# A Virtual Training Tool for Giving Talks

Oswald D. Kothgassner[1], Anna Felnhofer[1], Leon Beutl[2],
Helmut Hlavacs[2], Mario Lehenbauer[1], and Birgit Stetina[3]

[1] University of Vienna, Faculty of Psychology,
Working Group Clinical Psychology,
Liebiggasse 5/3, 1010 Vienna, Austria
http://psychologie.univie.ac.at/

[2] University of Vienna, Faculty of Computer Science,
Research Group Entertainment Computing,
Lenaugasse 2/8, 1010 Vienna, Austria
http://cs.univie.ac.at/

[3] Webster University Vienna Campus, Faculty of Psychology,
Berchtoldgasse 1, 1220 Vienna, Austria
http://www.webster.ac.at/psychology

**Abstract.** In this paper we present two studies concerning the application of a virtual environment for public speaking anxiety. We have created a program simulating a virtual lecture room, which can be filled with a large number of listeners behaving in different ways. The purpose of the scene is to train people who are anxious to give talks in front of a large audience. We present the results of two studies, showing the impact of this kind of virtual exposure. Results indicate that people do experience such a situation as realistic, as well as report social insecurity and show heightened psychophysiological arousal (HR). Furthermore, we show that especially curious people, and people with high social insecurity rate the system as useful.

## 1 Introduction

Social phobia (or social anxiety disorder, SAD) is a well-defined disorder in the DSM-IV. Individuals with social phobia suffer from a marked and persistent fear of one or more social or performance situations in which the patient is exposed to unfamiliar people or possible scrutiny by others. These patients suffer from maladaptive cognitions concerning the self-image and/or their own behavior in social situations (including a ruminative cognitive style) and furthermore they experience a physiological hyperarousal.

For treating phobia in general, people with social anxiety are often exposed to situations they are afraid of, and try to gradually adapt to them, thus decreasing the subjectively felt fear. Examples include, e.g., fear of certain animal types like spiders or dogs, fear of heights, places, situations, etc. Social phobia is special since it always involves other people, and treatment as described above involves the presence of a possibly large number of real humans, a scheme that is often impractical for psychological training and therapy.

M. Herrlich, R. Malaka, and M. Masuch (Eds.): ICEC 2012, LNCS 7522, pp. 53–66, 2012.

In contrast, exposing people with social anxiety to virtual situations by using videos or computers offers the potential of creating arbitrary situations with limitless other (virtual) human beings. In virtual reality (VR) one can interface with the environment, usually through peripheral devices, such as head-mounted displays and keyboards. By watching the scene through a head-mounted display, the patient should be immersed into the virtual scene, and ideally perceive the same or comparable stimuli as in real situations.

However, virtual exposures to flight, heights and social settings are well studied for psychological practice and can be more cost- and time-effective for both therapists and patients, thereby improving the accessibility of therapy to individuals who may previously have been unable to afford treatment. Newman et al. [15] estimated a savings of 540$-630$ per client when compared with standard individual therapy. Also, the use of inherently motivating virtual reality scenarios containing gaming aspects such as stimulating content and diverse levels of achievements has recently become very attractive. Especially so called serious games are increasingly applied in psychological therapy and training as they constitute a valuable endorsement of common cognitive behavioral approaches (for a detailed description see below). However, it is still an open question whether virtual exposure always achieves the same impact on patients compared to real situations, and which factors determine the efficacy of virtual exposures.

In this paper we demonstrate the efficacy of the virtual training tool for giving public lectures in front of an audience. The scene is 100% virtual, rendered in a computer using modern graphics cards and an open source render engine. We describe the software and results from experiments with a large sample size.

## 2 Related Work

Psychophysiological theories suggest that patients who suffer from social phobia experience heightened physiological arousal when they enter social situations. They interpret this arousal as an indication of danger or anxiety [9] and this leads to increased symptoms of anxiety (e.g., a racing heart, blushing). Individuals therefore learn to avoid social situations to evade this psychophysiological arousal [1,14]. Cognitive models of SAD highlight the centrality of fear of negative evaluation in the onset and maintenance of this disorder [5,12].

The goal of our approach is guided by the psychophysiological assumptions as mentioned above and the cognitive model by Clark and Wells [5]. According to this model, anxious people who enter feared situations believe, that (1) they are in danger of behaving in an unacceptable manner and (2) that such behavior will have disastrous consequences. The avoidance behavior is a complex constellation of cognitive, behavioral and psychophysiological changes, the danger is more imagined than real with anxiety responses (both physical and cognitive) being mostly inappropriate [5]. Cognitive-behavioral treatment methods (CBT) focus on changing maladaptive cognitions, psychophysiological reactions and include body relaxation training (such as biofeedback). Patients who undergo this kind of treatment report gaining a sense of empowerment and knowledge about how to best control their physiological symptoms [18].

The efficacy of technology-aided exposition methods has been shown to be comparable to traditional face-to-face settings [7,15,16,18]. VR can be combined with the compelling and motivating character of (serious) games which offer huge varieties of social interactions with other users or computer generated agents [4,11]. There are several serious games for health with promising results available, such as *Re-Mission* (provides knowledge about cancer), *Snow-World* (to distract burn recovery patients from pain), or *Sparx*, an online role-playing game for the treatment of depression[1]. Yet, for serious game developers it is a great challenge to find the right balance between a sufficient level of stimulation and motivation and at the same time satisfy the requirements of the cognitive behavioral treatment approach. Thus, studies concerning the users' perceptions of such scenarios as well as investigations regarding efficacy, usability and usefulness are required to provide entertainment computing specialist with sufficient knowledge.

In this paper we present the results from two studies concerning virtual exposures to a lecturing situation. It is well known that many people fear giving talks in front of large audiences. Examples for virutal training of giving public speeches are the products of *Virtually Better*,[2] often a mixture between pure virtual surroundings and real people filmed by video, or *Virtual Reality Medical Center*[3], a video that is presented through a visor. Another example using real people as a virtual audience is the Internet based tool *Talk To Me* [2], whose efficacy is researched in [3].

In contrast, we created a purely computer based scenario, using only virtual surroundings and artificial characters, in order to be able to synthesize different settings (e.g. varying sizes of the audience, different emotional expressions of the listeners). We present results from detailed analyses of the experiments, both indicating the efficacy of the virtual exposure and identifying factors which determine the usefulness of such a tool.

## 3 Virtual Training for Lecturing

This application allows users to virtually act out a situation in which they are supposed to give a lecture to an adjustable amount of people. The virtual environment consists of a room with space for about a hundred people. Since this room is supposed to resemble a lecturing hall, it has high walls with large windows, and small lights placed on the ceiling. Within the room there are two seating areas, a main one consisting of eighty seats in the middle of the room and a tribune in the back, resting on two columns. This main seating area is separated into a left and a right part, with a corridor between them. In this area

[1] http://sparx.org.nzfor
[2] http://www.virtuallybetter.com/
[3] http://www.vrphobia.com/therapy.htm

3 dimensional virtual avatars are placed in rows of red seats, with a table in front of each row. The last rows and the tribune are, when adjusted, filled up with 2 dimensional sprites, which is not noticeable at this distance and increases the performance of the application. As an example, Figure 1 shows the room with 70 people and fill sprites in the back.


**Fig. 1.** 70 avatars with fill sprites

To increase the realism of the scenario additional items which may be brought to a lecture are added for each avatar, like bags, magazines or laptops. The 3 dimensional avatars, both males and females, who simulate the audience have a number of animated seating poses, between which they change independently after a certain amount of time to create some liveliness. Additionally there are three different facial expressions, neutral, happy and hostile which can be changed in the options menu. The avatars also blink in irregular time steps and close their eyes when they mimic a sleeping position. The view of the test person is from a small, slightly elevated stage in front of the main seating area. Small stairs to the right and left of the stage lead up to it. On the stage there is a large screen behind and to the left of the test person, and a podium in front of him. The podium provides an additional small screen and a virtual microphone. On both screens slides for the lecture are displayed. The position of the test person is fixed, only his view is controllable. A virtual avatar is placed on the same position, so when the test person looks down, he sees parts of his body. After adjusting the settings explained in Section 3.1, the simulation starts and the test person has to give a lecture as he would do in front of a live audience. While doing so, the 3 dimensional avatars will display different poses and expressions during the speech, happy, hostile or tired ones. If adjusted, a request to speak louder or laughter will be heard after a certain amount of time, similar to a real lecture. Also, the real slides of the lecture can be imported into the application and are then displayed upon the big screen behind the test person and the small one on the podium. These slides can be switched upon pressing a button and can aid the lecturer during the speech.

### 3.1 Options

Before starting the application there are some settings that can be adjusted to alter the appearance and the perception of the simulation. The following list describes the available options:

1. **Number of people:** Here the number of 3 dimensional audience avatars is adjustable, and ranges from zero to seventy, which is about the maximum the main seating area can hold. This option has the most influence on the performance of the application, since visualizing the avatars is the most intensive in terms of computation.
2. **Percentage of happy people:** With his option the expression of a certain number of people can be changed. It defines the percentage of avatars with a smiling expression. What avatars this expression is assigned to is decided by change.
3. **Percentage of sleeping people:** This option allows to define a number of sleeping avatars, which do not change expression but rest their head on their arms on the table before them, mimicking a sleeping pose.
4. **Percentage of hostile people:** With this option the expression of a certain percentage of avatars can be changed to hostile, which will result in a frowning face with lowered mouth corners.
5. **Background sound:** Currently there are only two possible sounds, a rather silent one with only quiet talking and some coughing, and a noisy one. These can be used to fit the number of people or to set a certain mood for the lecture.
6. **PowerPoint Slides:** This option defines the number of slides to be used in the application. All available slides are stored in a predefined folder and have to have a consecutive numeration. However, with this option it is possible to use only a certain number of slides in the current test.
7. **Time offset for request:** This defines the number of seconds after which a request to speak louder will be heard from the audience (see Figure 2). The values reach from zero to 1800, where zero means no request at all.
8. **Time offset for laughter:** This defines the number of seconds after which a loud laughter from the audience will be heard. The values reach again from zero to 1800, where zero means no laughter at all.
9. **Add sprites:** If the maximum of seventy avatars is not enough for a test, and an even bigger audience should be simulated, then this option provides the possibility to fill the back of the main seating area and the tribune with 2 dimensional sprites.

**Fig. 2.** A person asking the participant to speak louder. Some listeners are sleeping.

### 3.2 Technical Implementation

The application was developed by a group of students during a practical course at the University of Vienna, using Visual Studio C++ Express and the Ogre3d graphics engine in combination with QuickGUI. All the 3 dimensional models were created in Blender3D and the textures were processed using Gimp.

For the creation of the models, especially the human faces, a simple technique was helpful by which a photograph of the front and the side of the object are loaded into Blender3D. Using these images as a guide the object can then be modelled to fit the pictures. The only thing to keep in mind is, since the modelling happens in a 3D environment, that each vertex of the model has to fit both of the pictures. Additionally this technique helps greatly in the texturing process. Blender3D allows to project a picture upon a model and then bake this projection into the uv-map. Also a combination of projections is possible. Unfortunately the border at which the two images are merged together is clearly visible on the final uv-map, and has to be processed in a image processing software as a final step. All the smaller objects, like bags or magazines, were modelled using only a single picture as a reference and as texture input. A single rig was created for all the human models, and the animations were created in a way that they are all based on a base pose. This base pose is important for the switching between poses, since it is the only one that has a seamless transition into the different poses. So to change from pose A to pose B, the avatar hast to change from pose A to the base pose, and from there then into pose B. The facial animations were created using shape keys, which allow to alter all the vertices of a model and save these deformations in relation to a base position. In case of the faces the base position is the neutral facial expression with open eyes, and in relation to this the different expressions, hostile, happy and blinking were created. These shape keys can then be exported as Ogre3d pose animations.

Ogre3d, which was used as a graphics engine, uses a node tree to visualize the scene. Each created element is therefore part of the RootNode, and can itself have children on its own. The different parts of the room, walls, doors etc. were therefore modeled in Blender3d and then put together in the source code. For the positioning in Ogre3d it is important to know where the center of each model is, because it is used as the base point for position, rotation and scale. Since there are lots of repetitions in the room design, like the chairs in the main seating area, most work could be handled by simple loops. The animations of the audience avatars, as well as the facial animations, textures and additional items, like backpacks etc. were implemented in a random fashion, allowing the scenario to be slightly different each time the application starts. QuickGUI is a simple independent GUI system which works well together with Ogre3d, and it was used to implement the user interface. It provides all the necessary methods and images needed to create simple menu items. All the additional images were created with Gimp. All the PowerPoint slides that are to be used in the simulation have to be put as consecutive numbered .jpg files into the /slide folder in the main directory. Joypad support was added via SDL. A simple wrapper for it was used to get the necessary inputs from the device. Since Ogre3d does not support sound on its own, OpenAL was used for the playback of the sound files, which are provided in .wav format.

## 4 Psychological Experiments

Two psychological studies were conducted on public speaking anxiety using the above described virtual lecture hall. The objective of the first study was the comparison of two groups holding a presentation either in front of a virtual audience (experimental group) or an imagined audience (control group). The groups were evaluated with regards to their social insecurity as a speaker, reported anxiety and physiological arousal as well as the perceived reality experience of the virtual and the imagined environment. The second study investigated predictors of the perceived usefulness of the virtual public speaking scenario in a larger sample. Both of the studies were conducted at the Department of Psychology at the University of Vienna in accordance with the current version of the Declaration of Helsinki. Prior to participation all participants signed an informed consent form indicating the experiments procedure and the possibility to terminate participation at any time. All statistical analyses were conducted using SPSS Version 15 (SPSS, Inc. Chicago, USA) considering an alpha error of 5%.

### 4.1 Study 1

**Participants.** The overall sample ($N = 50$) consisted of students who were recruited from several courses at the University of Vienna and received a course credit for their participation. The mean age of the virtual group ($N = 25$) was 23.44 years ($SD = 3.355$) ranging from 20 to 35 years. Eight percent were male ($N = 2$). The mean age of the control sample was 24.84 years ($SD = 3.023$). In this group the percentage of males was a little higher with an overall of N=8 males (32.0%).

**Procedure.** Upon arrival to the lab, participants were randomly assigned to either the control group or the experimental group and instructed to hold a 5 minute presentation after a 10 minute preparation period. All participants were given a printed version of the 20 slide presentation to get acquainted with it. In order to ensure the novelty of the subject across participants, a fairly unfamiliar theme was chosen: the description of the kingdom of Bhutan. After preparation, the experimental group was presented with the virtual lecture hall using a head mounted display (eMagin Z800 3D, Bellevue, Washington). A standardized protocol was used for the lecture hall resulting in an overall audience of 20 viewers (both male and female) among which 2 characters were bored and seemed to be asleep on the desks and 2 were laughing out loud once during the presentation. Furthermore, half of the remaining audience was showing neutral emotions. The slides were presented in the virtual environment and controlled by the presenting participant, who - like the participant's virtual self - was standing up during the presentation period. In contrast to the experimental group presenting in the virtual environment the controls were asked to merely imagine an audience. The participants were instructed to stand up in front of a small computer screen containing the presentation slides and speak out loud while imagining a lecture hall around them. To facilitate the imagination of the audience, a short imagination exercise was conducted prior to the start of the procedure.

**Measures.** Table 1 provides an overview over all psychological questionnaires used in study 1 and 2. The two-factor solution of the questionnaire Personal Report of Confidence as a Speaker (PRCS) [10], was used to assess the participants social insecurity (6 items) and anxiety (12 items) during the public speaking task on a 4 point Likert scale. The participant was asked to rate statements on a 4 point Likert scale (*does apply* - *does not apply*). Trait social anxiety was measured by the 20-item version of the Social Interaction Anxiety Scale (SIAS) [13] on a 5 point Likert scale (*not at all* - *extremly*). Additionally, a single 4-point-Likert-scaled item (*strongly agree – strongly disagree*), from the iGroup Presence Questionnaire, IPQ [17], was used to measure the perceived reality of the virtual and the imagined environment. To measure stress related sympathetic activity the participants heart rate during the speech was recorded using M-EXG (Schuhfried BFB 2000 x-pert, Moedling, Austria). EKG was assessed using three one-way electrodes (3M Medica RedDot electrodes, Perchtoldsdorf, Austria). Heart rate was monitored at 5s intervals throughout the speech; 60s intervals were computed using the Schuhfried BFB 2000 x-pert software for analysis.

**Table 1.** Psychological assessments

| | Factor | Description | Example for item wording |
|---|---|---|---|
| *Personality facets* | Neuroticism | anxiety, depression, self-consciousness and vulnerability to stress | I am easily concerned. |
| | Extraversion | assertiveness, activity and excitement seeking | I am a very active person. |
| | Openness for experience | fantasy and ideas | I often try new and foreign dishes. |
| | Conscientiousness | competence, order and self-discipline | I work hard to reach my goals. |
| | Agreeableness | altruism, compliance and modesty | I always try to act considerate and sensible. |
| *Technology facets* | Curiosity | inquisitive thinking about technology and the desire to explore new technological tools and devices | I was curious to use computer based applications like the VR. |
| | Usability | comfort and effortlessness of the technology usage | It was easy to transfer what I intended to do into the VR. |
| | Perceived Usefulness | enhancement of performance or well-being caused by the usage of the technology | Computer based applications like the VR constitute a good preparation for a speech. |
| *State facets* | Social Insecurity | competence in social situations (inverse items) | I look forward to an apportunity to speak in public. |
| | Anxiety | apprehension when the subject is faced with the audience | My hands tremble when I try to handle objects on the platform. |
| | Realness | experience of realism in the virtual world | Do you experience the audience as real? |
| *Trait facets* | Social Anxiety | insecurity and anxiety in social situations | I am nervous mixing with people I don't know well. |

**Results.** Neither heart rate, measured in a 60s interval previous to the task, ($t(48) = 1.589, p = 0.119$) nor trait social anxiety measured by SIAS ($t(48) = 1.442, p = 0.156$) did differ at baseline level.

*Psychological questionnaires:* In order to estimate whether the two groups showed any differences on the measures of social insecurity and anxiety during the public speaking task and perceived reality group comparisons using t-tests were conducted. Figure 3 shows the different distributions between groups on the PRCS scales and the perceived reality (means±SEM). The group presenting in front of the virtual audience differed significantly ($t(48) = 2.759, p = .008$) from the group imagining the scenario, in sum reporting a higher perceived realness of the situation (experimental: $M = 4.64$, $SD = 1.380$; control: $M = 3.56$, $SD = 1.386$). Additionally, the virtual group ($M = 27.56$, $SD = 6.980$) showed higher levels of reported anxiety than the control group ($M = 21.72, SD = 6.509$) ($t(48) = 3.590, p = 0.004$) and at the same time, the experimental group ($M = 18.76, SD = 4.064$) reported significantly higher levels of social insecurity than the control group ($M = 15.32, SD = 4.028$) ($t(48) = 3.006, p = 0.004$).

*Physiological Measures:* A repeated measures ANOVA comparing the two groups was employed. Additionally, a Greenhouse-Geisser adjustment was used to correct the violation of the sphericity assumption ($\epsilon = 0.48$). Heart rate

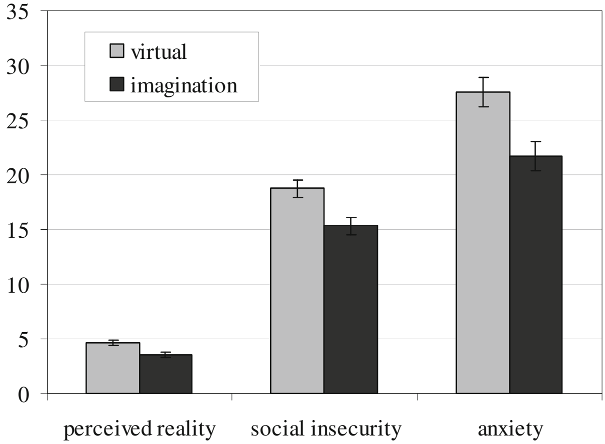


**Fig. 3.** Differences between the virtual and the control group in perceived reality, social insecurity and anxiety (means± SEM)

interval analysis indicates a significant main effect of time ($F(2.392, 114.819) = 77.007$, $p < 0.001$), a significant difference between the groups ($F(1, 48) = 7.110$, $p < 0.010$) and an interaction effect time x group ($F(1.617, 114.819) = 6.547$, $p < 0.001$). While both groups showed a higher heart rate (more physiological arousal) at the beginning of the speech it symmetrically declined for both groups during the speech. Yet, the virtual group showed an a priori higher heart rate than the control group, in sum indicating higher physiological stress and anxiety during the virtual exposition ($p < 0.001$). Figure 4 depicts the heart rate means (±SEM) according to the 60s intervals over the 5 minute speaking period.

## 4.2 Study 2

**Participants.** The sample consisted of $N = 137$ Psychology students recruited from several courses at the University of Vienna. The mean age was 24.18 years (SD= 3.565) ranging from 20 to 40 years. Approximately fifteen percent of the sample were males ($N = 20$) whereas the majority consisted of female students ($N = 117$, 85.4%). Most of the participants ($N = 109$) stated to have a lot of experience with public speaking (>5 presentations). Nineteen participants reported fair experience (4-5 presentations) and only nine persons had little experience (1-3 presentations). The majority ($N = 123$) of the sample was right handed (only $N = 14$ were left-handed). 133 participants were analyzed, 4 datasets were excluded because of missing values.

**Procedure.** The procedure was the same as for the experimental group in study 1 including the same instructions, the same subject and length of presentation and the same settings of the virtual lecture hall. Again, the virtual environment was presented using a head mounted display (eMagin Z800 3D, Bellevue, Washington) and the participant was standing up while presenting.

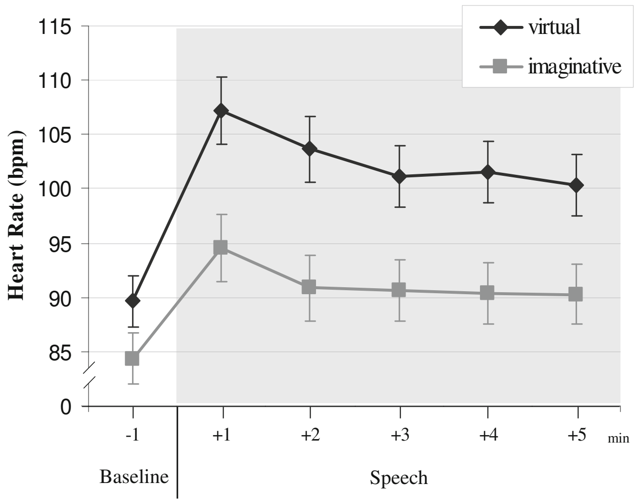


**Fig. 4.** Group differences between heart rates during a 5 minute speaking period (means±SEM)

**Measures.** In addition to the PRCS (described in study 1 above) a German version of the NEO-Five-Factor-Inventory (NEO-FFI) [6], was used in the second study (see table 1 for item wording). The 60-item NEO-FFI assesses 5 personality factors known as the Big Five on a 5 point Likert scale (*strongly agree* – *strongly disagree*). Furthermore, a self-constructed 12-item scale regarding the attitude towards technology (see Technology Acceptance Model, TAM) [8] was applied. It consists of 3 scales assessing curiosity towards technology use, usability of the technology and perceived usefulness of the technology on a 7 point Likert scale (*essential* – *unessential*).

**Results.** The perceived usefulness of the virtual lecture hall was rated by the participants after the exposition with the protocol. According to the average ratings over the 4 items 56% of the participants rated the system as *useful* or higher (28% rated the system as *very useful* or *essential*. In contrast, 21% rated the system as *unessential*, *very useless*, or *useless*, while 23% rated the system as *neither useful nor useless*. A multiple linear regression analysis was conducted to identify the best predictors of the technology's perceived usefulness. Both, the five personality factors (personality facets) and the two subscales of the technology facets curiosity and usability were entered as predictors in the regression model, additionally the variable social insecurity as speaker was included into the analysis.

The current results indicate that the participants' social insecurity as speaker during the speech and both technology facets (usability and curiosity) were encouraging predictors of the dependent variable. Assuming a higher alpha level at 0.10, two personality facets (extraversion and conscientiousness) would have shown a predictive value as well. Table 2 reports the standardized coefficient,

**Table 2.** Linear Regression analysis to predict perceived usefulness

| | | *Beta* | *t* | *p* |
|---|---|---|---|---|
| *Personality facets* | Neuroticism | 0.032 | 0.367 | 0.715 |
| | Extraversion | 0.144 | 1.805 | 0.073* |
| | Openness for experience | -0.041 | -0.517 | 0.606 |
| | Agreeableness | 0.106 | 1.366 | 0.175 |
| | Conscientiousness | -0.145 | -1.860 | 0.065* |
| *Technology facets* | Curiosity | 0.297 | 3.872 | 0.000** |
| | Usability | 0.408 | 5.095 | 0.000** |
| *State facets* | Social insecurity | 0.245 | 2.817 | 0.006** |

*Notes:* Dependent variable: Perceived Usefulness; * p< 0.10, **p<0.05

t-coefficient and significance level for each independent variable. Nevertheless, the usability of the system seems to predict the usefulness of the virtual lecture hall best, followed by the person curiosity towards technology use and high values of social insecurity. In sum, predictor variables included in the final regression model accounted for almost 31% of the variance ($R^2 = 0.35$; adj. $R^2 = 0.31$; $F(9, 124) = 8.460$, $p < 0.000$; Durbin-Watson= 1.756).

## 5 Conclusions

Results from Study 1 offer encouraging evidence that in comparison with the control group, which was asked to imagine the audience, the virtual lecturing scenario tends to decrease the participants' self-confidence as speaker and evoke insecurity as well as self-reported anxiety during the speech task. Also, the virtual group showed a significantly higher increase in heart rate (a psychophysiological indicator of stress and arousal) than the control group. These observations indicate the efficacy of the virtual lecture hall as a means for virtual exposition therapy. Additionally, participants of the virtual group had higher ratings than their controls when asked about the perceived level of realness of the lecture hall. In accordance to our findings, previous studies indicate that stronger feelings of actually being present in the virtual environment both positively alter the perception of its realness and vividness and evoke behavioral and psychophysiological reactions that are similar to those in a comparable real life situation. Thus, the more a person who is immersed in a virtual environment behaves like in a comparable real environment, the better the transfer of knowledge and learned skills will be. It therefore seems crucial to develop virtual scenarios with the best possible stimulating and rich content in order to enhance presence and therein increase the efficacy of the training tool. As demonstrated in the current study, a virtual lecturing scenario may indeed evoke satisfying emotional and psychophysiological reactions in order to be effectively used to train public speaking competencies.

In Study 2 curious and socially insecure persons were identified to rate the virtual lecture hall as more useful. We assume that these findings are a result of the participants' individually different motivations to use the technology. Thus, future research should take individual differences in terms of motive and motivation into account. Moreover, participants perceiving the system as usable and easy to use reported higher perceived usefulness of the virtual lecture hall; this result is consistent with Davis' technology acceptance model (1989), which indicates a strong causal relationship between the usability and the perceived usefulness of a technology or a technological system. Thus, if such virtual reality tools shall be designed for use in therapy and treatment a great focus should be put on their ease of use, including both, the programming of the virtual simulation and the application of immersive technologies such as head mounted displays. The user's satisfaction with an easy to use navigation through the virtual environment and a highly effective head tracking system may lead to a higher acceptance of the system and thus, enhance motivation to use it again. Also, if the user identifies a system as useful, he may be more prone to engage in it and develop a sufficient level of presence for the VR to be effective (see above).

Regarding personality facets, extraverted persons seem to rate the virtual technology as more useful than introverted persons, possibly reflecting the generally more positive attitude of extraverted persons towards new (social) experiences such as the experimental situation in general. In contrast, conscientious persons showed a negative trend in rating the technology as useful. The high achievement standards of the highly conscientious participants might have been counteracting with the satisfaction of their virtual presentation and hence, with the positive ratings of the technology altogether. These results are highly valuable, since they indicate that not all users may equally engage in and thus, benefit from these virtual scenarios. Yet, more research is needed if these findings shall effectively be used to identify a person to be unsuitable for a VR treatment or let alone to establish ideal user types for VR scenarios. In future, interdisciplinary approaches covering both, the development of the technologies and the area of their application are called upon extending their collaborations in order to study such phenomena more broadly.

**Acknowledgments.** We would like to thank Jasmine Gomm, Nathalie Hauk, Anna Hoffmann, Elisabeth Kastenhofer, MSc., Nora Poesl and Janka Scharfenberger for helping us with the acquisition of the data.

## References

1. Anderson, E.R., Hope, D.A.: The relationship among social phobia, objective and perceived physiological reactivity, and anxiety sensitivity in an adolescent population. Journal of Anxiety Disorders 23, 18–26 (2009)
2. Botella, C., Hofmann, S.G., Moscovitz, D.A.: A self-applied Internet-based intervention for fear of public speaking. Journal of Clinical Psychology 60, 1–10 (2004)
3. Botella, C., Gallego, M.J., Garcia-Palacios, A., Guillen, V., Banos, R.M., Quero, S., Alcaniz, M.: An Internet-Based Self-Help Treatment for Fear of Public Speaking: A Controlled Trial. Cyberpsychology, Behavior and Social Networking 13(4), 407–421 (2010)

4. Caplan, S., Williams, D., Yee, N.: Problematic Internet use and psychosocial well-being among MMO players. Computers in Human Behavior 25, 1312–1319 (2009)
5. Clark, D.M., Wells, A.: A cognitive model of social phobia. In: Heimberg, R.G., Liebowitz, M.R., Hope, D.A., Schneier, F.R. (eds.) Social Phobia: Diagnosis, Assessment and Treatment, pp. 69–93. Guilford Press, New York (1995)
6. Costa, P.T., McCrae, R.R.: Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEOFFI) professional manual. Odessa: Psychological Assessment Resources (1992)
7. Cote, S., Bouchard, S.: Virtual reality exposure for phobias: A critical review. Journal of CyberTherapy & Rehabilitation 1(1), 75–91 (2008)
8. Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13, 319–340 (1989)
9. Gerlach, A.L., Mourlane, D., Rist, F.: Public and private heart rate feedback in social phobia: a manipulation of anxiety visibility. Cognitive Behaviour Therapy 33, 36–45 (2004)
10. Hook, J.N., Smith, C.A., Valentiner, D.P.: A short-form of the Personal Report of Confidence as a Speaker. Personality and Individual Differences 44, 1306–1313 (2008)
11. Kothgassner, O.D., Stetina, B.U., Lehenbauer, M., Seif, M., Kryspin-Exner, I.: Behavior beyond the world of online gaming. In: Welker, M., Geiler, H., Kaczmirek, L., Wenzel, O. (eds.) General Online Research, pp. S53–S54. DGOF, Pforzheim (2010)
12. Laposa, J.M., Cassin, S.E., Rector, N.A.: Interpretation of positive social events in social phobia: an examination of cognitive correlates and diagnostic distinction. Journal of Anxiety Disorders 24, 203–210 (2010)
13. Mattick, R.P., Clarke, J.C.: Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. Behaviour Research and Therapy 36, 455–470 (1998)
14. Mauss, I.B., Wilhelm, F.H., Gross, J.J.: Autonomic recovery and habituation in social anxiety. Psychophysiology 40, 648–653 (2003)
15. Newman, M.G., Szkodny, L.E., Llera, S.J., Przeworski, A.: A review of technology-assisted self-help and minimal contact therapies for anxiety and depression: Is human contact necessary for therapeutic efficacy? Clinical Psychology Review 31(1), 89–103 (2011)
16. Parsons, T.D., Rizzo, A.A.: Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis. Journal of Behavior Therapy and Experimental Psychiatry 39, 250–261 (2008)
17. Schubert, T., Friedmann, F., Regenbrecht, H.: The experience of presence: Factor analytic insights. Presence: Teleoperators and Virtual Environments 10(3), 266–281 (2001)
18. Wiederhold, B.K., Wiederhold, M.D.: Virtual Reality Therapy for Anxiety Disorders. American Psychological Association, Washington (2005)