Abstract: In this paper, we try to present the problems of the modern approach to treating various phobias. Virtual environments created by virtual reality (VR) tools can help to make the treatment of certain types of phobias more efficient. Attention to this form of phobia treatment with the help of VR is on the rise in the world, so we are also monitoring its development, as well. Our paper introduces the necessary hardware and software that has been piloted in our department, but also methods of creating virtual environments, models and application designed for medical therapies of patients. In our work we have searched for and tested the following methods for creating virtual environments: A) modelling using computer graphics, B) modelling animation using animation programs, C) taking pictures of static objects and scenes, D) filming moving objects and scenes using classic video or special scanning techniques to create 360° panoramas or E) any combination of these methods.

Keywords: Virtual reality; virtual environments; treatment of phobias

1 Introduction

Technical inventions are nowadays quickly penetrating into all aspects of our lives. No wonder they are affecting also the area of medicine and psychotherapy. Thanks to virtual therapy, various types of phobias can be treated. This is the true progress for patients suffering from phobias.

Many studies describe their experience with using VR in psychotherapy. Our research was based on analysis of following resources as considerable success has been achieved by using VR for distraction from pain or for panic disorder and agoraphobia [1]. In recent years, Virtual Reality Exposure Therapy (VRET) has become an interesting alternative for the treatment of anxiety disorders and several phobias [2–5]. Also Virtual Reality Cognitive Behavior Therapy (VRCBT) is an effective technology with promising results [6, 7]. Treating simple phobias with VR techniques, clinical outcomes, cost effectiveness and possible side effects of this treatment are described in [8]. VR therapy enables the patient to experience a realistic yet carefully controlled exposure to an anxiety-provoking scenario in the therapist’s own office. While VR environments were initially quite costly and demanded powerful computers, lately their price has decreased, making this form of treatment an intriguing option for therapists [9]. There is also direct comparison of In-Vivo Exposure Therapy (IVET) and VRET using the same subjects and procedures in studies differing in experimental settings, data reduction procedures, and study populations [10]. Some researches focus on various social phobias. In [11–13] the fear of public-speaking that utilizes VR as a tool for exposure therapy is described. Re-exposure to memories of traumatic events via imaginably exposure therapy, which can lead to a reduction of Post-traumatic Stress Disorder (PTSD) symptoms is analysed in [14]. Articles [15–18] are dealing with specific phobias such as arachnophobia [19, 20], talk about Aviaphobia, numerous spatial phobias are discussed in [21, 22] and lastly [23] is based on treatment of phobias by computer games. The research results from these mentioned references gave us reasonable outputs and good examples on how to use VR to treat phobias.

Although our task at this moment is not to treat phobias, the fact that hundreds of patients leave the clinics around the world treated, gives us hope for the future.

At the Department of Informatics, Faculty of Natural Sciences, Matej Bel University in Banská Bystrica we have devoted our third year to issues of phobia treatment via VR. The definition of the problem that we have decided to deal with was to find the most efficient method of creation of environments, situations and objects for a certain kind of phobia. Our main goal was to prepare materials used...
by psychotherapists to help treat various kinds of phobias, such as for example fear of spiders (Arachnophobia), fear of reptiles (Herpetophobia), fear of heights, depth (Hypophobia, Akrophobia) or open spaces (Agoraphobia) and so on. For the use of phobia treatment, we are creating pictures, objects, 3D models, videos, 360° panoramas and sounds, to create realistic environments and situations easing the treatment process for psychotherapist and speeding up the inducement of the desired state for the patient.

2 Phobias and their treatment

Clinical psychology describes phobias as anxiety disorder, characterized by intense irrational fear of specific objects or situations. This excessive amount of fear does not correspond to the potential amount of danger of stimulus. Despite the fact, people suffering from phobias experience intensive psychic symptoms (anxiety, loss of control, fear) and vegetative symptoms (increased heartbeat, fainting, sweating, problems with breathing). The content of phobia has a compulsive characteristic – concern that the feared object could also occur outside the real time and place which might lead to anticipated fear and evasive behaviour [24, 25].

Generally, phobias could be divided into three main categories: agoraphobias, social phobias, and specific phobias [26].

Agoraphobias are characterized by fear of places or situations, i.e. large overcrowded spaces, or on the contrary, fear of closed and confined places. In the case of these types of phobia, patients are often concerned that by necessity, there will not be immediate help available. More serious cases of this disorder lead to complete isolation from the outside world, where patients do not leave their homes [27].

Another group is described as social phobias, which are usually connected with low self-confidence, fear of critique, fear of people, overcrowded places or fear of travelling in various kinds of transport. Social phobias might also be induced by performing publicly or sometimes just by general communication with an individual. All these situations lead to avoiding social contact. Sometimes the social phobia does not necessarily have to be caused by fear from other people, but rather from the patient themselves. This can stem from one’s failure or from what others might think of oneself. Even a performance for a small group of people might mean unbearable anxiousness, a panic fit or the inability to handle a situation.

A third group of phobias are so called specific phobias, also known as isolated phobias. Fear of certain objects and situations fall into this category. A good example is fear of spiders, bacteria, snakes, blood, lightning, dark etc. [27].

Categorization of some types of phobia could differ considering the above-mentioned source [26], as well as subject of the phobia could fall into several groups. For example, someone feels serious anxiousness when crossing through the town square. With one’s feet trembling, one can have difficulties with breathing and is unable to think rationally, escaping the place in panic. The described situation can be typical for agoraphobia, if caused by fear of large and open spaces while moving away from safety of one’s home. At the same time, the situation could be a type of social phobia, if being the centre of attention and in the presence of too many people caused the panic.

Nowadays there are several ways of treating phobia, some of them used in combination with others. The most commonly used treatment method is pharmacotherapy together with psychotherapy, where dominating approaches are cognitive-behavioural, psychosocial methods and relaxation procedures [27].

Many practical techniques were developed to overcome pathological fear. The core of these techniques is to provide patient with correction experience, which includes confrontation with the item or situation of fear in safe environment. Here, the psychotherapist creates specific conditions, which helps to overcome the fear of being exposed to concerned item or that makes the situation easier. Exemplary technique is systematic desensibilisation composed of three parts: 1. Evoking a suitable and comfortable state; 2. Creating of a set of situations, gradually evolving in strength and content (from completely harmless up to a stimulation creating maximal phobic response); 3. Getting gradually more accustomed to these situations and enduring them in the pleasant state. Joining the dreaded situation with emotional state, which excludes fear, takes place in real situations - “in vivo” or situations most vividly imagined by patients - “in vitro” in laboratory. Excessive fear is thus being suppressed by deliberate and repeated imagination of ideas. Situations that produce fear, combined with muscle and mental relaxation, to the contrary of fear in mental, are motoric and autonomic [28, 29].

In psychotherapy there are many other methods; implementation of which can be interconnected with newer types of treatment - therapy through VR [30–33]. Due to the fact that some human senses, such as sight and hearing, can be easily deceived, it is easy to simulate patient objects, situations and environments that would cause phobia with the tools of VR. This method of therapy includes
a number of features: computer graphics in real time, position control devices, sensor inputs, etc., that allow the patient to "dive" into the environment modified by computers. VR offers several advantages over the real exposure to stimulus. The treatment can be carried out in the office of the therapist, which is less costly for the patient and less restrictive for the therapist, who does not have to accompany the patient to be exposed to the real stimulus. Moreover, this type of therapy may also be used for patients who really have a great fear of the actual stimuli.

3 Methods of Creating virtual environments

In the first phase of our work we have searched and tested several methods for creating the virtual environment:

- Modelling using computer graphics,
- Modelling animation using an animation program,
- Taking pictures of static objects and scenes using special scanning techniques to create 360° panoramas,
- Filming moving objects and scenes using special scanning techniques to create 360° panoramas,
- Combining any of these above mentioned methods.

All mentioned methods we have used in the creation of objects, environments and situations that are built into the application for the treatment of phobias.

None of the above mentioned methods seems to be suitable when treating social phobias or when solving the problem of communication between people and communication with patient's inner voice. Suitable method is to capture scenes and situations by classic camera, or smartphone.

3.1 Modelling

3D graphics is currently experiencing a real breakthrough. The rendering of virtual worlds is becoming more and more realistic, boundaries between virtuality and reality are being erased and creation of 3D worlds is faster and better.

Modelling has an irreplaceable position in VR. Every year, the possibilities to improve and enhance realistic impressions are becoming better thanks to more powerful hardware and software. With the increasing power of computers there are more possibilities of larger image resolution, dimensionally improved objects, realistic textures, and, last but not least, realistic scene illumination (shadows, reflections, refraction, etc.)

Creating modelled environment for the purpose of phobia treatment has a particularly high demand on the compatibility and smooth implementation on a variety of computers, as well as on the quality of the picture. Output software should therefore be able to run on a regular desktop computer or a laptop (at the patient’s home or at the psychotherapist’s office), but also on special equipment designed for the needs of VR (stereoscopic glasses, head tracker, virtual glove, etc.).

Before the creation of the model itself, it was necessary to think about few things to achieve the best possible result:

- Planning, scheduling time.
- Design 3D models (preparing sketches).
- The proportions and dimensions.
- The environment in which the model will be used.
- The modelling method that should be used on which part of the object.
- Design model (texturing)
- Purpose of the model.
- Creation or selection of an interactive program to display the VR.

One of the three following modelling methods can be chosen, when creating a 3D model in a modelling program:

- Using curves: The surface model is created using multiple connected curves. This method has not been used recently, as there are simpler modelling techniques.
- Using polygons, respectively, polygonal modelling: The most used method for creating 3D model by plane (used when modelling a human head) or curves (individual curves are being cloned and thereby creating surface model).
- Using basic geometric shapes: by adjusting basic shapes, complex structures can be created (Box modelling).
- Using 3D scanners to create a model of an inanimate object without modeling. It should simply read the object from different angles and then transfer it to virtual form.

Through the combination of these methods, several viable models were created in our research lab.
3.2 Animation

All real-world objects are in motion. Some movements are unnoticeable, others one perceives more intensively. The human brain is able to process large amounts of information about environmental changes, even in the subconsciousness. It could be the movement of any object or, for example, the change of colour, shape, or size. People are accustomed to constant movement and if everything suddenly stopped, it would certainly not be treated naturally. Therefore, simulation of the real-world movement is a key to success in a virtual reality. The more realistic VR can show its environment, the greater the chance to fool the senses and evoke such feeling that one is really in the environment.

Animation of complicated models can run as follows:

- Creation of a model skeleton using the tool Bones,
- Creation of a network 3D model of an object.
- Connection between skeleton and the network 3D model.

To set up, define and establish the relative movement of bones, we need to know direct and inverse kinematics, which is supported by tools in most animation software.

While displaying with the help of VR, the feared situation or environment is strongly individual if it arouses some concern in the patient suffering from phobias. Someone might be frightened by only a vague thought or memory of the stimuli; others will not be convinced even by the most modern 3D graphics with special peripherals. To maximize chances of success, a timeline to the modelled scene will be created consisting of information about the change of position, shape, size, and other parameters of individual objects. Each object in the scene may have its own particularly defined changes and, thus, be part of the whole animated scenes.

The system is based on inserting key-frames into the timeline, and defining which parameter is to be remembered for that frame as a key. This may include an object position, rotation, size, or in the case of more complex objects with arms, also their current shape. At first, the system saves key-frames for the current position of the object. Then the object moves on the timeline, for example, by about 10 frames forward and saves the new position. Then each frame between these two predefined positions is automatically calculated and represents a partial change of the position, while two key frames are defined by their extreme points (values).

In the case of modelling the exterior environment, simple animations can be used, for example, to simulate the movement of the sun. It is a slow movement, but it continuously changes the angle of the object’s shadows and adds a sense of realism during longer follow-scenes.

3.3 Taking pictures

The third method, we have used, is a summary of the steps like: photographing 360° panoramas, processing them into interactive applications for different devices and final insertion into the application environment. Photography captures a nearly exact picture of the scene and is less difficult to create, than modelling, while looking realistic. But this is only when the scene is easily accessible for taking pictures. Therefore, it is appropriate when creating environments for the phobias treatment, to use the better technologies, for each environment. There are several forms of shooting and making exterior virtual environments using digital photographs:

- Capture technology for single row panoramas (e.g. taking pictures by smartphone, which has directly a function for creating panoramas) or installing special application. In that case, when taking pictures suitably rotate the phone and the software will automatically take care of everything, (steering angle sensing, finding and connecting points of reference to the rendering of the final image, etc.).
- Capture Technology of multi-line panoramas with full 360° horizontal and vertical coverage are called also FFOV (Full Field of View) panoramas. It is very easy and fast to record environment causing the phobia. This can be done, for example, by the patient or by someone family member, who can capture problematic object or environment.
- The shooting digital SLR camera belongs to solutions that provide more options and the best possible quality. Thanks to the panoramic head and photofinishing in specialized programs on a computer, one can better manage difficult scenes, achieve full control of exposure and produce a better overall quality and resolution in the final panorama. The disadvantages include the higher price of necessary equipment and time needed for processing. The problem of this technology for some scenes may be a time difference, which is generated by one camera when photographing the multiple images. The longer focal length of lens used, the smaller is the angle of the image on one picture. Then capturing of full 360° panoramas require more shots and the time difference between the first and the last slide start to be longer; the total length of time is cap-
tured on the panorama, as well. There are converters that can be used in combination with a conventional lens that display the whole region on one image. A time shifting problem does not arise, in this case. Use of a pano head will minimize complexity and reduce the necessary steps for processing; however, quality is their weakness. Resolution of the resulting panorama is directly limited by resolution of the camera sensor and optical defects occur when a vertical angle of view is very limited. When shooting outdoors, and the image hardly gets sky (zenith), the empty space remains down in a circle around one meter around the axis tripod (nadir).

### 3.4 Filming (Videocapture)

Another method is the capturing and processing of 360° panoramic images, which must be adapted to be played on different devices, and VR peripherals. For dynamic scenes, where there are impossible to capture fast moving objects (and it is impossible to capture them by one camera in the same place at the same time in FFOV) the most expensive option is offered by multiple capturing by more cameras at the same time. Such filming is technically the most complex method, because the environment is necessary to shoot at 360°. This requires at least three cameras with wide-angle lens, or 6 GoPro cameras placed in a special holder that firmly holds the direction of rotation and the proximity of the cameras. When shooting with one lens, the panoramic head gives an exact rotation in the axis of the nodal point, so there is no parallax and no change point of view. Using multiple scanners is not technically possible, because each used lens has its own nodal point and they cannot be together in the same place. Sensing object must keep enough distance; otherwise unrecoverable errors occur at joints of panorama images. Another technical precondition for flawless engagement is synchronization of all cameras. Claims for accuracy make the type and speed of the scene. The proven technical solution is a wireless 2.4 GHz band, either proprietary technology or using standard WiFi. Synchronization deviation varies widely between a few milliseconds, which are sufficient accuracy for most scenes. Functionality is normal even at a distance of tens of meters from the transmitter, but is reckoned with interference caused by other devices operating on the same frequency (Bluetooth, microwave oven, other WiFi devices, remote controls RC models, etc.). Most problems with synchronization and parallax provide the use of a special Bublcam camera with 4 built-in cameras, which are destined to capture 360° video.

Particularly when treating social phobias, we are not solving the problem of the environment, but especially the situation of verbal and nonverbal communication between people. Then it is necessary to aim for patient’s attention to a specific situation or object. None of the above mentioned methods is suitable, as in a virtual environment, we could not guarantee that the patient is focusing where we want. If we want to solve any communication, even a nonverbal, the panoramic video is not appropriate. To capture these scenes and situations we have to choose a classic view through one camera. In such situations it is necessary to prepare detailed scenario in which all of the following conditions are captured: camera view, angle of view, dialogues, the reactions of actors, where the variety of video effects (blur, haze, etc.) to be used and what sounds should be added to the video and so on.

When shooting environment for treating phobias, in comparison to earlier technologies, the video faithfully captures and recall this real environment.

### 3.5 Combination

The last option is about all four methods, their comparison, the assessment of advantages and disadvantages, and their suitability for different types of environments (especially about the possibilities of combinations). Each technology is different, yet can generate very similar results, which provides opportunities to their combination. Reasons for combining may be several. The first reason is to reduce the data volume of a 360° video, by replacing a certain part of a scene by still images. This will significantly reduce the hardware requirements for playback. The second reason may be enriched the filmed scene by object, which is actually not located there. This makes it possible to create environments or situations that would be difficult to film. The aim of this combination is not to reduce hardware, time, or processing of claims, but to create a virtual environment exactly according the patients phobias treatment needs.

### 3.6 Sound

Sound is a part of VR, which completes the environment and evokes the atmosphere. For some phobias, sound may be less relevant and for others it is essential. There are phobias, where the sound is the main stimulus for induction of anxiety and fear. There may be the phobias from different animals, musical instruments, wind or drafts, from fear of speech etc. An often-occurring phobia is a fear of
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large crowds and the reproduction of voices and the sound of rush can be crucial for the patient. Due to the great variety of sounds, there was a need to create a database of sounds for faster access and retrieval.

4 Methodology of creation in software

Modelling and animation of VR objects can be done in various types of software (Blender 3D, 3D Studio Max, Cinema 4D, Maya 3D, etc.) Blender 3D is best suited to our needs as it is multiplatform open source software with small capacity. It focuses not only on creating 3D models, animations and rendering (performed in the high performance computing centre), but also on post-production activities, creation of interactive applications and creation of 3D virtual environments. These include interactive elements like Blender Game Engine (BGE), which provides a wide range of interaction with the created environment and is an appropriate instrument for creating applications in the treatment of phobias.

Another group includes a number of high-quality software solutions for creating FFOV panoramas. For example, Autopano Giga software from Kolor can easily process environments at a resolution of tens gigapixels. After a successful process of connecting and setting cubic panorama, exportation of a near final version is created into one of the known graphic formats (jpeg, png, psd, tiff, etc.). In order to comfortably retouch the tripod from nadir in high quality, lower surface of the panorama needs to be converted into cubic faces, i.e. walls of the cube. This gives us six images, one of which is precisely the bottom view with tripod in the shot. After the necessary adjustments using a Photo editor “walls of the cube” are converted again into one cubic panorama projection.

For creating 3D virtual environments and interactive elements, we use the above-mentioned software Blender3D. A camera is placed in the centre of the object type UV Sphere. Important is that the scale of projection looks realistic compared to the dimensions of the real scene. We have to spread its surface so that our panorama can be applied as texture. In edit mode, we perform “UV extract”; then we change the direction of surface vectors from outer to inner and lastly we switch the view for displaying textures. After setting material to “shadeless”, we apply created panorama as its texture; meanwhile the extracted surface is used for the location of target vectors. After switching to the view from cameras, we can already see pre-built environment from the photographed panorama. This environment can later be supplemented by 3D modelled objects, or objects shot by a camera. For example, in nature environment, where almost everything remains still, the panorama is displayed from photographs (for example a waterfall with flowing water will be replaced by video recording). We create a new texture, which is above the existing. Again, we use the extracted vectors for "sticking" video recording to the surface of a sphere, and, by means of sliding and aligning features; we fit the video into the right place.

5 Special hardware

To convincingly immerse user into the virtual world, one needs to be surrounded by various stimuli, which are governed by similar rules that give the same sensations as they would in the real world. For example, when turning one’s head to the left, one sees things that are to the left of us. When we move forward, we are getting closer to the items that are in front of us, and so on. The virtual world is perceived mainly through three of our senses: sight, hearing and touch. For entering the virtual world, we are using the VR laboratory with a special set of hardware.

In addition to the basic computer line-up, our institute acquired immersive glasses for research of VR. These massive glasses contain two small LCD screens for each eye separately. Basic principle of display is that each eye gets a slightly different picture from its corresponding display. Each eye is watching a particular point from a different angle, and it is only in the brain the two images are put together to form a 3D impression of the image.

Image analysis and spatial sensors can be used to track the position and orientation. Spatial sensors inform about the current position and orientation. They are used in all areas of VR, such as in advanced simulators like those in aviation and in healthcare sectors. Our sensor is TrackIR 5 (hyper accurate, fully adjustable, 6 DOF optical head tracking, 120 fps sample rate, 51.7 field of view and only three square inches in size), which links actual movement in three-dimensional space (thanks to sensors, placed on a cap).

Another important piece of used hardware is a control device - Data Glove. This device records hand movement and sends the recorded information to a computer in the form of electrical signals. The computer transforms these signals to move a virtual hand and results in seeing our virtual hand floating in cyberspace in-line with movements of our real hand. This supports the correction of hand move-
ment in a virtual environment based on visual perception, such as clenched fist (object snap) or open palm (dropping the object).

All hardware tools are used for the testing of created environments used in the treatment of phobias. Similar devices are also needed in the therapist’s office, thus technical availability and economical affordability is important.

6 Approach of the project

Although the use of VR to treat phobias in the world becoming a very hot topic, such as treatment of Arachnophobia [15, 16, 34], Acrophobia [21], or Aviaphobia [20], etc., while no one paid attention to such a method of treatment in Slovakia. Therefore, finding the optimal path of creation of virtual environments is quite difficult and time-consuming. However, we think that the description of these methods can save time to other creators who would like to devote a similar problem. Our sub outputs cannot be presented in the article, because they require special hardware and software. We haven’t been able to prove yet the success of our methods in the treatment of phobias, because the transfer of research results into real practice takes time and care with respect to the patient’s life. But now we are ready for an important second part of the research - the use of software application. This application allows for the controlling and recording of the process during therapy. The main task of the application is the enabling of an immersion into the virtual environment during the therapy. The immersion is enabled by virtual reality peripherals (mentioned above). These devices are controlled by the application, too. Furthermore, a therapist is able to modify the therapy not only according to the observations, but also according to outputs from the embedded biofeedback. Rather than placing the patient in a passive observer position is his activity – direct action (e.g. touch a spider) monitored by a biofeedback. Either the therapist or the patient can repeat or skip sequences to keep the patient feeling comfortable. The sequences are sounds and elements of the VR described above. The records in the database keep information about patient such as name, kind of treated phobias, dates of session, progress of therapy, the last patient condition, etc.

We are just at the moment, where our application, full of different objects, environments and situations, in form of interactive video and audio, can begin to help patients.

7 First project’s results

During the first three years, we have created several objects and environments that are gradually coming out of the research laboratory into therapeutic practice (Fig. 1). Since we are only at the beginning we have no feedback from real patients. So far, we have feedback only from our psychotherapist about the suitability and the quality of our results. Based on these demands we concentrate on the creation of environments.

The first result is an environment for treating Hypsophobia realized through the view from a balcony of a tall building where the patient (or psychotherapist) can choose from more possibilities of the floors in the building (third, sixth and ninth). After selecting one of the options, the display of panoramic view of the chosen floor is loaded. A patient can look around in all directions from the balcony. The environment is a combination of panoramic photo and a balcony modeled in 3D software. The movement of his/her field of view can be controlled by head tracker or by data glove or even using different control devices. Depending on the comfort of the patient the floors can be changed.

Another result is an environment simulating open spaces where the patient can walk through a big square surrounded by people. It is created by panoramic video where the patient can move in all directions. Here he/she needs immersive glasses thanks to which he/she sees moving people. Some of them may be also looking at him/her what can be frustrating for a patient suffering from agoraphobia.

Furthermore, we have created an environment that is available for the patient and the psychotherapist through a game. The virtual environment of the game is a room with blackboards on the walls, which contain certain statements. These are specific sentences that the therapist has selected, depending on the patient’s needs. The therapist can write pairs of sentences in text editor or choose them from prepared propositions according to the needs of each patient. The first series of statements should represent negative thoughts i.e. the fears of the patient. The therapist then selects the appropriate opposite statement and the patient can communicate with blackboards and change negative thoughts to positive by clicking on each of them. It should enable patients to alleviate their fears and induce a more positive mindset. To create the game, we used the program Blender 3D with the tool Game Engine. The creation and management of objects were made with Blender Render Engine. Everything is reachable and more credible
for the patient through immersive glasses when s/he can control the movements and the angle of view.

Several classic videos are also created with the aim to treat social phobias such as waiting at the bus station, travelling in a bus, various situations in a classroom at school or meeting with young people in a park. All these situations required a direct attention of the patient to a specific place or to a communicating person. Therefore, we found that in these cases we cannot create panoramic videos, but only videos with standard field of view to let him/her see only what is important. Into these videos certain special effects were inserted. For example, image blurs, heartbeat or inner voice of the patient with various statements according to the requirements of psychotherapist.

Besides mentioned environments various objects of phobias are formed, such as models of spiders and snakes put into created environments (made by camera from real world). The advantage of this combination is the ability to simulate a suitable situation specific for each patient. For example, we prepared movement and trajectory of the spider or number of spiders in the virtual environment, which would be controlled by the therapist.

We believe that our efforts will confirm our hypothesis about the effectiveness of treatment of phobias through VR in the foreseeable future in Slovakia as well as the rest of the world.

8 Conclusion

In our paper we tried to introduce a special application and methods of creating virtual environments, models designed for medical therapies of patients and we also described necessary hardware and software. Based on our experience of making VR objects and environments, we can conclude that the best solution on how to create these helpful materials is a combination of panoramic photos or videos and the models controlled by therapist. This combination allows to adapt as much as possible to the needs of the patient. When making videos for the purpose of treating social phobias or when solving the problem of communication between people and communication with patient’s inner voice, it is very important to have a convincing performance of the actors who are captured by classic camera. Thus it is ensured that the patient is looking at particular situations simulated by the video.
In the future we would like to target our attention to the verification of our results in therapeutic practice, helping to push research in the treatment of phobias forward with the help of the VR to a modern platform. We realize that the results of such research will not be visible soon. Treatment of phobias is very time consuming process, whose effectiveness is also complicated to measure. It is similarly difficult to compare results. Every patient is different, each workplace has different conditions and each therapist has different procedures and practices. The treatment is usually used as a combination of treatment methods, for example psychotherapy with VR. The results can be assessed only after some time when the patient is cured of phobias completely.

Apart from that we would like also to focus on the creation of virtual space using 360 panoramic cameras in combination with model objects. A good opportunity for general use offers us a large number of virtual glasses which are available more and more on the market.

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