

# A VIRTUAL ENVIRONMENT TO CREATE SOCIAL SITUATIONS: FIRST STEP TO A VIRTUAL REALITY EXPOSURE THERAPY SYSTEM FOR SOCIAL PHOBIA

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## KEYWORDS

Virtual reality, social phobia treatment, presence.

## ABSTRACT

This paper describes a study to examine how a social situation can be simulated in a virtual environment, and how to provoke the same behavioral response as in a real life social situation. The aim is to create new Virtual Reality worlds for treating social phobia. Two cases were examined in a virtual environment to assess whether it was able to recreate social behavior of people. First, we examined if participants who enter a crowded room in the virtual environment prefer to take a seat in a chair that is close to them. Secondly, we investigated if participants in the virtual environment have the tendency to physically distance themselves from strangers when choosing a seat in a room full of strangers. We conclude that a social situation can be recreated in a virtual world.

## INTRODUCTION

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (1995) social phobia is a persistent fear of one or more social or performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others. The individual fears that he or she will act in a way that will be humiliating or embarrassing. Traditional exposure therapy (exposure in vivo) typically consists of confronting the feared situation in imagination or in real life (Hodges et al. 2001). Research has proven that Virtual Reality (VR) technology can be successfully implemented in clinical therapy Emmelkamp et al. 2002, Wiersma et al. 2008, Emmelkamp&Powers 2008). Clinicians are using Virtual Reality Exposure Therapy (VRET) to treat anxiety. The exposure therapy takes place in the therapist's office in a computer generated world of the feared situation. The VR gives the therapist greater control over the feared situation, which results in the most effective exposure.

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The Delft University of Technology and the University of Amsterdam are collaborating in the frame of the research project "Virtual Reality and Phobias". The Delft University of Technology, section of Human Computer Interaction (HCI), which studies the relation between human and computer. The University of Amsterdam, faculty of Psychology, is concerned with the therapy and psychological aspects of VR.

Delft University of Technology has developed several virtual environments for treatment of acrophobia, claustrophobia and fear of flying, however a specific virtual environment for social phobia exposure therapy had not been created yet.

The aim of this study is to create a realistic VR social environment that can generate the same response that social phobia patients would experience in the equivalent real life situation. We chose to create a small virtual class room on a campus where people are looking to a film projected on a screen. Not all chairs are occupied. The participants enter the room during the film. This can evoke social phobia. They have to make a choice to sit down on one of the empty chairs. In this paper is described how this virtual lecture room is designed and how a controlled experiment is performed to conclude about the social behavior in this world.

## BACKGROUND

Social phobia is not categorized as a specific phobia because, rather than fearing a specific object or situation, people with social phobia fear being judged or embarrassing themselves in front of other people. Social phobia also differs from the specific phobias in that it is more likely to severely disrupt a person's daily life (Kessler 2003).

People with social phobia are well aware of the irrationality of their feelings, but nevertheless feel great apprehension when facing the feared situation. Therefore, they will do anything to escape it and will start avoiding all sorts of social situations, with the result that the avoidance inhibits the person's functional character. In these feared social situations the social phobic will be constantly worried that other people might think they are anxious, weak, silly or strange.

One of the main characteristics of social phobia is the strong anxiety felt before the feared events take place, known as “anticipated anxiety”. People start worrying and getting a feeling of fear before confronting the feared situation, once they actually face it, and due to their nervousness, it comes out worse, this leading to an increase in the level of “anticipated anxiety” next time they confront the same situation. A vicious circle is created and which is self generating.

Some people report having had humiliating experiences that triggered their social phobia but others having felt extremely uncomfortable in social situations all their lives. Social phobia often co-occurs with mood disorders, other anxiety disorders and antisocial personality disorder (Neal&Edelmann 2003, Wittchen&Fehm 2003). Once develops, social phobia tends to be a chronic problem if untreated. Most people with a social phobia do not seek treatment for their symptoms (Kessler 2003).

People with social phobia, get more than a little nervous in social situations. Physical symptoms may begin trembling and perspiring, feel confused and dizzy, have heart palpitations, “mind going blank”, blushing, stomach ache, and eventually have a full panic attack.

Patients with social phobia have a marked and persistent fear of one or several social or performance situations such as attending social functions, dating, participation in small groups, using a public lavatory or even initiating simple social conversations. As a result, these individuals have great difficulty attending class, working alongside others, eating in public, shopping or even coming to medical attention. They often live alone and work at solitary jobs.

They are sure that others see their nervousness and judge them as inarticulate, weak, stupid or “crazy”. People with social phobia may avoid eating or drinking in public, for fear they will make noises when they eat, drop food, or otherwise embarrass themselves. People with social phobia tend to fall into three groups: people with only fear of public speaking; people moderate anxiety about a variety of social situations; people who have severe fear of many social situations, from speaking in public to having a conversation with another person, they all are said to have a generalized type of social phobia.

## METHOD

The preference of the participant for certain empty chairs in a room is measured under different circumstances. In order to verify if the prototype virtual environment is recreating the real life situation successfully and is able to provoke the same human response, two test cases were investigated. From Hall (1968) we know that a set of measurable distances exists between people as they interact. He presents public, social, personal and intimate spaces. Studies with standing and seated persons revealed interesting relations between psychological characteristics and interpersonal distance in vivo (Ickinger&Morris, 2001). The following two test cases are assumed to be representative to invoke critical behavior of social phobia patients, and were used for the experiment with the prototype virtual environment.

A. People who enter a crowded room want to sit down as quickly as possible to avoid being the center of

attention; they would prefer a chair which is close to them

B. People have the tendency to physically distance themselves from strangers when choosing a seat in a room full of strangers; they would prefer a chair with no one sitting around them

The hypothesis is that people with social phobia, get more than a little nervous in social situations. The majority of non sociophobic people will to a certain extent have experienced a nervous or awkward feeling in particular social situations, but when this feeling becomes extreme and intense, it can be classified as a social phobia. This can be a first step to create a social situation in which social phobia can be controlled by changing parameters (graded exposure).

In this pilot study the participants are for ethical reason not social phobia patients because of the experiment is in a first trial phase. The participants of our experiment are PhD students, staff members or students of Delft University of Technology. For this reason we prefer to choose a situation which can be recognized by the participants.

The social situation we choose for the virtual world is a social event at a university. The participants have to join this social event. The social event is movie night that will take place in a class room of the university building.

### The virtual environment scenario

To clarify our design approach we give a broad outline of the situation during the experiment in the virtual environment.

The avatars are sitting on the chair watching a movie. The participant is entering the room too late (which is a feared situation for a social phobia patient), the movie is already playing. They take a look in the room before entering through the window - in order to provoke possibly anticipated anxiety. After standing in the room the participant is going to be navigated through the room, without knowing precisely in which direction. The participants do not have control on the situation after entering the room and cannot get habituated to the situation in the room, since their place in the room is changing continuously.

At certain points, they receive questions about the empty chairs. The participant has to answer the question. The virtual tour ends at the moment after the last question is answered.

### The virtual room design of the prototype

Virtual room design has to consist the requirements for provoking anxiety for people with a social phobia. The seating capacity of the room is twenty. There are four rows of five chairs. The rectangular room has a windowed room divider wall. The door of the room is closed (no escape is possible or avoidance of the situation). In front of the room there is a video screen (Figure 1). On the chairs are “living” male avatars sitting, with different clothes (Figure 2). Entering the classroom one sees at the left a room divider wall with a big window. The participant can see already who are in the classroom. The

navigation is done automatically by the software as the project leader presses function keys. Also the questions about the preference of chairs to sit in are given automatically by the software with synthetic voice. The classroom and the interaction are modelled with Maya and played interactively with Vizard. The HMD used is an eMagin Z800 3Dvisor.



Figure 1: Overview of the virtual classroom.



Figure 2: View through the window in the room divider wall.

## THE EXPERIMENT

The animation path starts in front of the room; there are two different animation paths, see Figure 3. The animation paths are chosen randomly. The two different animation paths, which are between-subject variables, are used for different group of participants.

Animation path1 => red chair => yellow chair => green chair => blue chair

Animation path2 => blue chair => green chair => yellow chair => red chair

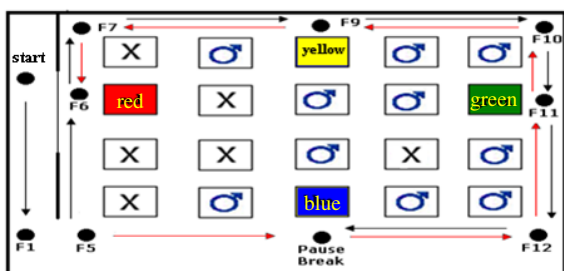


Figure 3: The navigation paths 1 and 2.

We used four measures for our experiment:

### 1) The Chair preference rate during the experiment with the animation path:

The participants do not get information about the experiment goal before entering the room. They are navigated to certain points in the virtual world and when they arrive nearby a colored chair they receive a question through their HMD a neutral computer generated voice.

They have to answer the question: “How willingly would you like to sit on the red/blue/green/yellow chair” and “Please state your answer with the number between 1 and 7” (Likert scale: 1 extreme unlikely, 7 extreme likely).

They are navigated to the next point at the moment they say loudly what their grade is. This repeats for each colored chair till the end of the experiment

### 2) The preference order of the chairs:

The participant is asked which chair they would prefer first, second, third and fourth if they could walk to a chair when they are standing in front of the group, after navigated tour in the virtual environment.

### 3) Presence

We used the igroup presence questionnaire (IPQ 2008) to measure the presence. The Igroup Presence Questionnaire (IPQ) is a scale for measuring the sense of presence experienced in a virtual environment (VE).

The scale development process of the current version of the IPQ identified one general item, three subscales. The three subscales can be regarded as fairly independent factors. They are Spatial Presence, Involvement, Experienced Realism. The current IPQ has a total of 14 items.

### 4) Social phobia

We used the Liebowitz Social Anxiety Scale (LSAS) to assess if our participants do have a social phobia (Heimbert et al. 2006). The more participants with a social phobia, the better we can confirm the effectiveness of our prototype.

The Liebowitz Social Anxiety Scale (LSAS) is a questionnaire by psychologist and researcher, Michael Liebowitz, whose objective is to assess the range of social interaction and performance situations which patients with social anxiety disorder may fear. It is commonly used to study outcomes in clinical trials, see Table 1.

Table 1: The scoring scale of the Liebowitz Social Anxiety Scale (The Anxiety Community 2008)

The scoring scale
55-65 Moderate social phobia
65-80 Marked social phobia
80-95 Severe social phobia
Greater than 95 – Very severe sociale phobia

The scale features 24 items, 13 relating to performance anxiety and 11 concerning social situations. It is not intended for use as a self-reporting diagnosis. The LSAS differs from many of the other measures of social phobia in that it is explicitly situation-based. The participant have to rate his/her fear experienced in a broad array of social situations, as well as to rate the degree to which he/she avoids the situation.

The experiment was performed in the multimedia lab at the EWI-faculty of the Delft University of Technology. The experiment is completed with 22 participants, 5 female and 17 male. The 22 participants were master students (n=15), PhD students (n=5) or staff members

(n=2). Some of the participants (n=9) already had virtual reality experience. According to the LSAS scoring scale (Anxiety Community 2008) the participants (19) did not have a social phobia and (3) marked social phobia.

## RESULTS

The first step of the analysis was to transform the individuals' chair preference scores (  $x$  ) into z-scores. This would remove individuals' use of the Likert scale. The z-scores were based on a participant's average (  $\mu$  ) and standard deviation of the chair (  $\sigma$  ) rating.

$$z = \frac{x - \mu}{\sigma}$$

As the red chair and green chair are identical in distance to the film screen, but differ on the number of avatars position around the chair, analyzing preference rating of these chairs would give an insight in the effect of these avatars on participants' preference for these chairs. Next, participants were led pass the chairs in opposite routes, including this information in the analysis gives an insight on participants' preference on preferring a chair rather soon than later when moving through the room. Therefore a MANOVA with repeated measures was conducted. Chair and Animation Path were taken as independent within-subject variables, and preference z-score of the two chairs as dependent measure. The analysis found no significant main effect for the chairs ( $F(1,20) = 0.13, p. = 0.72$  ) or for the animation route ( $F(1,20) = 0.80, p. = 0.38$ ). However, the analysis revealed a significant interaction effect between chairs and the animation route ( $F(1,20) = 5.72, p. = 0.027$ ).

Examining Figure 4 with the mean z-score, it seems that the rating of the red chair was higher rated by participants starting with animation path 1: (red-yellow-green-blue), when red chair is asked in the beginning of the path. Participant following the animation path 2 (blue – green – yellow – red), for whom the red chair was the last one on their path, gave a lower score for the red chair. The same was visible for the green chair. The green chair gets a higher score is if the rate for the chair is asked earlier in the path. For animation path 1, the green chair ratings are lower than in case of the animation path 2.

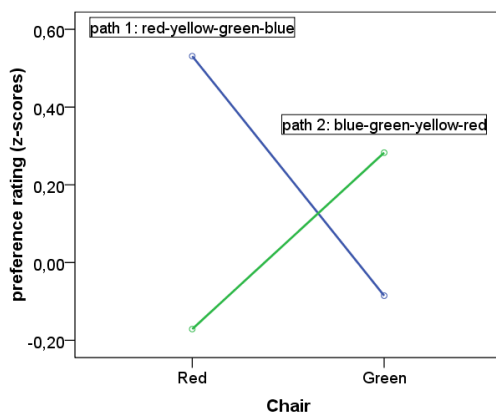


Figure 4: Preference rating chair in relation with the animation paths.

A difference between preferences in chairs was found in the participants preference ordering of the chairs at the end of session. The participants were asked to give a preference order for the colored chairs if they could walk to a chair independent of the animation path.

A Friedman Test on the ranking of all chairs revealed a significant difference ( $\chi^2(3, N = 22) = 12.49, p. = 0.006$ ) between the ranking of the chairs. Furthermore, a separate analysis of the ranking order of the green and red chair with a Wilcoxon Signed Ranks Test also found a significant difference ( $z = -2.56, p. = 0.011$ ) in the ranking order of these two chairs. Examining table 6.1 shows that the participants (n=13) prefer the red chair as their first choice. The yellow (n=8) and blue (n=9) are popular as second chair in preference order.

Table 2: The frequency table of participant preference order

preference	Red frequency	Yellow frequency	Green frequency	Blue frequency
1	13	5	3	1
2	4	8	1	9
3	2	5	10	5
4	3	4	8	7
Total	22	22	22	22

The LSAS results did not have correlation with any chair preference. The 3 participants who had a social phobia according to the LSAS were not sufficient to make conclusions, still we examined their data and observed that two of the three participant gave the first chair of their animation path the highest rate when was asked how willingly they wanted to sit.

The social phobic participants preferred the yellow chair which was the physically the most distance chair and the red chair was twice the fourth preference (see table 3).

Table 3: The preference ranking for the colored chairs for 3 social phobic patients

Participant	Red Chair	Yellow chair	Green chair	Blue chair
1	4.0	2.0	1.0	3.0
2	1.0	3.0	4.0	2.0
3	4.0	1.0	3.0	2.0

## CONCLUSION

In order to verify if the prototype virtual environment is recreating the real life situation successfully, and is able to provoke the same human response, two test cases were investigated. The following two test cases are assumed to be representative behavior of social phobia patients, and were used for the experiment with the prototype: (A) People who enter a crowded room want to sit down as quickly as possible to avoid being the center of attention; they would prefer a chair which is close to them, and (B)

People have the tendency to physically distance themselves from strangers when choosing a seat in a room full of strangers; they would prefer a chair with no one sitting around them.

The results for research case A showed that the rating of the red chair was higher when given at the beginning of the path, as was the case for animation path 1. Participants following animation path 2, for whom the red chair was the last one on their path, gave a lower score for the red chair.

The same is observed for the green chair which also gets a higher grade if it is graded earlier in the path. For animation path 1, the grades of the green chair are lower than in the case of animation path 2. Therefore we can conclude that the participants prefer to take a seat on the chair that is nearest to them. This is in line with the hypothesised behavior for case A.

Some participants reinforced this conclusion by actually stating that they wanted to sit down as fast as possible, since they did not want to disturb the people already sitting down (avatars). This confirms that they had the feeling of actually being in the virtual room and wanted to sit as soon as possible and not being the center of attention.

In research case B we observed that the red chair was significant more present than the green chair (see Figure 3). Since the only difference with the green chair was the fact that the chairs surrounding the red one were empty, we can conclude that the participants prefer a chair with no avatars around them rather than the chairs with avatars surrounding it.

For our experiment we used students, staff or PhD students of the Delft University of Technology. The Liebowitz Social Anxiety Scale was not taken into account in our results because we only had a limited number (n=3) of participants with a social phobia. Although we observed different results for the social phobia participants, the number of social phobia participants was limited to draw any significant conclusions for that group. The difference in the results for the social phobia participants was that they did not have as strong a preference for the red chair as the other participants. A possible explanation for this behavior could be that the recreated room was not totally symmetric, and although the red chair was not surrounded with avatars, the fact that it was next to a window could have influenced the choice of the social phobia participants. We assumed that the colors used were neutral colors and did not influence the preference of the participant.

Since the assumed behavioral response were observed for both case A and case B, we can conclude that a social situation can be recreated in a virtual world.

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