Virtual Reality

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Virtual Reality

Virtual Reality, much like all of computer graphics, is an ILLUSION.

Presence

   -a term used for a convincing VR Illusion

http://en.wikipedia.org/wiki/Immersion_%28virtual_reality%29#Presence

Virtual Reality

The goal of most virtual reality applications is to achieve a sort of Presence

-Allow the user to forget they are using a computer!

Virtual Reality

Unlike most of computer graphics, getting the illusions right in "VR" generally involves more of the human perceptual system

-Input Latency on head motion is
                VERY NOTICABLE

Things to know

1) Latency, Latency, Latency
2) Resolution, Resolution, Antialiasing
3) Beware Judder
4) Usability
5) Its not just the Oculus Rift anymore
6) Some links

Latency, Latency, Latency

-This is probably the most important thing to get right.

-Not talking about network latency

-Two relevant kinds

Two Kinds of Latency

-Input Latency

   -perceptual, how long to respond to input

-Frame Latency

   -all about performance

Input Latency

-Input Latency

   -caused by how long it takes between when a user does something (moves head, presses a key), and their eye registers a response to the input

-Can be reduced a lot

Frame Latency

- A couple of causes
    - Software - Time to render scene
    - Software - Double/Triple Buffering
    - Hardware - Wait till vblank
    - Hardware - display renders image
- **Can't reduce to zero, even if your render loop takes 0 ms!**

Kinds of Latency

-Its important to reduce both types for VR.

-Don't think 30FPS will suffice.

-Even a few milliseconds of difference can be important

Kinds of Latency

-However, input latency is generally more important for VR

    -Especially for user motions!

Kinds of Latency

-Example: Triple Buffering

   -good for GPU performance

   -terrible for input latency

-DONT USE IT!

Reducing Latency

-Use less expensive rendering

    -cheaper shaders

    -will provide a better user experience

-Raise system requirements

-"Time Warp" approach

https://www.oculus.com/blog/asynchronous-timewarp/

Resolution, Resolution, Antialiasing

Resolution is extremely important to quality visuals on the rift!

-constant tension between resolution and performance

Why Resolution?

-Head Mounted Display is maybe inches from the user's eyes, with fancy lenses that make things look bigger so even "retina" pixels

Improving Resolution

-Need to render to a larger-than-target hardware resolution render target to avoid pixelation because of how the distortion works

Improving Resolution

Additional Antialiasing is also recommended -take a look into MSAA etc.

Improving Resolution

Remember though! Input latency will generally hurt "presence" more than a low resolution!

Beware Judder!

So, you have a nice fast, high-resolution app, your done right?

WRONG.

Beware Judder

Sudenly, you notice your graphics look weird when you turn your head too fast!

Congratulations! You have judder!

Beware Judder

-Its a complex subject.

-Generally reducing latency helps, but even 120Hz won't be fast enough for all cases

-Important to understand exactly what image the eye is seeing and when

Beware Judder

-Its a complex subject.

-Display persistence can also be an issue

-Eye motion can cause issues

-Lots of other causes

-Judder is still an active research topic

http://blogs.valvesoftware.com/abrash/why-virtual-isnt-real-to-your-brain-judder/

Usability

A lot of things are much harder to do for a user in VR

-Walking around safely

-Finding peripherals, unless they're already next to their hands

Usability

A lot of things feel "wrong" in VR

-zero distance UI

   -render on a virtual plane a meter or two from the player

Usability

Head-Tracking and positional tracking provide some interesting, potentially more natural ways to interact with the world
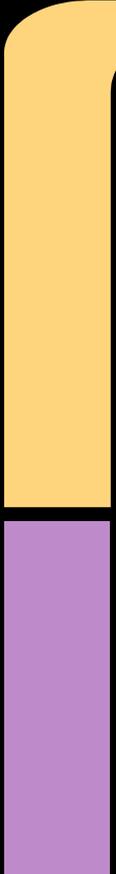
-like looking "at" things

-Don't overdo it!

-(Anyone remember the wiimotes in Twilight Princess?)

Usability

We'll have some examples of this later in the class

Not Just the Oculus Rift anymore

Recently, a lot of additional players have emerged on the VR scene

-Project Morpheus (Sony's PS4 HMD)

-Valve's VIVE (for Steam - releases in Dec.)

-Google Cardboard

-Razor and OSVR, also many others

Some Links

http://www.roadtovr.com/

-good general vr news source

https://developer.oculus.com/

-download Oculus software

-also check out the documents!

Some Links

http://blogs.valvesoftware.com/abrash/

-lots of cool research

https://www.oculus.com/blog/

-lots of stuff, often a bit oculus-centric though

Questions?

Don't you like L.C.A.R.S.?

(Library Computer Access and Retrieval System)