



## Are there common mechanisms in sensation seeking and reality distortion in schizophrenia? A study using memory event-related potentials

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### Abstract

A growing literature suggests that the characteristics of sensation seeking and reality distortion expressed in schizophrenia share several mechanisms. In a previous study, the comparison of patients with high vs. low reality distortion using event-related potentials (ERPs) recorded in a recognition memory task for unfamiliar faces identified neural and cognitive anomalies specifically related to the expression of these symptoms. As a follow-up, this study investigated the ERP correlates of sensation seeking in schizophrenia using the same recognition memory protocol. ERPs have been recorded in controls ( $N=21$ ) and schizophrenia patients separated into high (HSS;  $N=13$ ) and low (LSS;  $N=17$ ) scorers according to Zuckerman's Sensation Seeking Scale. The results show a reduced P2a that was found unrelated to reality distortion in the previous study of reality distortion. It identifies interference inhibition impairment as being specifically related to sensation seeking. On the other hand, HSS scorers display enhanced fronto-central and normal P600 effects also found in high reality distortion patients. These results indicate inappropriate context processing and mnemonic binding common to sensation seeking and reality distortion. LSS scorers also display a reduced temporal N300 similar to that found in low reality distortion patients. This anomaly could reflect the lower reactivity to emotionally significant stimuli that underlies anhedonia symptoms. Finally, the N400 effect and a late frontal effect are found in both HSS and LSS. Since they were unrelated to reality distortion, these indices have been related to basic aspects of schizophrenia, e.g., deficient knowledge integration, or other mechanisms, e.g. anxiety or impulsivity. In summary, the present study examines the strategy of investigating variables, such as temperamental characteristics, in addition to symptoms, to show how discrete impairments may contribute to the expression of the illness.

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## 1. Introduction

It has becoming increasingly evident that personality traits significantly influence the expression, the course and the outcome of severe psychiatric illness such as schizophrenia (Lysaker et al., 1998, 1999; Liraud and Verdoux, 2001; Guillem et al., 2002). Some studies have further suggested that symptoms can be conceptualized partly as manifestations of personality (Lysaker et al., 1999; Guillem et al., 2002). According to Zuckerman (1995), personality may be linked to symptoms through its association with common underlying psychophysiological mechanisms. Identifying such common mechanisms may thus help in understanding the determinants of symptom expression.

Because of its relationships to emotional disturbance, alcoholism, smoking and other substance use, sensation seeking has been one of the most studied temperamental traits in healthy and psychiatric populations. Initially based on optimal stimulation level and arousal theory (Hebb and Thompson, 1954), Zuckerman (1969) developed the sensation seeking concept, whereby a low level of arousability leads to a search for novel, stimulating and exciting experiences. In emotionally disturbed subjects, sensation seeking is thought to compensate for a difficulty in experiencing sensations and emotions from common stimuli, i.e., blunted affect or anhedonia (Carton et al., 1992; Michel et al., 1997).

This view closely resembles Bleuler's (1911) conception that reality distortion in schizophrenia, i.e., hallucinations and delusions, occurs to compensate for the primary psychopathological mechanisms expressed in negative and disorganization symptoms. More recently, other authors have similarly argued that positive symptoms, mainly delusions, act as a defense mechanism to preserve self-esteem (Bentall, 1994; Blackwood et al., 2001). Interestingly, a positive association has been reported between reality distortion and novelty seeking (Guillem et al., 2002), a neighboring concept of sensation seeking (Cloninger, 1987). This increases the likelihood that reality distortion and sensation seeking in schizophrenia share several mechanisms, the difference between the two lying only in their final expression, i.e., an internally oriented action, such as hallucinations, in reality distortion vs. an externally oriented action in sensation seeking.

There are several lines of argument to extend this similarity beyond the simple phenomenological level. Epidemiological studies showed that both reality distortion, or more generally positive symptoms, and sensation seeking decrease with increasing age (Cloninger et al., 1994; Schultz et al., 1997), and both are associated with substance abuse (Soyka, 1994; Liraud and Verdoux, 2000; Sorbara et al., 2003) and poor outcome in terms of hospitalizations or treatment compliance (Schuldberg et al., 1999; Liraud and Verdoux, 2001; Coldham et al., 2002; Novak-Grubic and Tavcar, 2002). At the neurobiological level, both sensation seeking and reality distortion have been related to monoaminergic function. Underlining the role of decreased dopamine activity in social withdrawal, Zuckerman (1991) proposed that high sensation seekers have lower levels of tonic dopamine activity and therefore compensate by seeking intense novel stimulations to phasically increase their dopamine activity. This account is very similar to Grace's model of schizophrenia (Grace, 1991). In this model, negative symptoms are a consequence of reduced tonic dopamine activity in the mesocortical system, which induces a phasic hyperactivity in the mesolimbic system responsible for positive symptoms. A role of serotonin in both sensation seeking and reality distortion is also likely since indices of low serotonin activity have been reported in both 'sensation seekers' (Netter et al., 1996) and schizophrenia (Lieberman et al., 1998). Concerning the cognitive and neural correlates of sensation seeking and reality distortion, studies (although using different tests) have similarly involved the monitoring function of the frontal lobe and the temporal memory function in novelty seeking (Kirsten et al., 1994, cited in Cloninger et al., 1994) as well as in reality distortion symptoms (Cuesta and Peralta, 1995; Norman et al., 1997; Guillem et al., 2001a). Despite some variance in the direction of the associations (likely owing to differences in subjects' characteristics and measures; see Blackwood et al., 2001), these observations received direct support from brain-imaging studies, showing that both novelty seeking (Sugiura et al., 2000; Youn et al., 2002) and reality distortion (Liddle et al., 1992; Kaplan et al., 1993; Schröder et al., 1996) correlate with temporal (superior/middle temporal and parahippocampal gyri) and lateral frontal activities.

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