



Aalto University

# Comparison of Real-Time Anti-Aliasing Methods on a Head-Mounted Display

Paula Jukarainen

Master's thesis presentation

[paula.jukarainen@aalto.fi](mailto:paula.jukarainen@aalto.fi)

October 4, 2016

# Background



a UL company

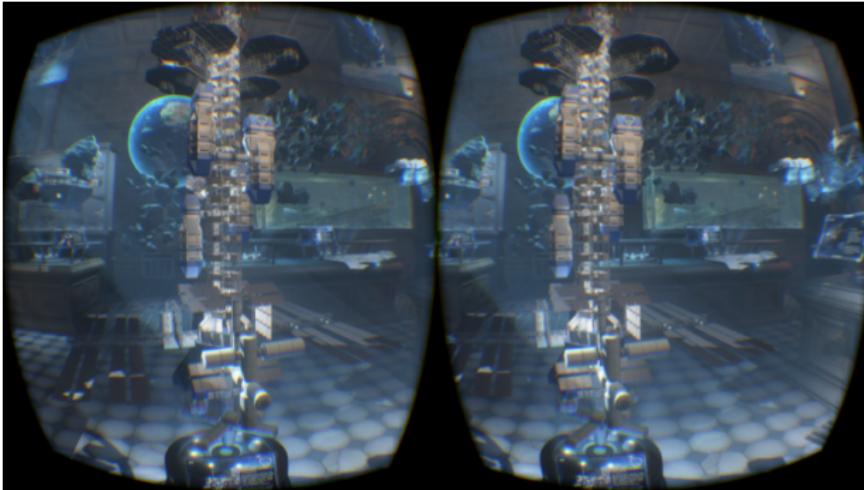
- ▶ Benchmarking company, Espoo
- ▶ Soon to-be-released virtual reality benchmarking software, VRMark
- ▶ Supervisor: Jaakko Lehtinen
- ▶ Advisor: Juha Sjöholm

# Virtual Reality (VR) & Head-Mounted Displays (HMD)



- ▶ The magical feeling of *presence*
- ▶ 90Hz display with wide-angle optics

# Challenges



- ▶ Twice the rendering work
- ▶ Double the FPS
- ▶ Stereoscopy

# Aliasing

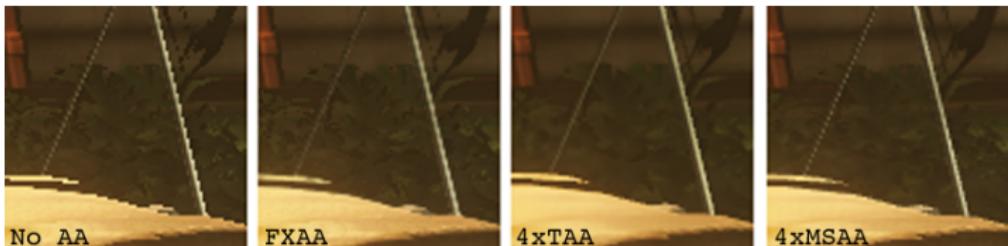


# Anti-Aliasing (AA)



- ▶ Prevent or reduce aliasing pattern
- ▶ Grow spatial (or/and temporal) resolution
- ▶ Find aliasing patterns and manipulate

# Anti-Aliasing Methods



- ▶ Multisample anti-aliasing (MSAA)
  - ▶ Increased resolution in a smart way
  - ▶ Gold standard for VR
- ▶ Fast-approximate anti-aliasing (FXAA)
  - ▶ Analyze shapes and manipulate
  - ▶ Popular and cheap
- ▶ Temporal anti-aliasing (TAA)
  - ▶ Use previous frames and blend
- ▶ Quality comes with a price

# Goals

- ▶ Understand how different AA methods affect visual quality and fatigue on VR
- ▶ Consider possible alternative for MSAA

# Performance Test



- ▶ Measure FPS
- ▶ Compare against performance without anti-aliasing

# Subjective Image Quality Test

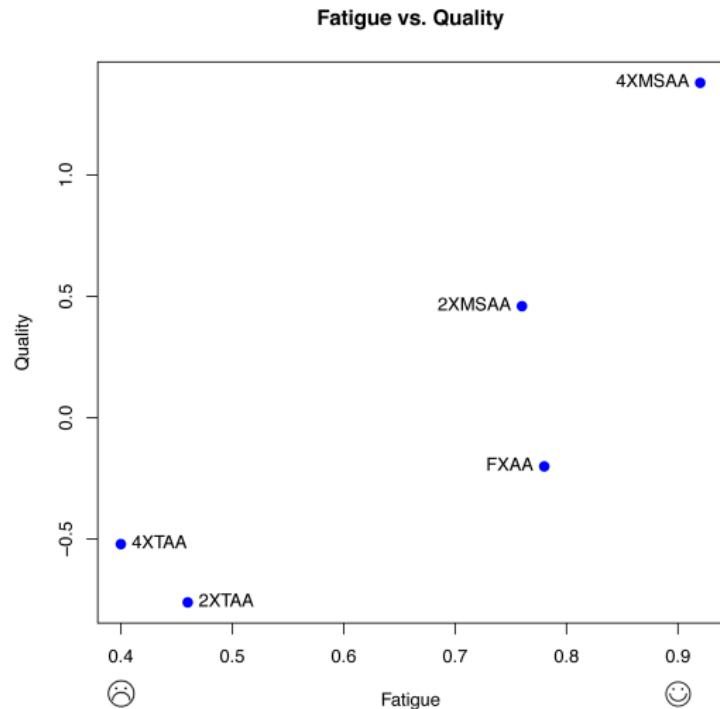


- ▶ Visual quality and fatigue assessment
- ▶ Stimuli: FXAA, 2xTAA, 4xTAA, 2xMSAA, 4xMSAA
- ▶ 26 participants with normal near-vision and stereo acuity
- ▶ Background information: age and previous experience of VR HMDs

# Results

## AA Method    FPS

No AA	135
FXAA	127
2xTAA	121
4xTAA	121
8xTAA	121
2xMSAA	106
4xMSAA	79
8xMSAA	52



# Summary

- ▶ Performance test: FXAA the fastest, MSAA the slowest
- ▶ Subjective test: MSAA was superior compared to others
- ▶ Comfort and quality should be top priority, performance is not everything
- ▶ Future: Develop faster MSAA
- ▶ New questions to be answered!
  - ▶ What are the features that contribute to quality or fatigue?
  - ▶ What is the relation between stereo acuity and quality or fatigue?