



The startle reflex in schizophrenia: habituation and personality correlates

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Abstract

Schizophrenia has long been associated with abnormal patterns of arousal that are thought to reflect disturbances in the reticular-activating system of the brain. Psychophysiological investigations of sensory responsivity have repeatedly demonstrated reduced reactivity and habituation to moderately intense stimuli in patients with schizophrenia. While not traditionally used as a measure of physiological arousal, the startle reflex represents an alternative method for studying reactivity and habituation in schizophrenia. This study examined eye blink responsivity to a repeatedly presented intense acoustic startle probe in men with chronic schizophrenia and healthy normal controls. Subjects' personality profiles were also measured, as increased reactivity and arousal have been traditionally implicated as a physiological component to the personality trait of neuroticism. Results indicated that schizophrenic subjects did demonstrate significantly reduced rates of habituation to the acoustic startle probe and higher scores on measures of neuroticism in comparison to normal controls. However, no correlation between habituation rate and neuroticism emerged. These studies replicate previous findings of habituation in schizophrenia and provide further evidence for sensory reactivity disturbances in schizophrenia. The relationship of these findings to cognitive disturbances in schizophrenia is considered and directions for future research are discussed.

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1. Introduction

Schizophrenia has long been associated with abnormal patterns of arousal to stimuli (Venables,

1966), which are thought to reflect disturbances in a well-described brain system ascending from the brain stem to midbrain regions (Steriade, 1996). Psychophysiological studies primarily using EEG or skin conductance orienting response (SCOR) paradigms have consistently demonstrated higher resting rates of arousal, but lowered responsivity to orienting and other moderately intense stimuli in patients with

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schizophrenia (Venables, 1966; Venables and Wing, 1962; Dawson et al., 1992, 1994, Olbrich et al., 2001). Consistent with these findings are studies that have demonstrated reduced autonomic habituation, as assessed by electrodermal activity, to a repeatedly presented sensory stimulus (e.g., Depue and Fowles, 1973; Gruzelier et al., 1981; Hollister et al., 1994). These findings have demonstrated that schizophrenic patients show irregular response patterns over time that result in slower rates of habituation.

Although not commonly used to quantify an organism's level of activation, the startle reflex is considered a measure of reactivity to environmental stimuli, and as such follows a similar course of decreasing sensitivity to stimuli when repeatedly presented. Behaviorally, the startle reflex is best characterized as a sudden, involuntary reaction to an intense, unexpected sensory event that is characteristically manifested as a quick, involuntary eye blink (Lang et al., 1990). Animal studies of the startle response indicate that a primary brain stem circuit through the nucleus reticularis pontis caudalis mediates the reflex (Davis, 1986; Cadenhead et al., 2000). The startle reflex is most often measured using electromyographic (EMG) technology to record the strength of contraction of the orbicularis oculi muscle surrounding each eye as it blinks to the startle probe (Lang et al., 1990). Studies of the startle response in schizophrenia indicate a similar pattern of abnormal reactivity to that observed with autonomic measures, with schizophrenic subjects habituating more slowly than non-schizophrenic psychiatric patients or normal controls (Geyer and Braff, 1982; Braff et al., 1992).

Also of interest is that arousal has been consistently implicated as a physiological component of certain personality styles or profiles (Stelmack, 1990; Gray, 1982; Larsen and Ketelaar, 1991), which have demonstrated to be characteristic of schizophrenia (DiLalla and Gottesman, 1995; Berenbaum and Fujita, 1994). In particular, the personality trait of neuroticism has been repeatedly associated with a hypersensitivity to aversive sensory stimuli. Conceptualized according to J.A. Gray's model of a Behavioral Inhibition System (BIS), neuroticism may be thought of as a biologically based susceptibility to negative stimuli that results in increased arousal and negative affect in response to aversive or mismatched sensory events (Gray, 1982). Previous study of this

theory has shown that neurotic subjects demonstrate more reactivity to negative stimuli than non-neurotic subjects (Larsen and Ketelaar, 1991).

The current study uses the startle reflex paradigm to further elucidate the nature and extent of habituation disturbances in schizophrenia and its relationship to personality traits. We first examine habituation rates of startle response in male patients compared to matched control subjects. Slower rates of habituation are predicted to characterize schizophrenic patients, all of whom show a chronic disease course. In addition, the personality trait of neuroticism will be measured and correlated with startle response amplitudes for all subjects to examine the extent to which habituation rates may relate to individual difference in personality profiles.

2. Methods

2.1. Subjects

Twenty-three men with a DSM-IV diagnosis of schizophrenia were recruited from inpatient and outpatient populations of a Veterans Affairs Medical Center. Seventeen normal controls were recruited via newspaper advertisements from the communities surrounding the medical center. Of the 40 subjects recruited, 5 schizophrenic subjects and 1 normal control were excluded from final analyses due to missing data and/or noncompliance with research protocol, leaving 18 schizophrenic patients and 16 normal controls. All subjects were screened for the presence of active substance abuse, medical illnesses, neurological problems, and lifetime incidence of loss of consciousness, all of which served as exclusion criteria for this study.

Before participation in the study, schizophrenic subjects' psychiatric diagnoses were confirmed through chart review and clinical interview with the Structured Clinical Interview for the Diagnostic and Statistical Manual-Fourth Edition (SCID-IV) (First et al., 1997). In addition, current symptom severity was assessed using the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1986). All schizophrenic subjects in this study were medicated with an average chlorpromazine (CPZ) equivalent dosage of 561.5 mg/day (range 120–1333 mg/day; see Table 1). The

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