Facial processing in schizophrenia and delusional misidentification: cognitive neuropsychiatric approaches

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Abstract

The human face is of great importance as a stimulus in view of the detailed information it contains – information vital to understand in order to survive in the complex social world. There are different aspects to facial processing, including: affect analysis, recognition of individuality and recognition of familiarity, all of which have been incorporated into the cognitive model of Bruce and Young (1986). The cognitive neuropsychiatric approach has recently been employed in the study of facial processing in schizophrenia. It has become apparent that schizophrenic subjects are impaired in facial processing tasks at all levels, and this may well be related to the misinterpretation of social interactions commonly found in such subjects. This approach has also led to a greater understanding of delusional misidentification, with particular syndromes explained in terms of processing deficits at different levels of the cognitive model above. At an anatomical level, the role of the right hemisphere in facial perception is well-known, with there being some evidence of right hemisphere hypofunction in subjects with schizophrenia and also in delusional misidentification. The review therefore emphasizes the importance of the neuropsychiatric approach for further investigation of facial processing and understanding of symptomatology in schizophrenia and related psychoses.

Keywords: Facial processing; Delusional misidentification; (Schizophrenia)

1. Introduction

In order for humans to compete and survive in the complex social world, it is important to have the ability to recognize and relate to other members of the group. It is the human face which, without doubt, contains the greatest amount of information relevant to this task (Sergent, 1988). Such information can be subdivided into various categories: the recognition of facial characteristics such as age or gender; the recognition of facial expression; and the recognition of familiarity (Ellis and Young, 1988).

In view of the importance of facial perception in the social world, it has been suggested that there is a specific mechanism for face perception in humans as distinct from perception of other objects (Bodamer, 1947). Despite some argument against this (Damasio et al., 1982), evidence has accumulated from studies of prosopagnosic patients to suggest that there is no correlation between face perception and perception of other complex objects (Tzavaras et al., 1970; McCarthy and Warrington, 1986; McNeil and Warrington, 1993).

The various aspects of facial perception described above have recently been incorporated into an information-processing model (Bruce and Young, 1986). The model suggests that the various aspects of facial processing work together to form a coherent representation of the face. This allows for the recognition of familiar faces and the establishment of social relationships.
components of facial processing can be conducted in parallel, with directed visual processing (e.g. matching of unfamiliar faces) distinguished from expression analysis, facial speech analysis and familiarity recognition. The model distinguishes between 'face recognition units', important for recognition of a particular face in the processing of facial familiarity, and 'person identity nodes', important for the linking of a face once recognized as familiar with multi-modal information about a familiar person.

Recent studies employing the use of subliminal presentation of unfamiliar and familiar faces have provided evidence for covert face recognition both in normal human subjects (Ellis et al., 1993) and prosopagnosic patients (De Haan et al., 1987; Young and De Haan, 1988). This justifies regarding face-recognition as a relatively independent module (Fodor, 1983).

Another approach to the mechanism by which humans process facial information has been the study of the way in which the sensory information conveyed by the facial stimulus is processed spatially. Sergent (1988) has proposed that the processing of facial information is performed at the configurational (Gestalt) level, as opposed to the sequential analysis of each facial feature individually. This hypothesis has been based upon empirical evidence suggesting that the configuration of the face changes significantly even with minor alterations in facial components which could not be detected at the individual level (Haig, 1984, 1986). This has been linked to the idea of the importance of low as opposed to high spatial frequencies in conveying salient facial information (Sergent, 1988).

The dominant role of the right hemisphere in facial perception in right-handed subjects is a well-known hypothesis, supported by neuropsychological and anatomical studies of prosopagnosic patients (for a review, see McCarthy and Warrington, 1990). The more recent technique of measurement of visual scan paths in the viewing of facial stimuli has provided further evidence of a right hemisphere (i.e., left visual field) bias in the processing of the facial information (Mertens et al., 1993). It has been proposed that the reason for the right hemisphere bias is its ability to distinguish between the various members of a category rather than the categories themselves (Kosslyn, 1987). Sergent (1988) has related the superiority of the right hemisphere in face perception to the preference of the right hemisphere for low spatial frequency stimuli—required for the processing of faces at the Gestalt level.

2. Studies in schizophrenic patients

If face perception is of importance for successful interaction in the social world then subjects with schizophrenia, who often appear to misinterpret social cues and exhibit poor social skills, would be expected to have impaired facial processing (or vice versa). Indeed, many studies have demonstrated poor judgement of facial emotion in such subjects (Novic et al., 1984; Feinberg et al., 1986; Gessler et al., 1989; Gaebel and Woelwer, 1992). The superior ability of paranoid as compared with nonparanoid schizophrenics in the labelling of negative affects has also been demonstrated (Kline et al., 1991).

More recently, investigators have attempted to determine the exact nature of the impairment in facial processing in schizophrenia. Earlier studies demonstrated impaired 'non-emotion' judgement in facial processing in schizophrenics (e.g. age of the face) (Gessler et al., 1989). The model of Bruce and Young (1986) has been applied to schizophrenic patients, with such patients being tested on tasks of facial recognition, facial expression recognition and unfamiliar face matching (Archer et al., 1992). The results indicated the presence of a generalized deficit in all three tasks in schizophrenia as opposed to a deficit in expression analysis only. Another recent study using tests of emotion perception (both face and voice discrimination and identification tasks) and 'non-emotion' control tasks (a task of facial recognition and a speech sounds perception test) has also provided evidence for a generalized performance deficit rather than a specific emotion recognition deficit in schizophrenia (Kerr and Neale, 1993). Both studies had the advantage over earlier studies in their use of stan-
standardized and cross-validated neuropsychological tests. The problem for research in this area is to match different face-related perceptual tasks in terms of difficulty so that a specific deficit may be uncovered (Chapman and Chapman, 1973).

The importance of the right hemisphere in face perception and the impairment in facial processing demonstrated in schizophrenia are consistent with the theory of right hemisphere dysfunction in schizophrenia proposed by Cutting (1990). The importance of the right hemisphere in attentional tasks in general (Bench et al., 1993) and the impaired performance of schizophrenics in such tasks has also been noted (David, 1993). Neuropsychological studies, employing the use of face and letter-recognition tasks presented tachistoscopically bilaterally and unilaterally, have indicated that a right hemisphere deficit exists for facial processing in paranoid schizophrenics with a left hemisphere deficit for the processing of letters in nonparanoids (Magaro and Chamrad, 1982 and 1983). The technique of presentation of facial chimeras (e.g. male/female chimeras) has been employed in the study of perceptual asymmetry in normal right-handed subjects, demonstrating a right hemisphere bias in facial processing tasks (Luh et al., 1991). The technique was successfully adapted for the investigation of lateralization of facial emotion perception in schizophrenic subjects (David and Cutting, 1990). The results indicated that the right hemisphere bias for facial emotion perception previously demonstrated in normals was lost in the schizophrenic subjects, thereby suggesting right hemisphere hypofunction in such subjects.

Another approach to the study of facial perception in schizophrenia has been the measurement of visual scan paths when viewing faces in schizophrenic subjects (see Phillips and David (1995) for a review). There have been relatively few studies to date employing this technique. A preliminary study has, however, demonstrated a pattern of reduced staring at salient facial features in schizophrenic subjects (Gordon et al., 1992). This is suggestive of impaired directed attention (Shiffrin and Schneider, 1977) in the early information processing stages in schizophrenia, leading to facial processing deficits later on.

3. Facial perception and delusional misidentification

The recent re-emergence of the cognitive neuropsychological approach in the study of psychiatric illness, or ‘cognitive neuropsychiatry’ (David, 1993) has highlighted the importance of the investigation of individual symptoms rather than syndromes. Delusions are a core feature of psychosis, and have been the subject of extensive neuropsychological investigation. Delusion formation has been explained in terms of abnormal sensory information processing (Maher, 1974), thereby providing a link between a subject’s perception of the world, or memory of it (David and Howard, 1995), and symptom formation. Thus, abnormal facial perception may well be related the presence of delusions in psychotic individuals. Of particular interest in the study of facial perception is the symptom of delusional misidentification. Eleven misidentification syndromes have been described (Joseph, 1986), but it is the syndromes relating to misidentification of people (and thus faces) which are of particular interest here—i.e. Capgras syndrome (familiar person replaced by physically similar double), Fregoli syndrome (unfamiliar person replaced by physically similar familiar person) and the syndrome of intermetamorphosis (another person replaced by someone with physical characteristics and identity familiar to the subject).

Understanding of the nature of delusional misidentification has advanced over the last few years, with the phenomenon no longer regarded a psychiatric rarity. In his review of the nature of this phenomenon, Cutting (1991) has linked delusional misidentification with a general failure to appreciate identity or uniqueness in general. The three delusions above have also been studied extensively by Young and colleagues (Ellis and Young, 1990; Young et al., 1990; Young et al., 1993; Ellis and Young, 1995). These authors have attempted to explain the formation of the three distinct symptoms in terms of the model of face perception described by Bruce and Young (1986). Accordingly, it has been hypothesized that intermetamorphosis is the result of malfunctioning at the level of the face recognition units, so that a subject will ‘recognize’ a seen face incorrectly. On the other hand, the origin of the Fregoli delusion
has been thought to lie at the slightly higher level of activation of the person identity nodes, so that an incorrect identity is given to the face seen and recognized at the face recognition unit level. This hypothesis has been linked to the theory of abnormal reasoning and decision making in the formation of delusions in general (Hemsley and Garety, 1986) and delusions of misidentification in particular (Ellis and Young, 1990). The importance of top-down influences on sensory information processing and recognition have also been noted (Fleminger, 1992).

The Capgras delusion has posed more difficulties for explanation in terms of the cognitive model of Bruce and Young. Other authors have suggested that the impairment in this delusion may be the failure to have the emotional experience of familiarity when regarding a familiar person (Ellis and Shepherd, 1992). It has thus been argued that the Capgras delusion is formed in the context of this impairment in the perception of familiarity, with the subject’s attempts to explain the phenomenon, i.e. recognition without familiarity, resulting in the delusion (Young et al., 1993).

4. Neuropsychology and delusional misidentification

The impairment in cerebral function responsible for delusional misidentification has received much attention in recent years. As for schizophrenia in general, there is some evidence of a right hemisphere link with the symptom, with evidence for this available from neuropsychological tests (Christodoulou, 1977) and brain imaging (Forstl et al., 1991). Cutting (1990) has emphasized the importance of the right hemisphere in the appreciation of identity, relating this to the theory of the superiority of the right over the left hemisphere in the perception of subcategories or individuals within a category (after Kosslyn, 1987). He has thus proposed that right hemisphere dysfunction is the common neuropsychological substrate for all misidentification syndromes.

Other authors have argued for the importance of impaired integration between the two hemispheres (Joseph, 1986) in the production of the Capgras delusion or for the presence of bilateral lesions in the subcalcarine visual association cortices in the production of abnormalities in facial processing in general (Damasio et al., 1982). Such theories, however, have met with less support than that proposing right hemisphere dysfunction. Indeed, a recent neuropsychological study investigating face and object perception has provided further evidence for right hemisphere dysfunction in subjects with the Capgras delusion (Ellis et al., 1993). Here, subjects with either paranoid schizophrenia or the Capgras delusion were presented with pairs of line-drawn objects or photographs of faces randomly in the left visual field (right hemisphere), right visual field (left hemisphere). The stimuli were presented tachistoscopically (for 200 ms), with the subjects being asked to decide as quickly as possible whether the two stimuli were the same or different. Although there was no significant difference in the two subject groups in pattern of stimulus perception for the line drawings, subjects with paranoid schizophrenia demonstrated a right hemisphere advantage for face perception whilst in subjects with the Capgras delusion this was reversed. This was suggestive of right hemisphere dysfunction in subjects with the Capgras delusion. It was also noted that for both subject groups, there was a reaction time advantage for the bilateral presentation, a result providing evidence against Joseph’s theory of impaired inter-hemispheric integration in the Capgras delusion. The authors noted, however, that the results did pose problems for other existing theories of face and object perception in schizophrenia and delusional misidentification. In particular, the theory of right hemisphere dysfunction for schizophrenia in general (Cutting, 1990) was not supported by the results of the study. The superior role of the left hemisphere in perception of categories of object (Kosslyn, 1987), as in the recognition of similarity or difference in the line drawings, also failed to be demonstrated for either subject group.

In reviewing the current literature, it is apparent that studies of subjects with prosopagnosia have furthered the understanding of normal face perception. The right hemisphere has emerged as important not only for all aspects facial information processing but also in the perception of individual-
ity within an object category. Dysfunctional facial perception in schizophrenic subjects is clearly evident from the large number of studies in this area, with theories attempting to explain this both psychologically in terms of impaired social functioning and perception of social cues and neuropsychologically in terms of right hemisphere dysfunction. Studies suggest that the deficit in facial perception in schizophrenia is generalized rather than specific to impaired facial expression analysis and are thus suggestive of right hemisphere dysfunction. Not all investigators have provided evidence for such dysfunction in schizophrenic subjects.

In investigation of delusional misidentification, it appears that the dysfunction can arise at one of several levels of facial familiarity processing in the cognitive model of Bruce and Young (1986). The level of dysfunction determines the nature of the misidentification – intermetamorphosis, Fregoli or Capgras. Thus the impairment in facial perception in such subjects is more specific than that of subjects with schizophrenia. As for schizophrenia, however, the impairment has been linked with right hemisphere dysfunction.

New approaches to the study of face perception in schizophrenia and delusional misidentification include the employment of visual scan path measurements in such subjects when viewing faces and linking the pattern of viewing with information processing in general. As indicated above, this technique has already led to promising results in schizophrenic subjects. It has not as yet been applied to subjects with delusional misidentification. It has also been argued that a certain delusional misidentification, the Fregoli delusion, results from abnormal decision-making or reasoning ability, as opposed to abnormal sensory information processing (Ellis and Young, 1990). As the authors have suggested, further investigation of such impaired decision-making ability in these subjects will help to further the understanding of the nature of the delusion. Some authors (Benson, 1990; Lewis, 1987) have performed a ‘two hit’ model to explain delusions in general and the Capgras syndrome, respectively. The model refers to an underlying perceptual disturbance (right hemisphere lesion) which accumulates around it delusional attributions (if a frontal lesion is also present). Such a model has also been worked to explain auditory hallucinations (Almeida et al., 1993).

It would seem that information as to the nature of facial processing impairments in schizophrenia and delusional misidentification in particular has been obtained to a great extent in recent years with the employment of the cognitive neuropsychological approach. Further use of this approach, which may be called cognitive neuropsychiatry, will undoubtedly lead to greater understanding of the various symptoms and syndromes of psychosis in which perception of the identity and intent of other people play such a dominant role.

References