Review

Face recognition in schizophrenia disorder: A comprehensive review of behavioral, neuroimaging and neurophysiological studies

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ABSTRACT

Facial emotion processing has been extensively studied in schizophrenia patients while general face processing has received less attention. The already published reviews do not address the current scientific literature in a complete manner. Therefore, here we tried to answer some questions that remain to be clarified, particularly: are the non-emotional aspects of facial processing in fact impaired in schizophrenia patients? At the behavioral level, our key conclusions are that visual perception deficit in schizophrenia patients: are not specific to faces; are most often present when the cognitive (e.g. attention) and perceptual demands of the tasks are important; and seems to worsen with the illness chronification. Although, currently evidence suggests impaired second order configural processing, more studies are necessary to determine whether or not holistic processing is impaired in schizophrenia patients. Neural and neurophysiological evidence suggests impaired earlier levels of visual processing, which might involve the deficits in interaction of the magnocellular and parvocellular pathways impacting on further processing. These deficits seem to be present even before the disorder out-set. Although evidence suggests that this deficit may be not specific to faces, further evidence on this question is necessary, in particularly more ecological studies including context and body processing.

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1. Introduction

Schizophrenia is a complex and heterogeneous psychiatric disorder leading to chronic incapacity. Clinical symptoms include positive symptoms (e.g. hallucinations and delusions), negative symptoms (e.g. apathy and avolition), cognitive deficits and also motor abnormalities. The disease is also characterized by marked social dysfunctions. Deficits in social cognition have an important role in social dysfunctions. Social cognition has been globally defined as the ability to perceive the intentions and dispositions of other (Brothers, 1990) and then guide social interaction. Important during this process is the ability to process facial information.

Several lines of research have provided evidence of impaired facial identification and facial emotion processing in schizophrenia (Marwick and Hall, 2008). As stated by Marwick and Hall (2008), although research has been conducted to investigate both facial processing and facial emotion processing, a greater part of the studies have focused on the latter. Nevertheless, two recent reviews have focused specifically on non-emotional aspects of facial processing. The first review by Watson (2013) focuses mainly on holistic face processing in schizophrenia patients. The review by Darke et al. (2013) presents a more general discussion on face processing outside the emotional context while attempting to respond to the question that appears in the title of the article: "Are patients with schizophrenia impaired in processing non-emotional features of human faces?". They suggested that a more general visual perceptual difficulty, in addition to an attentional deficit, might underline the deficits in face processing.

Nevertheless, we believe that the already published reviews do not address the current scientific literature in a complete manner. Overall, we can divide the literature on face processing in two main domains: behavioral studies and neuroimaging or physiological studies. Regarding behavioral studies, face processing deficits in schizophrenia patients include identity, gender, age and familiarity processing, face memory, face detection and face exploration (eye tracking studies). Previous reviews briefly explored the 5 mentioned topics, without providing a comprehensive understanding of the results found. In this review, we tried to present and discuss the current literature, including face exploration, and face detection, in a more comprehensive manner. Moreover, previous reviews barely discussed the studies focusing on neuroimaging and neuropsychological results. Conversely, in the present review we provide a broad discussion of the current literature in schizophrenia patients.

Thus, we raise the following questions: do schizophrenia patients present a true face recognition deficit or it is associated with a deficit at higher level cognitive functions such as memory, attention or processing speed? Are these deficits specific to a certain group of patients, such as those presenting severe negative symptoms? Are these deficits specific to faces or do they represent a more general deficit that includes object recognition? Moreover, are these deficits due to abnormalities in the face fusiform area or are they due to a deficit in the earlier stages of visual processing? Finally, if these are really true deficits, when did they start in the course of the disease?

Obtaining these answers would improve our understanding and the treatment of other deficits found in schizophrenia patients, with a particular emphasis on the social deficits. If schizophrenia does present a deficit in face processing, it is important to determine the impact of these on daily life and symptomatology. Therefore, the main aim of this review is to evaluate the evidence for and against the presence of face processing deficit in schizophrenia.

This paper is organized as follows. The first part describes the face processing theory including the well-known cognitive model of face recognition proposed by Bruce and Young (1986), the neural and neurophysiological correlates of face processing as well as the development of face processing in healthy subjects. The second part of the article reviews the existing findings on behavioral, neuroimaging and neurophysiological studies related to face processing deficits in schizophrenia patients. In the third part we briefly discuss recognition deficits that go beyond face processing. Finally, we discuss further topics for investigation.

1.1. Search approach

As mentioned above, this article is divided in two main sections. The first provides a general overview of the current literature on face processing. The second provides a comprehensive review of the current literature on face processing in schizophrenia patients. Therefore, we performed an extensive and systematic search on studies investigating non-emotional face recognition in patients suffering from schizophrenia using the following terms: schizophrenia, face, recognition, identity, perception, non-emotional, neutral, and detection. We also manually searched articles on other relevant reviews. Articles were selected if: (1) the study included a sample of schizophrenia (or schizoaffective disorder) patients; (2) the study included a specific task evaluating a non-emotional aspect of face processing or included a neutral face as a stimulus, even though the task did not evaluate specifically face processing (e.g. press a button to a target image such as a butterfly). Although some articles studied both emotional and non-emotional face processing, we reported here only those results concerning non-emotional aspects. Subsequently, we categorized the articles according to the type of task (e.g. identity discrimination, face detection) and the type of apparatus (e.g. neuroimaging, eye tracking, electroencephalography) employed.

2. Face recognition

2.1. Bruce and Young's model of face processing

The face is the most relevant part of the body during human social exchange. When we see a face several kinds of information