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REDUCED SELF-REFERENTIAL SOURCE MEMORY PERFORMANCE IS ASSOCIATED WITH INTERPERSONAL DYSFUNCTION IN BORDERLINE PERSONALITY DISORDER

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Source memory is impaired in schizophrenia, and this deficit is related to symptoms of interpersonal antagonism such as suspiciousness and hostility. The present study evaluated source memory in borderline personality disorder (BPD) and its relation to interpersonal antagonism. Forty-one noninpatient adults with BPD according to the DSM-IV and 26 healthy control subjects performed a verbal source memory test requiring completion of sentences with and without emotional content ("Hot" vs. "Cold" sentences). Subjects also completed self-report measures of suspiciousness and interpersonal antagonism (Buss-Durkee Hostility Inventory) and depression (Beck Depression Inventory). The BPD group showed no significant difference from the control group in self-referential source memory, recognition memory, response bias, and performance enhancement for items with emotion content. However, in the BPD group, poorer self-referential source memory was significantly related to Hostility measures including suspiciousness, but not with Depression scores. In contrast, generic item recognition memory was unrelated to Hostility. Heterogeneity in source memory function may be specifically related to some of the hallmark interpersonal disturbances of BPD, independent of the effects of general negative affect or general memory impairment.

Borderline personality disorder (BPD) is a serious, chronic disorder characterized by affective instability, impulsivity, and interpersonal disturbance. The neurocognitive basis for this disorder remains poorly characterized, though there is mounting evidence for dysfunction in underlying

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frontolimbic circuitry (reviewed in Johnson, Hurley, Benkelfat, Herpertz, & Taber, 2003). In particular, the neurocognitive aspects of interpersonal dysfunction in BPD remain obscure. In the current study, we examined the relationship of a metacognitive function, self-referential source memory, to interpersonal disturbances in BPD.

Source memory is the determination of the context, origin, or source, of remembered events (Johnson, Hashtroudi, & Lindsay, 1993). Common source memory determinations include distinguishing whether one actually perceived a certain event or merely imagined its occurrence, and distinguishing whether one perceived an event as occurring in one circumstance or another (such as *who* made a certain statement to the subject). The first of these is referred to as "reality monitoring" (or internal source monitoring) whereas the second is called external source monitoring (Johnson et al., 1993). Reality monitoring thus involves the discrimination of internally generated experiences (such as thoughts or subjective feeling states) from externally generated experiences (such as witnessed events). The self-referential aspect of source memory involves the retrieval of the sense of self or agency, which is necessary to determine an experience as originating internally (e.g., "*I* did this" or "*I* thought this") rather than in the environment.

Reality monitoring is achievable due to the capacity to retrieve phenomenological features of memories originating in perception, which include greater perceptual (sensory) detail, contextual detail (e.g., time and place of occurrence), semantic detail, and affective content, relative to imagined events. In contrast, memories that arise from reflection typically involve greater access to aspects of the cognitive operations that were involved at the time of memory formation (e.g., "I remember that I imagined my mother's voice because I was trying to decide at the time about how she would have responded to my father."). Though source memory judgments clearly involve decision making processes, they typically take place rapidly, in a heuristic, nondeliberative manner. At times, more conscious deliberation can come into play on a slower time scale, particularly for more difficult judgments (e.g., "Is this plausible that I *saw* this, given the other things that I am certain about?") (Johnson et al., 1993). Performance on a variety of source memory tasks appears to depend on activity in the prefrontal cortex in studies of focal brain-lesioned patients (reviewed in Johnson, 1997) and in functional brain imaging studies of normal subjects (Rugg, Fletcher, Chua, & Dolan, 1999; Dobbins, Foley, Schachter, & Wagner, 2002; Fan, Snodgrass, & Bilde, 2003). However, medial temporal lobe regions have also been implicated (Davachi, Mitchell, & Wagner, 2003; Takahashi, Ohki, & Miyashita, 2002; Fan et al., 2003), and complex interactions between these two regions appear likely in support of source memory.

Reality monitoring has been considered as a cognitive framework for the study of interpersonal disturbances such as paranoia, operationally defined as the misattribution of internally generated experiences to events originating in the environment. A number of tasks, primarily verbal in na-

ture, have demonstrated source memory deficits in schizophrenia to be associated with hostility (Vinogradov et al., 1997), thought disorder (Harvey, 1985), and hallucinations (Bentall, Baker, & Havers, 1991; Morrison & Haddock, 1997; Baker & Morrison, 1998; Johns et al., 2001; Brebion et al., 2000; Brebion, Gorman, Amador, Malaspina, & Sharif, 2002; Keefe, Arnold, Bayen, McEvoy, & Wilson, 2002). Source memory impairment has also been reported in small samples of patients with mania (Harvey, 1985), posttraumatic stress disorder (PTSD) (Golier, Harvey, Steiner, & Yehuda, 1997), and depression (Degl'Innocenti & Backman, 1999). Source memory has not been addressed in BPD, though one study found that adults who reported experiencing recovered memories of childhood sexual abuse exhibit reality monitoring deficits relative to both adults with continuous memories of childhood sexual abuse and to adults with no childhood abuse history (McNally, Clancy, Barrett, & Parker, 2005). In BPD, a range of interpersonal disturbances are observed, including projection, hostility, suspiciousness, and paranoia, and other forms of a graded "reality testing" impairment (Gunderson & Singer, 1975; Zanarini, Gunderson, & Frankenburg, 1990; Hatzitaskos, Soldatos, Sakkas, & Stefanis, 1997). Projection is a construct from psychoanalysis that may usefully be translated to experimental cognitive psychology as a misattribution of an internal state originating in the interpersonal environment (i.e., a reality monitoring deficit). Similarly, the clinical notion of reality testing is generally understood to involve similar types of cognitive operations as those described above for reality monitoring. The hostility, suspiciousness, and paranoia expressed by BPD patients, while exhibiting some differences from those observed in patients with schizophrenia, can be detected in both clinical populations using identical measures (Zanarini et al., 1990). These important clinical features of BPD may be associated with reality monitoring deficits as they are in schizophrenia.

In the present study, we hypothesized that: (1) Clinically stable outpatients with BPD exhibit a deficit in self-referential source memory; and (2) this deficit is specifically associated with measures of interpersonal antagonism; this relationship is not merely related to general negative affect states (such as depression) or more general memory impairment.

We refer to the present experiment as a *self-referential source memory* task, in order to emphasize the importance of self-referential aspects of processing in task performance. From a neurocognitive perspective, self-referential and self-monitoring functions must play critical roles in the establishment and maintenance of social and relational behaviors (Adolphs, 2003).

METHODS

SUBJECTS

Forty-one individuals with BPD were recruited from the community, primarily including mental health outpatients but also individuals not in treatment (Table 1). Exclusion criteria included the following: age <18 or

TABLE 1. Demographic and Clinical Data

	BPD (n = 41)	Control (n = 26)
Age (years)	35.3 ± 12.9	34.4 ± 9.3
Sex (% Female)	88	89
Education (yr)	14.2 ± 2.7*	15.5 ± 2.3
Parental education (yr)	14.9 ± 3.0	14.8 ± 2.2
Ethnicity (%)		
(W, B, L, A, N)	76, 7, 5, 10, 2	77, 8, 4, 12, 0
On medication at study	76%	*na*
GAF	56 ± 8.9	*ns*
Age of symptom onset	12.5 ± 5.8	*ns*
Buss-Durkee Hostility Inventory		
Suspiciousness	5.1 ± 2.8***	1.6 ± 1.2
Irritability	7.8 ± 2.1***	3.2 ± 2.1
Negativism	3.3 ± 1.6***	1.9 ± 1.4
Guilt	4.9 ± 2.4***	2.0 ± 1.7
Resentment	4.6 ± 2.0***	0.9 ± 0.9
Indirect Hostility	6.1 ± 1.5***	3.7 ± 1.9
Verbal Hostility	7.1 ± 2.7**	5.2 ± 2.2
Assault	3.2 ± 2.9*	1.8 ± 1.3
Beck Depression Inventory	23.2 ± 12.0***	4.2 ± 4.3

Values are group means ± *SD*. BPD: borderline personality disorder group; *SD*: standard deviation; Ethnicity: W (White), B (Black), L (Latino), A (Asian), N (Native American); GAF: Global Assessment of Function (DSM-IV).
* = $p < .05$, ** = $p < .01$, *** = $p < .001$.

>60; comorbid schizophrenia, schizoaffective, bipolar spectrum, or posttraumatic stress disorder, or current major depressive disorder, current substance dependence, or history of neurological disease. These diagnoses were employed as exclusion criteria in order to minimize potentially confounding diagnostic correlates of source memory impairment. Age, sex ratio, racial distribution, and parental education and socioeconomic status (Hollingshead, 1957) were not different from the control group. The BPD subjects were clinically stable, with a mean Global Assessment of Functioning (GAF) score =56 ± 8.9, none were hospitalized in the month prior to study, nor had psychotic or dissociative symptoms at study; 76% were on psychiatric medications (Table 1). BPD subjects were evaluated diagnostically with the Structured Clinical Interview for Axis II (SCID-II) using the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.) (DSM-IV; APA, 1994) criteria, after completing the SCID-II screening questionnaire (First, Gibbon, Spitzer, Williams, & Benjamin, 1997). Axis I disorders were evaluated with the SCID-I (First, Spitzer, Gibbon, Williams, & Benjamin, 1995). Twenty-one (51%) of the BPD subjects were randomly chosen for a videotaped diagnostic interview, which was reviewed by a second SCID-trained (PhD clinical psychologist) diagnostician, with $\kappa = .81$ for BPD criteria. Comorbid Axis I diagnoses included panic disorder ($n = 2$), dysthymic disorder ($n = 5$), bulimia ($n = 2$), gender identity disorder ($n = 1$), amphetamine abuse ($n = 1$), and cannabis abuse ($n = 1$). Comorbid personality disorder diagnoses included paranoid ($n = 10$), schizoid ($n = 3$), schizotypal ($n = 4$), antisocial ($n = 5$), histrionic ($n = 3$), narcissistic ($n = 4$), avoidant ($n = 19$), dependent ($n = 8$), and obsessive-compulsive ($n = 6$).

Control subjects ($n = 26$) were recruited from the community (Table 1).

Exclusion criteria were the following: age <18 or >60, past/present psychiatric diagnosis or treatment, current substance abuse, or neurological disease. Prospective control subjects were screened for personality disorders using the SCID-II screening questionnaire, and for Axis I disorders using a modified version of the SCID-I Non-Patient version. None of the control subjects met more than one DSM-IV criterion for BPD, nor were near the screening threshold for other personality disorders. After complete description of the study to the subjects, written informed consent was obtained.

SELF-REPORT MEASURES

Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957). This is a 75-item self-report measure of suspiciousness; negative/antagonistic affects such as hostility, anger, irritability, negativism, and guilt; and aggressive (verbal and physical) behavior. Item content is predominated by emotions and behaviors that are interpersonally directed, providing measures of interpersonal dysfunction. Items are rated as True or False as applicable to the subject. The inventory includes 8 subscales (indicated in Tables 1 and 3). For the BDHI subscales, the internal reliability (Cronbach's α) ranges from .65 to .74 (Coccaro, Bergeman, Kavoussi, & Seroczynski, 1997) and the test-retest reliability from .64 to .82 (Biaggio, Supplee, & Curtis, 1981). This measure is hereafter referred to as the Hostility index.

Beck Depression Inventory (BDI; Beck & Steer, 1993). This 21-item questionnaire evaluates cognitive and vegetative symptoms of depression, with each item rated on a four-point scale. The internal consistency reliability (Cronbachs α) is 0.86 (Reynolds & Gould, 1981) and test-retest reliability is >.90 (Beck, 1970).

SOURCE MEMORY TASK

This is a pencil-and-paper sentence completion test of source memory, observed here as the ability to discriminate the origin of written words. This task is adapted from Mitchell, Hunt, and Schmitt (1986) as per Vinogradov et al. (1997) and modified by adding an equal number of additional sentences judged to contain emotion content, in order to compare performance on "Hot" versus "Cold" target words. This modification was made in order to evaluate whether individuals with BPD exhibit a differential self-referential source memory impairment in the processing of target stimuli with emotion content, which would be consistent with the clinical observation of interpersonal antagonism emerging in emotionally provocative situations. Subjects read out loud 80 sentences of the structure subject-verb-object, using high-semantic associates, 40 of which were complete (e.g., "The boy played with the ball") and 40 of which were completed vocally by the subject with a single target noun (e.g., "The sailor sailed the _____"). These sentences are referred to as *Experimenter*-generated and *Self*-generated, respectively. Half of the complete sentences and half

of the incomplete sentences were Cold (e.g., examples above) and the other half were Hot. Hot sentences were predominantly negative in valence (e.g., "The kitten was crushed by the bus" and "The woman slapped the _____"). There were a total of 20 items of each sentence combination of complete/incomplete by Hot/Cold, presented in a pseudorandom order. Subjects were not informed of the recognition phase to follow. After a 1-hour interval, a pseudorandomly ordered written list of all subject/object noun pairs that had been read or generated at study was presented (e.g., boy-ball, kitten-bus), including 40 noun pair *Lures* (new word pairs, not presented initially). These Lures were also divided evenly between Hot and Cold items. The subject was instructed to identify the second word in each pair as "Made-up" (by the subject, [i.e., Self-generated]), "Read" (i.e., Experimenter-generated) or "New" (Lure). We have previously reported the performance of a sample of subjects with schizophrenia on the original task (Vinogradov et al., 1997).

DATA ANALYSIS

Source Memory Measures: Overview. Measures from this task were computed according to Corwin's "two-high threshold theory" (Corwin, 1994), which posits that accurate performance requires both correct identification of target items and correct rejection of distractor (Lure) items. This approach deconfounds discrimination from response bias, and is not contaminated by response bias when there are unequal numbers of targets and distractors (such as in the present task). We computed the following measures separately for Item Recognition Memory and Source Memory: Hit Rate, False Alarm Rate, Discrimination Index, and Response Bias (see below). The primary measures for group comparisons and correlations with clinical measures were the Discrimination Index and Response Bias; each of these was computed for Hot and Cold items separately, in order to test the effect of item emotion content on Source Memory and Item Recognition performance. Raw response rates for each type of item/response pair are indicated in Table 2.

TABLE 2. Source Memory Task Response Rates

Group and Response Type	TEST ITEM CATEGORY					
	SELF		EXPERIMENTER		NEW	
	Cold	Hot	Cold	Hot	Cold	Hot
BPD subjects (n = 41)						
Self	15.1 ± 4.8	16.2 ± 4.3	1.7 ± 1.7	1.4 ± 1.6	0.6 ± 1.8	1.0 ± 1.4
Experimenter	2.2 ± 2.9	1.5 ± 2.3	8.5 ± 4.0	10.0 ± 3.5	3.8 ± 3.9	3.3 ± 3.5
New	2.6 ± 3.1	2.4 ± 2.9	9.9 ± 4.3	8.6 ± 3.3	15.6 ± 4.1	15.7 ± 3.9
Normal Control subjects (n = 26)						
Self	17.0 ± 2.1	17.8 ± 1.4	1.4 ± 1.8	1.5 ± 1.4	0.2 ± 0.7	1.1 ± 1.1
Experimenter	1.4 ± 1.4	0.9 ± 1.1	9.1 ± 4.3	10.0 ± 3.5	4.3 ± 3.7	3.3 ± 2.4
New	1.6 ± 1.6	1.3 ± 1.0	9.5 ± 4.4	8.6 ± 3.6	15.5 ± 3.9	15.6 ± 2.9

Each test item category contains 20 items. See text for complete description of task and derivation of test measures. Abbreviations: BPD = borderline personality disorder group; Cold = items with emotionally neutral content; Hot = items with emotion content.

Item Recognition Memory. In assessing Item Recognition Memory performance, the crucial distinction at test is *Old (Targets) versus New (Lures)*. Therefore, Hits for Item Recognition Memory consisted of responses to either Self-generated or Experimenter-generated items as *not* New. This included Made-Up responses to Self-generated items, Read responses to Experimenter-generated items, as well as Made-Up responses to Experimenter-generated items, and Read responses to Self-generated items. The total Item Recognition Hit Rate then consisted of the total number of Hits divided by the total number of targets (with constants added to the formula to preclude scores of 0 or infinity): HR = (total Hits + 0.5)/(total Targets + 0.01). False Alarms, on the other hand, were either Made-Up or Read responses to Lures. The total Item Recognition False Alarm rate then consisted of the total number of False Alarms divided by the total number of Lures: FAR = (total False Alarms + 0.5)/(total Lures + 1). The Discrimination Index (Pr) was then equal to HR minus FAR: Pr = HR – FAR. For Response Bias (Br), Br = FAR/(1 – HR).

Self-Referential Source Memory. Source Memory performance, in contrast, refers to the distinction between the *source* of studied items. Therefore, Hits for Self-referential Source Memory consisted only of Made-Up responses to Self-generated items. The total Hit Rate then for Self-referential Source Memory was equal to the total number of Hits divided by the total number of targets (here, all Self-generated items *only*). HR = (Hits + 0.5)/(total Self-generated items + 1). False Alarms for Self-referential Source Memory consisted of Made-Up responses to Experimenter-generated items. The total False Alarm Rate for Self-referential Source Memory was then equal to total False Alarms divided by total Experimenter-generated items. FAR = (total False Alarms + 0.5)/(total Experimenter-generated items + 1). The following measures were computed as for Item Recognition Memory. Discrimination Index (Pr) was equal to HR minus FAR: Pr = HR – FAR. Response Bias (Br): Br = FAR/(1 – HR).

Analysis of Group Differences in Performance. A series of mixed-model analyses of variance (ANOVA) was conducted with diagnosis (BPD vs. NC) as the between-group factor, and emotion content (Hot vs. Cold) as the within-group factor, and Discrimination Index and Response Bias as dependent variables. These analyses were conducted for two categories of variables: Self-referential Source Memory and Generic Item Recognition Memory. These "subsystems" of variables from the test were analyzed separately (Huberty & Morris, 1989) following the hypothesis that BPD subjects would exhibit Self-referential source memory deficits in the absence of generic item recognition memory deficits.

Relationship of Self-referential Source Memory to Interpersonal Dysfunction. To evaluate the relationship of Source Memory performance to clinical variables, the Discrimination Index for Self-referential Source Memory was used to compute Pearson product-moment coefficients with clinical variables. Because there was no significant interaction of subject group with emotion content on Self-referential Source Memory performance (see Re-

sults below), Discrimination Indices for Hot and Cold items were averaged (in order to maximize reliability) for this correlation analysis. The Generic Item Recognition Memory Discrimination Index (also the average of Hot and Cold items) was entered into parallel bivariate correlation analyses with interpersonal measures to test the specificity of hypothesized relationships between Self-referential Source Memory and interpersonal measures. For all tests, significance was set at $p < .05$.

RESULTS

SOURCE MEMORY TASK: GROUP DIFFERENCES

For Self-referential Source Memory, the Discrimination Index showed a statistically significant main effect of emotion content (Hot vs. Cold), $F(1,65) = 11.29$, $p = .001$, but no significant effect of group, $F(1,65) = 2.36$, $p = .13$, or group by emotion interaction, $F(1,65) = 0.68$, $p = .4$. The Source Memory Response Bias similarly showed a significant main effect of emotion, $F(1,65) = 8.19$, $p = .006$, but no significant effects of group, $F(1,65) = 1.33$, $p = .25$, or group by emotion interaction, $F(1,65) = 2.06$, $p = .16$. The effect size (Cohen's d) for the group difference was –0.4 for the Source Memory Discrimination Index and –0.3 for the Response Bias.

For Generic Item Recognition Memory, the Discrimination Index showed a significant main effect of item emotion content, $F(1,65) = 4.36$, $p = .04$, but no significant effects of group, $F(1,65) = 0.58$, $p = .5$, or group by emotion interaction, $F(1,65) = 0.04$, $p = .8$. The Item Recognition Response Bias showed no significant effects of emotion content, $F(1,65) = 1.90$, $p = .17$; group, $F(1,65) = 0.26$, $p = .6$; or group by emotion interaction, $F(1,65) = 0.07$, $p = .8$. The effect size (Cohen's d) for the group difference was –0.2 for the Item Recognition Discrimination Index and –0.1 for Item Recognition Response Bias.

RELATIONSHIP OF SELF-REFERENTIAL SOURCE MEMORY TO INTERPERSONAL DYSFUNCTION IN BPD

We conducted a preliminary correlation analysis among the BPD group as an overall test of significance before proceeding to bivariate correlation analyses of Hostility index subscales to more precisely delineate the relationships of Self-referential Source Memory to interpersonal antagonism. Self-referential Source Memory was correlated with Total Hostility (sum of all BDHI subscales) by bivariate Pearson's $r = –.33$, $p = .04$. Follow-up bivariate correlational analyses for the BPD group showed Self-referential Source Memory to be moderately and significantly correlated with the Suspiciousness, Negativism, Resentment, and Irritability subscales of Hostility (Table 3). The remaining Hostility subscales (Indirect Hostility, Guilt, Verbal Hostility and Assault) and Depression scores were unrelated to Self-referential Source Memory performance (Table 3). In addition, Generic

TABLE 3. Association of Self-Referential Source Memory Performance with Interpersonal Dysfunction in BPD

CLINICAL MEASURES	Self-referential Source Memory	Generic Item Recognition Memory
Buss-Durkee Hostility Inventory		
Suspiciousness	–.38*	–.16
Irritability	–.43**	–.12
Negativism	–.44**	–.14
Resentment	–.35*	–.10
Guilt	–.21	–.10
Indirect Hostility	.06	.06
Verbal Hostility	–.02	.11
Assault	–.19	–.03
Beck Depression Inventory	–.08	–.02

Values are Pearson product-moment coefficients for bivariate correlations of Discrimination Indices with clinical measures.
*$p < .05$, **$p < .01$.
See text for complete description of task, cognitive test measures, and clinical measures.

Item Recognition Memory was unrelated to Total Hostility, r= -.08 (n.s.), and in bivariate correlations, Generic Item Recognition Memory showed no correlations with Hostility subscales that approached significance (Table 3).

DISCUSSION

BPD is a disorder characterized in part by hostility, projection, suspiciousness, and paranoia, which are interpersonally directed symptoms that have been attributed to source memory deficits in studies of patients with schizophrenia (see Introduction). Source memory has not been previously studied in BPD. We hypothesized in the present study that BPD patients would exhibit a self-referential source memory deficit that is related to these clinical phenomena. We found that the overall mean performance of the BPD was not significantly different from the healthy control group, unlike a sample of stable outpatients with schizophrenia using a task that is identical in structure but merely extended to include emotional content for the present purposes (Vinogradov et al., 1997). This suggests that our sample of BPD outpatients may experience fewer problems with source memory function than patients with schizophrenia, though this remains to be tested directly.

Nevertheless, we found that differences in source memory performance among BPD subjects were related to important aspects of their interpersonal functioning. Lower self-referential source memory performance in these subjects was associated with suspiciousness and other measures of interpersonal antagonism, comparable to our earlier findings in outpatients with schizophrenia (Vinogradov et al., 1997). These relationships were not accounted for by general negative affect, or more general problems with memory performance. Interestingly, self-referential source memory performance in our BPD sample was not associated with the three Hostility subscales that measure *overt* aggressive behavior (Indirect Hostility,

Verbal Hostility, and Assault). This suggests that the interpersonal effects of impaired self-referential source memory may involve a mechanism different from the well-established serotonergic dysfunction that is associated with overt aggressive behavior across a range of psychiatric disorders including BPD (reviewed in Minzenberg & Siever, 2005).

The present findings suggest that the relationship between impaired source memory and interpersonal antagonism may be largely independent of diagnosis. Although an early study found differing patterns of reality monitoring impairment between subjects with schizophrenia and bipolar disorder (Harvey, 1985), it remains to be tested whether categorical (diagnostic) or dimensional (symptom-oriented) measures are relatively more strongly related to source memory dysfunction. Studies that vary both categorical and dimensional measures of psychopathology in study samples will be necessary to resolve this issue.

We additionally found a main effect of item emotion content on self-referential source memory performance, indicating that subjects in general show enhanced performance with emotion content. This is consistent with a previous study of source memory in healthy subjects (Doerksen & Shimamura, 2001). We did not find a differential effect of item emotion content on the self-referential source memory performance of the BPD group, relative to the Control group. It is possible that the emotion content of these items was not strong enough to induce differential effects on processing between subject groups. However, main effects of emotion content on both self-referential source memory and generic item recognition memory were apparent across the sample as a whole. Together with the lack of association with depressive symptoms, these findings suggest that variation among individuals with BPD in self-referential processing function may be somewhat independent of both the emotional content of the stimulus and the emotional state of the patient. Resolution of this issue will be aided by factorial study designs that vary the emotional state of the subject (e.g., by mood induction) together with the emotion content of the stimuli.

STUDY LIMITATIONS

This study did not include a clinical comparison group; therefore, the specificity of these findings for the diagnosis of BPD is uncertain. In particular, comparison to samples of subjects with schizophrenia, PTSD, or major depression (particularly those who are well-matched demographically, with levels of clinical function and general memory impairment comparable to a BPD sample if possible) would be important to address the possibility of a shared pathophysiology underlying self-referential source memory impairment.

We also chose to include only those subjects who lack comorbid diagnoses such as PTSD and current major depression. These criteria were important to preclude the confounding effects of these illnesses on source memory performance in BPD patients. However, as a result this sample of

BPD patients is less representative of clinical BPD populations, and therefore it is not clear how the present findings relate to BPD patients who have these comorbid conditions. In addition, the relative effect sizes in group comparisons suggest that an increased sample size may confer power to detect significant group differences in self-referential source memory performance. Nevertheless, the present sample size was larger than that typically found in pilot studies, and given that this is the first study of its kind in BPD, together with the relationships with important clinical phenomena that we found, we believe that the present dataset warrants reporting.

Finally, the judgment of item emotion content in the source memory task was made in an unstandardized manner as a part of test modification. The lack of an established procedure for normative rating of emotion content may have contributed to the lack of a differential group effect of emotion content, even though the effects of emotion content on performance were apparent across the study sample as a whole. Future investigations of source memory will need to address this methodological issue in order to address the issue of emotion-related processing more adequately.

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