

# Update on IEEE standardisation activities on Human Factors for Visual Experience

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# Human Factors for Visual Experience (HFVE)

Chair: Prof Maria Martini, Kingston University London

co-Chair: Prof Patrick Le Callet, University of Nantes

The group focuses on the coordination of VQEG activities in liaison with the IEEE Standards Association Working Groups on HFVE, especially on the following items:

- **Deep Learning-Based Assessment of Visual Experience Based on Human Factors – chaired by Prof Sanghoon Lee, Yonsei University, draft submitted**
- **Quality assessment of light-field imaging contents based on human factors – chaired by myself, expected draft submission end of the month**
- Perceptual Quality Assessment of Three Dimensional (3D), Ultra High Definition (UHD) and High Dynamic Range (HDR) Contents
- Quality of experience assessment for VR and MR based on human factors

Examples activities:

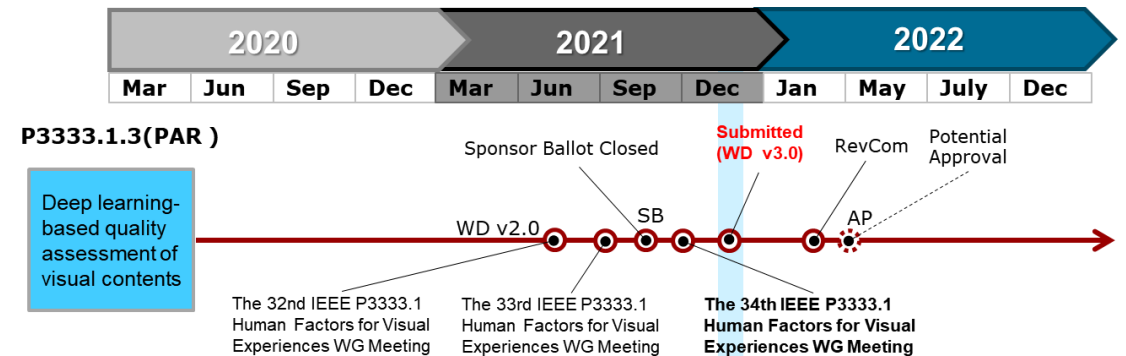
- Co-located meetings
- Contributions from VQEG members to IEEE Standards on HFVE
- Updates on the status of the standards in VQEG meetings.

## IEEE P3333.1.3

### Standard for the Deep Learning-Based Assessment of Visual Experience Based on Human Factors

Chair: Prof Sanghoon Lee, Yonsei University

- Current draft standard defines and covers
  - Deep-learning based metrics of content analysis
  - QoE assessment for visual/immersive contents
  - Quality assessment of visual contents
  - Cybersickness assessment of visual contents
  - A database of immersive contents
- Currently submitted to RevCom (IEEE Standards Review Committee) for final approval
  - Expected date of final approval as a standard: **Feb 2022**
- New VR database is released online
  - VR-SP (VR Sickness & Presence), VR-SP 360 / VR-SP RT Database (360 VR and Ray-Traced VR)



# IEEE P3333.1.4

## Standard for the Quality Assessment of Light Field Imaging

Chair: Prof Maria Martini, Kingston University London

- Scope

This standard establishes methods of quality assessment of Light Field visualization based on psychophysical studies. This standard also defines metrics for the quality assessment and establishes criteria for subjective assessment of Light Field imaging, including human factors and judgments, and identifies and quantifies quality degradation including the impact of visual contents, camera settings, compression distortion, interpolation distortion by intermediate view rendering, and structural distortion. The standard addresses a series of visual phenomena that can degrade visualization specifically for Light Field imaging. Visual environment characteristics and viewing conditions are also part of the scope of the standard, including viewing distance, viewer position, viewing freedom, and display characteristics.

- Expected Date of submission of draft to the IEEE SA for Initial Standards Committee Ballot: Dec 2021
- Project Completion Date for Submittal to Review Committee: May 2022

# IEEE P3333.1.4

## Standard for the Quality Assessment of Light Field Imaging

The current draft standard defines and covers:

- 1) Use cases, acquisition, visualisation and content characterisation
- 2) Influencing factors and impairments for the quality of Light Field imaging
- 3) Subjective assessment of Light Field imaging
- 4) Objective assessment of Light Field imaging
- 5) Datasets

# Subjective assessment

## Example: viewing distance

### Rule of thumb for maximum viewing distance based on AR

(AR: angular res, DE: interpupillary distance, Dv: max viewing distance)

$$D_V = \frac{D_E}{\tan(AR)}$$

(also to assess the required angular resolution if the distance is fixed)

### Considerations on viewing distance for different use cases

Kara, P. A., Barsi, A., Tamboli, R. R., Guindy, M., Martini, M. G., Balogh, T., & Simon, A. (2021, June). Recommendations on the viewing distance of light field displays. In *Digital Optical Technologies 2021* (Vol. 11788, p. 117880R). International Society for Optics and Photonics.

Kara, P. A., Tamboli, R. R., Cserkaszkzy, A., Barsi, A., Simon, A., Kusz, A. Bokor L. & Martini, M. G. (2019, December). Objective and subjective assessment of binocular disparity for projection-based light field displays. In *2019 International Conference on 3D Immersion (IC3D)* (pp. 1-8). IEEE.

Kara, P. A., Tamboli, R. R., Cserkaszkzy, A., Martini, M. G., Barsi, A., & Bokor, L. (2018, December). The viewing conditions of light-field video for subjective quality assessment. In *2018 International Conference on 3D Immersion (IC3D)* (pp. 1-8). IEEE.

# Datasets

- Three classes:
  - Content only
  - Task based
  - QoE
- Discussion and recommendation on usage of datasets in different use cases
- Recommendations for new datasets
- Notes:
  - Very limited LF video content available
  - No QoE datasets with video content
  - Only one public QoE dataset with tests on LF display

Tamboli, R. R., B. Appina, S. Channappayya, and S. Jana (2016). Super-multiview content with high angular resolution: 3D quality assessment on horizontal-parallax lightfield display. In *Signal Processing: Image Communication*, vol. 47, pp. 42–55, 2016.

[version with content at highest angular resolution: Tamboli, R. R., Reddy, M. S., Kara, P. A., Martini, M. G., Channappayya, S. S., & Jana, S. (2018, May). A high-angular-resolution turntable data-set for experiments on light field visualization quality. In *2018 Tenth International Conference on Quality of Multimedia Experience (QoMEX)*]

# KU light field video dataset

## Acquisition

Raytrix R8 plenoptic camera



## Content

6 different scenes:  
toy car, statue, spinning top,  
fan, bouncing ball, eye  
Fixed camera, moving camera

## Display

LGF 4K LF display





# Objective assessment

Recommendation on selection of objective metrics per use case

Recommendations for the design of new objective metrics

## Notes:

- Most objective metric designed and tested with datasets visualised on 2D or stereoscopic displays
- Only one objective metric designed and tested with dataset visualised on LF display
- Testing the current objective metrics on datasets with subjective results on LF displays is required
- Recommendation to test new metrics on datasets displayed on LF datasets

# Acknowledgements & next steps

As the first draft standard is closing, thanks to the excellent working group members of the IEEE SA P3333.1.4 WG!

We expect a revision of this standard as technology/research evolves. If you are interested in getting involved in a possible revision, please contact me  
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