

Oculus Rift:

Analysis and potential use in Higher Education

1. Intro

After speaking to the Innovation Team, they kindly lent me their Oculus Rift VR headset for a week to get some feedback. Below are my thoughts, ideas and comments on how I got on.

If you don't know what the Oculus Rift (OR) is, it is a virtual reality (VR) headset that covers your eyes blocking out any sight other than what it's embedded screens show you. The OR tracks your head movements and where you are in space which is mimicked on the screens in front of you.



*Example of Oculus Rift.
Source: <https://goo.gl/0OUgsI>*

1.1 Hardware

The OR hardware consists of two parts, the headset itself and an infrared camera that sits on top of your monitor just like a traditional web cam. These are all linked together with cables and connected to a PC. The version of the OR that I was testing was the DK2 which is a development version and not the final product that will be released to market.

The PC requires a space HDMI output, two free USB sockets (one for the headset, one for the camera) and a standard 3 pin power socket. These are all connected via cables, and generous length cables are included, especially to the headset.

The PC I was testing on was a high spec PC running Windows 10:

- i7 Extreme, 16GB DDR4 RAM, X99 board, 2x Nvidia 980GTX, Evo 850 SSD

Connecting everything up was fairly simple, the guide provided by Nvidia was easy to follow.

1.2 Software

The software installation was also fairly simple, you download the latest SDK from Oculus which in my case was version 0.8. This has a standard installer which installs the drivers and weighs in at around 45MB.

Once installed, I anticipated being able to launch one of the demos and off it goes, but the orange 'standby' light was on the headset and the light on the camera was unlit. I opened up the Oculus configuration tool which is installed with the SDK (and resides in the system tray) to look at the logs and run the diagnostics, and with that open the OR came to

life. It appears that the config tool needs to be open (not just running in the system tray) for the OR to work. The headset light was now green and the light on the camera was lit up blue.

2. Using the Rift

2.1 Initial Thoughts

I downloaded a few demos from the OR website (<https://share.oculus.com/category/all>) and was impressed by the level of immersion. The standard OR demo has you sit on a conveyor belt going through a tunnel while it shows off some capabilities of the device and it's very strange to be able to look behind you, or look down and see your legs and chair, but they're not your legs and chair. Several times when going through these demos did I try and reach out to touch something and then immediately feel stupid, the level of immersion is that good.

The resolution of the headset is 1920,1024 which is HD quality, however, as the screens are an inch from your eyes, it's not that great and I understand that this is being increased in the final production model.

A lot of the demos I was trying didn't work or crashed quite early on which was frustrating, and more on both of those topics later but to be honest, the crashes were a relief as motion sickness crept in and I needed a break.

2.2 Future Usage

Throughout the week I tried many different demos and applications that make use of the OR. The obvious use case for the device is in gaming and that makes up most of the available content. Most of the games are the 'first person shooter' type and horror seems a common theme due to the immersion levels. However the most impressive uses I tested were in the simulation field, be that driving, flying, surgery and so on. However simple demos of just an office environment are also very good.

When showing the OR to others to get their feedback, the most impressive application is Project CARS which is a driving simulator, they make use of the stereo vision much more than other applications. By using stereo you can get a proper 3d effect similar to a 3d movie. Objects that are further away require you to focus on them which then takes your focus away from nearby objects and this is what was the game changer for me.

The other aspect that I haven't mentioned yet is the tracking. The Rift headset tracks your head movement and that's expected, but the external camera tracks where in space that is. So if you stand up and walk around then you do the same in VR space too. So if a VR object is placed in front of you, you don't have to use the mouse to rotate it you can lean forward and look behind it or lean over it which is odd the first time, but it soon becomes natural.

3. Issues

During my week with the device, I did encounter several issues which I've listed below. Most of these were overcome or a result of the unit still being in development.

3.1 Crashes

I was finding that most applications were crashing a lot, even after just a couple of minutes of running. I managed to narrow this down to my hardware setup, specifically the graphics card SLI setup. Once I removed one of the graphics cards and ran with just a single 980GTX things became much more stable.

The OR does push your hardware much more, and the temperature of my PC did increase significantly as it coped with the demand, so if you're on the limit of cooling, it's one to watch out for.

3.2 Stability

Similar to the crashing, on occasion I'd get very bad flickering in applications, these were mainly vertical and from the reading I did, playing with the VSync settings can help this (and it did), but occasionally on launch you'd get vertical banding which could be sorted by closing and opening the application again.

3.3 SDK Versions

This is completely down to the development cycle, but worth noting. The version of the SDK that I was running was 0.8. This works well under Windows 10. However when they released v0.6 they made massive changes to how the OR works, it no longer duplicates or extends the screens in Windows like a second monitor does, instead it needs native support so that the application recognises the OR.

The result of this is that most applications that were developed pre 0.6 will not work on anything after 0.6 and some of the big showcase applications just don't run which is a shame. You can still download 0.6 and run that to access the older apps (someone has even made a launcher to switch between the two), but 0.6 doesn't work under Windows 10 which my test PC was running and I didn't have the time to rebuild it with Win 7 or 8.

Once the device is released, this issue will be fixed and everyone will be developing to a known standard, but until then Oculus could change it all again and break compatibility in the next version as they find the best way of implementing their system.

3.4 Keyboard and Mouse

When you have the headset on, all you can see is virtual reality, you can't see what is around you. This means that if your application requires you to type or press certain keys, it can be difficult to find them on the keyboard as you can't see (or even find) your keyboard. The same goes for the mouse but to a less degree. For most applications, even those that aren't games, a gamepad style controller is recommended, and on a PC the Microsoft Xbox wireless controller is perfect as it runs natively.

Other technologies that are Augmented Reality or Blended Reality like Google Glass or Hololens don't suffer from this, but it's a different use case. Augmented or Blended reality isn't capable with the Rift.

3.5 Cables

As mentioned previously, the device uses a bunch of cables connecting everything together. Although the umbilical cord from the PC to the headset is quite long to allow you to roam, it does get in the way, and when seated you have to be careful not to run over it with your chair. No doubt in time a wireless high bandwidth version will come, but then that will add batteries which is more weight so it's not an easy fix.

3.6 Motion Sickness

Motion sickness is the bug bear of virtual reality and most people who I showed the device to suffered it to some degree. The concept behind motion sickness is that if your movements are different to what your eyes see then your body assumes that it's been poisoned and tries to make you be sick.

I found that if the application was laggy then the sickness was worse, or if you were not in control of your movements. If it was a demo that allowed you to walk around physically or via the keyboard then it wasn't too bad.

I think as applications are optimised and performance increases this will help reduce sickness, but it's going to effect some people more than others. Personally I could feel the sickness coming and just stop and I'd be fine, but for one person, the sickness came on very suddenly and they looked physically ill.

However early first person games such as Doom also had an issue with motion sickness, yet people adapted and the technology improved and the industry centred around games such as Call of Duty is more lucrative than the movie industry.

4. Possible Uses

As previously mentioned, most applications out there are gaming or entertainment focused or simple demos of what is possible. However, it's clear that there are many use cases outside of entertainment where VR could be used in academia.

Collaboration would be possible linking many OR users together in a sort of WebEx or virtual meeting room. You'd be able to see other attendees, who is speaking, as well as being able to see content both in terms of slides or products in the room.

Teaching could involve 3d environments such as Geology students studying formations or riverbeds. I recall one course in Public Health used the Second Life virtual world to teach health and safety assessments with a number of hazards, interviews with staff and documentation all simulated. This would be all the more beneficial in a VR space.

Pre-lab simulations or tutorials could be created. Currently instruction on using instruments is done on the actual machines which ties up valuable time. As part of the CTL project, some simulations for instruments are created so that students can simulate and get used to using the machines prior to arriving at the lab so that they are already familiar. This could be either interactive or a 360 degree video.

Museum or other attractions could have VR elements. The Lapworth museum which is currently going through a multi-million pound refit could not only have a virtual museum created, but you could create interactivity too. Imagine for instance while touring the museum, you clicked on the Tyrannosaurus's skull and you were teleported to the Cretaceous period and could see a virtual T-Rex.

For research there are lots of ideas, and the OR is already in use in Psychology by some senior staff. But more off the wall ideas such as linking the OR to an exercise bike. Instead of sitting spinning the bike looking at the wall, your bike speed could be translated into cycling through a VR world making the experience more interesting or having visible goals or races, therefore making exercise more fun and sustainable.

In medicine, VR is already active in simulating surgeries or for a better way of visualising MRI scans instead of trying to view the 3d image in a 2d medium. There is already software out there doing this but it's in its infancy.



Surgeon filming operation using Oculus camera



View from Oculus rift user perspective

There are endless possibilities that I'm sure the minds of our academic colleagues could imagine once they're introduced to the technology.

5. Development

I'll start this section by saying that I am not a developer but I have dabbled with various 3d engines and packages in the past.

Most of the common 3d engines and middleware support the Oculus Rift. Sensibly what works on the OR mostly works on the Samsung Gear VR headset also (also due to hit the market shortly) which will reduce development overheads. A lot of the demos and applications I used were developed either in the Unreal Engine or Unity, although there were plenty of other examples such as the CryEngine.

Most 3d engines are developed for the entertainment industry and as these need to have VR support the support is there.

I have done some very basic test work which I plan to build on in the coming months using the Unreal Engine so that a proof of concept that is more academic focused could be created.

6. Conclusion

The Oculus Rift is an impressive device. It definitely needs a release model with a higher resolution display and some bugs ironing out, but the potential is there.

There are clear uses in our environment where the technology could be beneficial across teaching, research, recruitment and our arts.

I believe motion sickness will be the biggest hurdle for the technology to overcome which hopefully will be addressed as the technology improves.

It will be interesting to see if VR wins over augmented reality or blended reality as there is some cross over, but ultimately they do have different unique selling points.