\eta^2_{partial} = 0.31$	SS > NS, $F = 5.92$, $p = 0.02$, $\eta^2_{partial} = 0.15$ SS > HC, $F = 10.04$, $p = 0.003$, $\eta^2_{partial} = 0.18$ NS > HC, $F = 26.86$, $p < 0.001$, $\eta^2_{partial} = 0.34$
EASE total	5.32 (4.95)	102.94 (12.94)	60.90 (27.13)	47.78, $p < 0.001$, $\eta^2_{partial} = 0.59$	SS > NS, $F = 19.76$, $p < 0.001$, $\eta^2_{partial} = 0.37$ SS > HC, $F = 173.79$, $p < 0.001$, $\eta^2_{partial} = 0.79$ NS > HC, $F = 35.94$, $p < 0.001$, $\eta^2_{partial} = 0.41$

Note:
[a] BPRS total scores and age were controlled for.

$\eta^2_{partial} = 0.59$). Schizophrenia spectrum patients had more severe basic self-disturbance than non-spectrum FEP patients (EASE Total score, $F_{(1,33)} = 19.757$, $p < 0.001$, $\eta^2_{partial} = 0.374$) with higher scores on all EASE domains.

3.2.2. Aim 2: Schizophrenia spectrum vs other disorders on basic self-disturbance (UHR/FEP combined analysis)

For the combined UHR/FEP sample an ANCOVA controlling for BPRS total score and age was performed (Table 6). Results suggested that schizophrenia spectrum cases rated significantly higher than non-spectrum cases on EASE total score and on four out of five EASE domains. The clinical groups did not differ on the transitivism/demarcation domain. Post-hoc tests comparing groups revealed that both the schizophrenia spectrum group and the non-spectrum disorders group differed from healthy controls on all EASE domains. Similar results were obtained in a comparison between the non-spectrum disorders group and healthy controls with p values ranging from 0.02 and $\eta^2_{partial} = 0.06$ for the transitivism/demarcation domain to $p < 0.001$ and $\eta^2_{partial} = 0.16$ for the existential reorientation domain. The analyses were also conducted with dichotomous EASE scores (for FEP-only and UHR/FEP combined) with the same pattern of results.

3.2.3. Aim 3: Schizophrenia spectrum vs other diagnoses on source monitoring and aberrant salience

Data on neurocognitive measures were available for 48 UHR patients, 29 FEP patients and 33 healthy controls (90.2% of the total sample). For the analysis in the FEP-only group, 10 and 13 patients in each group (schizophrenia spectrum vs other disorders) were available. In the combined UHR/FEP sample, 12 patients with schizophrenia spectrum and 52 patients with non-spectrum disorders were available.

First, an ANCOVA analysis adjusting for BPRS total score and age on the FEP-only sample was conducted. Both clinical groups (schizophrenia spectrum and non-spectrum) differed significantly from healthy controls on some of the neurocognitive measures (see Table 7). Schizophrenia spectrum patients had significantly lower temporal binding, $F_{(1,60)} = 8.26$, $p = 0.01$, $\eta^2_{partial} = 0.30$, forgot performed actions more often, $F_{(1,60)} = 15.91$, $p = 0.001$, $\eta^2_{partial} = 0.46$, and had more internal attribution biases, $F_{(1,60)} = 4.81$, $p = 0.04$, $\eta^2_{partial} = 0.20$, than the non-spectrum patients. While the healthy control and non-spectrum groups differed significantly on number of words heard for the Babble Task, the non-spectrum group did not differ significantly from either schizophrenia spectrum or healthy control groups for longest word phrase heard. Clinical groups did not differ in terms of action source monitoring biases or aberrant salience indices.

Second, we performed a similar ANCOVA on the combined UHR/FEP sample (see Table 8). The results showed significant group differences with schizophrenia spectrum patients showing more impairments in temporal binding, $F_{(1,60)} = 4.68$, $p = 0.034$, $\eta^2_{partial} = 0.07$, forgetting performed actions more often, $F_{(1,60)} = 18.08$, $p < 0.001$, $\eta^2_{partial} = 0.23$, and having more internal, $F_{(1,60)} = 6.63$, $p = 0.012$, $\eta^2_{partial} = 0.10$, and external attributions biases, $F_{(1,60)} = 4.55$, $p = 0.037$, $\eta^2_{partial} = 0.07$, than non-spectrum patients. Again, healthy controls and non-spectrum participants differed significantly from each other on number

Table 6
Group differences in self-disturbances (UHR and FEP combined sample).

	HC - healthy controls ($n = 34$)	SS - schizophrenia spectrum ($n = 21$)	NS – non-spectrum disorders ($n = 65$)	ANCOVA[a] $F(2, 115)$	Post-hoc tests[a]
Self-disturbances (EASE domains)					
Cognition and streaming of consciousness	3.85 (3.67)	39.24 (8.92)	26.80 (11.28)	21.408, $p < 0.001$, $\eta^2_{partial} = 0.27$	SS > NS, $F = 13.10$ $p = 0.001$, $\eta^2_{partial} = 0.14$ SS > HC, $F = 58.96$, $p < 0.001$, $\eta^2_{partial} = 0.54$ NS > HC, F = 17.53, $p < 0.001$, partial = 0.16
Self-awareness and presence	1.12 (1.47)	33.38 (11.83)	18.62 (10.54)	22.60, $p < 0.001$, $\eta^2_{partial} = 0.28$	SS > NS, $F = 20.52$, $p < 0.001$, $\eta^2_{partial} = 0.20$ SS > HC, $F = 53.86$, $p < 0.001$, $\eta^2_{partial} = 0.51$ NS > HC, $F = 12.67$, $p = 0.001$, $\eta^2_{partial} = 0.12$
Bodily experiences	0.21 (0.72)	12.90 (7.29)	6.11 (6.25)	13.63, $p < 0.001$, $\eta^2_{partial} = 0.19$	SS > NS, $F = 14.78$, $p < 0.001$, $\eta^2_{partial} = 0.15$ SS > HC, $F = 15.06$, $p < 0.001$, $\eta^2_{partial} = 0.23$ NS > HC, $F = 7.63$, $p = 0.007$, $\eta^2_{partial} = 0.07$
Demarcation/transitivism	0.03 (0.17)	5.43 (4.96)	3.49 (5.29)	6.08, $p = 0.003$, $\eta^2_{partial} = 0.10$	SS = NS, F = 2.52, $p = 0.12$, $\eta^2_{partial} = 0.03$ SS > HC, $F = 19.08$, $p < 0.001$, $\eta^2_{partial} = 0.27$ NS > HC, $F = 5.92$, $p = 0.017$, $\eta^2_{partial} = 0.06$
Existential reorientation	0.12 (0.41)	10.57 (6.84)	4.94 (4.74)	18.25, $p < 0.001$, $\eta^2_{partial} = 0.24$	SS > NS, $F = 17.41$, $p < 0.001$, $\eta^2_{partial} = 0.17$ SS > HC, $F = 19.08$, $p < 0.001$, $\eta^2_{partial} = 0.21$ NS > HC, $F = 18.00$, $p < 0.001$, $\eta^2_{partial} = 0.16$
EASE total	5.32 (4.95)	101.52 (30.43)	59.95 (28.33)	29.17, $p < 0.001$, $\eta^2_{partial} = 0.34$	SS > NS, $F = 23.56$, $p < 0.001$, $\eta^2_{partial} = 0.22$ SS > HC, F = 59.42, $p < 0.001$, $\eta^2_{partial} = 0.54$ NS > HC, $F = 21.75$, $p < 0.001$, $\eta^2_{partial} = 0.19$

Note:
[a] BPRS total scores and age were controlled for.

of words heard for the Babble Task but the non-spectrum group did not differ significantly from either the schizophrenia spectrum or healthy controls groups for longest word phrase heard. Differences between both clinical groups were not observed for action source monitoring biases, as well as for aberrant salience measures.

4. Discussion

The primary aim of this study was to assess whether basic self-disturbance is more prominent in first episode psychosis (FEP) patients with schizophrenia spectrum diagnoses compared with FEP patients with other psychotic disorders, thereby replicating the findings of our previous study in an independent sample (Nelson et al., 2013). A secondary aim was to determine whether early psychosis patients with schizophrenia spectrum diagnoses, irrespective of severity of psychotic symptoms, display higher levels of basic self-disturbance compared with early psychosis patients without schizophrenia spectrum diagnoses. Findings indicate that in both the FEP-only and combined sample of FEP and UHR patients a higher degree of basic self-disturbance was observed among patients with schizophrenia spectrum disorders compared to patients with non-spectrum disorders. These findings were maintained after controlling for severity of general psychopathology and age, suggesting that more severe basic self-disturbance may be a specific characteristic of schizophrenia spectrum disorders and not simply an artefact of greater symptom severity or age. Detailed analysis of specific basic self-disturbances revealed differences between schizophrenia spectrum and other psychosis groups in four out of five domains. Indeed, in the combined sample of UHR and FEP patients the demarcation/transitivism domain did not significantly distinguish schizophrenia spectrum from non-schizophrenia spectrum patients. This result was somewhat surprising given that demarcation/boundary disturbances, as observed in hallucinations for instance, are inherently associated with source monitoring deficits which are considered to be characteristic of schizophrenia spectrum disorders (Waters et al., 2012). Interestingly, in the FEP-only group, schizophrenia spectrum patients *did* exhibit elevated levels of demarcation/transitivism when compared to non-spectrum patients as with the four other domains. The difference in result when UHR and FEP patients were combined suggests that abnormalities in the subjective experience of ego-boundaries are related to schizophrenia spectrum particularly in patients who have developed full-blown psychotic symptoms and not in those with schizotypal/paranoid personality features and attenuated psychotic symptoms.

As a tertiary aim, we tested whether source monitoring and aberrant salience measures discriminated schizophrenia spectrum disorders from non-schizophrenia spectrum disorders. Consistent with a range of literature (Waters et al., 2012; Gawęda et al., 2013; Gawęda et al., 2018), source monitoring deficits, with the exception of action source monitoring biases, were significantly more pronounced in the schizophrenia spectrum group for both the FEP-only and the UHR/FEP

Table 7
Group differences on cognitive measures (the FEP group only).

	HC - healthy controls ($n = 33$)	SS - schizophrenia spectrum ($n = 10$)	NS other psychosis ($n = 13$)	ANCOVA[a] $F(2,51)$	Post-hoc test[a]
Source monitoring					
Action memory task					
Imagined actions recognized as performed	1.42 (1.00)	2.20 (1.61)	2.30 (1.60)	0.39, $p = 0.53$, $\eta^2_{partial} = 0.01$	SS = NS, $F(1,19) = 0.07$, $p = 0.79$, $\eta^2_{partial} = 0.03$ SS = HC, $F(1,39) = 1.16$, $p = 0.28$, $\eta^2_{partial} = 0.03$ NS = HC, $F(1,42) = 1.78$, $p = 0.19$, $\eta^2_{partial} = 0.04$
Performed actions recognized as imagined	2.30 (2.00)	2.80 (2.44)	2.84 (1.72)	0.39, $p = 0.68$, $\eta^2_{partial} = 0.01$	SS = NS, $F = 0.11$, $p = 0.74$, $\eta^2_{partial} = 0.00$ **SS > HC, $F = 6.36$, $p = 0.02$, $\eta^2_{partial} = 0.14$** NS = HC, $F = 0.20$, $p = 0.88$, $\eta^2_{partial} = 0.00$
Forgetting imagined actions	3.57 (2.64)	5.10 (2.68)	4.23 (1.58)	0.65, $p = 0.52$, $\eta^2_{partial} = 0.02$	SS = NS, $F = 1.11$, $p = 0.30$, $\eta^2_{partial} = 0.05$ SS > HC, $F = 127$, $p = 0.27$, $\eta^2_{partial} = 0.03$ NS = HC, $F = 0.25$, $p = 0.62$, $\eta^2_{partial} = 0.01$
Forgetting performed actions	3.21 (1.99)	5.00 (2.16)	2.69 (1.31)	5.62, $p = 0.006$, $\eta^2_{partial} = 0.18$	**SS > NS, F = 15.91, $p = 0.001$, $\eta^2_{partial} = 0.46** SS > HC, $F = 3.87$, $p = 0.056$, $\eta^2_{partial} = 0.09$ NS = HC, $F = 0.28$, $p = 0.59$, $\eta^2_{partial} = 0.01$
Word recognition task					
Internal attribution bias	3.45 (3.27)	6.50 (4.30)	3.15 (1.57)	2.08, $p = 0.13$, $\eta^2_{partial} = 0.08$	**SS > NS, $F = 4.81$, $p = 0.04$, $\eta^2_{partial} = 0.20** SS = HC, $F = 0.51$, $p = 0.48$, $\eta^2_{partial} = 0.01$ NS = HC, $F = 0.31$, $p < 0.58$, $\eta^2_{partial} = 0.01$
External attribution bias	3.76 (3.09)	7.20 (3.64)	3.38 (2.60)	3.55, $p = 0.036$, $\eta^2_{partial} = 0.12$	SS > NS, $F = 4.29$, $p = 0.052$, $\eta^2_{partial} = 0.18$ SS = HC, $F = 0.08$, $p = 0.77$, $\eta^2_{partial} = 0.00$ NS = HC, $F = 1.41$, $p = 0.24$, partial = 0.03
Total errors	7.97 (5.57)	13.70 (7.61)	6.54 (3.43)	3.37, $p = 0.042$, $\eta^2_{partial} = 0.12$	**SS > NS, $F = 5.35$, $p = 0.032$, $\eta^2_{partial} = 0.22** SS = HC, $F = 0.05$, $p = 0.82$, $\eta^2_{partial} = 0.00$ NS = HC, $F = 0.83$, $p = 0.37$, $\eta^2_{partial} = 0.02$
Temporal binding task					
Libet_CorrectScores	16.42 (46.70)	−39.51 (54.08)	8.81 (34.82)	4.72, $p = 0.01$, $\eta^2_{partial} = 0.16$	**SS > NS, $F = 8.26$, $p = 0.01$, $\eta^2_{partial} = 0.30** **SS > HC, $F = 9.36$, $p = 0.004$, $\eta^2_{partial} = 0.19** NS = HC, $F = 0.33$, $p = 0.57$, $\eta^2_{partial} = 0.01$
Libet_Differences	0.55 (1.15)	−1.29 (1.57)	−0.34 (0.95)	5.02, $p = 0.01$, $\eta^2_{partial} = 0.16$	SS > NS, $F = 3.52$, $p = 0.076$, $\eta^2_{partial} = 0.16$ **SS > HC, $F = 4.64$, $p = 0.038$, $\eta^2_{partial} = 0.11** NS = HC, $F = 4.97$, $p = 0.31$, $\eta^2_{partial} = 0.11$
Aberrant salience					
Aberrant salience task					
SAT – implicitBlock1	36.28 (30.58)	44.50 (35.85)	30.76 (33.42)	0.98, $p = 0.38$, $\eta^2_{partial} = 0.04$	SS = NS, $F = 0.01$, $p = 0.92$, $\eta^2_{partial} = 0.00$ SS = HC, $F = 0.36$, $p = 0.55$, $\eta^2_{partial} = 0.01$ NS = HC, $F = 0.77$, $p = 0.38$, $\eta^2_{partial} = 0.02$
SAT – implicitBlock2	16.57 (18.34)	−2.46 (9.72)	6.47 (18.81)	1.01, $p = 0.37$, $\eta^2_{partial} = 0.04$	SS = NS, $F = 1.92$, $p = 0.18$, $\eta^2_{partial} = 0.09$ SS > HC, $F = 2.99$, $p = 0.09$, $\eta^2_{partial} = 0.07$ NS = HC, $F = 0.03$, $p = 0.87$, $\eta^2_{partial} = 0.00$
Babble task – total number of words heard	12.85 (8.97)	10.00 (6.19)	8.81 (9.61)	3.69, $p = 0.03$, $\eta^2_{partial} = 0.12$	SS = NS, $F = 0.54$, $p = 0.47$, $\eta^2_{partial} = 0.02$ SS = HC, $F = 1.19$, $p = 0.28$, $\eta^2_{partial} = 0.03$ **NS < HC, $F = 5.31$, $p = 0.03$, $\eta^2_{partial} = 0.10**
Babble task – longest word phrase heard	2.32 (1.47)	2.33 (1.77)	1.62 (1.78)	1.65, $p = 0.20$, $\eta^2_{partial} = 0.06$	SS = NS, $F = 0.89$, $p = 0.35$, $\eta^2_{partial} = 0.04$ SS = HC, $F = 0.60$, $p = 0.44$, $\eta^2_{partial} = 0.01$ NS = HC, $F = 1.76$, $p = 0.19$, $\eta^2_{partial} = 0.04$

Note: Significant differences in post-hoc ANCOVA comparisons are bolded.
[a] BPRS total scores and age were controlled for.

combined samples. This suggests that some types of source monitoring (e.g., self-monitoring), but not others (e.g., internal vs. external source), may be more specifically related to schizophrenia spectrum disorders. Interestingly, clinical group differences were not observed for aberrant salience tasks, deviating from phenomenological and neurocognitive models identifying a link between such memory-attention disturbances and the schizophrenia spectrum (Sass and Parnas, 2003; Morris et al., 2012; Nelson et al., 2014a, 2014b). In fact, despite there being no significant difference between spectrum and non-spectrum participants, healthy controls in fact performed significantly worse than non-spectrum participants on the aberrant salience Babble Task (i.e. identified a higher number of words in the meaningless auditory stimulus). A possible explanation may be that healthy controls, who were primarily university students, may have been particularly motivated to identify as many words as possible in the auditory stimulus, taking this to represent 'good performance'. A broader range of tasks or a larger sample may be required to better assess group differences on aberrant salience. While source monitoring deficits and aberrant

Table 8
Group differences on neurocognitive measures (UHR and FEP combined sample).

	HC - healthy controls ($n = 33$)	SS - schizophrenia spectrum ($n = 12$)	OP – other psychosis ($n = 52$)	ANCOVA[a] $F(2, 115)$	Post-hoc tests[a]
Source monitoring					
Action memory task					
Imagined actions recognized as performed	1.42 (1.00)	2.50 (2.06)	2.73 (1.86)	2.54, $p = 0.08$, $\eta^2_{partial} = 0.05$	SS=NS, $F(1,60) = 0.20$, $p = 0.65$, $\eta^2_{partial} = 0.00$ SS=HC, $F(1,41) = 0.02$, $p = 0.96$, $\eta^2_{partial} = 0.00$ **NS>HC, $F(1,81) = 6.56$, $p = 0.021$, $\eta^2_{partial} = 0.06$**
Performed actions recognized as imagined	2.30 (2.00)	3.25 (2.66)	2.92 (2.06)	0.09, $p = 0.91$, $\eta^2_{partial} = 0.00$	SS=NS, $F = 015$, $p = 0.70$, $\eta^2_{partial} = 0.00$ **SS=HC, $F = 2.95$, $p = 0.09$, $\eta^2_{partial} = 0.07$** NS= HC, $F = 0.65$, $p = 0.42$, $\eta^2_{partial} = 0.01$
Forgetting imagined actions	3.57 (2.64)	5.25 (2.59)	4.94 (2.63)	0.82, $p = 0.44$, $\eta^2_{partial} = 0.01$	SS=NS, $F = 0.02$, $p = 0.89$, $\eta^2_{partial} = 0.00$ SS>HC, $F = 1.96$, $p = 0.17$, $\eta^2_{partial} = 0.05$ NS=HC, $F = 0.77$, $p = 0.38$, $\eta^2_{partial} = 0.00$
Forgetting performed actions	3.21 (1.99)	5.08 (1.97)	3.03 (1.50)	7.51, $p = 0.001$, $\eta^2_{partial} = 0.14$	**SS>NS, F=18.08, $p < 0.001$, $\eta^2_{partial} = 0.23** **SS>HC, $F = 4.41$, $p = 0.042$, $\eta^2_{partial} = 0.10** NS= HC, $F = 0.21$, $p = 0.65$, $\eta^2_{partial} = 0.06$
Word recognition task					
Internal attribution bias	3.45 (3.27)	6.17 (4.11)	3.40 (2.46)	3.48, $p = 0.035$, $\eta^2_{partial} = 0.07$	**SS>NS, $F = 6.63$, $p = 0.012$, $\eta^2_{partial} = 0.10** SS= HC, $F = 0.24$, $p < 0.62$, $\eta^2_{partial} = 0.01$ OP=HC, $F = 1.37$, $p < 0.24$, $\eta^2_{partial} = 0.02$
External attribution bias	3.76 (3.09)	6.58 (3.65)	4.00 (3.06)	2.82, $p = 0.064$, $\eta^2_{partial} = 0.06$	**SS>NS, $F = 4.55$, $p = 0.037$, $\eta^2_{partial} = 0.07** SS= HC, $F = 0.01$, $p = 0.92$, $\eta^2_{partial} = 0.00$ NS=HC, $F = 0.13$, $p = 0.72$, $\eta^2_{partial} = 0.00$
Total errors	7.97 (5.57)	12.75 (7.25)	7.40 (4.70)	3.947, $p = 0.02$, $\eta^2_{partial} = 0.08$	**SS>NS, $F = 7.18$, $p = 0.009$, $\eta^2_{partial} = 0.11** SS= HC, $F = 0.33$, $p = 0.86$, $\eta^2_{partial} = 0.00$ NS=HC, $F = 0.61$, $p < 0.44$, $\eta^2_{partial} = 0.01$
Temporal binding task					
Libet_CorrectScores	16.42 (46.70)	−36.29 (49.70)	−2.90 (49.83)	3.69, $p = 0.029$, $\eta^2_{partial} = 0.07$	**SS>NS, $F = 4.68$, $p = 0.034$, $\eta^2_{partial} = 0.07** **SS> HC, $F = 9.38$, $p = 0.004$, $\eta^2_{partial} = 0.19** NS=HC, $F = 1.21$, $p < 0.27$, $\eta^2_{partial} = 0.01$
Libet_Differences	0.55 (1.15)	−0.96 (1.74)	0.03 (1.33)	3.14, $p = 0.048$, $\eta^2_{partial} = 0.06$	SS>NS, $F = 4.24$, $p = 0.044$, $\eta^2_{partial} = 0.07$ **SS> HC, $F = 5.62$, $p = 0.02$, $\eta^2_{partial} = 0.12** NS=HC, $F = 0.85$, $p = 0.36$, $\eta^2_{partial} = 0.01$
Aberrant salience					
Aberrant salience task					
SAT – implicitBlock1	36.28 (30.58)	42.50 (35.58)	32.45 (32.35)	1.48, $p = 0.23$, $\eta^2_{partial} = 0.03$	SS=NS, $F = 0.18$, $p = 0.67$, $\eta^2_{partial} = 0.00$ SS= HC, $F = 0.05$, $p = 0.82$, $\eta^2_{partial} = 0.00$ NS=HC, $F = 1.67$, $p = 0.20$, $\eta^2_{partial} = 0.02$
SAT – implicitBlock2	16.57 (18.34)	−2.33 (10.47)	3.79 (19.58)	0.86, $p = 0.45$, $\eta^2_{partial} = 0.02$	SS=NS, $F = 0.53$, $p = 0.47$, $\eta^2_{partial} = 0.01$ SS=HC, $F = 2.21$, $p = 0.14$, $\eta^2_{partial} = 0.05$ NS= HC, $F = 0.54$, $p = 0.46$, $\eta^2_{partial} = 0.01$
Babble task – total number of words heard	12.85 (8.98)	10.00 (5.41)	9.19 (6.72)	4.68, $p = 0.01$, $\eta^2_{partial} = 0.08$	SS=NS, $F = 0.20$, $p = 0.66$, $\eta^2_{partial} = 0.00$ SS= HC, $F = 0.90$, $p = 0.35$, $\eta^2_{partial} = 0.02$ **NS<HC, $F = 7.88$, $p = 0.006$, $\eta^2_{partial} = 0.08**
Babble task – longest word phrase heard	2.32 (1.47)	2.00 (1.67)	1.95 (1.36)	0.96, $p = 0.38$, $\eta^2_{partial} = 0.02$	SS=NS, $F = 0.00$, $p = 0.99$, $\eta^2_{partial} = 0.00$ SS= HC, $F = 1.09$, $p = 0.30$, $\eta^2_{partial} = 0.02$ NS=HC, $F = 1.29$, $p = 0.26$, $\eta^2_{partial} = 0.01$

Note: Significant differences in post-hoc ANCOVA comparisons are bolded.
[a] BPRS total scores and age were controlled for.

salience were the constructs measured in this study, a larger-scale study by this group has recently commenced examining a broader scope of neurocognitive constructs in relation to basic self disturbance.

Our findings are consistent with theoretical accounts (Sass and Parnas, 2003), as well as a line of empirical studies, suggesting that disturbances of the basic self may be an early indicator of schizophrenia spectrum disorders. The results obtained from the present study confirm, in a larger sample, the findings of an earlier pilot study conducted by our group (Nelson et al., 2013) in which basic self-disturbance was significantly more pronounced in first episode psychosis (FEP) patients with a schizophrenia spectrum diagnosis compared with FEP patients with other psychoses. The findings further suggest that assessment of basic self-disturbance and source monitoring biases may have clinical utility in diagnostic clarification and outcome prediction for patients with attenuated or full-threshold psychotic symptoms, although longitudinal studies are needed to test this speculation. The development of tailored psychosocial interventions aimed at addressing such disturbances may be beneficial given their centrality to the schizophrenia spectrum disorder (Sass, 2019). Preliminary work has been conducted in this area with an emphasis on approaches that serve to foster an understanding of subjective experience, develop a more robust pre-reflective self-awareness and encourage immersion in present activity (Nelson and Sass, 2009).

A limitation of the current study is the relatively small number ($n = 4$) of UHR patients with schizophrenia spectrum diagnoses (schizotypal personality disorder and paranoid personality disorder). The finding would need to be replicated in a larger sample of UHR patients with schizophrenia spectrum disorders in order to discount the possibility

of type I error. The cross-sectional methodology is also a limitation of the study. Analysis of follow up measures would provide more insight into group differences.

5. Conclusion

The findings suggest that the occurrence of basic self-disturbance, independently of severity of general psychopathology, may constitute an important early marker for schizophrenia spectrum disorder. Hence, from a clinical perspective it seems reasonable to assess the presence of anomalous subjective experience at the very early presentation of psychosis or its risk states. Moreover, our results suggest that some neurocognitive deficits, in particular verbal source monitoring biases and aberrant implicit sense of agency, may serve as risk factors for development of schizophrenia spectrum disorders in early stage patients.

Ethics statement

The study was approved by the Melbourne Health Human Research and Ethics Committee (HREC). Study participants provided full written and informed consent.

Contributors

B. Nelson, Ł. Gawęda, K. Allott, J. Hartmann, B. Jack, D. Koren, S. Lavoie, P. McGorry, J. Parnas, A. Polari, L. Sass, T. Whitford were responsible for the study concept and design. B. Nelson was responsible for oversight of the study. E. Li was responsible for data collection. Ł. Gawęda and J. Spark were responsible for statistical analysis and drafting the manuscript. All other authors were responsible for critical revision of the manuscript and have accepted the final version.

Data availability statement

Data available on request from the authors. The data that support the findings of this study are available from the corresponding author upon reasonable request.

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The funding source had no involvement in the collection, analysis, interpretation, writing or decision to submit this article for publication.

Declaration of competing interest

The authors have no conflicts of interest.

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