

GETTING THE VRET APPLICATION WORK UNDER WINDOWS XP



Delft University of Technology

Siemen Roorda
Student number: 9706067

Delft University of Technology
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INTRODUCTION

The Virtual Reality Exposure Therapy (VRET) system is developed starting from 1998. The VRET-software has changed in the years following by students working on it and its extensions, but the software and hardware on which it is running never changed. Up to 2004, VRET ran on Windows 98 and Windows NT based computers, that were high-tech at the moment bought, but are quiet oldfashioned right now. The virtual worlds could be used for treatment, but were a little slow.

This is the reason why we want to migrate the VRET system to a pair of new, faster computers. Another driving force behind this is the fact the VRET system is going to be used 'for real' by Parnassia, a Dutch health care organization. Hoping it was as simple as just copying the right files to the new computers, installing the (outdated) WorldUp player, connecting headmounted display and tracker and running the program, our hope was deceived: a lot of problems raised, and the attempts solving them are described in this report.

Besides of the split in hardware and software, I follow no particular order in the contents, maybe for there is none. Whenever a new migration is necessary (which is likely, as the VRET system is meant to last a lot longer than the intermediate hard- and software setup!), this documentation may prove very useful.

TERMINOLOGY

The VRET system consists of (basically) two computers: the **therapist's computer** is the one that is used by the therapist and shows a complete control panel, including a copy of the patient's view. The **patient's computer** is used to show the immersive world to the patient, and for that reason additional hardware (headmounted display, tracker) is attached. Both computers are connected either by a direct cable, or via a network (e.g., Internet).

A **headmounted display** is a helmet containing two little projection screens, one for each eye. Due to a slight shift in viewpoint for the left and right eye, this device enables 3D viewing.

The **Flock of Birds** motion tracker is used to get information about position and orientation of one or multiple sensors. In the VRET application, one sensor is used and this one is attached to the headmounted display. In this way, it is always clear to where the patient looks.

A WorldUp virtual world exists of only one file, that contains all information and additional sources (objects, materials, textures, sounds, movies, scripts, etc.). Such a compiled file has the extension **.WUP**.

.DLL-files are used for functionality that can not be implemented in the WorldUp scripting language. These files are (originally) written in Delphi 5.0 and allow a direct communication with the WorldUp scripts (these scripts can call the DLL functions).

CONCLUSION

A little early for a conclusion, but because of a lack of structure in the remainder of the report, a small summarizing section is best placed here.

The main conclusion is that the current VRET application is not easily transferable to other computer systems. The main reason for this is the fact that (almost sure) one of the used Delphi units ('classes') is digging that deep into the systems configuration, that the therapist's user interface should be recompiled on almost every other machine it will be installed. Another main reason complicating transferability is the fact that we cannot easily reconfigure the WorldUp code, because no working WorldUp editor is present.

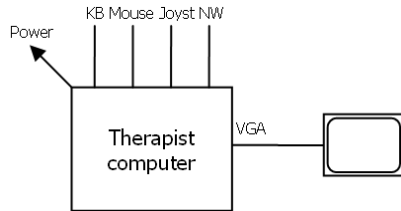
Regarding all those problems, it sometimes was very discouraging at the moments everything was working well, and after doing one little, tiny thing, the system hung again... Luckily, at the moment of writing the Parnassia system (the only really working system) will be transferred to The Hague, and after that, I hope never to have these troubles again - full power onto the new development software!

One of the main improvements to be made in the nearby future is developing following a framework, that enables a modular structure. In case the new software cannot be used any more at any point in time, it has less impact than the bankruptcy of Sense8 now. Clearer documentation is important, too. Those two elements are the basis of my master thesis, so at this moment I cannot go deeper into this matter, just read my report after a few months!

HARDWARE SETUP

THERAPIST'S COMPUTER

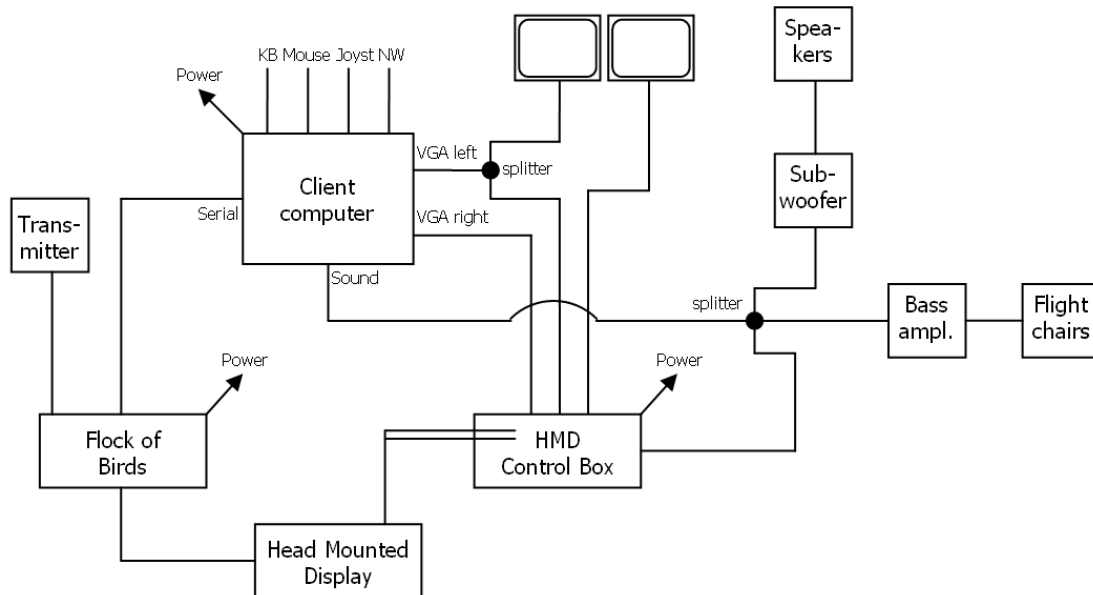
The hardware setup for the therapist's computer is very easy: just an ordinary PC-configuration, with a connection to the Internet or a local network and a joystick connected:



PATIENT'S COMPUTER

The hardware configuration for the patient is less usual, due to a lot of additional devices. As far as possible, all hardware connections are shown in the picture below. Depending on the type of therapy, the flight chairs and the bass amplifier are not necessary. Neither is the second display, for most of the time the two displays will show almost the same picture (left and right eye). Even both displays can be removed, if only the patient is using the headmounted display: the therapist always has this viewpoint in the user interface, although this is a lot smaller.

Regarding the Flock of Birds control unit, take care of the DIP Switch status: in the currently working situation, the switches 1, 2, 3 and 7 are 'on' (down), the others are 'off', indicating the setup of the unit (e.g., speed of the serial port data). This setting is also important when using multiple Flock of Birds.



SOFTWARE SETUP

FILES AND PROGRAMS

On both computers several files and programs should be present in order to run VRET correctly. In this section I describe which those files are.

FILES BACKUP

For future use, I created a CD-ROM with all files needed for the setup of a new system. On this CD-ROM are stored:

- two example phobia.ini files (should be changed before use)
- the worlds (only the .WUP-files, not the separate uncompiled files)
- the DLLs and the Delphi source files (containing the source code of the DLLs)
- the WorldUp player installation files
- two WorldUp player executable files
- database files in correct directory structure

To create a new VRET system, you should follow the steps below:

General:

- Create a directory C:\DLLs on both computers
- Be sure on both computers is a readable and writable D-drive. This can be either two physic partitions, or one physic partition and on the other computer a network share
- Copy the directories Worlds and database to the D-drive (resulting in D:\Worlds\... and D:\database\...)
- Be sure no firewall limitation is present (all traffic should be allowed on all ports between these two machines)

If installing the patient's computer:

- Copy phobia.ini to C:\
- Copy VRETlistener.exe to C:\
- Copy the DLL-files found in the Patient directory to the C:\DLLs directory
- Install wup_plyr_r5p7_setup.exe
- Overwrite the just installed executable file WuPlayOGL.exe with that one on the CD-ROM in the directory Patient
- Adjust the C:\phobia.ini file (most likely you will have to change the values for WUP, IP and Port console and Vrstation)
- Start the listener application

If installing the therapist's computer:

- Copy phobia.ini to C:\
- Copy the DLL-files found in the Therapist directory to the C:\DLLs directory
- Install wuplay_d3d_r5p5_setup.exe
- Overwrite the just installed executable file WuPlayD3D.exe with that one on the CD-ROM in the directory Therapist
- Adjust the C:\phobia.ini file (most likely you will have to change the values for WUP, IP and Port console and VRstation, and the Vefilename's)

Troubleshooting:

- If on the therapist's computer you get an error when starting a world, you'll have to recompile PhobiaServer.dll and LastPhobiaServer.dll. See my report how to do that. The source files can be found in the Delphi source directory

LOCATION OF THE WORLDS

In the current setup both computers share a common D-drive (physic partition on the therapist's computer, network share on the patient's computer). On this drive, the worlds are stored. An advantage of this is that you only have one copy of them, and version conflicts are eliminated. In a 'real' environment, with the therapist at his office and the patient at home, probably you'll have two separate D-drives.

Currently, the .WUP-files containing the worlds are stored in the directory D:\Worlds\, according to the settings in the phobia.ini-file on the therapist's computer. It is possible to change the location of the worlds; in that case, change the phobia.ini file accordingly. See the *Program flow* section for more information.

WORLDUP PLAYER

On both computers a WorldUp player should be installed. In the old setup, the Windows 98-computer (patient) ran the OGL-player, whereas the Windows NT-computer (therapist) ran the Direct3D-player due to hardware restrictions. For an unknown reason, the way the players work best on the new Windows XP-computers is rather swapped: the OGL-player on the therapist's computer, and the Direct3D-player on the patient's computer.

The newest versions found on the Sense8-website are dating from respectively 2004 and 2001. These installation files are found on the CD-ROM. However, many problems can rise when just installing. In one way or the other, different versions of the .exe-file were present on the oldest Windows XP-installations. To prevent problems, first install the players using the respective installation files, and after that copy the executables found on the CD-ROM to the installation directory, overwriting the freshly installed executables.

LISTENER APPLICATION

The executable program ListenerApp.exe (the purpose of this program is explained in the section *Program flow*) should be available on the patient's computer and, if a therapy will be started, it should be running. The location of this file is of no interest, as it depends on no other data or files.

PHOBIA.INI

The phobia.ini file is the configuration/initialization file for the VRET application. Both the therapist's and the patient's computer should contain such a file, both different regarding the contents. This file is read by both the WorldUp scripts and the DLLs. The table below shows the variables that should be declared in this files; the particular order is of no interest as long as the variable names are unique; if not, the first value is taken. The first column is the variable name, the two following columns indicate if the variable is to be set on the patient's (P) and/or therapist's (T) computer, and the description of the variable. Everything in this file is case sensitive.

Take care of the format when editing the phobia.ini-file: the functions used by Delphi and WorldUp to retrieve a certain variable are strictly coded to handle the following format: {variable_name}{space}={space}{variable_content}{new_line} e.g.:

```
IPConsole = 100.101.102.103
```

Variable	T	P	Description
ThisCompu	+	+	States whether this computer is the therapist's (<i>Console</i>) or patient's (<i>VRstation</i>)
DLLdir	+	+	Path to DLL-files (currently not in use)
VEdir	+	+	Path to the virtual environments
WUP	+	+	Path and filename of the WorldUp player application
IPConsole	+	+	IP-address of the therapist's computer
PortConsole	+	+	Port to which the therapist's computer listens
IPVRstation	+	+	IP-address of the patient's computer

Variable	T	P	Description
PortVRstation	+	+	Port to which the patient's computer listens
NumberofBirds		+	Number of Flock of Birds connected to the patient's computer
VEfilenamexx	+		This variable contains the relative path with respect to the value in VEdir to the virtual environment number xx. This number is set in the WorldUp scripts.

An example of a currently running phobia.ini file is quoted below:

```

ThisCompu = Console
DLLdir = c:\DLLs\
VEdir = d:\Worlds\

WUP = C:\WuPlayD3D.exe
IPconsole = 130.161.157.192
PortConsole = 999
IPVRstation = 130.161.157.198
PortVRstation = 998

VEfilename02 = Hoogtevrees\Brandtrap\ophoogtevreesv09.wup
VEfilename03 = Hoogtevrees\Dakterras\hduni06.wup
VEfilename04 = Hoogtevrees\Bouwplaats\hbouwplaatsuni05.wup
VEfilename05 = Neutral\Binnenplaats\Nbinnenplaats04.wup

```

DLL FILES

The DLL files that are used by the VRET application are stored in the directory C:\DLLs. Note that although a variable *DLLdir* is present in phobia.ini, this directory is hardcoded and should not be changed!

The therapist's computer needs three, or in fact two DLLs: AirplanePhobiaServer.dll, PhobiaServer.dll and LastPhobiaServer.dll. 'In fact two' refers to the fact that the last two files are exactly the same, but some worlds use the one or the other. For I cannot (easily) re-compile the .WUP-files, I cannot change this ambiguity. The AirplanePhobiaServer.dll is different, as the user interface for the airplane world is quite different.

The patient's computer needs similar DLLs: AirplanePhobiaClient.dll and PhobiaClient.dll.

Although one would not expect problems with the DLLs when copying to another similar system, it seems to be quite system dependent: I copied the therapist interface to multiple computers for demonstration and presentation purposes, and on each computer I had to recompile the source code. Initially I attributed it to the dual processor setup of the other system, but a copy on a laptop resulted in problems, too. Digging further, my current theory for this problem is the use of the CoolForm-unit in the PhobiaServer DLL. This unit (described in a next chapter) makes parts of the current window transparent, and I guess this is too low-level to make it work on each system. With a recompile, the unit is adapted to the new system and compiles in a right way.

For this reason I put the source on the CD-ROM to be compiled using Borland Delphi 7.0. See for more information on this subject the section *Delphi*.

PROGRAM FLOW

In this section I describe shortly how the process of starting a therapy is performed. Keep in mind that in the patient's computer the ListenerApp.exe must be running!

- ListenerApp.exe listens on a specific port, indicated in phobia.ini, for network requests.
- When the therapist opens a .WUP-file, this file does the following:
 - Initiates the PhobiaServer.dll.
 - The DLL-function InitServer loads the graphical user interface with the controls.

- The DLL-function InitServer sends to the patient's computer (IP-address and port configured in phobia.ini) a message that the world with filename f is loaded. The filename is gathered from phobia.ini using the VEfilename xx variable. xx is hardcoded in the WorldUp-scripts.
- The .WUP-file shows two viewpoints on the screen; one that is an exact copy of the patient's viewpoint, and one free viewpoint.
- The ListenerApp.exe application receives a request to open file f and starts the WorldUp player with the respective filename.
- As long as the application is running, every tenth of a second the patient's computer sends information about position and orientation to the therapist's computer; based upon this data the patient's viewpoint is adapted.
- As soon as the therapist changes any control variable, this updated information is sent to the patient's computer, which adapts the virtual environment.
- The patient's WorldUp player is closed as soon as the therapist closes the user interface (a message is sent to the patient's computer).

FIREWALL SETUP

For a correct use of the VRET application, network traffic should be allowed between the two computers. According to the phobia.ini files, it should be clear that both sending and receiving data on ports 998 and 999 (default settings, can be changed) should be allowed.

However, testing the application using firewall restrictions, it appeared at least one more connection is tried to be established. This connection has no specific port number, and upon failure, the next port is tried. When testing, I saw ports 2100 up to say 2110 being tried.

When a demonstration is given, it is preferable all network traffic on all ports is allowed between the two computers.

PROBLEM SOLVING FOR THE DIFFERENT PARTS OF VRET

LISTENER APPLICATION

The listener application should only be run on the patient's computer, although some reports may say it should be run on the therapist's computer, too. This does not lower the performance, but it is just another taskbar button, and better get rid of it :). The listener application functions just (as the name suggests) as a 'listener': this program runs 'always' on the patient's computer, listening to a specified IP-address and port. When a world is started at the therapist-computer, the server DLL of this world sends a signal to the listening socket (therefore both IP-addresses and ports should be specified in the phobia.ini file). The listener only reads the filename from the sending socket and runs the WorldUp-player with the specified file. After that, it is listening again.

The original listener application included only a text label that showed the latest status message. This message changed sometimes a few times a second: too fast to be able to read them all. For debugging purposes, I changed this text label into a 'Memo' (the Delphi name for a text field) that contains all the status messages from the start of the application up to the latest one, without overwriting the old values. Regarding the functional aspect, there is completely no difference. I used the new version when changing things that might result in errors, and I re-set the old version at the 'live' computers of Parnassia, because this looks nicer.

Be sure the listener application runs before trying to start a world on the therapist's computer. If not, an error will occur. Also misconfigurations regarding IP-addresses or ports can cause this type of errors (the therapist's DLL cannot see if the listener application is just not running, or a wrong IP-address is given).

PATIENT'S USER INTERFACE

Regarding the patient's user interface, I can be very short: there were no problems with it. The Delphi-code was once recompiled to get it working on Windows XP, and between the different Windows XP computers (single or dual processor, desktop or laptop), I experienced no problems.

THERAPIST'S USER INTERFACE

The therapist's user interface is the part of VRET that caused and causes the most problems. To pick one: on every computer I installed the therapist's user interface, I had to recompile the DLL file to solve 'Unknown program errors - do you want to send an error report?'. Sometimes even no error is given, and the WorldUp player just doesn't start. I have no proof, but I think the fact the DLL is not cross Windows XP compatible has to do with a Delphi-extension called 'CoolForm'. This is no default Delphi unit, but a third party one that enables the possibility to finetune screen rendering. In the VRET application, it is used to make parts of the user interface (exactly that parts that show the two viewpoints) transparent. The reason to implement it this way, is probably that WorldUp does not allow an output window to always stay on top. With making the right regions transparent, the free and the patient's viewpoint are always visible. (An imperfection of this method is that when moving the user interface window, the transparent blocks move with it, but the underlying WorldUp viewpoints do not; these will therefore disappear behind the user interface.)

For there is no particular order in which I discovered and solved the problems, I list them below. I'll start (well, it is indeed a sort of ordering...) with the problems I encountered when running the VRET application for the first time on the old, original Windows 98/Windows NT computers. After that, some general Delphi troubles are solved and finally the other problems are addressed.

WINDOWS START-UP PROBLEMS ON THE ORIGINAL PATIENT'S COMPUTER

Starting the original patient's computer, an error pops up: *One service or driver failed during system startup*. Looking in the Event Viewer, it seems to be caused by a *DriverLINX Port I/O* that failed due to a missing file. The popup error can be removed by disabling the driver in the *Control Panel* → *Devices* screen. I decided not to do so (I want to keep the original systems as far as possible without changes, and this error did not prevent the VRET application to work correctly).

WINDOWS START-UP PROBLEMS ON THE ORIGINAL THERAPIST'S COMPUTER

Starting the computer, Windows complains about a DLL-file that can not be found. This results in two errors. Both can be clicked away without disturbing the working of the system. Copying the specified

ClaustrophobiaServer.dll-file into the mentioned directory caused the errors to disappear; at the same time, the DLLtester.exe-program is started and gives an error whatever the value entered. (To be complete: for DLL files cannot be run and consequently debugged from within Delphi, the DLLtester program is written, which just like WorldUp calls a DLL function. It is clear this program has no need to be run at Windows startup.)

A few minutes after Windows completely started, an 'illegal operation'-error on the Gmt-program is thrown. This program is started from the Startup-folder, but even removing it from there does not remove this error. I have no idea what this program does, but for the same reason as described above I decided to leave the file. By the way, I think most of the startup-items can be removed safely, but for the same reason I didn't do this.

Sometimes a 'key violation' error occurs. This has to do with the database functionality and means the specified primary key is already in use. Close this error box and restart the VRET application, hoping you get a unique number. Sometimes all numbers already seem to be occupied. If so, you can try to copy an older version of the database-directory to the D-drive, that contains less records. Because this data is only very rarely used (only for research purposes), it is no problem to do so.

Another often encountered error is the I/O 103-error. This error never comes alone, but will flood the system. The only way to stop the flow of 103-errors is to keep pressing Alt+F4, and hoping one time you shut down the last error message and the user interface... If you do not do or succeed to do so, the system will freeze for there are too many open windows/alerts.

The source of this problem the D-drive being completely full. The 103-error means 'cannot write to file'. I moved one directory to the E-drive (into the directory BACKUP_SIEMEN), and after that the problems disappeared.

This last solution is applicable to a lot of 'Illegal operation'-errors, too. If you encounter a strange problem, first release some space; if the error still occurs after doing so, you'll have to look further. An example of such a message is a 'Network write error'.

DELPHI PROBLEMS

On the original computers, Delphi 5.0 was installed. However, this version can not be installed on Windows XP. Therefore I decided to install the newest version, Delphi 7.0. Socket support is not installed by default. You can activate it by choosing *Component* → *Install packages...* → *Add...*; look in the Delphi\Bin-directory for the needed components: dclsockets70.bpl and dclRave70.bpl. I'm not sure if this last one is necessary too, but I installed because I got some errors including the text 'Rave'; that's the only reason.

There were some errors with the 'CoolForm' unit. Looking on the Internet, I found the website <http://www.lawrenz.com/coolform>. It is a Delphi-add on that makes it possible to style your windows in a way you really want, not just the Windows-way. Another option is to make part of the window transparent. This last feature is used for the therapist-forms: the form is made transparent at the locations of the 3D-views (the real 3D-screens are separate processes, located at exactly these locations). I tried to remove the CoolForm-declaration, but in that case the main form is showed on top of the 3D-screens, and these are not visible. Installing the package from the noted website was no solution. Finally, I copied from an older version the file CoolForm.pas into the directory Delphi7\Rave5\Lib.

BUT (and now I will continue more technical and less structured...) even if coolform.pas exists in the right directory, I encountered problems that Delphi could still not find this unit. Even if copying it into the project directory Delphi complains. The only way I could recompile the DLLs was making sure I did not open the form, just the project file. Changes in the form code should be made with notepad or another editor. If done so, you can recompile the main project file and in one way or the other Delphi doesn't care about this not existing CoolForm. Strange...

A very strange problem is that network communication was not always available. As an example: the window curtains in the airplane world can be closed or opened by the therapist. Sometimes this doesn't

work at all, sometimes it works a few times and after that no commands are received by the patient's computer. It appeared the new computers are too fast for the Delphi-programs. In the phobiaserver-dll's (both *Airplane*, *Last*, and the 'default'), look into the function `SendData` (in the `form.pas`-file). Two lines are coded here:

```
1. SendThreadAvailable := false;
2. SendThread := TsendThread.Create(False);
```

In the original code, these two lines were reversed (first line 2, than line 1). Looking into the `Execute`-function, you see the `SendThreadAvailable`-variable is assigned a 'true' value. I think there are two threads, so on a slow computer, first the STA-var is assigned 'false', and after that the execute is performed and 'true' is assigned. This doesn't result in any problems. But on a quick computer, I guess the socket-execute function is performed much faster, so 'true' is assigned before 'false'. The resulting value is therefore 'false', and this let the program freeze in the lines that say 'repeat until `SendThreadAvailable`';'. A lot of text above, but I hope you understand ;).

In the `ClientRead`-function the socket is closed in the last line. This action caused the 'Client disconnected' message, and seemed not too logical to me. Although no problems occurred, commented this line out. Again no problems occurred, so this line has no real purpose.

PROBLEMS TO BE EXPERIENCED WORKING WITH THE CURRENT SYSTEM

Shutting down the VRET application results in 'send / don't send' errors on the patient's computer. I don't know how to solve it, I guess it has something to do with the endless loop 'repeat until `SendThreadAvailable`;' as described before. At this moment, on the Parnassia computers, shutting down the therapist's user interface results in a clean shutdown of this interface, and an error on the patient's interface.

Besides this way, there are several ways to shut down, in the case things work not as expected:

- The patient's interface can be shut down by activating the left- or right eye viewpoint, and pressing ALT+F4.
- In case this doesn't work: press CTRL+ALT+DEL and close the left- and right eye viewpoints; the running DLL function follows automatically in shutting down. Sometimes also the therapist's user interface shuts down automatically.
- If the therapist's user interface cannot be shut down by just clicking on the cross in the upper right corner of the screen, press CTRL+ALT+DEL and shut down the respective processes (left eye, right eye, and the `PhobiaServer DLL`).

Not all textures are always shown in the viewpoints the therapist sees. I experienced this with the airplane world (missing textures on the chairs) and several other worlds. In this cases the textures *are* shown in the patient's viewpoints, so it isn't that important.

However, the elevator world has texture problems in the patient's viewpoints too: a completely black wall is shown instead of nice textures. I could not solve this in the scope of this project and regarding the limited time.

Make sure a joystick is connected, if possible to both computers (in the underground world this is mandatory), but in either case to the therapist's computer. If not, a `WorldUp` error will occur, saying *LastServerControl.ebs: Runtime error: Object variable or With block variable not set.*

In all worlds sometimes an illogical error may occur, although in the last weeks I didn't encounter them. Try if this can be solved by removing/renaming the `.LCK`-files in the directories `D:\database` and `D:\database\OPdatabase`. I think this is caused by database-functions in Delphi?

Running two worlds at the same time on the therapist's computer results in a socket error (two identical sockets are opened, which isn't possible), even before the listener is alerted of opening a new world. Therefore the client computer doesn't throw an error but continues listening.

Due to the faster processors and other computer elements, the worlds render faster, too. This seemed a problem for real therapies, where the patient is navigated too fast through the worlds. Using the 'autopilot speed' slider in the therapist's user interface this speed can be adjusted, but for several worlds this wasn't slow enough. For this reason I changed the function TPhobiaServerForm.UpdateAutoSpeed in the PhobiaServerForm.pas source file: originally, the slider position was divided by two to gain the speed of the autopilot; I introduced a variable *factor* that differs for each world, assigned through a 'case'-statement.

GLOBAL REMARKS

In principle, the PhobiaClient.dll and PhobiaServer.dll files are the same for all worlds. The global structure of the forms is equal, and for each world *in* the Delphi-code some parameters are set and some items are or are not shown. If you want to create a new world, just add the specific parts to the code and compile: it should work with the older worlds again.

However, the airplane world is a lot more complex (e.g., has a lot more options). For this world additional .dll-files are created by Lucy: AirplanePhobiaServer.dll and AirplanePhobiaClient.dll.

Then of course the question why there are both a PhobiaServer.dll *and* a LastPhobiaServer.dll: I really don't know... After having compiled the final PhobiaServer.dll, I copied the same file to PhobiaServer.dll and LastPhobiaServer.dll. These files are completely the same! The only problem is, I cannot remove one of them, as the WorldUp-files link to either of these files. Without having the possibility to recompile the WorldUp-files, I cannot change it. Just live with it ☺.