



POLITÉCNICA

360VR User Behavior

Narciso García

Grupo de Tratamiento de Imágenes (GTI)

Universidad Politécnica de Madrid (UPM)



Presentation scheme



POLITÉCNICA

- Motivation
- Preliminary evaluation
- Test consideration
- Testing procedure
- Some results
- Conclusions

- 360VR cinematic stereoscopic streaming system

DASH VoD Streaming
Server



VR Content

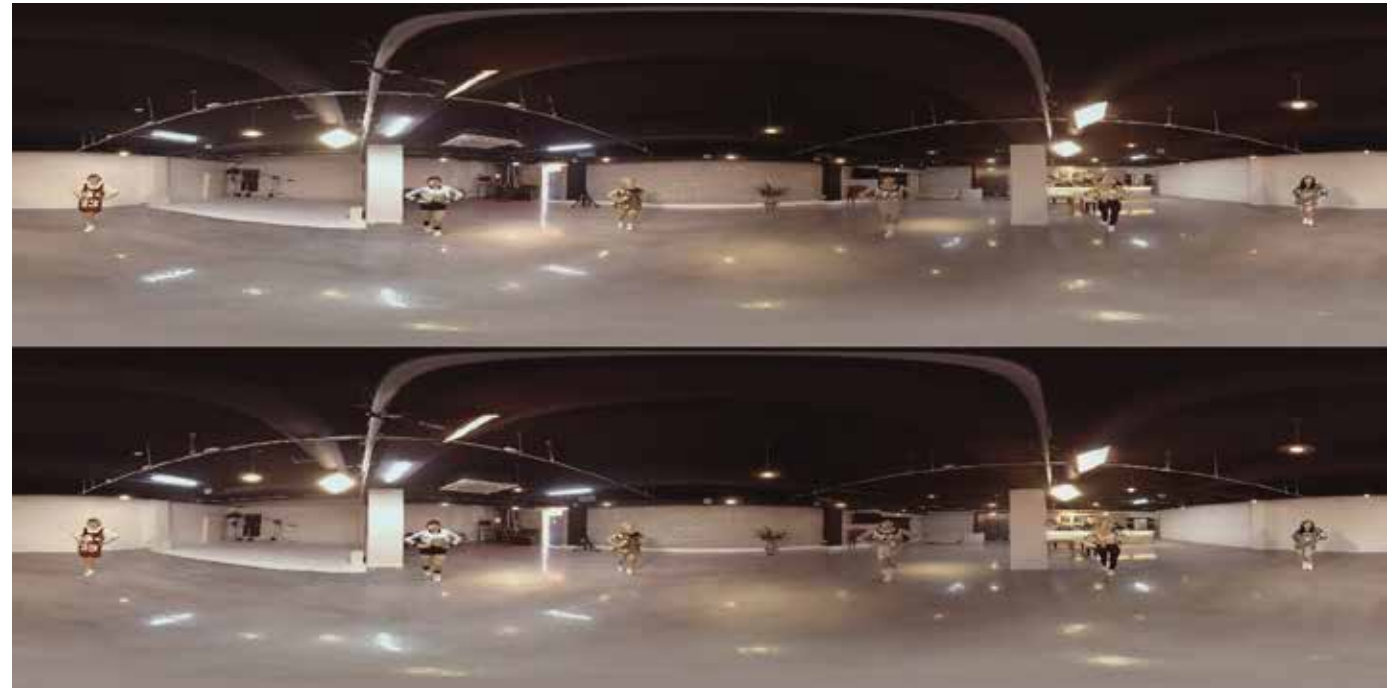


- Adaptive streaming over HTTP delivery

- Standard
MPEG
360VR
content

2048

4096



- Analysis of the minimum requirements in terms of encoding quality.
- Estimation of possible bandwidth savings by using Spatial Relationship Description (SRD).



Preliminary system evaluation



- Experiments with several users watching 360VR video
 - Users **decided freely** on the use of the VR device
 - Different choices: **seated, standing, walking, ...**
 - Unfeasibility of a formal statistical analysis
- Qualitative preliminary conclusions:
 - Unexpected appearance of **lower bitrate** representations
disturbance of the user stability -> dizziness
 - **Minimum** bitrate for quality acceptance: **5 Mbps**
 - **No** significant **difference** over **15 Mbs**
- Need for user behavior characterization for DASH Spatial Relationship Description operation (region setting and chunk length) --> view direction, movement speed, ...



Test considerations



POLITÉCNICA

- Classical audiovisual consumption and, therefore, QoE assessment:
 - Seated subject looking at a fixed screen from a pre-set distance
 - Content narrative governing user attention
 - Audio (very) important for user opinion score
- Immersive systems enhance user experience, but:
 - Narrative not longer governing user behavior
 - Audio essential for user engagement
 - Minimum content duration should be over one minute
 - Should we look for **opinion score** or for **engagement score**?



Looking for realistic environments



POLITÉCNICA





Considered options



POLITÉCNICA

- Few available documentation
- VQEG_IMG_2016_116: Test Plan for Subjective Assessment of VR Video Quality
... but, neither the head, nor the viewport could be fixed
- Many free parameters avoid clear conclusions
- Therefore, a simplified testing environment was considered:
 - Audio and video immersion
 - Swivel chair
so, 360° rotation plus translation ... but no dizziness or vertigo
 - 3DoF head movement
 - 90 seconds clips

Subject positions (swivel chair)





Testing procedure for user behavior



POLITÉCNICA

- Initial tests not requiring user feedback
- Subject screening
 - Persons not involved in previous QoE assessments and new or quite new to 360VR video
 - Visual acuity
- Instructions to subjects
 - Behave as you wish!
- Audiovisual experience
 - Initial video for device adjustment (comment)
 - Omnidirectional content
 - Oriented content



Tracking results: omnidirectional content



POLITÉCNICA

- Omnidirectional content: classical music concert
- 100 second duration clip
- Google azimuth and elevation angle tracking (60 times/sec)



- Outcomes: set of (approximate) fixation positions, covered area, overall length, movement speed, ...





Conclusions



POLITÉCNICA

- User satisfaction and engagement
- Large variability of user behavior results
- Useful results for adaptive streaming delivery
- Interesting results for QoE system assessment
- Not so clear results for specific QoE analysis
- Warning: need for goggle re-adjustment for every subject and lens cleaning between subjects

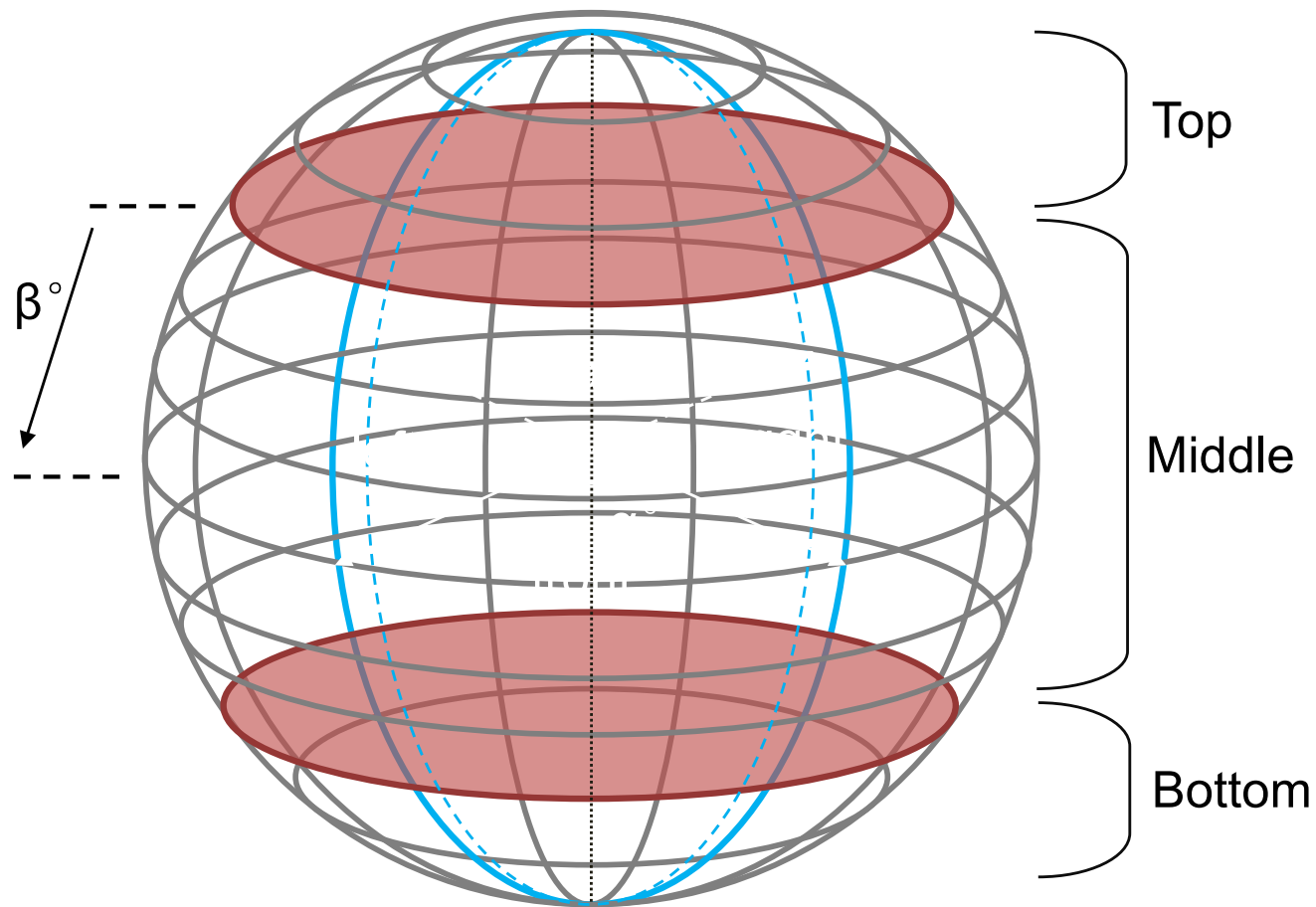


Some “clear” conclusions



POLITÉCNICA

- Users usually aim at the middle section





Finally, ... do not forget!

