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Priming to Induce Paranoid Thought in a Non Clinical Population

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Abstract. Freeman et al. reported that a substantial minority of the general population has paranoid thoughts while exposed in a virtual environment. This suggested that in a development phase of a virtual reality exposure system for paranoid patients initially a non-clinical sample could be used to evaluate the system's ability to induce paranoid thoughts. To increase the efficiency of such an evaluation, this paper takes the position that when appropriately primed a larger group of a non-clinical sample will display paranoid thoughts. A 2-by-2 experiment was conducted with priming for unsafety and vigilance as a within-subject factor and prior-paranoid thoughts (low or high) as a between-subjects factor. Before exposure into the virtual world, participants (n = 24) were shown a video and read a text about violence or about mountain animals. While exposed, participants were asked to comment freely on their virtual environment. The results of the experiment confirmed that exposure in a virtual environment could induce paranoid thought. In addition, priming with an aim to create a feeling of unsafety and vigilance increased paranoid comments in the non-clinical group that otherwise would less often exhibit ideas of persecution.

Keywords. Paranoia, priming, virtual reality, exposure, mental health computing

Introduction

Paranoia is a state of mind where the subject has a belief that other people have intention to harm them. This state is characterized by hypervigilance, emotional arousal and selective attention for threat. Paranoia can be delusional in psychotic disorder, but also occurs in the general population where people have no history of mental illness [1]. This creates the opportunity to study paranoia evoking stimuli in a non-clinical population, which is specifically relevant when evaluating new virtual reality (VR) applications in this area. Before studying with actual patients, research could be done with non-patients initially. Furthermore, Freeman et al. [2] reported that, although substantial, only a minority of above 40% of their 200 participants recruited from the general population had paranoid thoughts when exposed in a neutral VR world, suggesting the need for relative large samples to evaluate a VR application on its ability to evoke paranoid thoughts in non-patients. Because of the impracticability of using a large sample, this paper takes the position that when appropriately primed a larger group of the general population will more intensely display paranoid ideation in

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a VR world. That priming is effective in VR has already been demonstrated by Bouchard et al. [3]. They showed that informing individuals, with a snake phobia, prior to the VR exposure about the existence of dangerous snakes in the VR world, could increase the anxiety experienced in VR later on. In addition, Qu et al. [4] also showed that text and video priming could increase the chance that an individual would mention a specific keyword in a discussion with a virtual character. Results from both studies encouraged an investigation into whether it is also possible to induce paranoid thought to a non-clinical sample using priming prior to the exposure. Therefore, this study aims to demonstrate that video and textual priming prior to exposure can indeed increase paranoid thought during VR exposure.

1. Method

1.1. Procedures and Participants

The experiment was set up with a two by two design, with type of priming (paranoid or neutral) as a within-subjects factor, and prior-paranoid thoughts (low or high) as a between-subjects factor. In addition, the experiment was controlled by a computer that followed a double-blind procedure where both the participants and experimenter did not know the order of the priming condition. 24 students of Delft University of Technology (16 male and 8 female) participated in the experiment. The participants' age ranged between 23 and 33 (M = 27.8, SD = 2.8). All the participants had at least a bachelor degree and reported to have no history of psychosis. Ethical approval for this experiment was obtained from the university ethics committee. Before the experiments, all the participants read, and signed a consent form. They were not informed about the hypothesis of the experiment until the experiment had ended. They were only informed that their participation would help in the developing a VR environment that could be used to help treating people with a mental disorder.

1.2. Interventions

The type of priming in the experimental condition consisted of two levels: paranoid priming and neutral priming. In the paranoid priming condition, the participants were shown a 6.5 minutes video of a news report on street violence[1] and read an A4 page long fake news report about violence in the Netherlands. The aims of the video and the text was to raise attention to threat and increase the level of vigilance so that participants could carry-over these feelings into the VR exposure to influence the way they perceive the VR world. In the neutral-priming condition, participants were shown a 6.5 minutes wildlife video [5] and read an A4 page long text about mountain animals. Both this text and video were selected with the intention not to evoke suspicious thoughts or feelings. After reading the text and watching the video, participants were either exposed to a VR environment of a restaurant or a train platform [6] for 5 minutes each. The orders of the two priming conditions and the VR worlds were counterbalanced. Both environments included virtual characters that had no specific tasks, did not show specific emotions, and did not initiate conversations or physical

[1] Downloaded on 27 February 2012 from http://www.youtube.com/watch?v=jQjZpiJt5ic

interactions with the participants. Some virtual characters walked around, either following a fixed path, or a random path, and stopped at random points to look around. Furthermore, some virtual characters looked occasionally at the participants. Figure 1 shows pictures from the VR environments. To establish a baseline measurement and to train the participants with a commenting protocol, participants were exposed in a training VR environment [5] at the start of the experiment after which they were presented with priming video and text.

Figure 1. The VR environment. Left the restaurant world and right the train platform world.

1.3. Materials and Measurements

The participants were exposed in the VR world by wearing a Sony HMZ-T1 Personal 3D Viewer head mounted display with resolution of 1280x720. The tracking was done using 6DOF Ascension Flock of Birds tracker. Mobi8 data recorder from TMSi was used to collect heart rate data from the participants. Throughout the exposure, the participants were instructed to comment freely on their environment, including the virtual characters. They were asked to focus on how they experienced and perceived the environment rather than simply providing an 'objective' description of the environment or an assessment of the quality of the VR environment. During the exposure the experimenter recorded what the participants said and also saw in the VR environment at that moment. The participants' voice and screen view were recorded using Camstudio software. To measure the participants' paranoid comments, two independent coders went through all 48 commentaries and counted the number of times participants made comments that could be labeled as paranoid thoughts (Table 1). In addition, The Green et al. Paranoid Thoughts Scale (GPTS) [7] was used as a measure of the participants' base paranoid level prior to the experiment, and the State Social Paranoia Scale (SSPS) [8] was used as a measure of the participants' paranoid thought directly after the VR exposure.

2. Result

A strong level of inter-observer correlation (Spearman r = .83, n = 48, $p.$ < .01) suggested an acceptable reliability level of the coded comments. For further analysis the average value of two coders was used. Taking the median score of 58.5 on the Green et al. Paranoid Thoughts Scale (GPTS) as a cut off point, the participants were split into two equal groups, a low and a high GPTS group. As the SSPS score and the paranoid comments deviated from a normal distribution, an Aligned Rank Transformation (ART) for nonparametric factorial data analysis [9] was conducted first. Afterwards, repeated-measures ANOVA analyses were conducted using the

priming condition and the two GPTS groups each time as independent factors and the ART of SSPS score, Heart Rate, and the ART of the number of paranoid comments as dependent variables. Table 2 shows the result of the analyses.

Table 1. Coding Scheme Paranoid thoughts commentaries.

• **Persecution/accusation**: a reference that suggests that a virtual character is acting suspiciously or is dangerous. • Examples: *he looks suspicious; I believe he has bad intentions; he is up to no good.*
• **Distress**: a reference regarding feeling uncomfortable or distressed, which was caused by a virtual character or the environment. • Examples: *the way he looks at me makes me feel uncomfortable; people keep staring at me and it feels uncomfortable; I am not feeling comfortable to sit beside him.* • Not included: references to feelings that are caused by unrelated events or objects, such as: *I feel uncomfortable since there is no food on my table; I am bored.*
• **Threat**: a reference towards a threat from a virtual character or the environment or a feeling of unsafety. • Examples: *the way he looks at me makes me feel insecure; I do not think this place is a safe place.* • Not included: references that are caused by unrelated events or objects such as: *I am afraid that the HMD will fall if I move too actively; I am not feeling safe wearing all these gadgets.*

Table 2. Results of analyses on SSPS, Heart Rate, and Paranoid comments.

	GPTS group		**Priming**		**GPTS group x Priming**	
Measures	***F*(1, 22)**	***p.***	***F*(1, 22)**	***p.***	***F*(1, 22)**	***p.***
SSPS	3.05	.095	< 0.01	.941	0.14	.247
Heart Rate	4.22	.052	0.06	.808	0.79	.384
Paranoid comments	0.75	.395	0.77	.389	5.10	.034

Although no significant main effects were found, analyses revealed a significant two-way interaction effect between GPTS groups and the priming condition ($F(1,22) = 5.10$, $p = .034$) on the number of paranoid comments (Figure 2).

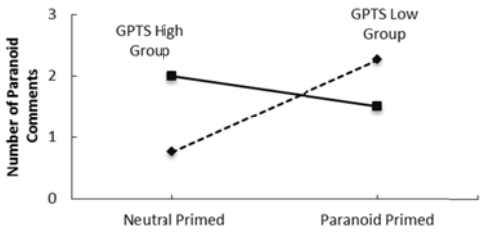

Figure 2. Median number of paranoid comments mentioned in the exposure.

In the neutral priming condition, the low GPTS group (*Mdn* = 0.75) made significant ($z = -2.08$, $p = .04$) fewer paranoid comments than the high GPTS group (*Mdn* = 2.0), whereas in the paranoid priming condition no significant ($z = -.29$, $p = .80$) difference was found between the low (*Mdn* = 2.25) and the high GPTS group (*Mdn* = 1.5). Also for the low GPTS group, the number of paranoid comments significantly increased between the neutral and the paranoid priming condition ($z = -2.68$, $p < .01$), while for high GPTS group, no significant difference ($z = -0.55$, $p = .58$) was found between the neutral and the paranoid priming condition. Instead, the number of comments seemed to remain relatively high. Furthermore, although the main effect for the GPTS groups on SSPS scores (low GPTS group *Mdn* = 15.5; high GPTS group *Mdn* = 24.5) and participants' heart rate (low GPTS group *M* = 86.2; high GPTS group

M = 79.6) approached a significant level of .05, no significant main effect for priming or an interaction effect between priming and GPTS groups was found on both.

3. Discussion

The result of the effects of priming on paranoid comments seems similar to the result of Fett et al[10]. In a trust game, they found that the paranoid individuals were inflexibly mistrusting, while non-paranoid individuals were trusting in neutral situations and mistrusting in situations in which they were cheated. No significant interaction effect between the GPTS groups and priming was found on the SSPS score and the heart rate. Presumably priming might not result in a large physiological effect, while SSPS score was only collected after the exposure, where the priming effect might have worn off, or might not have a large effect on the recollected experience of this non-clinical sample.

4. Conclusion

The results of the experiment confirmed that exposure in a virtual environment could induce paranoid thought. In addition, priming with an aim to create feelings of threat and vigilance could increase paranoid comments in a non-clinical group that otherwise would less often exhibit ideas of persecution. Together these findings suggested that when appropriately primed a non-clinical sample could be used to evaluate VR environment ability to elicit paranoid thought.

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