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What can the study of first impressions tell us about attitudinal ambivalence and paranoia in schizophrenia?

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ABSTRACT

Although social cognition deficits have been associated with schizophrenia, social trait judgments – or first impressions – have rarely been studied. These first impressions, formed immediately after looking at a person's face, have significant social consequences. Eighty-one individuals with schizophrenia or schizoaffective disorder and 62 control subjects rated 30 neutral faces on 10 positive or negative traits: attractive, mean, trustworthy, intelligent, dominant, fun, sociable, aggressive, emotionally stable and weird. Compared to controls, patients gave higher ratings for positive traits as well as for negative traits. Patients also demonstrated more ambivalence in their ratings. Patients who were exhibiting paranoid symptoms assigned higher intensity ratings for positive social traits than non-paranoid patients. Social trait ratings were negatively correlated with everyday problem solving skills in patients. Although patients appeared to form impressions of others in a manner similar to controls, they tended to assign higher scores for both positive and negative traits. This may help explain the social deficits observed in schizophrenia: first impressions of higher degree are harder to correct, and ambivalent attitudes may impair the motivation to interact with others. Consistent with research on paranoia and self-esteem, actively-paranoid patients' positive social traits judgments were of higher intensity than non-paranoid patients'.

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1. Introduction

Social cognition is quite impaired in schizophrenia (Green et al., 2008). Although the study of social cognitive deficits has contributed to recent advances in our understanding of psychopathology and functional outcomes in schizophrenia (Green et al., 2008), one domain of social cognition that has rarely been investigated is social trait judgments.

We regularly form trait judgments of others even before we get to know them, to the point that we need to be reminded not to "judge a book by its cover". The social trait judgments that rely on short observation of others without any other form of knowledge are referred to as "first impressions" or "trait inferences" (Todorov and Uleman, 2002; Willis and Todorov, 2006). These judgments can be formed after brief glimpses of the target subject interacting with others or from static pictures of others. Indeed, studies in social perception have shown that when looking at people's faces, we rapidly evaluate them on multiple personality and social traits (Bar et al., 2006), and make judgments of their attractiveness and how sociable, trustworthy, dominant and aggressive they are. First impressions are fast and spontaneous, and we are often unaware of them (Willis and Todorov, 2006). Even though their accuracy is limited (Olivola and Todorov, 2010b; but see also Ambady et al. (2000)), the influence of first impressions on people's choices and behaviors is considerable (Zebrowitz and McDonald, 1991; Olivola and Todorov, 2010a). A high level of agreement in first impressions (Cronbach's coefficients >0.80) has been demonstrated among observers and across races and cultures (Zebrowitz et al., 1993;

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Albright et al., 1997), and researchers have identified several facial factors involved in our judgments of others (Montepare and Dobish, 2003; Said et al., 2009).

Little is known about first impressions in schizophrenia. Kraepelin described patients with schizophrenia as indifferent to others and to their environment, which may imply that they do not form impressions of others. However, recent laboratory research has shown that people with schizophrenia do form impressions of others. When compared to healthy controls, individuals with schizophrenia give higher ratings for "attractiveness" (Haut and MacDonald III, 2010), similar ratings for "friendly" (Kline et al., 1992) and "likeable" (Haker and Rössler, 2009; Taylor et al., 2011), whereas results for "trustworthiness" have been inconsistent (Baas et al., 2008; Couture et al., 2008; Pinkham et al., 2008; Haut and MacDonald III, 2010; Hooker et al., 2011; Strauss et al., 2012). More recently, McIntosh and Park (2014) used static (pictures) and dynamic (videos) stimuli, and participants rated each target on attractiveness, trustworthiness, approachability and intelligence. Although schizophrenia subjects gave higher ratings for social traits, there were no significant group differences.

Trustworthiness has been the social trait judgment most studied in schizophrenia, perhaps based on the assumption that paranoia may lead to Suspiciousness and poor attribution of trustworthiness in others. Studies that examined the relationship between trustworthiness judgments and paranoid ideas have yielded inconsistent results: one study reported that actively paranoid patients found faces trustworthy less frequently than non-paranoid patients (Pinkham et al., 2008). Two other studies found a positive correlation between trustworthiness ratings and positive symptoms (McIntosh and Park, 2014) or Suspiciousness (Hooker et al., 2011), whereas a fourth study found no correlation between trustworthiness ratings and persecutory delusions (Haut and MacDonald III, 2010). A major limitation has been the low sample size of these studies (fewer than 30 patients). Also, the use of other positive social traits besides trustworthiness may bring more clarity (Said et al., 2009).

Attitudinal ambivalence is the inclination to give an attitude object equivalently strong positive and negative evaluations (see Thompson et al. (1995)). Its measurement has been the subject of debate, and experts have recommended an indirect measure over a direct measure (Jonas et al., 2000). In indirect measures, positive and negative evaluations are measured separately. Investigators instruct participants to rate topics or objects on a series of distinct positive and negative attributes or beliefs, and a mathematical formula is used to measure ambivalence. Attitudinal ambivalence has been shown to impair decision making and motivation (Conner and Sparks, 2002). Consequently, people who have ambivalent impressions of others are less incline to approach and interact with others. Although affective ambivalence (the experience of pleasure and displeasure at the same time) is a core feature of schizophrenia (Trémeau et al., 2009; Cohen and Minor, 2010), little is known about attitudinal ambivalence in schizophrenia. Recently, we reported that attitudinal ambivalence is increased in schizophrenia (Antonius et al., 2013).

In the current study, we examined ten social trait judgments (attractive, trustworthy, intelligent, emotionally stable, fun-to-be-with, sociable, dominant, aggressive, mean and weird) in patients with schizophrenia or schizoaffective disorder. The primary aim of the study was to compare patients' first impressions of traits to healthy controls'. Although clinical observation of indifference would predict lower levels of trait ratings in schizophrenia, the few previous studies have reported similar or higher ratings, at least for positive traits. In order to resolve these conflicting hypotheses, we enrolled more subjects than previous studies and we used multiple positive and negative trait judgments. A second aim was to examine the relationship between paranoid ideas and social trait judgments using a correlational and categorical approach. Based on previous reports (Hooker et al., 2011; McIntosh and Park, 2014), we hypothesized that paranoid ideas are associated with higher positive traits. Finally we explored attitudinal ambivalence towards faces. We hypothesized that ambivalence would be higher in patients.

2. Methods

2.1. Participants

Participants included 81 individuals with schizophrenia or schizoaffective disorder and 62 non-patient control subjects. Patients were inpatients in a research unit at the Nathan Kline Institute for Psychiatric Research (NKI) or outpatients at Bellevue Hospital, New York. All were English-speaking and between 18 and 65 years of age, and had capacity to give consent. Diagnosis of schizophrenia or schizoaffective disorder was assessed using the Structured Clinical Interview for DSM-IV (SCID) (First et al., 1998) or the Diagnostic Interview for Genetic Studies (DIGS) (Nurnberger et al., 1994). Participants had normal or corrected vision. Non-patient control participants, who were community subjects who responded to advertisement and volunteered to participate in research studies conducted at NKI or Bellevue Hospital, had no psychiatric history and diagnosis as assessed with the Non-patient version of the SCID or the DIGS. All participants provided written informed consent as approved by the local Institutional Review Boards before completing any study procedures.

2.2. Procedures

A computer task was developed with thirty neutral faces (15 females, 15 males) from the Karolinska Faces[1] (Lundqvist et al., 1998). From a previous study (Said et al., 2009), we selected nine traits that are quite easy to comprehend, and we added the positive trait of "fun to be with". Participants were provided with a definition of each trait before they rated the faces on that trait (for example "dominant" was defined as "How controlling or powerful the person seems to be") Participants were asked to rate all of the faces on these ten trait judgments sequentially. "Attractive/good looking" was rated first as we wanted to measure attractiveness for completely novel faces, and the order for the other nine traits was randomized and kept constant across subjects, leading to the following order: mean, trustworthy, intelligent, dominant, fun to be with, sociable, aggressive, emotionally stable and weird. For example, for "intelligent", participants viewed the 30 Karolinska faces one by one, and were asked to rate "how intelligent the person seems to be" on a 1–5 point-Likert scale (from "not at all" to "extremely"). For each trait, the 30 faces were presented in a different randomized order. Exposure/response times were not limited.

2.3. Clinical ratings

Patients were assessed with the following scales: 1) the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987), using the original positive, negative and general psychopathology subscales; 2) the modified Scale for the Assessment of Negative Symptoms (SANS) (Andreasen, 1989); 3) the Calgary Depression Scale for Schizophrenia (CDSS) (Addington et al., 1992); 4) the Simpson and Angus scale (Simpson and Angus, 1970) for

[1] Female faces: 03, 04, 05, 09, 10, 16, 17, 18, 21, 23, 25, 26, 28, 31, 33. Male faces: 37, 40, 42, 43, 46, 52, 53, 56, 57, 63, 64, 66, 67, 68, 70.

extrapyramidal symptoms, and 5) the Independent Living Scales (Loeb, 1996) problem-solving factor (ILS-ps), which measures everyday problem-solving skills and has previously been used in schizophrenia in- and out-patients (Revheim et al., 2006). All raters demonstrated good inter-rater reliability during training.

2.4. Statistical analyses

First, we examined the internal consistency of the task by calculating Cronbach's α for each trait separately (using participants' scores for each face). Cronbach's α ranged from 0.94 to 0.96 for patients, and from 0.90 to 0.94 for controls.

Group comparisons were analyzed using mixed model analyses (SAS, Proc Mixed; Singer, 1998) because of the nested structure of our data. The dependent variable was participants' ratings; "subject" was entered as random factor and "group" and "trait" as fixed factors. An omnibus analysis was run, and as the interaction factor, group by trait, was significant, group differences were analyzed for each trait separately. In order to correct for multiple testing (ten traits), a false discovery rate correction was applied (Benjamini and Hochberg, 1995). Cohen's d effect sizes were calculated.

To examine correlations between traits and demographic and clinical data, we averaged each participant's ratings for each trait, and calculated Spearman's ρ coefficients. All analyses were two-tailed.

3. Results

Groups did not significantly differ for age, gender, ethnicity and parents' social economic status. Individuals with schizophrenia had a lower educational level (Table 1).

3.1. Trait ratings

The omnibus test showed a significant effect of group ($F_{(1,42739)}=16.03$, $p<0.0001$), trait ($F_{(9,42739)}=216.95$, $p<0.0001$) and group by trait interaction ($F_{(9,42739)}=9.39$, $p<0.0001$). When traits were examined individually, patients gave higher ratings than controls for attractive, fun, sociable, dominant, aggressive and mean (Fig. 1). Group differences for attractive, fun, dominant, aggressive and mean survived correction for multiple tests. The effect size (d) was highest for attractive and lowest for trustworthy. The significance of group differences did not change after controlling for education.

We examined the correspondence between patients' and controls' ratings across and within faces. First, we analyzed each trait separately. For each trait, we calculated each group's mean ratings for each face (n=30). We examined the Spearman's correlation between patients' 30 mean ratings and controls' 30 mean ratings, leading to 10 individual analyses. Correlation analyses showed very high correspondence between patients' and controls' ratings. Correlation coefficients were all significant and ranged from 0.81 for "fun-to-be-with" to 0.97 for "weird". Then, we analyzed each

Table 1
Demographics and clinical characteristics.

	Patients ($n=81$)	Non-patient controls ($n=62$)	Test statistic
Number of females (%)	23 (28)	24 (39)	$\chi^2=1.69$, $p=0.19$
Age (in years) (SD)	40.32 (10.6)	38.13 (13.61)	$F_{(1,141)}=1.17$, $p=0.28$
Education (in years) (SD)	12.22 (2.21)	14.34 (1.81)	$F_{(1,141)}=37.51$, $p<0.0001$
Parents' social economic status (Hollingshead index for occupation) (SD)	5.34 (1.77)	5.14 (2.14)	$F_{(1,141)}=0.34$, $p=0.54$
Race/ethnicity (%)			
African–American	43 (53)	22 (35)	Fisher's exact test: 7.48, $p=0.11$
White	20 (25)	23 (37)	
Hispanic	12 (15)	7 (11)	
Asian	3 (4)	7 (11)	
Other	3 (4)	3 (5)	
Quick IQ (SD)	90.12 (14.34)		
Outpatients (%)	39 (48)		
Number of hospitalizations (number of patients) (%)			
Less than 5	25 (31)		
From 5 to 14	42 (52)		
More than 14	14 (17)		
Diagnostic subtypes (%)			
Schizophrenia, paranoid	33 (41)		
Schizophrenia, undifferentiated	20 (25)		
Schizophrenia, residual	3 (4)		
Schizoaffective disorder	25 (31)		
Age at first psychiatric hospitalization (SD)	21.20 (8.06)		
Duration of illness (in years) (SD)	21 (11)		
Dosage of antipsychotic medication (chlorpromazine equivalent) (SD)	509 (336)		
Antipsychotic medications (%)			
First generation	8 (10)		
Second generation	55 (68)		
Combined	17 (21)		
No antipsychotics	1 (1)		
PANSS total score (SD)	66.35 (17.08)		
PANSS positive symptom subscale (SD)	16.44 (6.66)		
PANSS negative symptom subscale (SD)	16.78 (7.92)		
PANSS general psychopathology subscale (SD)	33.14 (8.07)		
SANS (SD) total scores	6.43 (6.42)		
ILS-ps factor (SD)	51.25 (9.26)		
CDSS (SD)	2.69 (3.46)		
Simpson and Angus scale (SD)	2.19 (2.60)		

PANSS: Positive and Negative Syndrome Scale. SANS: modified Scale for the Assessment of Negative Symptoms. ILS-ps: Independent Living Scales problem-solving factor. CDSS: Calgary Depression Scale for Schizophrenia.

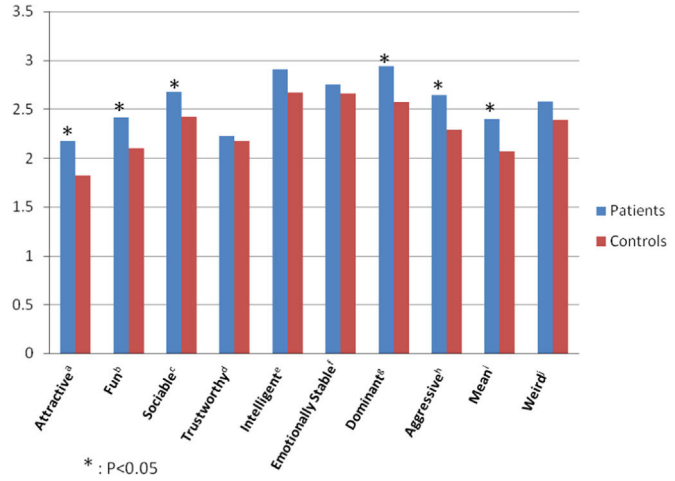

Fig. 1. Trait ratings. [a] Patients: m=2.16 (SD: 0.81), controls: 1.82 (SD: 0.44), $F_{(1,4147)}=9.51$, $p=0.002$ (after false discovery rate [FDR] correction: $p=0.01$), $d=0.55$. [b] Patients: m=2.43 (SD: 0.82), controls: 2.10 (SD: 0.63), $F_{(1,4147)}=6.51$, $p=0.01$ (FDR: $p=0.02$), $d=0.43$. [c] Patients: m=2.67 (SD: 0.75), controls: 2.42 (SD: 0.63 $F_{(1,4147)}=3.85$, $p=0.05$ (FDR: $p=0.07$), $d=0.35$. [d] Patients: m=2.23 (SD: 0.76), controls: 2.17 (SD: 0.55), $F_{(1,4147)}=0.45$, $p=0.50$ (FDR: $p=0.50$), $d=0.07$. [e] Patients: m=2.92 (SD: 0.84), controls: 2.67 (SD: 0.57), $F_{(1,4147)}=3.77$, $p=0.052$ (FDR: $p=0.07$), $d=0.31$. [f] Patients: m=2.76 (SD: 0.72), controls: 2.66 (SD: 0.56), $F_{(1,4147)}=0.82$, $p=0.36$ (FDR: $p=0.40$), $d=0.14$. [g] Patients: m=2.95 (SD: 0.82), controls: 2.57 (SD: 0.62), $F_{(1,4147)}=8.90$, $p=0.003$ (FDR: $p=0.01$), $d=0.50$. [h] Patients: m=2.67 (SD: 0.78), controls: 2.29 (SD: 0.61), $F_{(1,4147)}=9.94$, $p=0.002$ (FDR: $p=0.01$), $d=0.50$. [i] Patients: m=2.41 (SD: 0.84), controls: 2.07 (SD: 0.61), $F_{(1,4147)}=6.57$, $p=0.01$ (FDR: $p=0.02$), $d=0.44$. [j] Patients: m=2.62 (SD: 0.83), controls: 2.39 (SD: 0.60), $F_{(1,4147)}=3.44$, $p=0.06$ (FDR: $p=0.08$), $d=0.25$.

face separately. For each face, we calculated each group's mean ratings for each trait (n=10). We examined the Spearman's correlation between patients' 10 mean ratings and controls' 10 mean ratings, leading to 30 individual analyses. All correlations were significant ranging from 0.63 to 0.99 (only 4 out of 30 correlation coefficients were <0.80).

Finally, we ran an exploratory factor analysis with oblique rotation in each group (Oblimin) as previously done (Said et al., 2009). We specifically examined between-subjects factors by using each participant's mean ratings for each trait. In each group, two factors had an Eigenvalue greater than 1, explaining 60.2% of the variance in patients, 65.4 in controls and 62.4 in combined groups. In order to confirm a two-factor model we ran a parallel analysis and a Minimum Average Partial (MAP) test, and both analyses confirmed a two-model factor as the best model. As can be seen in Table 2, the first factor corresponded to positive social traits, and the second factor to negative social traits. Dominant loaded on the negative factor in controls, and on both factors in patients and when groups were combined, reflecting some valence ambiguity for "dominant".

3.2. Attitudinal ambivalence

Although several formulas have been used to measure attitudinal ambivalence (Jonas et al., 2000), the Griffin formula[2] (Conner and Sparks, 2002) has been the most used and recommended. First, we used the results of the factor analyses to categorize traits as positive or negative. We selected the six positive traits that loaded highly on the first factor in both groups (attractive, fun, emotionally stable, intelligent, sociable and trustworthy) and the four negative traits that loaded highly on factor 2 in both groups (aggressive, mean, dominant and weird). For each subject, we used

[2] Attitudinal ambivalence $=((P+N)/2)-|P-N|$. Where P=positive traits ratings and N=negative traits ratings.

Table 2
Factor analysis for trait judgments. Loadings of trait ratings on the first three factors (extraction method: principal component analysis. rotation method: oblimin).

	Groups combined		Patients		Controls	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
Eigenvalues	*3.89*	*2.35*	*3.78*	*2.24*	*4.00*	*2.54*
Fun	0.83	−0.06	0.79	−0.06	0.88	0.16
Intelligent	0.83	−0.07	0.83	0.001	0.83	0.02
Sociable	0.83	−0.12	0.83	−0.07	0.82	0.02
Attractive	0.77	−0.02	0.77	−0.02	0.74	0.12
Trustworthy	0.70	−0.15	0.69	−0.03	0.81	−0.08
Emotionally stable	0.55	−0.42	0.59	−0.46	0.53	−0.17
Dominant	0.56	0.61	0.51	0.61	0.38	0.77
Weird	−0.16	0.75	−0.20	0.73	−0.41	0.64
Mean	0.14	0.76	0.13	0.70	−0.24	0.81
Aggressive	0.28	0.80	0.20	0.79	0.07	0.89

Variances significantly differed between groups for "attractive", "intelligent", "mean" and "trustworthy" (Levene's test of homogeneity of variances).

their mean positive rating and their mean negative ratings for each face, to calculate the Griffin score. We compared groups using a mixed model with "subject" as random factor, and patients showed greater attitudinal ambivalence than controls (patients' Griffin scores: mean=2.03, SD=0.76, controls' Griffin scores: mean=1.74, SD=0.70; $F_{(1,4147)}=13.78$, $p=0.0002$). In a second analysis, we removed "dominant" from the negative traits as it loaded on both factors in patients. Again, patients showed higher attitudinal ambivalence than controls (patients' Griffin scores: mean=1.92, SD=0.81, controls' Griffin scores: mean=1.67, SD=0.74; $F_{(1,4147)}=10.51$, $p=0.001$).

3.3. Associations with paranoia

We examined the correlations between the PANSS item, *Suspiciousness* and trait ratings in patients. *Suspiciousness* significantly and positively correlated with "fun" ($\rho=0.27$, $p=0.02$), and "sociable" ($\rho=0.35$, $p=0.001$), and the latter correlation remained significant after Bonferroni correction for multiple tests. Of note, *Suspiciousness* did not correlate with "trustworthy" judgments ($\rho=0.07$, $p=0.53$). We also divided patients into two classes: actively-paranoid patients (PANSS Suspiciousness score >3; $n=24$) and non-paranoid patients (PANSS Suspiciousness score ≤ 3; $n=57$) (see Thewissen et al. (2008)). The omnibus test showed a significant effect of class ($F_{(1,24201)}=5.42$, $p=0.02$), trait ($F_{(9,24201)}=94.25$, $p<0.0001$) and class by trait ($F_{(9,24201)}=11.23$, $p<0.0001$). Actively-paranoid patients gave significantly higher ratings on sociable ($F_{(1,2349)}=10.09$, $p=0.002$), fun ($F_{(1,2349)}=5.09$, $p=0.02$) and emotionally stable ($F_{(1,2349)}=4.78$, $p=0.03$). Only differences found for the trait "sociable" survived correction for multiple testing.

3.4. Associations with demographics and clinical ratings

As the Karolinska faces are Caucasian, we examined the effect of ethnicity/race. Ethnic/racial groups did not differ from each other on any traits, and more specifically, African–American participants did not differ from Caucasian participants on their ratings of any traits.

In controls, correlations between trait ratings and age or education did not reach significance, and males did not significantly differ from females on any traits ratings. Among patients, females gave higher ratings for "dominant" than males (females: mean=3.48, SD=0.81, males: mean=2.75, SD=0.74, $F_{(1,79)}=15.36$, $p<0.0001$, $d=0.94$). Schizophrenia patients did not

significantly differ from patients with schizoaffective disorder on any traits. Compared to outpatients, inpatients gave higher ratings for emotionally stable ($F_{(1,79)}=6.38$, $p=0.01$), and sociable ($F_{(1,79)}=11.56$, $p=0.0007$). Other demographics and medication dosages (chlorpromazine equivalency values; Andreasen et al., 2010) did not significantly correlate with any trait ratings. Among clinical ratings, only depression scores negatively correlated with ratings of "emotionally stable" ($\rho=-0.36$, $p=0.001$). Of note, correlations between each PANSS positive symptom (except Suspiciousness) and social traits were all non-significant. In patients, ILS-ps scores were negatively and significantly correlated with aggressive ($\rho=-0.28$, $p=0.01$), intelligent ($\rho=-0.23$, $p=0.04$), sociable ($\rho=-0.25$, $p=0.03$), and weird ($\rho=-0.24$, $p=0.03$) ratings. We were also interested in the association between attitudinal ambivalence and independent living skills. For each patient, we averaged the Griffin scores obtained for the 30 faces, and this variable was used as the patient' global degree of attitudinal ambivalence. Correlation analysis showed that patients' attitudinal ambivalence was significantly and negatively correlated with ILS-ps scores ($\rho=-0.27$, $p=0.02$).

4. Discussion

We examined trait impressions of neutral faces in patients with schizophrenia or schizoaffective disorder. We found that: 1) compared to controls, patients' first impressions ratings were of higher intensity for some positive and negative social traits, 2) patients showed a higher degree of attitudinal ambivalence than controls, 3) active paranoia was associated with higher ratings of some positive social traits, and 4) in patients, better daily life skills were associated with lower first impression intensities.

4.1. Group comparisons

Patients with schizophrenia or schizoaffective disorder were able to form trait impressions from faces, and we found a high correspondence between patients' and controls' judgments.

Patients gave higher ratings than controls for attractive, fun, sociable, dominant, aggressive and mean. Group differences for attractive, fun, dominant, aggressive and mean survived correction for multiple tests. The largest effect sizes were for attractive, dominant and aggressive. Our results are generally consistent with previous studies that mostly reported similar or higher positive traits ratings in schizophrenia (Kline et al., 1992; Haker and Rössler, 2009; Haut and MacDonald III, 2010; Taylor et al., 2011; McIntosh and Park, 2014), and extend those results to negative traits. As patients gave higher ratings to some positive and negative traits, response bias needs to be considered. This can be ruled out since patients' and controls' ratings for "trustworthy" or "emotionally stable" were very similar, and the group-by-trait interaction was significant (meaning that group differences differed across traits). For the same reason, other global explanations such as group differences in scaling, visual processing, or context sensitivity can be ruled out. Although, group differences in calibration at the individual trait level cannot be ruled out, we have shown that patients and controls used similar strategy when making trait ratings (Trémeau et al., 2015).

As all faces were neutral, our result of higher trait ratings in patients parallels findings from laboratory affective studies, which show that schizophrenia subjects rate neutral stimuli as both more pleasant and more unpleasant (Trémeau et al., 2009; Cohen and Minor, 2010; Ursu et al., 2011), and reinforces the idea that schizophrenia participants give more salience to neutral stimuli than healthy controls. This general finding extends to other domains such as motivation (see Gold et al. (2013)).

Our results challenge the view that patients see others simply as more positive or as more negative, and bring a more nuanced perspective. Patients attributed both more positive and more negative traits to faces than controls: they were more ambivalent. Moreover, attitudinal ambivalence was inversely correlated with functional skills. In social psychology, important proximal and distal consequences of attitudinal ambivalence have been identified. Attitudinal ambivalence impairs decision making, and weakens the association between attitudes and intention, and between attitude and behavior (Conner and Sparks, 2002). Our results suggest that attitudinal ambivalence towards others results in lack of social motivation and engagement, opening the door to new research. Another potential explanation for asociality can be derived from our results of more intense trait ratings in patients. As first impressions are often incorrect (Olivola and Todorov, 2010b), and since patients' traits ratings tended to be more intense than controls', patients may have a more difficult time correcting their first impressions. This could have negative social consequences. In accord with another study (McIntosh and Park, 2014), intensity of trait ratings was significantly and negatively associated with functional skills but not with negative symptoms. However, these results should be interpreted with caution as trait ratings of static faces in a laboratory situation may be quite different from social trait judgments formed in the presence of richer information in a naturalistic setting. In this study, participants were specifically instructed to rate specific traits in the faces, thus the question remains: do patients form intense impressions of others in everyday life?.

Overall, very few clinical data correlated with study variables. Patients with more depressive symptoms rated faces as less emotionally stable. This finding is consistent with previous studies showing that sad mood induces a mood-congruent negative bias in the perception of others (Bouhuys et al., 1995).

4.2. Paranoia and social traits

We found that Suspiciousness was positively correlated with ratings of fun and sociable, and actively-paranoid patients rated some positive traits as more intense than non-paranoid patients. These results are in accord with two other studies that found a positive correlation between positive traits ratings and positive symptoms (McIntosh and Park, 2014) or with Suspiciousness (Hooker et al., 2011). Moreover, a related finding has been reported in studies using the "Ultimatum game", in which participants have to reject or accept an offer to share money, and feelings of unfairness and trust are probed. Intuitively it could be expected that paranoid participants would reject offers more frequently; however, the opposite result was reported (Csukly et al., 2011). All these results clearly show that paranoid patients can have positive perceptions of others, and argue for the stochastic emergence of paranoid ideas (which was further suggested by the lack of association between *Suspiciousness* and "trustworthy" ratings). A potential explanation for higher positive trait ratings in paranoid patients comes from research on self-esteem and self-concepts. Extensive research has found that paranoid delusions are associated with low self-esteem (Kesting and Lincoln, 2013; Tiernan et al., 2014), and decreases in self-esteem immediately precede the occurrence of paranoid ideas, suggesting a causal role of low self-esteem in the experience of paranoia (Thewissen et al., 2008). In a seminal study, Graham and Clark (2006) showed that people low in self-esteem form unstable and poorly integrated impressions of others. Compared to people with high self-esteem, people with low self-esteem form higher positive impressions of others in a no-threat environment and lower positive impressions of others in threatening conditions. In our study, the tasks were conducted in a non-threatening environment, and brought positive feelings:

participants reported feeling excited about the tasks (see Trémeau et al. (2014)) and they earned money for their participation. Consequently, if we assume that actively-paranoid patients behaved as people with low self-esteem, our results of higher positive traits ratings in actively-paranoid patients are consistent with Graham and Clarke's study results. Interestingly, Hooker et al. (2011) showed that the traits ratings of patients with high *Suspiciousness* scores were particularly sensitive to negative cues (which can be compared to a threatening environment), leading to a drop in their ratings of positive social traits. All these finding should bring a better understanding of the dynamic relationship between social functioning and psychopathology in paranoid subjects.

4.3. Limitations

Measuring attitudinal ambivalence has been challenging, and no formula-based measure has been considered fully adequate (Conner and Sparks, 2002). For this reason we chose the most used measure. No control task (such as age or gender discrimination task) was used to test for relatively normal face processing in patients. As in other studies (Pinkham et al., 2008; Thewissen et al., 2008; Hooker et al., 2011), we used the PANSS item, Suspiciousness, to measure paranoia. It can be argued that a multi-item scale would have brought more reliability and precision, and should be considered in future studies. All patients were on antipsychotic medications. Although no study variable was associated with chlorpromazine equivalents, the exact role of medications in affect processing cannot be fully examined unless unmedicated participants are enrolled.

4.4. Conclusions and future developments

Patients with schizophrenia or schizoaffective disorder can readily form impressions of social traits from static photographs of faces and do so in a rather similar pattern to controls, but tend to assign higher ratings on positive and negative traits. Moreover, their impressions are more ambivalent, combining positive and negative attitudes to a higher degree than in controls. These two differences may explain some of the social deficits observed in schizophrenia: first impressions of higher degree may be harder to correct, and ambivalent attitudes may impair the motivation to interact with others. Actively-paranoid patients' positive traits judgments were of higher intensity than non-paranoid patients'. Even though this finding appears counterintuitive at first sight, it is consistent with previous studies and with research on self-esteem and self-concepts, and refutes the view of paranoia as a constantly pervading process.

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Conflict of interest

Fabien Trémeau, Daniel Antonius, Alexander Todorov, Yasmina Rebani, Kelsey Ferrari, Sang Han Lee, Daniel Calderone, Karen A. Nolan, Pamela Butler, Dolores Malaspina and Daniel Javitt have declared that there are no conflicts of interest in relation to the subject of this study.

Contribution

Fabien Trémeau, Daniel Antonius, Alexander Todorov, Dolores Malaspina and Daniel Javitt designed the study. Fabien Trémeau, Daniel Antonius, Yasmina Rebani, Kelsey Ferrari and Daniel Calderone conducted the study. Fabien Trémeau, Sang Han Lee, and Karen A. Nolan analyzed the data. Fabien Trémeau, Daniel Antonius, Karen A. Nolan and Pamela Butler worked on the first drafts of the paper.

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