Examining the latest resurgence of interest of Virtual Reality

Dr. Andrew Ray – Radford University

Outline

- History

- Current trends

- What hasn't changed

- What it means for researchers and end users

History

- Long history dating back to the 60s (Sword of Damocles)

- Commercial ventures starting the in the late 80s / early 90s
  - CAVE in 1992

- Generally high cost / low quality (compared to today)

- Heavy interest
  - ABC evening news segment in 1991 (quoting 50-200k price tag) -> 90k to 359k
    - Updating kitchen layout, Medical uses, Games, Military
    - Clearly stated limitations
  - Arcade experiences

- Never took off at the consumer level
  - Virtual boy

History

- Hype
  - Publications, books, advertisement, TV spots, even a major movie

- No "killer app" found
  - PCs had Spreadsheets
  - "It was remarkably crude, but the promise was pretty amazing" – Ben Delaney

- Reality
  - Too limited
  - Too expensive (consumer grade was $1800 just for the hardware. Computer + Software…)
  - Too uncomfortable (heavy / not ergonomically designed)

History

- Mid 90s to 2012 was a lull in terms of consumer products
  - Small community but kept the seeds of VR alive

- Lower profile but consistent usage amongst different industries
  - Benefits of immersion needed to be validated
  - Military (Training)
  - Academia (Interaction, graphics, haptics, many more)
  - Industry (Oil exploration, flight simulators)

- Required non-trivial but not outlandish investment for a system
  - 100,000 to a million

- Has had niche success in research / industry
  - Visbox
  - Mechdyne

History

- Technology kept improving in the 2000s
  - Graphics capabilities (games)
  - Sensors (phones)
  - Screens (phones)

- Cost to produce hardware was gradually decreasing
  - Still outside of consumer reach

- Research kept improving
  - Groundwork for successful hardware, software improvements
  - UI lessons
  - Researching VRs effectiveness in different areas (Mining engineering, Construction, Health Care, etc…)
  - Justification / analysis of benefit of immersion

Current Trends

- Resurgence centered around head mounted displays
  - Kickstarter in 2012
    - 2.4 million dollars to bring the Oculus rift to life
    - 2 billion dollar buyout from Facebook (Hype or reality?)
  - Oculus Rift, Sony VR, HTC Vive available in 2016
  - Smaller manufacturers as well

- Focus is on entertainment (games)
  - Estimated 1.7 milllion sales amongst top 3 in 2016, 2.5-3 estimated in 2017 (compared to 53 million PS4s sold)
  - Since 2015 less than 20 games have a million+ sales (steam)
  - Median time spent in game is 2.3 hours (2 exceptions with > 10 hours median usage)
  - Popular non-VR games range in 4-80 hour median time played
  - Price (during a sale $51 to free) vs ($143 to free non-VR)

- Content available
  - 750 on SteamVR, 750+ on Rift store

- Founder of Oculus believes it will be 5-10 years before VR meets expectations…

Current Trends

- Has a measurable impact on VR Research
  - IEEE VR 2017 paper analysis (6 CAVE, 32 HMD; 23 non display papers)
  - Wide range of topics
    - Usage (Ethical use on children, cinematic experience)
    - Navigation / Interaction
    - Stereo / tracking

- Requirements to do VR research / development today
  - $350 Oculus Rift (Display, tracking, and interaction)
  - $680 PC
  - Roughly $1100
  - An idea and time to work on it

Factors in success

- Fidelity
  - What can be reliably done at 263x230 resolution (1995) [Original Eye-Phone] ?
  - Current HMDs are 2160x1200 (90 hz refresh rate)

- Interactivity
  - Rotational and 3 buttons in 1995
  - Rotational, positional and *5* buttons per hand 2017

- Cost
  - Consumer level HMD equivalent to $1800
  - Started at $800, down to $350 in 2017

- Content and creation
  - 1500+ games / experiences
  - 2 major game engines with HMD / CAVE support

Current direction

- Virtual Desktop Interfaces
  - Basic interface borrowed from academic publications

Software development

- C++ support
  - Windows only

- Guidelines on how to integrate with existing projects

- Guide on how to best create VEs (lessons learned from academia)

- Web options
  - ReactVR
    - Virtual reality and javascript (three.js)
  - A-Frame
  - X3D
  - WebAssembly

What hasn't changed

- HMDs are just a display
  - Simple to code for and display in multiple operating systems

- Tracking software capability
  - Essentially Windows only development platform for official support
  - Linux is being slowly embraced by Vive
  - Oculus not providing official support
  - OpenHMD and SteamVR providing

- Software tools available for creation
  - Sample programs do not use VR Toolkits, they are all in one applications
  - Support for drivers in a non-Windows environment is problematic
  - Only 62 Linux VR games available vs 600+ on Windows

What hasn't changed

- Needs of researchers still not addressed
  - Application Creation for an Immersive Virtual Measurement and Analysis Laboratory in 2016
  - Everyone creates their own tools (part of dissertation work in 2008)

- Existing VR software projects stagnated
  - VR Juggler, DIVERSE, VRUI, etc…
    - Some success at spreading beyond original creators
    - Long term questionable
  - Next generation never went beyond creators / research stage
    - 3DUI Tools (Viargo, Chasm, InTml , IFFI)

What it means for you

- Hardware is better than ever
  - HMDs are cheaper than ever before
  - Larger than HMD displays roughly unchanged

- Hardware driver support
  - Not as robust as desired
  - Generally windows based, some hope of 1st party Linux support

- Software support
  - Sample applications are pre-VR Toolkit level applications
  - Prepare to build everything from the ground up
  - Lock-in is an issue (Oculus rift)

Future

- Industry is building great hardware, making attempts at software
  - Focus is on consumer usage
  - Developers essentially given a game engine
  - Web is the focus for hobbyist development

- Performance benchmarking needed between traditional VR / Web based VR
  - Web assembly may be a game changer

- Survey of VR researchers / users into their development requirements

- Standardized toolkit supported by industry

- Standardized interaction library supported by industry