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Evidence for impaired visual context processing in schizotypy with thought disorder

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Abstract

Visual context processing was examined in relation to schizotypy in a large nonclinical university population. Schizotypal status was assessed with the Schizotypal Personality Questionnaire (SPQ) [Schizophr. Bull. 17 (1991) 555]. Schizotypal ($n=32$) and non-schizotypal ($n=37$) subjects were tested on a contour integration task (where context processing is necessary for good performance) and a visual size perception task (where context processing impairs accurate performance). In addition, a short form of the Thought Disorder Index (TDI) [Psychol. Assess. 5 (1993) 75] was administered to 28 schizotypal subjects. Thought disordered schizotypal subjects showed significantly impaired performance on the contour integration task but more accurate performance on the visual size perception task. These results support the hypothesis that deficits in visual context processing are the manifestation of a larger disturbance of cognitive coordination in schizotypy and schizophrenia.

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Schizophrenia is a heterogeneous clinical disorder associated with cognitive deficits in multiple domains, such as thought, language and perception (Blanchard and Neale, 1994). Cognitive deficits can be found in subjects who are actively psychotic and in clinical remission (Nuechterlein and Dawson, 1984) as well as in children at heightened risk for schizophrenia

(Cornblatt and Erlenmyer-Kimling, 1985). These findings suggest that cognitive deficits represent a core pathology of the disorder (Carr and Wale, 1986).

Theories have been developed that account for the multiple cognitive deficits in schizophrenia by postulating impairments in a single underlying mechanism (Andreasen, 1999; Cohen and Servan-Schreiber, 1992; Phillips and Silverstein, in press). Such models are related to recent developments in neuroscience that emphasize interactions that coordinate activity within and between different regions of the brain (Phillips and Singer, 1997). That is,

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more recent views of cognitive impairment in schizophrenia emphasize faulty interactive activity, as opposed to localized structural pathology. In our past work, we have emphasized cortical computation that involves context-based coordination of long-range modulatory interactions. We have argued elsewhere (Phillips and Silverstein, *in press*; Silverstein et al., 2000; Silverstein and Schenkel, 1997) that multiple cognitive deficits in schizophrenia may result from an impairment in a core processing algorithm, which is manifested in the inability to use context efficiently. Our perspective builds upon the work of Cohen and Servan-Schreiber (1992) who proposed that impairments in tasks such as Stroop Interference, the A-X continuous performance test and a lexical disambiguation task can be understood as reflecting a single impairment in the ability to maintain an internal representation of context during ongoing behavior. Context in this model has been related to information supplied by preceding events and stored in working memory (Cohen and Servan-Schreiber, 1992, p. 46). However, in our model (e.g., Phillips and Silverstein, *in press*) context refers also to the effects of concurrent stimuli on a target stimulus.

Integrative theories of normal brain function and theories of psychiatric disorders linking multiple cognitive deficits to a common underlying biological and cognitive impairment (Brock et al., 2002; Phillips and Silverstein, *in press*) predict similar types of impairments across domains of functioning in schizophrenia. Previous results from this research group have confirmed such predictions. Results from our studies (Knight and Silverstein, 1998; Silverstein et al., 1998, 2000) have reliably demonstrated that deficits in the organization of visual stimuli based on context are linked to disorganized symptoms, supporting the hypothesis that deficits in visual context processing in schizophrenia are one manifestation of a larger disturbance in the coordination of context-related stimuli (Phillips and Silverstein, *in press*). From this viewpoint, context processing in vision is seen as a form of “object thinking” (Glezer, 1995) involving the binding of image elements into context-appropriate coherent wholes, in which the context can be seen as the other elements that combine to make up the figure perceived (Phillips and Singer, 1997). This is seen as

analogous to the binding of words into coherent linguistic structures, where context takes the form of meaning (Logan and Zbrodoff, 1999). It has been suggested that the propositional representations necessary for the processing of visual images are structurally similar to those representations underlying thought and language (Chechile et al., 1996). This evidence is consistent with predictions from theories of brain functioning, where cortical algorithms operate across cognitive domains to coordinate contextually appropriate cognitive activity (Phillips and Singer, 1997).

Despite a wealth of evidence indicating impairments in the processing of context in schizophrenia (e.g., Cohen et al., 1999; Silverstein et al., 1996) and their association with disorganized symptoms (Knight and Silverstein, 1998; Kuperberg et al., 1998; Silverstein et al., 1998, 2000), it is unclear whether such impairments are a feature of schizotypy. Identification of deficits in context processing in schizotypy would emphasize the usefulness of this construct as a candidate mechanism for schizotaxia, the underlying genetic predisposition to schizophrenia (Meehl, 1962). Research which has addressed this question in subjects with increased levels of schizotypy has so far produced conflicting results. Silverstein et al. (1992), for example, found no differences on three perceptual organization tasks in student samples identified on the basis of elevated scores on Scales of Physical Anhedonia, Perceptual Aberration or Magical Ideation. Nevertheless, some experimental data suggest that deficits in the processing of visual context are present in schizotypy. For example, Rawlings and Claridge (1984) reported that normal subjects with elevated scores on schizotypy scales showed an advantage in processing local information in the global/local letter identification task of Navon (1977).

In the present study, we examined aspects of visual context processing in a student population in relation to schizotypy as assessed by the Schizotypal Personality Questionnaire (SPQ) (Raine, 1991). Two tasks were selected in order to implement a Process Oriented Approach (Knight and Silverstein, 1998, 2001). This approach uses well established models from cognitive psychology to predict specific theory-driven patterns of performance within and across tasks that should be found

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