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Facial affect recognition in symptomatically remitted patients with schizophrenia and bipolar disorder

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ABSTRACT

Both schizophrenia and bipolar disorder (BD) have consistently been associated with deficits in facial affect recognition (FAR). These impairments have been related to various aspects of social competence and functioning and are relatively stable over time. However, individuals in remission may outperform patients experiencing an acute phase of the disorders. The present study directly contrasted FAR in symptomatically remitted patients with schizophrenia or BD and healthy volunteers and investigated its relationship with patients' outcomes.
Compared to healthy control subjects, schizophrenia patients were impaired in the recognition of angry, disgusted, sad and happy facial expressions, while BD patients showed deficits only in the recognition of disgusted and happy facial expressions. When directly comparing the two patient groups individuals suffering from BD outperformed those with schizophrenia in the recognition of expressions depicting anger. There was no significant association between affect recognition abilities and symptomatic or psychosocial outcomes in schizophrenia patients. Among BD patients, relatively higher depression scores were associated with impairments in both the identification of happy faces and psychosocial functioning.
Overall, our findings indicate that during periods of symptomatic remission the recognition of facial affect may be less impaired in patients with BD than in those suffering from schizophrenia. However, in the psychosocial context BD patients seem to be more sensitive to residual symptomatology.

1. Introduction

Facial affect recognition (FAR) is the ability to recognize and discriminate emotion in the faces of others (Ekman et al., 1972) and is central to successful socialization and effective interpersonal communication (Beale and Keil, 1995; Blair, 2003). It represents one component of the multidimensional model of social cognition (Green et al., 2005). FAR has consistently been shown to be impaired in patients with schizophrenia and bipolar disorder (BD) (Hofer et al., 2010). In schizophrenia, some studies have reported on a positive correlation between the duration of illness and poor affect recognition abilities (Mueser et al., 1997; Kucharska-Pietura et al., 2005), whereas others have not found any differences between patients experiencing a first episode and those in a later stage of the disorder in this regard (Addington et al., 2006; Pinkham et al., 2007; Leung et al., 2011). These impairments have also been detected in the prodromal state of psychosis (Addington et al., 2008; Phillips and Seidman, 2008) and in individuals at familial high risk for schizophrenia (Eack et al., 2010). Accordingly, impairments in FAR have been considered to represent a possible endophenotype related to genetic risk and the development of psychosis (Green, 2006; Kohler et al., 2010) and to represent an enduring deficit and a trait marker of psychosis (Addington et al., 2006).

Similarly, impairments in FAR have been demonstrated to be present during both mood episodes (Lembke and Ketter, 2002; Gray et al., 2006) and periods of remission in patients suffering from BD (Yurgelun-Todd et al., 2000; Bozikas et al., 2006; Derntl et al., 2009; Hoertnagl et al., 2011).

We have previously reported on particular impairments in the recognition of facial expressions depicting disgust and happiness in symptomatically remitted BD patients. Moreover, correct recognition of both happiness and fear was positively associated with functional outcomes (Hoertnagl et al., 2011). In order to expand on this previous research we have now investigated an extended sample of remitted BD patients and compared their performance on a task of FAR with the performances of symptomatically remitted patients with schizophrenia and a non-psychiatric control group on the same task. Taking into account methodological limitations of previous studies, we

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included a larger sample of BD and schizophrenia patients meeting strict remission criteria. The second aim was to explore the relationship between FAR abilities and patients' psychosocial functioning and quality of life (QoL).

2. Materials and methods

Forty outpatients with paranoid schizophrenia and 57 outpatients with bipolar I disorder according to DSM-IV as well as 50 healthy control subjects between the ages of 18 and 60 years were included in a cross-sectional study. In patients, diagnoses were confirmed by using the Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998). In order to ensure symptomatic remission, schizophrenia patients had to meet the severity component of the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987) proposed by Andreasen et al. (2005), whereas BD patients had to have a score of 8 or less on both the Montgomery–Asberg Depression Rating Scale (MADRS) (Montgomery and Asberg, 1979) and the Young Mania Rating Scale (YMRS) (Young et al., 1978). Healthy participants had to have a score of 63 or less on the Brief Symptom Inventory (BSI) (Franke, 2000) and to have no history of any psychiatric illness. Exclusion criteria included any other axis I disorder, developmental disorders and any physical illness that may have affected the participants' cognitive performance.

Patients were recruited from the psychiatric outpatient services of the Medical Universities Innsbruck and Salzburg, while healthy controls were recruited from the community and were chosen to match patients in age, sex, and education. All participants signed informed consent forms in accordance with the local ethics committees.

2.1. Premorbid intelligence

Premorbid intelligence was measured by using the German adaptation of the National Adult Reading Test (Nelson, 1992), the Mehrfachwahl-Wortschatz-Test B (MWT-B) (Lehrl, 1977), a reliable and valid multiple-choice vocabulary test. The items of the MWT-B consist of 37 lines, each comprising five words. The subject is asked to find the correct word in every line and to underline it. Each word correctly recognized scores one point.

2.2. Facial affect recognition test

FAR was assessed with the Facially Expressed Emotion Labeling (FEEL) test (Kessler et al., 2002). This computer program displays portrait pictures of actors with the typical facial expression of one of the six basic emotions for 300 ms each, after the same faces have been shown with a neutral expression. Subjects then have to decide quickly and accurately which of the six emotions they have just seen by clicking on the appropriate label (forced-choice response format). With 42 pictures being shown the FEEL score ranges from 0 to 42. In addition, we calculated misidentification scores for each of the six emotions.

2.3. Psychosocial functioning

Psychosocial functioning was evaluated by assessing the participants' partnership and employment status, and by assessing their living situation. In addition, the Global Assessment of Functioning Scale (GAF) (American Psychiatric Association, 1994) and the self-administered 26-item version of the World Health Organization Quality of Life assessment instrument (WHOQOL-BREF) (The WHOQOL Group, 1998) were used in patients.

2.4. Statistical analyses

Comparison of the three groups (schizophrenia, BD, and control) with regard to sociodemographic and clinical variables was performed by means of one-way analysis of variance, Kruskal–Wallis test and chi-square test, depending on the variable type (normally distributed metric, non-normally distributed metric, and categorical, respectively). Normality was checked by assessing the skewness of the distribution, considering values above 1 or below −1 as a substantial departure from a symmetrical distribution. Due to the non-normal distribution of the majority of the subscales of the WHOQOL-BREF quality of life (QoL) scores of the two patient groups were compared by means of the Mann–Whitney *U*-test.

Comparison of the three groups with respect to FAR (FEEL test) was performed by means of analysis of covariance (ANCOVA) with adjustment for gender since the three groups differed significantly in this variable. If statistical significance ($p \leq 0.05$) was attained in the overall comparison of the three groups, subsequent pairwise comparisons were performed by means of the least-significant difference method. In the case of three groups, this sequential testing procedure grants that the family-wise alpha-level of 0.05 is retained without correction for multiple testing (Levin et al., 1994). In some cases, the dependent variable had to be subjected to an appropriate transformation prior to the ANCOVA in order to obtain approximate normality (e.g., $x \rightarrow \sqrt{\{\text{highest possible score} - x\}}$). As most of the misinterpretation scores showed substantial departures from a normal distribution, the Kruskal–Wallis test was used for group comparisons with regard to misinterpretations, followed by Mann–Whitney *U*-tests for pairwise comparisons (after checking by means of Spearman rank correlation that the potentially confounding variable gender was not significantly associated with any of the misinterpretations).

In patients, associations of FAR with residual symptomatology, psychosocial functioning and QoL were evaluated by Spearman rank correlations due to the non-normal distribution of the majority of the variables involved. Separate correlation analyses were performed for the two patient groups. To account for the large number of statistical tests performed, all correlation analyses were subjected to a Bonferroni correction. Significant correlations were inspected more closely by means of partial correlation analysis adjusting for age and gender as potential confounders. Significant correlations between FAR and QoL were also adjusted for patients' residual symptomatology to check whether the latter may act as a common cause of both reduced affect recognition abilities and impaired QoL.

3. Results

3.1. Sample characteristics

Demographic and clinical characteristics of the study sample are summarized in Table 1. Patients and control subjects were comparable with respect to age and education, and there were no significant differences between the two patient groups with regard to duration of illness. However, the three groups differed significantly in gender distribution ($p = 0.037$). As expected, patients and control subjects differed significantly with respect to partnership, employment status and living situation. The mean GAF score was significantly lower in schizophrenia than in BD patients.

An overview of patients' QoL, as assessed by the WHOQOL-BREF, is given in Table 2. Compared to patients with schizophrenia those with BD achieved significantly lower scores in the domains ‘physical health’, ‘psychological health’, and global QoL.

3.2. Facial affect recognition

An overview of patients' and control subjects' FAR abilities, as assessed by the FEEL test, is given in Table 3. Within the schizophrenia group, recognition was best for facial expressions depicting happiness followed by those depicting surprise, anger, disgust, sadness, and fear. In contrast, BD patients recognized facial expressions depicting happiness best followed by those depicting anger, surprise, sadness, disgust, and fear. Compared to healthy control subjects, schizophrenia patients

Table 1
Sample characteristics.

Variable	Group		
	Schizophrenia patients ($n = 40$)	Bipolar patients ($n = 57$)	Controls ($n = 50$)
Age, mean ± SD	40.3 ± 8.5	41.9 ± 11.7	38.8 ± 6.9
Gender, *n* (%)*			
Male	22 (55.0)	20 (35.1)	29 (58.0)
Female	18 (45.0)	37 (64.9)	21 (42.0)
Education, years, mean ± SD	13.1 ± 2.8	13.1 ± 3.0	13.2 ± 2.2
MWT-B, mean ± SD	28.1 ± 4.6	29.1 ± 4.2	
Duration of illness, years, mean ± SD	12.5 ± 7.0	13.5 ± 9.8	–
PANSS positive symptoms, mean ± SD	8.1 ± 1.6	–	–
PANSS negative symptoms, mean ± SD	10.0 ± 3.1	–	–
PANSS general symptoms, mean ± SD	20.1 ± 3.2	–	–
PANSS total score, mean ± SD	38.2 ± 6.5	–	–
MADRS, mean ± SD	–	2.8 ± 2.3	–
YMRS, mean ± SD	–	1.1 ± 1.4	–
GAF score, mean ± SD#	75.7 ± 15.4	81.9 ± 11.5	–
Treatment, *n* (%)			
MS monotherapy	0 (0.0)	9 (16.1)	–
AP monotherapy	24 (61.5)	0 (0.0)	–
AP + AP	5 (12.8)	0 (0.0)	–
AD monotherapy	0 (0.0)	0 (0.0)	–
MS + AP	3 (7.7)	20 (35.7)	–
MS + AD	0 (0.0)	9 (16.1)	–
AP + AD	6 (15.4)	3 (5.4)	–
MS + AP + AD	1 (2.6)	15 (26.8)	–
Partnership status, *n* (%)**			
Single	20 (50.0)	26 (45.6)	16 (32.0)
Married/stable partnership	9 (22.5)	17 (29.8)	30 (60.0)
Divorced/separated	10 (25.0)	13 (22.8)	4 (8.0)
Widowed	1 (2.5)	1 (1.8)	0 (0.0)
Housing, *n* (%)**			
With original family	4 (10.0)	6 (10.5)	1 (2.0)
With own family	7 (17.5)	27 (47.4)	46 (92.0)
Alone	24 (60.0)	22 (38.6)	3 (6.0)
In a small group home	2 (5.0)	0 (0.0)	0 (0.0)
Other	3 (7.5)	2 (3.5)	0 (0.0)
Employment status, *n* (%)**			
Full-time employment	6 (15.0)	13 (22.8)	34 (68.0)
Part-time employment	6 (15.0)	11 (19.3)	10 (20.0)
Supported employment	6 (15.0)	1 (1.8)	0 (0.0)
Training	2 (5.0)	3 (5.3)	3 (6.0)
Housewife	1 (2.5)	1 (1.8)	3 (6.0)
Retired	16 (40.0)	22 (38.6)	0 (0.0)
Unemployed	3 (7.5)	6 (10.5)	0 (0.0)

Abbreviations:
MWT-B = Mehrfachwahl-Wortschatz-Test B (possible scores range from 1 to 99; higher scores indicate better performance).
PANSS = Positive and Negative Syndrome Scale.
MADRS = Montgomery–Asberg Depression Rating Scale.
YMRS = Young Mania Rating Scale.
GAF = Global Assessment of Functioning Scale.
MS = mood stabilizer.
AP = antipsychotic.
AD = antidepressant.
* $p = 0.037$ chi-square test (bipolar patients vs. controls: $p = 0.021$, Fisher's exact test).
\# $p = 0.045$ Mann–Whitney *U*-test.
** $p < 0.001$ chi-square test (schizophrenia patients vs. controls, bipolar patients vs. control.

achieved significantly lower FEEL scores for angry, disgusted, sad and, at a trend level, happy facial expressions, while BD patients achieved significantly lower scores for disgusted and happy facial expressions. The direct comparison of the two patient groups resulted in higher FEEL scores for expressions depicting disgust in schizophrenia patients (trend level) and in significantly higher FEEL scores for expressions depicting anger in BD patients.

3.3. Misinterpretations of facially expressed emotions

A listing of the most relevant misinterpretations of facially expressed emotions is given in Table 4. Within the schizophrenia group, the most frequently observed misinterpretations (>5%) included disgusted faces misinterpreted as angry expressions and vice versa, fearful faces misinterpreted as angry expressions, and sad faces misinterpreted as disgusted expressions. In BD patients, the most frequently observed misinterpretations included disgusted faces misinterpreted as angry expressions and vice versa.

A comparison of the two patient groups revealed that schizophrenia patients misinterpreted both happy and angry faces significantly more often as disgusted expressions, and, at a trend level, fearful faces as angry expressions than those suffering from BD, while BD patients significantly more often misinterpreted disgusted faces as angry expressions. Compared to the healthy control group patients with schizophrenia misinterpreted fearful faces more often as angry expressions and disgusted faces as surprised expressions. In addition, both sad and angry faces were more frequently misinterpreted as disgusted expressions. On the other hand, when compared to healthy subjects, BD patients misinterpreted disgusted faces as surprised or angry expressions, and sad faces as happy expressions.

Table 2
Quality of life (WHOQOL-BREF)[a] in schizophrenia patients and bipolar patients.

WHOQOL domain	Schizophrenia patients (S) ($n = 38$)		Bipolar patients (B) ($n = 55$)		Comparison S vs. B (Mann–Whitney *U*-test)	
	Mean	SD	Mean	SD	*z*	*p*
Physical health	74.8	11.6	66.1 ↓	16.6	2.491	0.013
Psychological	73.6	13.9	64.5 ↓	18.2	2.508	0.012
Social relationships	70.4	17.0	64.8	20.0	1.263	0.207
Environment	78.1	12.4	75.5	15.2	0.404	0.686
Global Quality of Life	76.0	16.3	65.4 ↓	21.0	2.355	0.019

[a] Range: 0 (poorest quality of life) to 100 (best quality of life).
↓ Significantly lower than in the schizophrenia group, $p < 0.05$.

3.4. Association of affect recognition abilities (FEEL) with psychopathological symptoms (PANSS, MADRS, YMRS) and psychosocial functioning (GAF, partnership, independent living, employment status)

Within the schizophrenia group, there was no significant association between FAR abilities and residual symptomatology or functioning after Bonferroni correction. Among BD patients, correct identification of happy faces correlated with lower scores on the MADRS ($r = -0.48$, Bonferroni corrected $p = 0.002$) and with the GAF score ($r = 0.42$, Bonferroni corrected $p = 0.022$). Adjustment for age and gender by partial correlation did not affect these findings. No significant correlations were observed between FAR abilities and YMRS scores as well as functioning.

3.5. Association of FAR abilities (FEEL) with QoL (WHOQOL-BREF)

Again, no significant correlations between affect recognition abilities and QoL were seen in schizophrenia patients (Bonferroni corrected). In BD patients, correct recognition of expressions depicting happiness was associated with global QoL ($r = 0.45$, Bonferroni corrected $p = 0.014$) as well as with the physical ($r = 0.44$, Bonferroni corrected $p = 0.022$) and psychological ($r = 0.47$, Bonferroni corrected $p = 0.006$) domains of the WHOQOL-BREF. When adjusting for age, gender and illness severity (MADRS, YMRS) by partial correlation, these associations lost significance ($r = 0.25$, $r = 0.19$ and $r = 0.27$, respectively; always Bonferroni uncorrected $p > 0.05$), mainly due to the MADRS score. Notably, depression as measured by the MADRS negatively correlated both with the patients' ability to recognize happy faces (see above) and with their QoL ($r = -0.47$, Bonferroni uncorrected $p < 0.001$ for global QoL, similar for other WHOQOL domains) and thus may be considered as a common cause of both impaired FAR and reduced QoL.

4. Discussion

The current study showed FAR impairments in both symptomatically remitted patients with schizophrenia and BD. These deficits were more pronounced in schizophrenia patients, but associations with residual symptomatology were only present in BD patients.

Generally, the correct recognition of affect represents an essential part of social cognition in people with psychosis (Amminger et al., 2012) and impacts both social relationships (Mueser et al., 1996; Pan et al., 2009; Amminger et al., 2012) and social functioning (Kee et al., 2003; Phillips et al., 2003; Addington et al., 2006; Fett et al., 2011). Accordingly and similar to previous studies (Bozikas et al., 2006; Chan et al., 2008; Hoertnagl et al., 2011), the current investigation revealed that symptomatically remitted patients with both schizophrenia and BD performed more poorly than healthy control subjects on a task of FAR. In addition, schizophrenia patients performed more poorly than those suffering from BD, which corroborates the findings of Addington and Addington (1998). However, the schizophrenia sample investigated in that study did not meet the strict remission criteria that were applied in the present survey and no formal instrument had been used to assess symptomatology in BD patients.

Previous studies in schizophrenia patients have reported on a negative relationship between affect recognition abilities and the degree of symptomatology (Poole et al., 2000; Kohler et al., 2003; Hofer et al., 2009; Chan et al., 2010; Chen et al., 2012). Due to a very low mean PANSS total score and the small range of scores in our sample we cannot address this issue. However, there was an inverse association between the degree of residual symptoms of depression and the ability to correctly recognize happy facial expressions in BD patients, which corroborates the findings of Gray et al. (2006). On the other hand, a mood-congruent bias was not detectable in patients suffering from residual symptoms of mania, also found by Gray et al. (2006).

Altogether, our data indicate that symptomatically remitted patients suffering from psychosis are especially impaired in the recognition of

Table 3
FEEL test (percent correct answers): comparison of schizophrenia patients, bipolar patients and healthy controls (percentage scores).

Emotion	Group			Comparison (analysis of covariance[a])				
	Schizophrenia patients (S)	Bipolar patients (B)	Controls (C)	Overall		S vs. B	S vs. C	B vs. C
Fear	58.9 ± 24.9	63.9 ± 26.6	68.3 ± 27.9	$F_{2,142} = 1.24$	ns	ns	ns	ns
Happiness	95.0 ± 9.5	93.7 ± 9.7	98.3 ± 5.5	$F_{2,142} = 4.04$	0.020	ns	(0.054)[b]	0.007
Surprise	82.1 ± 19.3	80.2 ± 19.6	86.0 ± 17.0	$F_{2,142} = 1.99$	ns	ns	ns	ns
Disgust	77.5 ± 25.0	68.4 ± 28.5	86.9 ± 21.6	$F_{2,142} = 8.73$	<0.001	(0.092)[b]	0.028	<0.001
Sadness	66.8 ± 25.6	69.4 ± 27.7	79.1 ± 22.2	$F_{2,142} = 2.50$	(0.086)[b]	ns	0.032	ns
Anger	79.6 ± 25.0	88.2 ± 21.4	91.1 ± 14.7	$F_{2,142} = 4.06$	0.019	0.016[c]	0.011	ns
Total score	76.7 ± 12.4	77.3 ± 13.0	85.0 ± 11.9	$F_{2,142} = 6.70$	0.002	ns	0.002	0.002

Table entries are mean ± standard deviation.
ns = not significant ($p > 0.1$).
[a] ANCOVA with adjustment for gender (for the emotions happiness, disgust and anger a "normalizing" transformation was used prior to the ANCOVA; see Statistical analyses).
[b] Trend-level significance, $p < 0.1$ (but >0.05).
[c] Significantly higher scores (better performance) in bipolar patients than in schizophrenia patients.

Table 4
Misinterpretations in the FEEL test (percentage scores)[a].

Misinterpretation		Group (mean ± SD)			Comparison (Mann–Whitney *U*-test)		
Correct answer	Given answer	Schizophrenia patients (S)	Bipolar patients (B)	Controls (C)	S vs. B	S vs. C	B vs. C
Fear	Anger	6.4 ± 9.1	3.0 ± 5.9	1.7 ± 5.5	(0.054)	0.002	ns[b]
Happiness	Disgust	1.4 ± 4.3	0.0 ± 0.0	0.3 ± 2.0	0.015[c]	ns	ns
Disgust	Surprise	1.8 ± 5.8	2.5 ± 6.1	0.0 ± 0.0	ns	0.023	0.003
Disgust	Anger	18.2 ± 25.5	25.8 ± 24.8	10.9 ± 17.5	0.048[d]	ns	<0.001
Sadness	Happiness	0.7 ± 4.5	2.0 ± 5.0	0.0 ± 0.0	ns	ns	0.006
Sadness	Disgust	6.1 ± 9.1	3.5 ± 7.3	2.3 ± 6.0	ns	0.019	ns
Anger	Disgust	10.4 ± 15.9	5.0 ± 15.2	2.6 ± 6.9	0.018 [c]	0.003	ns

[a] Only those misinterpretations are listed, for which significant overall group differences were found (Kruskal–Wallis test: χ^2 (2) > 6.0, $p < 0.05$).
[b] ns = not significant: $p > 0.10$.
[c] Significantly higher score (more misinterpretations) in the schizophrenia group than in the bipolar group.
[d] Significantly higher score (more misinterpretations) in the bipolar group than in the schizophrenia group.

negative facial affect. This finding was independent of the underlying disorder: both patients with schizophrenia and BD were impaired in the recognition of facial expressions depicting fear, disgust and sadness, while recognition was best for expressions depicting happiness. This is in agreement with previous research (Mandal et al., 1998; Edwards et al., 2002; Namiki et al., 2007; Hofer et al., 2009; Sparks et al., 2010; Hoertnagl et al., 2011; Martino et al., 2011). When directly comparing the two patient groups, individuals with schizophrenia performed worse in recognizing faces depicting angry expressions. This clearly might be relevant in the psychosocial context, especially as the appreciation of emotional expressions is essential for successful social functioning (Keltner et al., 2003). Dickerson et al. (2001), for example, have shown that schizophrenia patients are more impaired than patients suffering from BD on measures of social effectiveness and social acceptability. However, this issue cannot be addressed by our data and has to be studied in longitudinal studies.

Compared to the BD group, schizophrenia patients achieved higher QoL scores, which is in contrast to the findings of Latalova et al. (2011). However, that study did not use the strict remission criteria and another questionnaire was used to assess QoL. Accordingly, the two samples are not entirely comparable. We hypothesize that the schizophrenia patients investigated in the current study might have had better coping strategies to accept their illness and therefore to adjust their expectations of life. However, we did not address this issue.

Correlations of FAR abilities with QoL were low in the present patient sample. On the other hand, in BD patients the degree of residual depressive symptoms was negatively associated with QoL. Again, we hypothesize that particularly in patients suffering from BD the presence of residual symptoms might lead to difficulties to adjust to their state of health and to available resources. This would also be in line with our finding of an inverse association between MADRS scores and the correct identification of happy faces, which, on the other hand, was positively correlated with GAF scores.

To the best of our knowledge, this is the first study that directly compares misinterpretations of facial affect in schizophrenia and BD patients who are in remission. Despite the minimal residual symptomatology both patient groups were clearly impaired compared to the control group. Interestingly, the direct comparison of the two patient groups showed that schizophrenia patients more frequently misinterpreted both happy and angry faces as disgusted expressions, whereas BD patients more often misinterpreted disgusted faces as angry expressions. Again, these divergent deficits might be relevant in the psychosocial context, although an impairment in affect recognition is clearly not the sole reason for psychosocial deficits in these patient groups. For example, emotion responsivity has recently been suggested to be of special relevance in this context (Mathews and Barch, 2010).

The current study also has some limitations: (1) the FEEL test is conducted under time pressure and we did not use a control task to assess whether the deficits seen were associated with speed of information processing. In addition, one has to consider the issue of simulated vs. spontaneous or authentic affects which may be relevant to our findings. (2) Our patient sample was on psychotropic medication and the effect of these treatments on FAR is unclear. (3) The remission criteria were applied cross-sectionally and we do not know when patients had first met them, which clearly entails some degree of uncertainty regarding the time course of illness outcomes. On the other hand, in schizophrenia patients the remission status has been shown to be of considerable stability (Ciudad et al., 2009). (4) The design of the current study does not allow for direct causal conclusions regarding the influence of symptomatic remission and FAR abilities on patients' outcome. As this was a cross-sectional study, it will be critical to generate longitudinal follow-up data, to determine how the reported associations interact and change over time. However, our findings complement the increasing concerns in the field that both patients with schizophrenia and BD, even when in symptomatic remission, are in need for continuous psychosocial support. In addition, our findings support the need for metacognitive and social cognition training programs, which have been shown to improve affect recognition, social cognition, and psychosocial functioning (Sachs et al., 2012; Bersani et al., 2013; Rocha and Queirós, 2013).

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Contributors
N. Yalcin-Siedentopf recruited patients, made assessment of patients and wrote the manuscript. A. Hofer designed the study, wrote the study protocol and supervised revisions of the manuscript. G. Kemmler made the statistical analysis. A. Hausmann and E. Deisenhammer recruited patients. C. Hoertnagl, F. Biedermann, S. Baumgartner, A. Kaufmann and M. Muehlbacher recruited patients and made assessment of patients. W.W. Fleischhacker gave thoughtful comments and approved the final version.

Conflict of interest
There are no conflict of interests for any author.

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