Perception of faces in schizophrenia: Subjective (self-report) vs. objective (psychophysics) assessments

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ABSTRACT

Objectives: Face perception impairment in schizophrenia has been demonstrated, mostly through experimental studies. How this laboratory-defined behavioral impairment is associated with patients' perceptual experience of various faces in everyday life is however unclear. This question is important because a first-person account of face perception has direct consequences on social functioning of patients. In this study, we adapted and administered a self-reported questionnaire on narrative perceptual experience of faces along with psychophysical assessments of face perception in schizophrenia.
Methods: The self-reported questionnaire includes six rating items of face-related functioning in everyday life, providing a subjective measure of face perception. The psychophysical assessment determines perceptual threshold for discriminating different facial identities, providing an objective measure of face perception.
Results: Compared to controls (n = 25), patients (n = 35) showed significantly lower scores (worse performance) in the subjective assessment and significantly higher thresholds (worse performance) in the objective assessment. The subjective and objective face perception assessments were moderately correlated in controls but not in patients. The subjective face perception assessments were significantly correlated with measurements of a social cognitive ability (Theory of Mind), again in controls but not in patients.
Conclusion: These results suggest that in schizophrenia the quality of face-related functioning in everyday life is degraded and the role that basic face discrimination capacity plays in face-related everyday functioning is disrupted.

1. Objectives

Schizophrenia patients have severe social functioning problems in everyday life (Green et al., 2008; Harvey, 2013). Given that human faces provide a rich source of social information, understanding social functioning problems in this psychiatric disorder should begin with and focus on face processing. In fact, face perception impairments have been shown in schizophrenia (Phillips and David, 1995; Chen, 2011; Darke et al., 2014; Bortolon et al., 2015). The impaired perception of faces was largely defined by neuropsychological tests administered in laboratory (Archer et al., 1992; Whittaker et al., 2001; Butler et al., 2008; Chen et al.,

2008; Shin et al., 2008; Zivotofsky et al., 2008). From a neuropsychological perspective, face perception is about identifying a personal identity or recognizing a type of emotion conveyed on faces (Bruce and Young, 1986). From an ecological perceptive, however, face perception is about extracting and utilizing social signals conveyed on faces to guide social behaviors in everyday life (McArthur and Baron, 1983).

It remains an open question to what extent the neuropsychological measures of face perception represent and reflect patients' perceptual experience of various faces in everyday life. Answers are needed here in order to provide an ecologically validated assessment of face perception and face-related everyday functioning in patients, especially in assessment of face-related perceptual and social experience in schizophrenia.

In prosopagnosia, a condition referring to a selective perceptual deficit in recognizing facial identities (Bodamer, 1947), face perception problems elicited from neuropsychological tests and in

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self-reported questionnaires were significantly correlated (Stollhoff et al., 2011). Face perception training in individuals with prosopagnosia produced not only improved performances assessed using neuropsychological tests but also yielded consistent self-reported diary improvements (DeGutis et al., 2014). The findings in this face recognition disorder suggest that comparison of objective measurements from laboratory setting and subjective measurements based on self-reported questionnaire provides a way to link neuropsychological assessment of face perception to face-related perceptual behaviors in everyday life.

In this study, we aimed to evaluate and compare face perceptions in schizophrenia using both subjective and objective assessments. The subjective assessment, geared towards ecological aspects of face perception, was designed and implemented through a self-reported questionnaire (DeGutis et al., 2014). The objective assessment, geared towards neuropsychological aspects of face perception, was designed and implemented through a psychophysical test (Chen et al., 2009). We hypothesized that scores from the self-reported face perception questionnaire and measurements from the laboratory-based psychophysical face perception test are associated in schizophrenia patients.

We also aimed to evaluate the relationship between face perception assessments (both subjective and objective) and social cognitive functioning in patients. Social cognitive functioning was assessed using the Eyes Test (Baron-Cohen et al., 2001) which measures an important aspect of social cognition — theory of mind. Given the vital role of face in the social world, we hypothesized that the subjective (self-reported) and objective (psychophysical) measurements of face perception are associated with the measurements of theory of mind in schizophrenia patients.

2. Methods

2.1. Participants

Thirty-five schizophrenia patients (SZ) participated. All patients met DSM-IV criteria for schizophrenia or schizoaffective disorder, based on a standardized interview (First et al., 1994) and a review of all available clinical records. All patients were outpatients when participating in this study with an average illness duration of 20.36 years (std: 13.01 years). All but four patients were medicated with antipsychotic drugs (averaged CPZ dose equivalent = 387.9 mg (std: 359.0 mg)) (Woods, 2003). Patients' psychotic status was assessed using the Positive and Negative Syndrome Scales (Kay et al., 1987). Their scores in positive, negative and general subscales scores were 16.8 (4.4), 13.6 (3.7) and 30.2 (6.1), respectively.

Twenty-five healthy controls (HC) participated. They were screened for exclusion of any Axis One psychiatric disorders using non-patient SCID (First et al., 2002). Controls were also screened to exclude those with family members who had histories of psychosis.

Additional inclusion criteria for both groups were 1) no history of any neurological disorders (such as seizure or stroke) or head injuries, 2) IQ > 75, and 3) no substance dependence within the last six months. The two groups did not differ in age, gender or verbal IQ (Wechsler, 1981). The two groups however differed in the Eyes Test score ($p < 0.05$). Table 1 provides detailed demographic and

cognitive information for all of the subjects.

The study protocol was approved by the Institutional Research Board (IRB) of McLean Hospital. Written informed consent was obtained from all subjects after the nature of the study protocol had been fully explained. The study was carried out in accordance with the latest version of the Declaration of Helsinki.

2.2. Stimuli

2.2.1. Subjective assessment

The assessment — face perception questionnaire — includes six items. The first five items were presented as.

(1) I treat strangers as if I know them to avoid offending people I might already know (poor face perception);
(2) I find it hard to keep track of characters in TV shows or movies (poor face perception);
(3) I try to remember non-facial information about people's appearance (poor face perception);
(4) I can recognize family members and close friends out of context (good face perception);
(5) I can visualize the faces of family members and close friends (good face perception).

These five items were adopted from a study on prosopagnosia (DeGutis et al., 2014). The sixth item was based on Capgras delusion, a face-related delusion that is prevalent in neuropsychiatric disorders including schizophrenia (Phillips and David, 1995). It was presented as

(6) I feel as though people I know have been replaced by physically identical imposters (poor face perception).

2.2.2. Objective assessment

For this test, face photographs of two individuals (Caucasian men) (Tottenham et al., 2009) were used as original face images after non-facial features such as hair and other body parts were cropped out. Additional face images were created through morphing between the two original face images (Fig. 1). The morphed images (using FantaMorphPro (v5.0, 2012)) contained varying proportions of two original face images. Paired images for comparison had six different proportions of two original faces: 2.5, 5, 12.5, 25, 50, and 100%, generating six task difficulty (stimulus difference) levels for face identity discrimination. For example, to create a 5% stimulus difference, the two original face images would
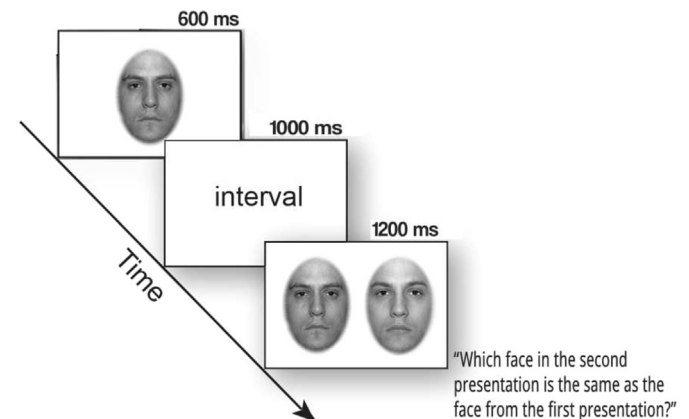
Table 1
Demographic information of sample (Means (Standard Deviations)).

	Age (year)	Gender F:female; M:male	Eyes test[a]
HC (n = 25)	47.2 (15.8)	14 F, 11 M	75.1 (9.96)
SZ (n = 35)	43.3 (13.9)	19 F, 16 M	66.6 (15.51)

[a] A significant group difference at $p < 0.05$.

Fig. 1. Schematic illustration of the psychophysical test paradigm.