

## Mental imagery vividness as a trait marker across the schizophrenia spectrum

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### Abstract

We investigated the vividness of mental imagery and its possible relationship with the predisposition towards hallucinations in 52 schizophrenia (SZ) patients, 44 of their first-degree relatives (R) and two healthy control groups (high-schizotypy [CHS;  $n=24$ ]; low-schizotypy [CLS;  $n=24$ ]). We investigated phenomenological and cognitive trait markers of schizophrenia, including cognitive correlates of hallucinations and vividness of mental imagery, and the influence of individual psychopathology. Overall, scores on the mental imagery questionnaire (QMI [Sheehan, P.W., 1967. Reliability of a short test of imagery. *Perceptual and Motor Skills* 25, 744.]) suggested higher mental imagery vividness in first-degree relatives, high-schizotypy controls and patients, than in low-schizotypy controls. However, vividness of mental imagery was independent of predisposition towards hallucinations and cognitive test performance scores. These results suggest that vividness of mental imagery may be a trait marker across the schizophrenia spectrum. In addition we propose that imagery proneness is relatively independent of the individual psychopathology.

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### 1. Introduction

Mental imagery is defined as a perceptual experience that occurs in the absence of an adequate physical stimulus (Finke, 1989). It is associated with core psychological mechanisms such as perception and memory and may facilitate cognitive performance (Kosslyn, 1994). It has been proposed that increased mental imagery vividness may be associated with hallucinations in schizophrenia.

Vividness of imagery denotes the degree of perceptual detail that is experienced when mentally imagining sounds or speech, visual scenes or objects, touch, smells or tastes. Imagery vividness can be measured using a self-report questionnaire (e.g., Betts' Questionnaire of Mental Imagery; Sheehan, 1967), which probes the subjective vividness of imagery experience across different sensory dimensions.

Auditory verbal hallucinations (AVH), the perception of voices in the absence of sensory input, constitute an important clinical phenomenon, affecting about 60% of patients with schizophrenia (Sartorius et al., 1978; Hahlweg, 1998). Hallucinations in other sensory modalities may also be present in schizophrenia, but are much less prevalent. AVH differ from mental imagery by the lack of control over the sensations (David, 1994; Hahlweg, 1998). Studies investigating the distribution of hallucinations in the general population yielded consistent findings showing that a considerable proportion of individuals experience hallucinations at some time in their lives (Johns and van Os, 2001). Tien (1991) reported a lifetime prevalence of hallucinations (not related to drugs or medical problems) of 10% for men and 15% for women, and the overall rates were similar for visual, auditory, and tactile hallucinations.

Psychological and neurobiological data suggest that hallucinations in schizophrenia arise from a combination of both monitoring and perceptual abnormalities (Mintz and Alpert, 1972; Horowitz, 1975; Cahill and Frith, 1996; Brebion et al., 1997; Dierks et al., 1999; Behrendt, 2003). Mintz and Alpert (1972) suggested that hallucinations in schizophrenia are characterized by a tendency to perception-like internally generated experiences and a weak ability to distinguish real perception from imagery. Böcker et al. (2000) tested the hypothesis that hallucinations in schizophrenia result from confusing internal with external stimulus sources (perception and mental imagery, respectively). These authors found that the hallucinating patients showed a higher level of vividness of mental imagery, especially in the auditory modality, in comparison to healthy participants.

However, the literature is inconsistent with respect to the role of mental imagery in hallucinations. Occasional reports of increased imagery vividness in relation to hallucinations (Mintz and Alpert, 1972; Morrison et al., 2002a,b) were not supported by other studies (Brett and Starker, 1977; Starker and Jolin, 1982). Several studies have suggested that vivid imagery per se does not account for reports of hallucinatory experiences (Aleman et al., 1999). Evans et al. (2000) showed that inner speech and AVH are not connected in a direct way. The study of imagery and its potential relation to hallucinations has not

been confined to patients with a clinical diagnosis of schizophrenia. A number of non-clinical populations report hallucinatory experiences as well (Barrett and Etheridge, 1992; Poulton et al., 2000). Van de Ven and Merckelbach (2003) investigated hallucination predisposition and mental imagery vividness in healthy individuals and found that increased reported hallucinatory experience was explained better by non-specific response bias than by increased imagery vividness (Merckelbach and Van de Ven, 2001; Van de Ven and Merckelbach, 2003). This finding suggests that the role of mental imagery in non-clinical hallucinations is indirect, and may be associated with hallucinations via other traits or cognitive systems. A recent study showed increased vividness of mental imagery in schizophrenia patients independent of hallucinations or other symptoms (Sack et al., 2005), which suggested that a vivid mental imagery may be a trait of schizophrenia. It is thus important to determine whether higher vividness of mental imagery is a general feature of the schizophrenia spectrum.

In contrast to categorical models of schizophrenia that posit a qualitative difference between normal and psychotic experiences, some authors suggested that differences may be quantitative rather than qualitative (Hahlweg, 1998; Van Os, 2003) and that hallucinatory experiences are found on a continuum of schizophrenia and non-clinical psychosis. The wider context for this hypothesis is provided by the identification of schizophrenia-like traits in the normal population, which are often referred to as "schizotypy" (Claridge and Broks, 1984; Raine, 1991). Schizotypy is thus defined and identified by personality features that correspond to attenuated forms of psychotic symptoms typical of schizophrenia (Meehl, 1962, 1990). They may include perceptual aberration, magical thinking, delusional beliefs, a disposition to experience hallucinations, cognitive impairments and attentional dysfunction, but also symptoms corresponding to the negative symptoms of schizophrenia (Meehl, 1990; Lenzenweger 1994; Van Kampen, 2006). The role of mental imagery for hallucinations in schizotypy has not been widely studied, but it seems that the association between imagery vividness and hallucinations is unclear at best (Van de Ven and Merckelbach, 2003).

The current study is the first study of mental imagery vividness across the putative psychosis continuum that includes high schizotypy participants and genetically vulnerable but unaffected participants (first-degree relatives). We expected higher vividness of imagery in both the relative and the high schizotypy group in the present study. In contrast, we did not expect an association between imagery and predisposition to hallucinations across our groups.

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