NOKIA Bell Labs

Project Vertigo

Monitoring sickness and discomfort in high-motion 360 video

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Project Vertigo

Monitoring sickness and discomfort in high-movement 360 video

- Targeting high-motion 360VR video
  - Live streaming
  - Video communications
  - First-person POV experience
- Need to measure sickness
  - *Cybersickness* effects [1]
  - Partially detectable via biological signals [2]
  - More aggressive than 3D discomfort
- Project goals
  1. Set up subjective assessment lab
  2. Reduce high-sickness video
  3. React to user feedback
- We are starting
  - Comments are more than welcome!
  - Engagement with VQEG-IMG.

[1] Barrett, J. (2004). *Side effects of virtual environments: A review of the literature* (No. DSTO-TR-1419). DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION CANBERRA (AUSTRALIA).
[2] C. Nakagawa, "Toward the detection of the onset of virtual reality sickness by autonomic indices," *2015 IEEE 4th Global Conference on Consumer Electronics (GCCE)*, Osaka, 2015, pp. 662-663.

Test definition

Target: validate some intuitions and kick-off test methodology

- High-movement vs low-movement 360 videos
  - PVS -> add some fixed visual cues (windows, bars, fixed elements).
- *Vertigo* scale:
  - Based on visual discomfort scale (ITU-R BT.2021)
  - Incorporating explicit tolerability information

VERTIGO SCALE		
5	No problem	No perceptible effect, natural feeling
4	Light effects	Slight discomfort, but no sickness
3	Uncomfortable	Moderate discomfort, but tolerable for a while
2	Unpleasant	Strong discomfort or sickness, but able to complete the playout
1	Unbearable	Severe discomfort or sickness, and want to terminate the playout immediately

Test description

Target: validate some intuitions and kick-off test methodology

- 22 test subjects
  - 17 male / 5 female, age 28-55
  - Technical background
- 2 video sequences (30s each)
  - High movement: cellar visit
  - Low movement: metro lightweight rail stop
- 4 PVS
  - Original sequence
  - Fixed-position logos
  - Fixed-position circular windows
  - Fixed-position horizontal & vertical bars

Video sequences (1/6)

Original sequences: Wine Cellar (high motion, hand-held camera)

Video sequences (2/6)

Original sequences: Metro Lightweight Rail (low motion, fixed camera)

Video sequences (3/6)
Adding logos in fixed positions

Video sequences (4/6)
Overlay of jail-like bars

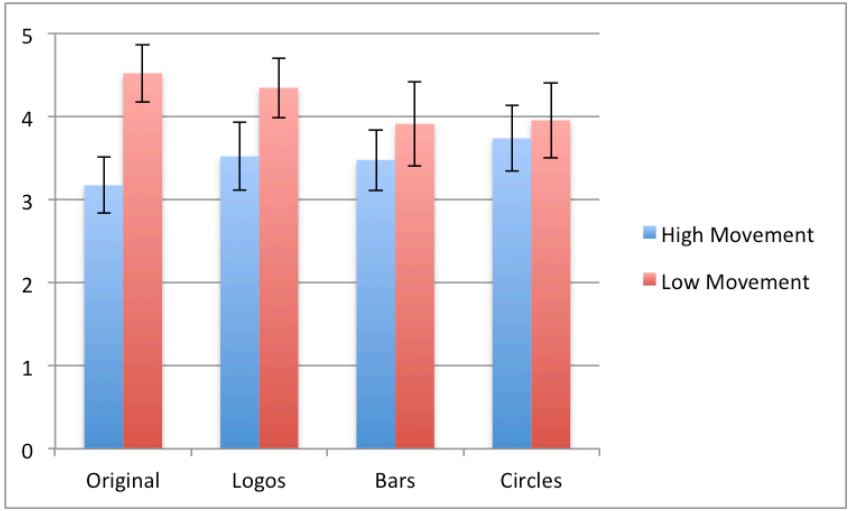
Video sequences (5/6)
Overlay of circular windows

Video sequences (6/6)
Links to Vimeo

- Wine cellar
  - https://vimeo.com/214983643
  - https://vimeo.com/214983686
  - https://vimeo.com/214983723
  - https://vimeo.com/214983761
- Metro Light Railway
  - https://vimeo.com/214983803
  - https://vimeo.com/214983843
  - https://vimeo.com/214983898
  - https://vimeo.com/214983934

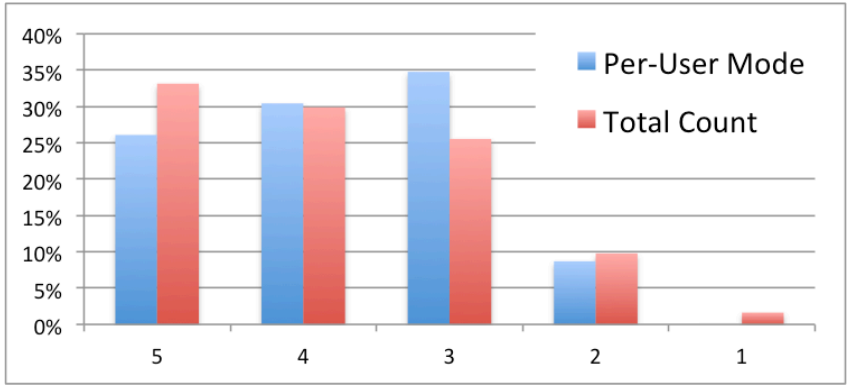
Test results
Preliminary conclusions (1/2)

- Unprocessed high-movement video is significantly aggressive.
- Sickness can be mitigated by introducing fixed visual references…
- …but those references have strong impact on experience by themselves
  - Some subjects reported “claustrophobic” sensations and general discomfort.



Test results
Preliminary conclusions (2/2)

- Variability between users
  - Global comfort across sequences
    - ~10% of users do not tolerate VR video at all (vote 1-2 for most sequences)
    - ~25% of users are unaffected by high-motion (vote 5 for most sequences).
  - Individual feedback about what they consider uncomfortable
  - Gaze pattern and strategies
- Post-experience SSQ
  - Light to moderate effects (dizziness, headache)



But we are just starting!
Next steps

1. Improve subjective assessment methodology
   - Collaboration with IMG initiatives
2. Improve video experience for high-movement video
   - Software-based stabilization
   - Less intrusive visual helpers (when required)
3. Monitor and predict user discomfort, based on
   - Global video motion (+ disparity)
   - User reactions (head motion analysis)
   - Bio-feedback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