Schizophrenia Research 160 (2014) 142–149

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Forming first impressions of others in schizophrenia: Impairments in fast processing and in use of spatial frequency information

J. Vakhrusheva [a], V. Zemon [a,b], M. Bar [c,d,*], N.G. Weiskopf [b,e], F. Tremeau [b], E. Petkova [b,f], Z. Su [f], I.Y. Abeles [b,g,h], P.D. Butler [b,g,h]

[a] Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY, United States
[b] Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY, United States
[c] Gonda Multidisciplinary Brain Research Center, Bar-Ilan University, Ramat Gan, Israel
[d] Martinos Center at Massachusetts General Hospital, Harvard Medical School, Charlestown, MA, United States
[e] Department of Biomedical Informatics, Columbia University, New York, NY, United States
[f] Department of Child and Adolescent Psychiatry, New York University Langone Medical Center, New York, NY, United States
[g] Department of Psychiatry, New York University School of Medicine, New York, NY, United States
[h] Department of Psychology, City University of New York, New York, NY, United States

ARTICLE INFO

Article history:
Received 18 June 2014
Received in revised form 14 September 2014
Accepted 9 October 2014
Available online 29 October 2014

Keywords:
Schizophrenia
Social cognition
Spatial frequency
Visual processing
First impressions
Threat

ABSTRACT

Individuals form first impressions of others all the time, which affects their social functioning. Typical adults form threat impressions in faces with neutral expressions quickly, requiring less than 40 ms. These impressions appear to be mediated by low spatial frequency (LSF) content in the images. Little is known, however, about mechanisms of first impression formation in schizophrenia. The current study investigated how quickly individuals with schizophrenia can form consistent impressions of threat compared with controls and explored the mechanisms involved. Patients and controls were presented intact, LSF- or high spatial frequency (HSF)-filtered faces with durations that varied from 39 to 1703 ms and were asked to rate how threatening each face was on a scale from 1 to 5. In order to assess the speed of impression formation for intact faces, correlations were calculated for ratings made at each duration compared to a reference duration of 1703 ms for each group. Controls demonstrated a significant relation for intact faces presented for 39 ms, whereas patients required 390 ms to demonstrate a significant relation with the reference duration. For controls, LSFs primarily contributed to the formation of consistent threat impressions at 39 ms, whereas patients showed a trend for utilizing both LSF and HSF information to form consistent threat impressions at 390 ms. Results indicate that individuals with schizophrenia require a greater integration time to form a stable "first impression" of threat, which may be related to the need to utilize compensatory mechanisms such as HSF, as well as LSF, information.

1. Introduction

People with schizophrenia have deficits across a number of social cognitive domains including facial emotion recognition, theory of mind, and social perception (Green et al., 2008; Kohler et al., 2010; Savla et al., 2013). These impairments affect ability to engage in social interactions and are related to poor functional outcome (Couture et al., 2006; Fett et al., 2011; Irani et al., 2012). One important area of social functioning is the ability to make spontaneous judgments about an individual's personality characteristics or perceived intent based on facial information. However, there is a paucity of studies examining mechanisms by which individuals with schizophrenia form first impressions.

Frequently, individuals form first impressions of others' traits and characteristics to determine how threatening, trustworthy, intelligent, likeable, attractive, or competent they are. First impressions can be made based on emotional expressions in faces, facial structure, and even subtle expressions in neutral faces (Hassin and Trope, 2000; Oosterhof and Todorov, 2008; Said et al., 2009). This process is spontaneous, based on limited information, and, regardless of accuracy, can affect social interactions and behavior (Willis and Todorov, 2006; Olivola and Todorov, 2010).

Additionally, some judgments, particularly those of threat and trustworthiness, may be crucial for survival. Thus, one would expect these judgments to be made very quickly, which turns out to be the case. In two similar studies, ratings of threat (Bar et al., 2006) and trustworthiness (Todorov et al., 2009) made by healthy individuals after exposure to neutral faces in as short a duration as 33–39 ms agreed with ratings made at more leisure. Whether patients with schizophrenia need longer durations of viewing faces than controls to make a first impression

* Corresponding author at: Bar-Ilan University, Ramat Gan 5290002, Israel. Tel.: +972 3 531 7755; fax: +972 3 535 2184.
E-mail address: Moshe.bar@biu.ac.il (M. Bar).

http://dx.doi.org/10.1016/j.schres.2014.10.012
0920-9964/

remains an open question. Studies showing that patients need longer exposure durations to achieve configural processing of faces similar to that of controls (Butler et al., 2008) and have increased reaction time when making social appraisals (Taylor et al., 2011) suggest that this may be the case.

Little is known about mechanisms used to form first impressions, even in healthy individuals. Bar et al. (2006) assessed the role of spatial frequency content in first impression formation because low spatial frequency (LSF, low resolution) information is extracted much more rapidly than high spatial frequency (HSF, fine detail) information, providing coarse-to-fine processing of information (Bar, 2003). Furthermore, LSF information involves neural circuitry implicated in threat perception (Adolphs et al., 1999; Vuilleumier et al., 2003). As hypothesized, LSF processing played a role in first impression formation: a significant relationship was found between threat judgments made from LSF-filtered faces, but not HSF-filtered faces, shown for 39 ms and judgments made from unfiltered faces. Some studies show that patients with schizophrenia exhibit impairment in processing LSF information in objects, faces, and simple stimuli (O'Donnell et al., 2002; Butler et al., 2005; Martinez et al., 2008; Silverstein et al., 2010; Martinez et al., 2011; Calderone et al., 2013). Other studies found impairment in processing both LSF and HSF information (Slaghuis, 1998; Keri et al., 2002). Thus, patients may not utilize spatial frequency, particularly LSF information, similarly to controls in forming first impressions.

Given the impact of first impressions and difficulties in social cognition of patients with schizophrenia, it is important to understand the mechanisms of first impression formation. The present study utilized the paradigm of Bar et al. (2006) to investigate the possibility that patients need longer duration and utilize different mechanisms than healthy controls to form first impressions. Specifically, it was hypothesized that controls would be able to quickly form a consistent first impression that would be reliant on the use of LSF information. It was hypothesized that patients with schizophrenia would take longer to make a stable first impression and require HSF as well as LSF information to do so.

2. Materials and methods

2.1. Participants

Data were collected in two separate experiments. In Experiment 1, participants were 47 patients (39 male) meeting Diagnostic and Statistical Manual of Mental Disorder (Fourth Edition; DSM-IV) criteria for schizophrenia (n = 38) or schizoaffective disorder (n = 9), and 43 controls (24 male) of similar age. In Experiment 2, participants were 40 patients (34 male) meeting criteria for schizophrenia (n = 32) or schizoaffective disorder (n = 8) and 38 controls (21 male) of similar age. Thirty-seven patients and 33 controls participated in both experiments, so that the total sample included 50 patients and 48 controls. Clinical and demographic information are presented in Table 1.

Patients were recruited from inpatient and outpatient facilities associated with the Nathan Kline Institute for Psychiatric Research. Diagnoses were obtained using the Structured Clinical Interview for DSM-IV (SCID) and all available clinical information. Controls were recruited through the Volunteer Recruitment Pool at the Nathan Kline Institute and individuals with a history of SCID-defined Axis I psychiatric disorders were excluded. Participants were excluded if they had any neurological or ophthalmic disorders that might affect performance or met criteria for alcohol or substance dependence within the last six months or abuse within the last month. All participants provided informed consent according to the Declaration of Helsinki. This study was approved by the Nathan Kline Institute for Psychiatric Research/Rockland Psychiatric Center and Rockland County Department of Mental Health Institutional Review Boards.

Patients and controls did not differ significantly in age. However, there was a significant difference in gender between groups (Fisher's exact test,

Table 1
Demographics and clinical characteristics of patients with schizophrenia and healthy controls in each experiment.

	Experiment 1		Experiment 2	
	Patients (n = 47)	Controls (n = 43)	Patients (n = 40)	Controls (n = 38)
Age, y	38.9 ± 10.8	37.4 ± 12.1	39.0 ± 10.4	38.4 ± 12.0
Gender (male/female)	39/8	24/19[a]	34/6	21/17[a]
Diagnosis				
Schizophrenia	38	–	32	–
Schizoaffective disorder	9	–	8	–
Chlorpromazine daily equivalent (mg)	733.4 ± 588.7 (n = 46)[b]	–	656.8 ± 465.3 (n = 39)[b]	–
Antipsychotics				
Atypical	35	–	30	–
Typical	1	–	1	–
Both	10	–	8	–
None	1	–	1	–
Duration of illness (y)	14.8 ± 9.2 (n = 46)	–	15.3 ± 8.9 (n = 39)	–
Participant socioeconomic status	28.2 ± 12.9	45.7 ± 8.8[c]	26.0 ± 10.5	45.9 ± 9.1[c]
Parental socioeconomic status	41.1 ± 13.4	44.0 ± 13.2	38.8 ± 13.7	45.4 ± 12.4
PANSS total score	70.4 ± 12.7 (n = 40)	–	70.0 ± 12.5 (n = 37)	–
PANSS Positive Scale	18.5 ± 6.1	–	18.4 ± 5.9	–
PANSS Negative Scale	17.2 ± 3.9	–	16.9 ± 4.1	–
PANSS General Psychopathology Scale	34.7 ± 6.3	–	34.5 ± 6.3	–
SANS total score (including global scores)	28.3 ± 16.1 (n = 39)	–	26.7 ± 10.7 (n = 34)	–
Highest grade achieved	12.3 ± 2.2 (n = 46)	14.8 ± 2.0	11.9 ± 1.8	14.8 ± 2.0
IQ (quick test)	96.3 ± 9.1	108.4 ± 10.9[c]	95.8 ± 9.3	107.5 ± 10.4[c]

Note: Values are M ± SD. Numbers of participants per group are noted when there are missing data. Socioeconomic status was measured by the four-factor Hollingshead Scale (Hollingshead, 1975). PANSS, Positive and Negative Syndrome Scale (Kay et al., 1987); SANS, Scale for the Assessment of Negative Symptoms (Andreasen, 1984).

[a] Fisher's exact test, $p < .01$.

[b] Chlorpromazine equivalence mean is based on total amount of participants receiving medication at time of testing.

[c] t-Test, $p < .001$.