VRE
Manual

Updated October 2013

Table of Contents

Introduction

VRE is a virtual environment to both show some possibilities of how VR can be used for education, and what's currently possible when using a brain-computer interface in a virtual environment.

These are the devices you'll need to fully experience all the simulations, although you don't necessarily need any of them except for the Hydra:

- **Oculus Rift** – virtual reality headset
- **Razer Hydra** – motion sensing controllers
- **Emotiv EPOC** – neuroheadset

The environment is comprised of an island with a university campus. The campus has several simulations based on practical learning exercises and there is also a first person shooter styled military simulation near the lake where the user starts.

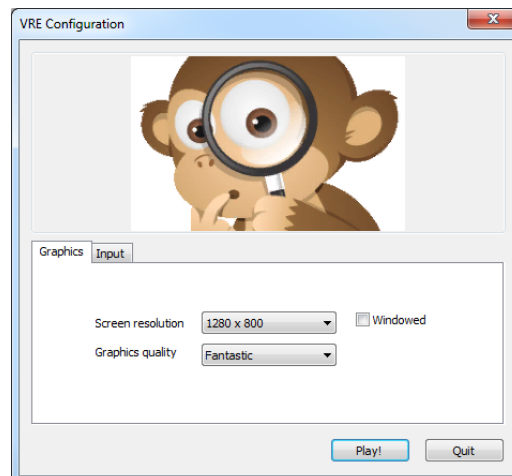These are the simulations available:

- Architecture & City Planning
- Chemistry
- Military
- Surgery

Setup

Once you install the app, you should be able to run it by going in one of the following locations, unless you manually changed it during installation:

- C:\Program files (x86)\Zookal\vre.exe
- C:\Program files\Zookal\vre.exe

When you run the app, choose **1280 x 800** for the **resolution** as the environment was optimized for only this resolution and the Oculus Rift only supports this resolution as well.

Additional Setup for EPOC

Using the EPOC involves an additional step if you want to use the device. Basically the app needs to use **edk.dll** and **edk_utils.dll** which is located in the folder where you would've previous installed the EPOC's software. This software comes with the Developer and Research versions of EPOC but we are not sure if it does with the Consumer version.

Here is what you need to do:

1. Locate the folder where those dll files are located, which would be in a location similar to one of the following:
   a. C:\Program Files\Emotiv…
   b. C:\Program Files\Emotiv Developer Edition SDK_v…
   c. C:\Program Files\Emotiv Research Edition SDK_v…
2. Add that location to Window's CLASSPATH so the app can use both dll files when it runs. Here is an example on how to do this.

Devices

Oculus Rift

With the Oculus Rift you can immerse yourself in the simulation's environment and look around using its head tracking capability. Currently only the developer version of the headset is available, but a consumer version is on track to launch in 2014.

Razer Hydra

The Razer Hydra tracks your hand movements and translates those to virtual hands in the environment. You can use the buttons on each device for different actions and the joysticks to move and look around.

Emotiv EPOC

The Emotiv EPOC reads your brainwaves to match up your thoughts to movements in the simulation. You'll first need to train yourself to move in at least one direction, and then train a few times to improve the accuracy.

The technology is still quite primitive and latency is not low enough for fast-paced action, but it is interesting to see that the technology is possible and experience what it is capable of at this point in time.

Controls

Keyboard

Key	Action
W	Forward
A	Left
S	Backward
D	Right
Space	Jump
Up (arrow)	Forward
Left (arrow)	Left
Down (arrow)	Backward
Right (arrow)	Right
ESC	Menu
T	EPOC Training Menu

Mouse

Key	Action
Left (mouse)	Look left
Right (mouse)	Look right

Razer Hydra

Key	Action
Left Joystick	Move
Right Joystick	Look (left/right)
LT	Grab object
RT	Grab object
LB	Levitate
RB	Jump
1 (left)	Open palm
2 (left)	Point finger
3 (left)	N/A
4 (left)	Shoot (gun)
1 (right)	Point finger
2 (right)	Open palm
3 (right)	Shoot (gun)
4 (right)	N/A
Left Joystick (pressed)	Sprint
Right Joystick (pressed)	Sprint faster

Oculus Rift

Key	Action
Move head	Look

Emotiv EPOC

The EPOC will require training first to match your thoughts with movements on the screen. You'll need to go to the Main Menu (ESC key) or EPOC Training Menu (T key) to begin the training module. See the EPOC Training section of this guide on how to train.

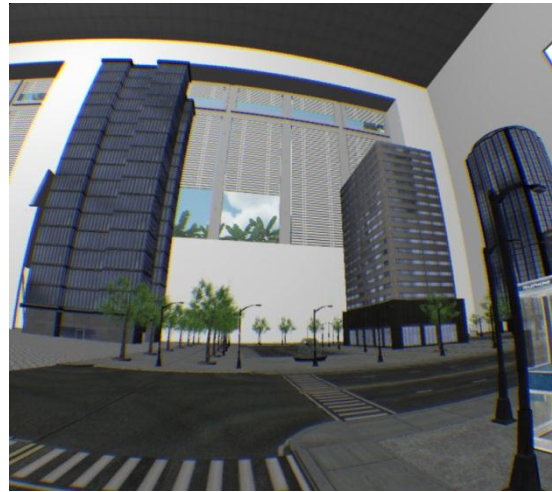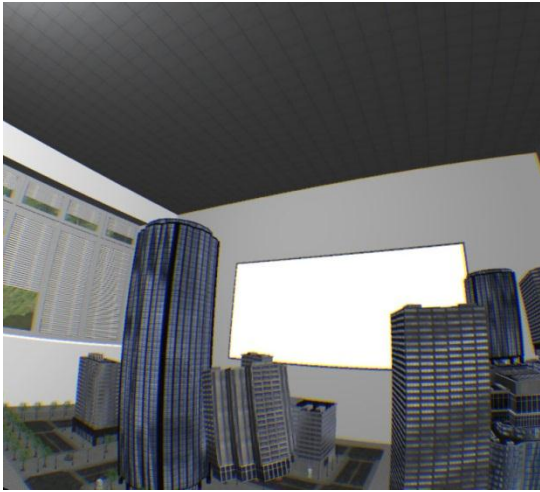| Key	Action
Forward (thought)	Forward
Backward (thought)	Backward
Left (thought)	Left
Right (thought)	Right
Levitate (thought)	Levitate

Simulations

Locations

When you start the simulation, you will be facing north with several buildings on your right. The location of each simulation can be found as follows:

- **Architecture & City Planning** – northern-most location of the campus.
- **Chemistry** – At the far end of the campus at south east.
- **Military** – As you start you will see a pistol on the ground next to the tree in front of you, pick it up to start the simulation.
- **Surgery** – Slightly past the Architecture building to the east.
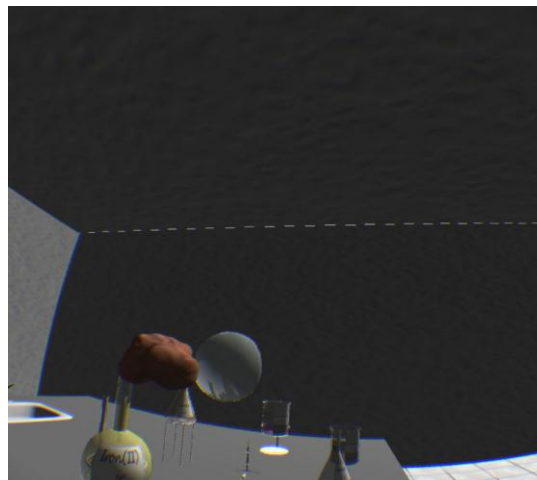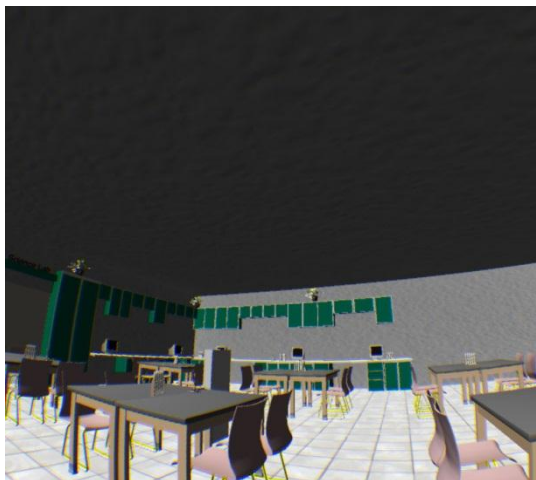
Architecture & City Planning

You'll see a miniature city when you enter the building, as well as a stockpile of buildings around the room. You can remodel the entire city by adding or removing buildings onto the city's foundation. You can move buildings around by using your virtual hands to grab buildings and drag them anywhere on the board or outside of it.

Once you finished building the city, you can shrink yourself so you can have a walk around the city. To do this, there is a wall switch inside the room right next to the entrance. Grapple the switch with your hand to shrink yourself. You can become big again by walking onto a tiled floor switch on the opposite end of the room from the wall shrinking switch.

Chemistry

In the science lab on the far end of the entrance is a table with several flasks, a Bunsen burner and several other tools for chemical experiments. Right now there is one experiment you can try out which involves mixing the Zinc II and Iron II chemicals.

If you look at both flasks, you'll notice that Zinc is a light blue colour, whilst Iron is a bluish green colour. Pick up the flask labeled Zinc, and just place the end of it close to the flask labeled Iron. After a few seconds the liquid in the Iron flask will change to a yellowish colour, demonstrating what happens when these 2 chemicals are mixed together.

Although this is a basic experiment, this simulation can be expanded to teach people the reactions that occur when mixing many different chemicals in a practical manner.
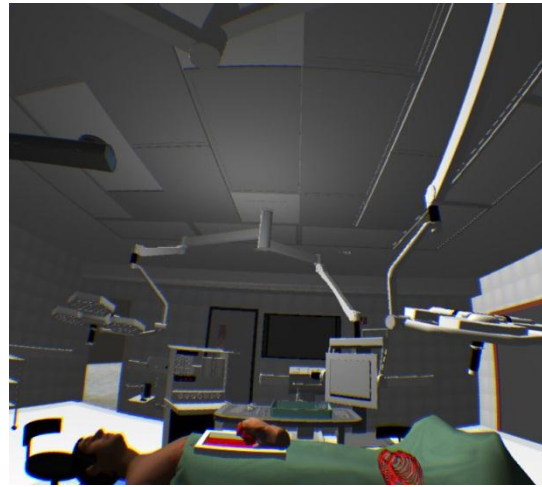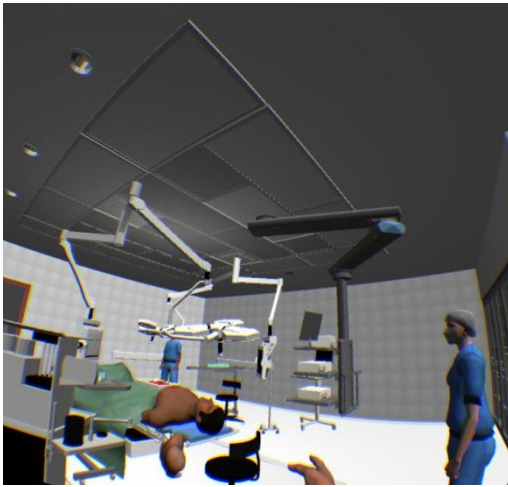
Military

This is more of a basic first person shooter example. What is unique here though is that you can use the EPOC and Hydra together to fight soldiers by moving with your mind and using your hands to fire the gun at the enemies.

To start this simulation you'll need to walk about 2 metres or 6 feet in front of you front the starting point of the simulation. There should be a tree in front of or next to you. On the ground besides the tree is a pistol. Grab the pistol and enemies will begin to swarm you from different directions. Use the trigger on the Hydra to fire the weapon.

Once you defeat all the enemies, they will re-spawn after 10 seconds. The simulation will slightly increase in difficulty on each cycle of defeating the enemies.

Surgery

Currently this is just a basic medical simulation where you can perform a biopsy on a patient. Using your hands you can reach within the patient's chest and take out either their rib cage or heart.

The simulation is quite simple but can be developed further to include surgical procedures such as open heart surgery, brain surgery and many more.

EPOC Training

To move around the environment with your mind you first need to train the app to figure out which of your thoughts should match to moving in certain directions.

To start the training, go to the Main Menu by pressing **ESC** and click on the Emotiv EPOC button followed by the Training button. Alternatively you can press **T** to open the training menu.

Before you can start to train any movements, you'll need to train the neutral action which is basically just keeping your mind clear of any thoughts. You need to do this first as the device needs to tell the difference between thinking of an action and not thinking of one.

Once you click to train the neutral action, keep your mind clear for 10 seconds and the action will be learnt by the EPOC.

After training neutral, many other training options will appear. You can train to move in any direction, as well as train to levitate on the spot.

To train yourself to move forward, start the forward training and picture yourself in your mind that you're moving forward in the environment. After 10 seconds the device should have learnt a bit about how you think of moving forward, and you should be moving forward in the game when you think of that thought.

You should train each action at least a few times, as your movements won't be very accurate and you'll probably be moving and stopping a lot involuntarily. The more you train an action, the more accurate it becomes.

Once you train more than one action, the accuracy of each movement you've trained before goes down until you train those actions further as well. This is because the EPOC now needs to differentiate which of your brainwaves correspond to which movements in the environment.

If you notice the accuracy getting worse on movements, try to train the neutral action again or focus on training the inaccurate actions several times in a row.

Finally, there is a limitation to how many actions you can train which is 4 times. For example, if you train all 4 directions then you won't be able to train to levitate until you start the app again. This is currently a limitation of the EPOC but it'll also be improved in the app over time too.

Change Log

Version	Date	Description
0.1	14/10/2013	Initial release

Troubleshooting

Q. The application doesn't start up, an error shows, or the EPOC won't work when I try to train using it.

A. Try to do any of these:

   a. Install Microsoft Visual C++ 2005 SP1 Redistributable Package (x86), this is required for the EPOC to work properly. You might need to restart the computer after installing this.

   b. For the EPOC to work, there are 2 files that you need to include when the app runs. See the section Additional Setup for EPOC.

Credits

Development

Chris Zaharia

Filming

Michael Imstepf

Graphics

Chris Zaharia

Michael Imstepf

Ideas

Ahmed Haider

Chris Zaharia

Keane Montague

Michael Imstepf

3D Models

3D Medical Equipment

AgileWolf3d

Arteria3d

dartler

GFX_Artist

mimarburak1

Mixamo

niche3d

Sev-n Interactive

Tibor Szijjarto

Vertigo Games

Special Thanks

Emotiv

Oculus

Razer

Sixense