

# Virtual reality and persecutory delusions: Safety and feasibility

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## Abstract

**Objective:** Virtual reality (VR) has begun to be used to research the key psychotic symptom of paranoia. The initial studies have been with non-clinical individuals and individuals at high risk of psychosis. The next step is to develop the technology for the understanding and treatment of clinical delusions. Therefore the present study investigated the acceptability and safety of using VR with individuals with current persecutory delusions. Further, it set out to determine whether patients feel immersed in a VR social environment and, consequently, experience paranoid thoughts.

**Method:** Twenty individuals with persecutory delusions and twenty non-clinical individuals spent 4 min in a VR underground train containing neutral characters. Levels of simulator sickness, distress, sense of presence, and persecutory ideation about the computer characters were measured. A one-week follow-up was conducted to check longer-term side effects.

**Results:** The VR experience did not raise levels of anxiety or symptoms of simulator sickness. No side effects were reported at the follow-up. There was a considerable degree of presence in the VR scenario for all participants. A high proportion of the persecutory delusions group (65%) had persecutory thinking about the computer characters, although this rate was not significantly higher than the non-clinical group.

**Conclusions:** The study indicates that brief experiences in VR are safe and acceptable to people with psychosis. Further, patients with paranoia can feel engaged in VR scenes and experience persecutory thoughts. Exposure to social situations using VR has the potential to be incorporated into cognitive behavioural interventions for paranoia.

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## 1. Introduction

Presence in virtual reality (VR) occurs when a person has a sense of being in the place depicted by the VR system

and responds realistically (Sanchez-Vives and Slater, 2005). This has been exploited in the treatment of anxiety disorders by exposing patients to virtual environments related to their fears (e.g. Difede and Hoffman, 2002; Emmelkamp, et al., 2002; Garcia-Palacios et al., 2002; Rothbaum et al., 2000). Intriguingly, people have been found to respond to computer-generated characters (avatars) as if they were social agents (Garau et al., 2005; Pertaub et al., 2001), even in extreme social situations

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(Slater et al., 2006). Subsequently, individuals' reactions to avatars have been used to investigate paranoid thinking, a key symptom of psychosis (see review by Freeman, 2008).

Paranoia exists on a continuum in the general population, ranging from mistrust to clinical persecutory delusions (e.g. Combs and Penn, 2004; Fenigstein and Vanable, 1992; Freeman, 2007). VR has several key advantages in studying paranoia. If individuals are presented with a neutral social situation, then any paranoid thinking that occurs is known to be unfounded. Moreover, the participant's own mistrustful or unusual behaviour cannot elicit hostile responses from the avatars. Further, if patients do experience paranoid thoughts in virtual reality then this offers the possibility of the technology being incorporated into the emerging cognitive behavioural treatments (Freeman et al., 2006).

In the initial reports virtual reality has been used to study persecutory ideation in the general population (e.g. Freeman et al., 2008) and those at high risk of psychosis (Valmaggia et al., 2008). The validity of the methodology has been shown by higher levels of trait paranoia being associated with the occurrence of persecutory ideation in VR. Of theoretical interest these studies have consistently shown that persecutory ideation in VR is predicted by anxiety, worry, interpersonal sensitivity and perceptual anomalies.

The main aim of the present study was to investigate if it was feasible to use immersive VR with people with psychosis who have current persecutory delusions. We predicted that VR would be safe and acceptable to people with persecutory delusions. Safety was operationalised as the absence of an increase in level of anxiety, no triggering of significant levels of simulator sickness, and no adverse experiences in the following week. Simulator sickness refers to symptoms similar to motion sickness (e.g. nausea, dizziness) that can sometimes be caused by virtual environments because the visual system indicates movement while the balance mechanisms in the inner ear register no movement.

The secondary aims of the study were to examine whether people with persecutory delusions could be immersed in a VR social scene (i.e. experience presence) and whether they would have paranoid thoughts about neutral avatars. We also hypothesised that people with persecutory delusions would be more likely to report paranoid thoughts in VR than non-clinical volunteers.

## 2. Method

### 2.1. Participants

Twenty participants with early psychosis were recruited from two specialist early intervention in psychosis services in London. These early intervention

services accepted referrals of people aged 16–35 presenting to mental health services for the first time with symptoms of non-organic psychosis (e.g. F20–29; F31; ICD-10, World Health Organization, 1992). The inclusion criteria for the study were: diagnosis of non-affective psychosis; a score of at least moderate severity (4) on the Suspiciousness item (P6) of the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987); and a current persecutory delusion as defined by Freeman and Garety (2000). The exclusion criteria were: primary diagnosis of substance misuse or learning disability. Twenty age-matched non-clinical participants were recruited from participant panels at the Institute of Psychiatry, King's College London and University College London (UCL). The inclusion criteria were: no previous psychiatric history and a negative screen for psychotic symptoms on the Psychosis Screening Questionnaire (Bebbington and Nayani, 1995). Exclusion criteria for both clinical and non-clinical participants were: poor command of English; a history of epilepsy. The demographic and clinical characteristics of the participants are displayed in Table 1.

### 2.2. Design and procedure

The study had received approval from a NHS research ethics committee. The study was conducted in four stages. All participants completed the baseline assessments before entering the virtual environment. The second stage involved entering the virtual environment. The virtual reality equipment was situated in the Department of Computer Science, University College London. There was a training task to help participants to familiarise themselves with VR. The training task lasted approximately 5 min and required the participant to move through a series of numbers to practice navigation in VR. The experimental environment consisted of a virtual underground train carriage. Participants boarded the virtual train and disembarked after two stops. The train journey lasted 4 min. The instructions were "Please explore the environment, and try to form an impression of what you think about the people in the train and what they think about you." In the third stage, after the virtual train ride, participants were asked to complete a series of assessments of their experience. Lastly, participants were contacted by telephone a week later to investigate the occurrence of any adverse reactions.

#### 2.2.1. Virtual environment

2.2.1.1. *Apparatus.* The virtual environment was displayed in an immersive projection system typically

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