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Using Virtual Reality to Study Paranoia in Individuals With and Without Psychosis

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Abstract. A virtual reality environment was created to study psychotic symptoms of patients that experience psychosis. In the environment people could navigate through a bar with a gamepad while wearing a head mounted display. Their task was to find five virtual characters that have a small label number on their chest. The density and ethnic appearance of the virtual characters in the bar was controlled. To study the effect of these two factors a 2 by 2 experiment was conducted with a group of 24 non-patients, and two patients. For the non-patient group results showed a significant main effect for density on participant's physiological response, their behaviour, reported level of discomfort, and their ability to remember place and location of the numbered avatars. The avatar ethnicity had significant effect on non-patients' physiological responses. Comparison between the two patients and non-patient group shows difference in physiological responses, behaviour and reported level of discomfort.

Keywords. Virtual reality, psychosis, social scene, psychotic, paranoia, exposure.

Introduction

Psychosis is a mental condition whereby people have delusions or prominent hallucinations. For example, individuals in a state of paranoid psychosis can experience fear as they believe that others intend to harm them. One key variable of understanding psychosis is the social environment. Epidemiological studies have shown high rates of psychotic disorders in densely populated urban environments and among immigrants who live in neighbourhoods with a low proportion of ethnic minorities, likely reflecting the causal influence of environmental risk factors [3]. Recreating the social environment in virtual reality (VR) has been put forward as means to study psychotic symptoms [2]. A VR system was therefore developed including the control of two potential environmental stressors: population density and ethnic appearance of the avatar group in a bar. A study is reported into the effect of these factors on a group of non-patients and two patients.

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1. Method

Individuals could freely navigate through the bar consisting of an indoor and outdoor setting. Potential stressors that could be set were: (1) ethnic appearances of avatars group either mainly white-European or mainly North-African; and (2) the density of the avatars in the bar either between 7 and 9 or between 34 and 38 avatars. To engage the people with these avatars the system randomly gave five of these avatars a number, visible on their clothing, which participants had to find. During this task the navigation behaviour with Logitech Chillstream Gamepad was automatically recorded. Participants wore an Emagin Z800 3D Visor with a resolution of SVGA 800x600 24 bit, with 40 degrees diagonal Field of View, and build in 3DOF tracker.

Participants were a white Dutch non-patient group consisting of university staff and students, including four females and 20 males, with average age of 29 years (SD = 9.2); and two Dutch male patients, 36 and 25 years old, who completed technical and vocational training for 12-16 year-olds and for 16-18 year-olds. The experiment was set up with a 2 by 2 within-subjects design for the two factors of the avatar group (ethnicity and density). As a baseline measurement for galvanic skin response, a three minutes neutral physiological measurement was taken, where participants sat in a chair. After this, participants had a training session in which they navigated through the VR world and looked for the numbered avatars. Once this was completed participants were exposed to the four experimental conditions, with a maximum of three minutes each for the non-patients group and four minutes for the patients. The experiment of the non-patient group was conducted in a university lab, while the two patients participated at the mental health clinic.

2. Results

To study the effects for ethnicity and density a series of MANOVAs with repeated measures were conducted. Compared to low density conditions, in the high density conditions: fewer locations ($F(1,23) = 7.07$, $p. = 0.014$) and numbers ($F(1,23) = 10.47$, $p. = 0.004$) were correctly remembered of the labelled avatars; self-reported level of discomfort was higher ($F(1,23) = 5.24$, $p. = 0.032$); standard deviation of the heart rate was larger ($F(1,23) = 10.09$, $p. = 0.004$); average distance towards an avatar was smaller ($F(1,23) = 4.86$, $p. = 0.038$) in a two meter radius of a visible avatar. Compared to white-European avatars, in the conditions with a majority of North-African avatars, the standard deviation of heart rate was larger ($F(1,23) = 4.70$, $p. = 0.041$) and standard deviation of galvanic skin response was larger ($F(1,22) = 4.40$, $p. = 0.048$). The data obtained from the two patients were compared with a series of One-sample t-tests with means of the non-patient group. Compared to the non-patient group the overall trends across the conditions for these two patients was that they positioned themselves more closely to the avatars in the two meter radius of the avatar. Furthermore, their heart rate was higher, they sweat more, and their self reported level of discomfort was higher.

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3. Conclusion and Discussion

Results seem to indicate that density and ethnicity had an effect on the non-patients group. The latter seems to support earlier reports on physiological responses towards ethnicity of avatar [1]. The collected data from the non-patient groups forms a baseline to compare patients with as was done for two patients that showed differences in their physiological responses, their behaviour and their reported level of discomfort. Besides baseline comparison, future work could also consider in depth analysis of a specific patient behaviour towards various types of avatars, e.g. gender, and ethnicity.

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