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Social environments and interpersonal distance regulation in psychosis: A virtual reality study

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ABSTRACT

Background: Experimentally studying the influence of social environments on mental health and behavior is challenging, as social context is difficult to standardize in laboratory settings. Virtual Reality (VR) enables studying social interaction in terms of interpersonal distance in a more ecologically valid manner. Regulation of interpersonal distance may be abnormal in patients with psychotic disorders and influenced by environmental stress, symptoms or distress.

Aims: To investigate interpersonal distance in people with a psychotic disorder and at ultrahigh risk for psychosis (UHR) compared to siblings and controls in virtual social environments, and explore the relationship between clinical characteristics and interpersonal distance.

Methods: Nineteen UHR patients, 52 patients with psychotic disorders, 40 siblings of patients with a psychotic disorder and 47 controls were exposed to virtual cafés. In five virtual café visits, participants were exposed to different levels of social stress, in terms of crowdedness, ethnicity and hostility. Measures on interpersonal distance, distress and state paranoia were obtained. Baseline measures included trait paranoia, social anxiety, depressive, positive and negative symptoms.

Results: Interpersonal distance increased when social stressors were present in the environment. No difference in interpersonal distance regulation was found between the groups. Social anxiety and distress were positively associated with interpersonal distance in the total sample.

Conclusion: This VR paradigm indicates that interpersonal distance regulation in response to environmental social stressors is unaltered in people with psychosis or UHR. Environmental stress, social anxiety and distress trigger both people with and without psychosis to maintain larger interpersonal distances in social situations.

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1. Introduction

Psychotic disorders often involve impaired social functioning (Couture et al., 2006; Van Beilen et al., 2003). Adequate social functioning includes keeping an appropriate physical distance to others. It is difficult to study a dynamic concept such as interpersonal distance, as laboratory settings do not represent real life social contexts and often lack interaction between the subject and environmental characteristics. Using Virtual Reality (VR), the current study investigated the influence of social environments on interpersonal distance in psychosis.

Personal space or interpersonal distance, is the distance we keep to people in our surroundings. Personal space is regulated dynamically and intrusion of personal space boundaries causes discomfort

(Hayduk, 1978). Several factors influence which distance is desirable or appropriate at a certain moment. For example, when feeling threatened, people enlarge their distance to others (Hayduk, 1978). In contrast, when accompanied by familiar people, personal space boundaries become smaller (Hall, 1963; Nechamkin et al., 2003). Other factors influencing interpersonal distance are cultural norms, age, gender (Ozdemir, 2008) and psychopathology (Asada et al., 2016; Kim et al., 2009).

People with psychosis were shown to prefer larger distances than controls in dyadic paradigms, that is, relative to a single person or single stimulus (de la Asuncion et al., 2015; Deus and Jokić-Begić, 2006; Duke and Mullens, 1973; Schoretsanitis et al., 2015). Dyadic studies usually use tasks on paper or stop-distance tasks. In stop-distance tasks subjects are approached and have to indicate when they feel the approaching person gets so close that the subject starts to feel uncomfortable (Schoretsanitis et al., 2015).

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In the last decade, dyadic interpersonal distance research has been extended with VR. Immersive VR experiments are more ecologically valid than pen and paper tasks but can still be controlled and replicated in a degree that is impossible in real life experiments (Blascovich et al., 2002). Healthy subjects showed a positive relation between subclinical paranoid ideation and interpersonal distance in a dyadic VR setting (Fornells-Ambrojo et al., 2016). Park and others (2009) observed a complex relation between interpersonal distance, facial affect and negative symptoms in patients with psychosis. Interpersonal distances were smaller when more negative symptoms were present, but only if avatars looked angry or neutral and not when looking happy. These findings suggest that interpersonal distance regulation may depend on multiple social and personal characteristics.

An unexplored aspect of interpersonal distance is the influence of social environments. Especially in patients with psychosis, the environment may be of importance for social functioning. Social stimuli in the surrounding which are meaningless to most people, can be threatening or over-arousing to people with psychotic disorders (Collip et al., 2011; Haralanova et al., 2012; Kapur, 2003) and may increase interpersonal distance as a form of safety behavior. Moreover, increased stress reactivity (Myin-Germeys and van Os, 2007) and cognitive biases are common in psychosis (Van der Gaag et al., 2013). Together, this could result in elevated distress levels or paranoia in response to social environments. Primary results of the current study showed that patients with psychosis and at ultrahigh risk for psychosis (UHR) were indeed more sensitive to virtual social environmental stress than controls (Veling et al., 2016). Higher levels of social environmental stressors were related to increased paranoia and psychological distress.

Abnormal interpersonal distances can cause problems in social interactions (Hall, 1966). When distances become larger it might be more difficult to see and interpret facial affect. Also, people could respond differently if someone does not follow the social norms of personal space, which can contribute to paranoia, misinterpretations and social isolation in psychosis. A safety and feasibility pilot study on social environmental VR designs by our research group unexpectedly found that, compared to controls, psychosis patients kept smaller rather than larger interpersonal distances in virtual social environments (Veling et al., 2014), but the sample was too small to draw conclusions.

In this study we investigated interpersonal distance regulation in response to social environments in people with different psychosis liability; patients with a psychotic disorder, individuals at UHR, siblings of patients and controls. Participants were exposed to virtual surroundings differing in social stress in terms of crowdedness, ethnicity and hostility. To explore mechanisms by which environmental stress might influence interpersonal distance, the relation with symptoms and mental states was examined.

We hypothesised that (a) interpersonal distance increases with the number of VR social stressors in the environment, (b) independent of psychosis liability, interpersonal distance is positively related to baseline levels of (subclinical) social anxiety and paranoia, and state paranoia and distress during VR experiments, (c) people with psychotic disorders and UHR keep larger interpersonal distances compared to healthy controls and siblings, and (d) there is an interaction between level of virtual social stressors and psychosis liability on interpersonal distance, that is, the effect of social stressors on interpersonal distance is larger in people with psychotic disorders and UHR than in siblings and controls.

2. Methods

2.1. Subjects

Four groups of participants aged 18–35 were enrolled: people with a psychotic disorder (psychosis), people with an UHR status (UHR), siblings of people with a psychotic disorder (siblings) and healthy controls (HC).

Psychosis participants were in treatment for first episode psychosis (unrelated to substance use or medical conditions), diagnosed in the preceding five years. The diagnosis was verified with a Schedules for Clinical Assessment in Neuropsychiatry (Wing et al., 1990) or Comprehensive Assessment of Symptoms and History interview (Andreasen et al., 1992). No cut off scores for positive or negative symptoms were used as an exclusion criteria for the psychosis group. UHR participants were help-seeking patients at outpatient departments of mental health care facilities, and were identified as being at risk for psychosis according to the Comprehensive Assessment of At-Risk Mental States criteria (Yung et al., 2005). Siblings and HC had no history of psychosis, nor did first degree relatives of HC. Exclusion criteria for all subjects were: IQ < 75, history of epilepsy and insufficient command of the Dutch language. Psychosis, UHR and siblings were recruited from five mental healthcare facilities. HC were recruited through advertisements at schools, dental offices and healthcare institutes.

Subjects signed informed consent preceding the study, and received a ten euro gift card for participating. The study was approved by the medical ethical committee of Leiden University Medical Center and conducted according to the principles of the Declaration of Helsinki (October 2008).

2.2. Study design

The study has a crossover between group design. Participants completed questionnaires and subsequently five experimental blocks consisting of a VR experiment, followed immediately by a distress measure and questionnaire.

2.3. VR environment

Experiments took place in a VR 3D café with a terrace covering an area of 181 m² (Fig. 1), created by CleVR with Vizard software. The café was presented through a head mounted display (HMD, Sony HMZ-T1) with a resolution of 1280 × 720 per eye and 51.6 diagonal field of view, integrated headphones and a built-in 3DOF head tracker. Participants moved by operating a joystick (Logitech F3 Gamepad). Avatars were standing or sitting at tables in the VR café. When participants approached avatars, some avatars would look their way briefly, others remained interacting and drinking. Participants heard random café background noises through the headphones.

The social stressors present in the café differed in each experiment. This was accomplished by manipulating three variables: crowdedness, facial expression and ethnicity, see Table 1. The ethnicity of minimal 80% of the avatars was similar or different (white Caucasian or North-African) to the ethnic appearance of the participant. The facial expression of the avatars was neutral or hostile. During the neutral condition avatars continuously looked neutral at each other and the participant. In the hostile condition hostile looks (duration of five seconds) were interspersed with neutral looks.

2.4. Procedure

Subjects were instructed to explore the virtual environment with the avatars, and perform a task to ensure that the VR café was explored. Five avatars had a number on their shirt, ranging from 0 to 99. Participants had to find the avatar with the highest number, and remember that avatar's number and gender. Each VR exposure lasted four minutes; between experimental blocks was a five-minute break. The order of exposure was randomized, with exception of the last experiment, when a minimal of two stressors was always present.

2.5. Measures

Baseline measures included demographic variables (see Table 2), the Community Assessment of Psychic Experiences (Konings et al., 2006),

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