Expert viewing and activities in MPEG Visual Quality Assessment

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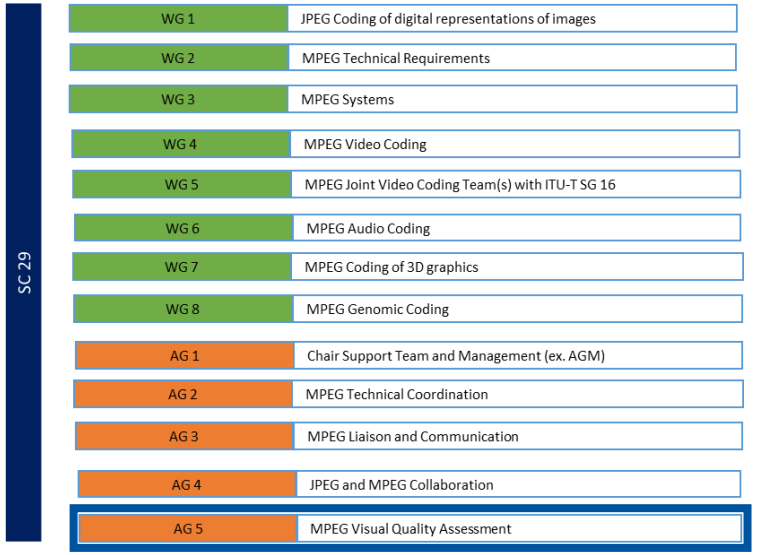
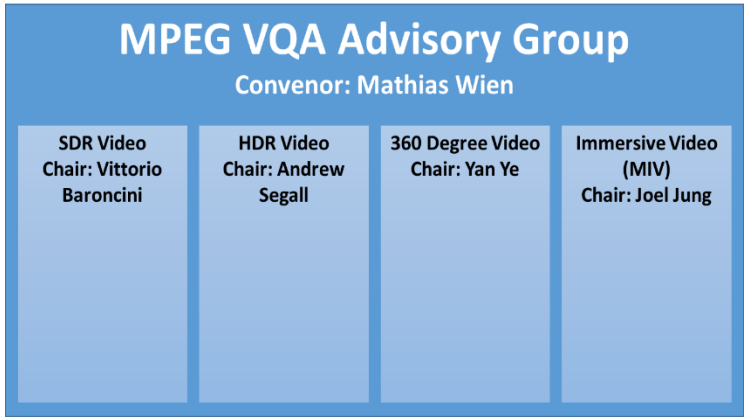
MPEG Visual Quality Assessment (VQA)

- New structure of MPEG since Oct. 2020: Foundation of ISO/IEC JTC 1/SC 29/AG 5 MPEG VQA as one of 10 MPEG groups (WGs and AGs)
- Scope
  - Select and design VQA methodologies and objective quality metrics for the assessment of visual coding technologies
  - Guidance and support on VQA at start of and during standardization projects (e.g. CfE, CfP), and for verification testing
  - Liaison with ITU and other organizations on VQA standards creation and improvement
- 4 Focus Groups: SDR, HDR, 360, Immersive Video
- 2 Ad-Hoc Groups:
  - Learning-based quality metrics
  - Guidelines for subjective visual quality evaluation

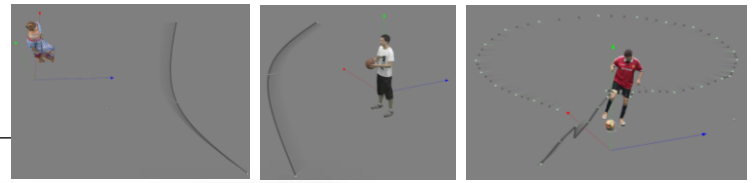




ISO: International Standardization Organization | IEC: International Electrotechnical Commission | JTC1: Joint Technical Committee | MPEG: Moving Pictures Experts Group
SC29: Sub-committee 29 “Coding of Audio, Picture, Multimedia and Hypermedia Information” | AG: Advisory Group | WG: Working Group | CfE: Call for Evidence | CfP: Call for Proposals

VQA: Visual assessment at CfP stage

- Call for Proposals:
  - Evaluation of responses (competitive stage of standardization process)
  - Defined test set, encoding constraints, reporting requirements (algorithm description, objective quality metrics, complexity metrics, …)
  - Formal assessment (two or more laboratories)
    - MOS results
    - Ranking of proposals
- Example: CfP for video based dynamic mesh coding
  - CfP October 2021, evaluated in April 2022, DCR test
  - Collaborative standardization phase since then



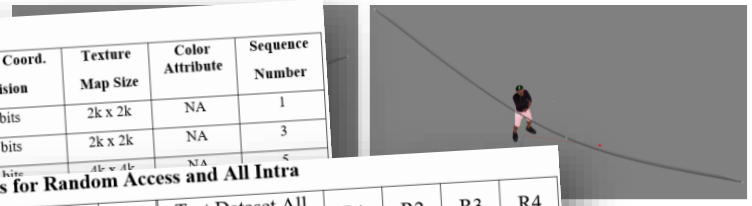
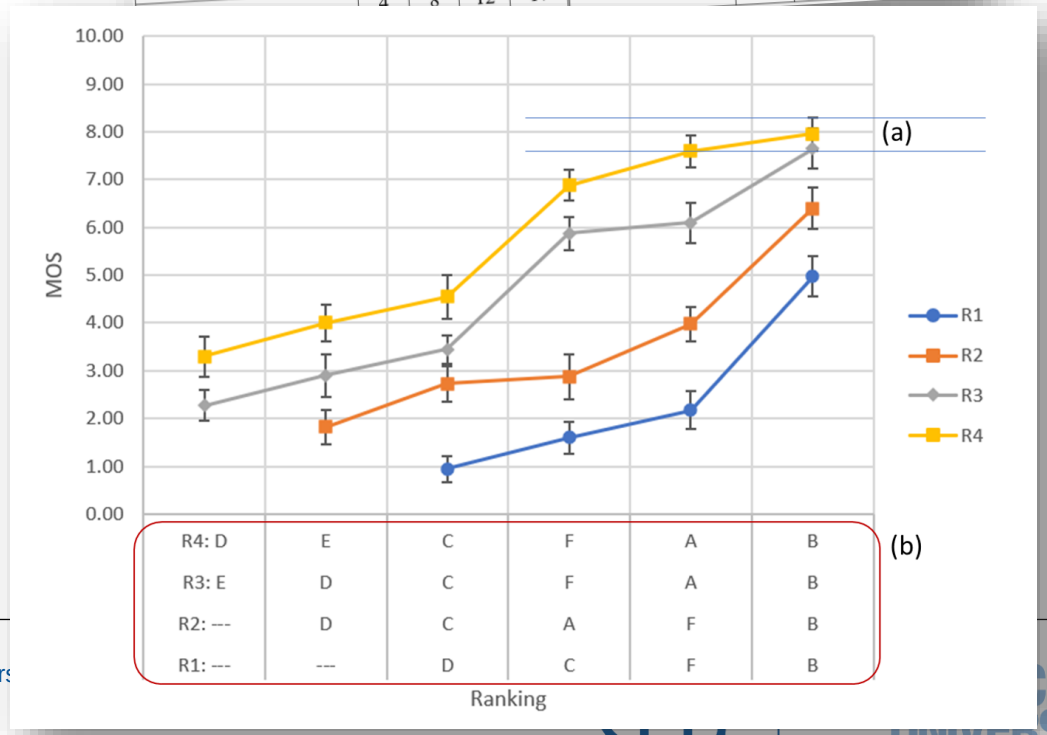


Table 1 Test material datasets

Test material dataset filename	# Frames	# Vertices	# Faces	Geometry Precision	Texture Coord. Precision	Texture Map Size	Color Attribute	Sequence Number
longdress	300	22k	40k	10 bits	12 bits	2k x 2k	NA	1
basketball_player	300	20k	40k	12 bits	12 bits	2k x 2k	NA	3
mitch	300							
football	300							
levi	150							

Table 2 Target bitrates in Mbit/s for Random Access and All Intra

Test Dataset Random Access	R1	R2	R3	R4	Test Dataset All Intra	R1	R2	R3	R4
Longdress	4	8	11	14	Longdress	5	9	12	15
Basketball_player	3	5	10	14	Basketball_player	3	5	10	14
Mitch	3	4	6	8	Mitch	4	6	11	16
Football	4	8	12	17	Football	4	8	12	17
	4	8	12	17	Levi	4	8	12	17



Figures from MPEG doc m59772

MPEG Verification Tests

- MPEG traditionally conducts verification tests for its media coding standards

- **AG5N39: Guidelines for Verification Testing of Visual Media Specifications**
  - Purpose and goals of the verification tests
  - Procedural steps in a verification tests
  - Selection of test material
  - Preparation of bitstreams and rate points
  - Conduction of visual tests
  - Reporting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ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC 1/SC 29/AG 5
MPEG VISUAL QUALITY ASSESSMENT
ISO/IEC JTC 1/SC 29/AG 5 N39
Online – October 2021

Title: Guidelines for Verification Testing of Visual Media Specifications
Source: AG 5 MPEG Visual Quality Assessment
Status: Approved
Serial Number: 20975

1 Introduction

4 Selection of Test Material

5 Preparation of Bitstreams and Rate Points

6 Conduction of Visual Tests

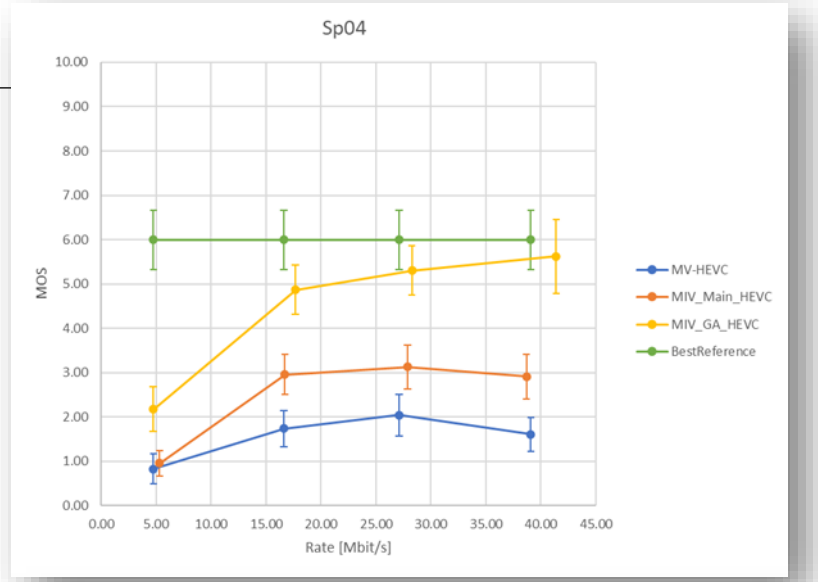
7 Reporting

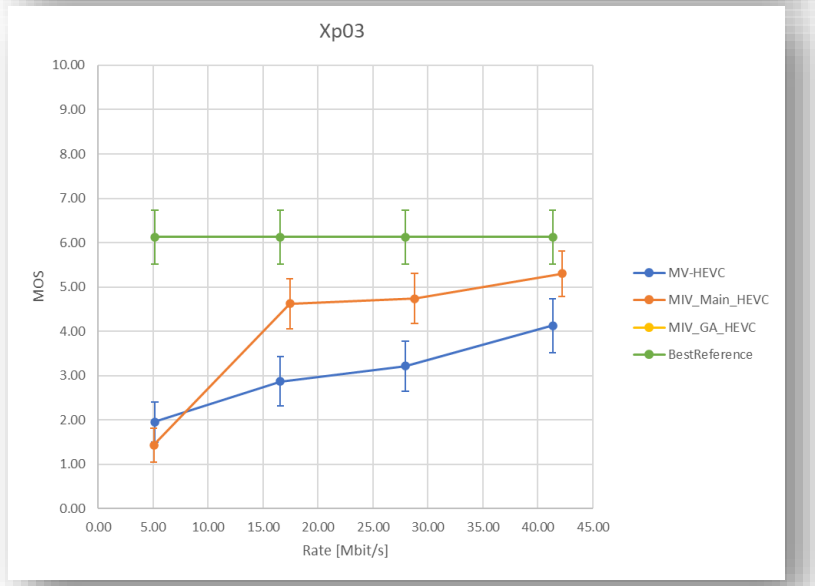
AG5N39: https://www.mpeg.org/wp-content/uploads/mpeg_meetings/136_OnLine/w20975.zip

VQA: Verification Testing Activities

- **Completed verification test activities** (mostly DCR)
  - *MPEG-5 Part 1*: Essential Video Coding (EVC): SDR and HDR. *MPEG-5 Part 2*: Low-Complexity Enhancement Video Coding (LCEVC): AVC, EVC, HEVC, VVC + enhancement layer
  - *MPEG-I Part 3 / ITU-T H.266* Versatile Video Coding (VVC): SDR, HDR, 360° video
  - *MPEG-I Part 4*: V-PCC
  - *MPEG-I Part 12: MPEG Immersive Video* (MIV) (ACR test, example)

- **Emerging activities**
  - Multilayer VVC verification testing
  - Visual evaluation of film gain characteristics SEI message





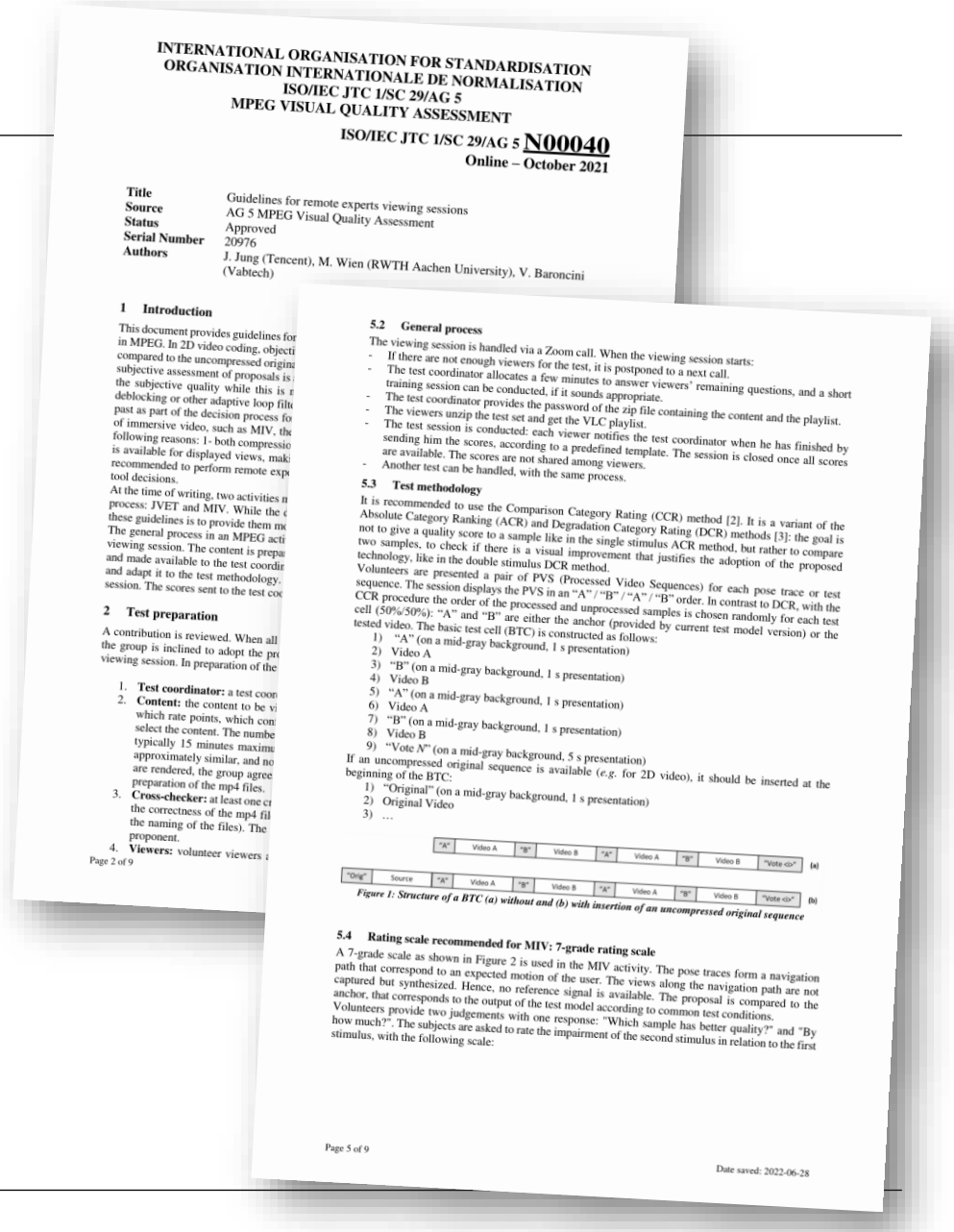
Figures from MPEG document m62279

VQA: Expert viewing and investigations

- **AG5N40: Guidelines for remote expert viewing** (REV)
  - *Remote* testing in focus due to pandemic situation
  - Typically A-B comparisons, 4-grade force choice, 7-grade scale
  - Typically testing test model against variant vs. proposed change

- Investigations on efficient methods for (expert) viewer training
  - Goal: reliable results, good differentiation / ranking of proposals under test
- Investigations on objective metrics

  Goal: recommendation (and potentially development) of metrics suitable for use in decision making process of standardization context (across all types of MPEG visual media)
  - Collecting data bases, studying metrics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MPEG VISUAL QUALITY ASSESSMENT

ISO/IEC JTC 1/SC 29/AG 5 N00040
Online – October 2021

Title: Guidelines for remote experts viewing sessions
Source: AG 5 MPEG Visual Quality Assessment
Status: Approved
Serial Number: 20976
Authors: J. Jung (Tencent), M. Wien (RWTH Aachen University), V. Baroncini (Vabtech)

1 Introduction

2 Test preparation

5.2 General process

5.3 Test methodology

5.4 Rating scale recommended for MIV; 7-grade rating scale

Figure 1: Structure of a BTC (a) without and (b) with insertion of an uncompressed original sequence

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Date saved: 2022-06-28

AG5N40: https://www.mpeg.org/wp-content/uploads/mpeg_meetings/136_OnLine/w20976.zip

VQA: Expert viewing

- **Expert viewing tests often used at JVET / MPEG meetings**
  - Decision making for visually sensitive coding tools (e.g., deblocking / loop filters)
  - Dry-run testing in preparation for CfE / CfP / verification tests
  - Exploration of coding tools (e.g., for JVET EE1/Neural Network-based Video Coding)

- Viewing performed and evaluated on-site at the meeting (or remote, see previous slide)
  - Request for suitable room at meeting
  - Time critical, tests compete with other meeting sessions
  - Use of one or more 65” OLED displays intended
  - Driven by PC with suitable player software

Test setups for expert viewing at JVET meetings in Mainz (top) and Antalya (bot.)

VQA: Expert viewing example JVET-AD0399

- **Expert viewing for the spatial scalability category of the VVC multilayer verification tests, JVET-AD0399**
  - DCR test with 11-grade scale, for comparison of dual layer coding with a downscaled base layer at scaling ratios 1.5 and 2 to single layer coding
  - 4 test sequences (10 sec), 3 rate points (low, mid, high), 3 configurations
  - 42 BTCs (incl. 3 stabilization, 3 trap)

Test Site	**On-site**
Display, size, connection (resolution setting)	Samsung 65” S95B, HDMI (3840×2160), 10bit input
Viewing distance	3 viewers sitting at 1.5H, 2 views standing at 1.6H
Viewing angle	±75°, 90° (at screen center)
Total number of viewers	19 (6 female, 13 male)

Score	**Impairment item**	
10	Imperceptible	
9	Slightly perceptible	somewhere
8		everywhere
7	Perceptible	somewhere
6		everywhere
5	Clearly perceptible	somewhere
4		everywhere
3	Annoying	somewhere
2		everywhere
1	Severely annoying	somewhere
0		everywhere

VQA: Expert viewing example JVET-AD0399

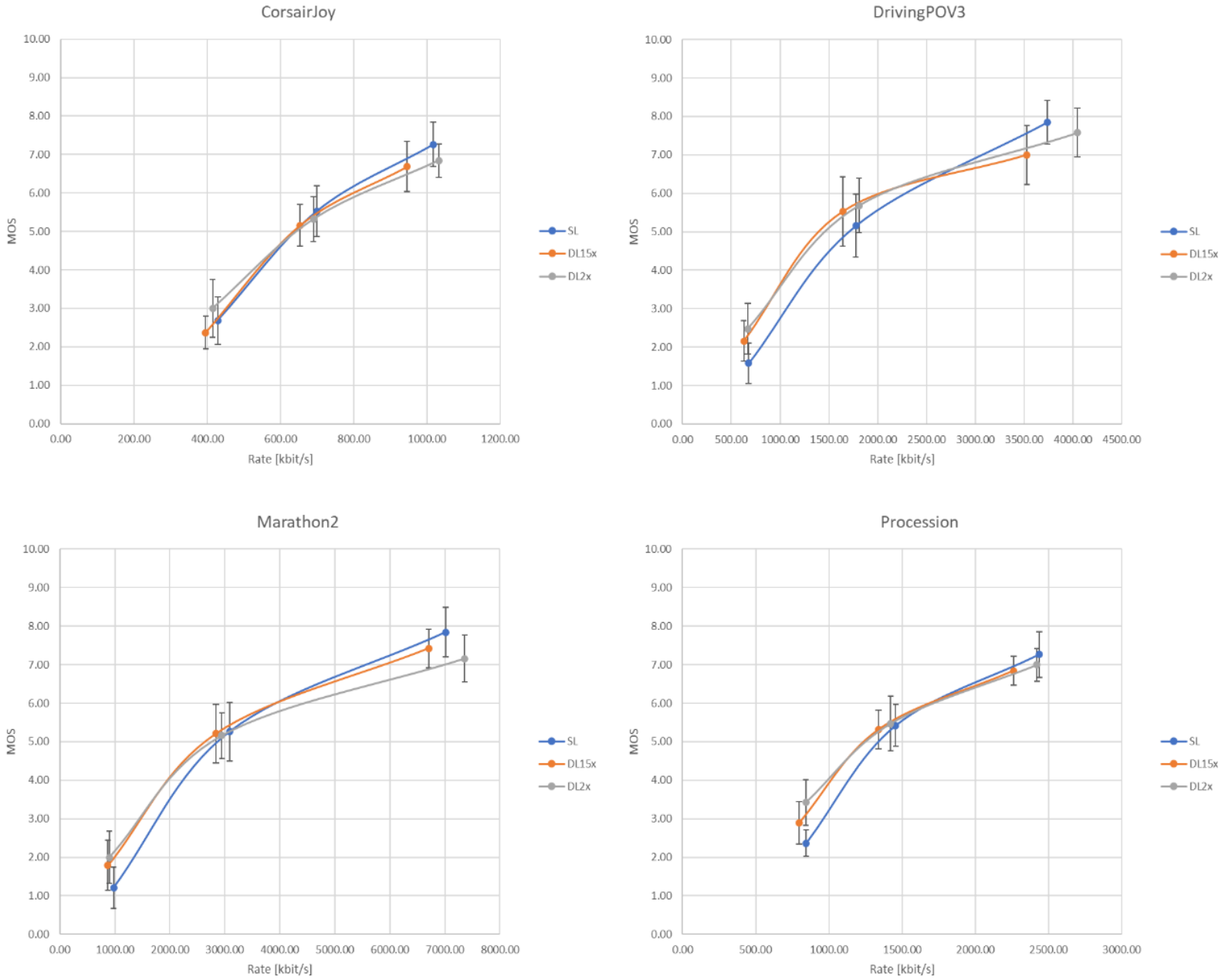
- **Training**
  - Explain procedure and scoring scale.
  - Run training session (6 BTCs, covering examples of the impairment range).
  - Let viewers note their scores.
  - Let them read out their scores. If variation is larger than 3 on the grading scale, re-run BTC
    - Viewers shall reconsider their scoring for that sequence (not enforced to change their mind)
    - No indications where to look allowed, viewers have to make it up by themselves

- **Data processing**
  - No failure on trapping sequences observed
  - Single (clear) outlier value removed

VQA: Results in JVET-AD0399

- **Plots**: MOS values with ±95% confidence intervals
- Results used for finalizing impairment range for tested rate points

- **Observation**
  - Expert viewing session often show relatively large confidence intervals
  - Applied training method seems to lead to more consistent use of grading scale by experts
  - Further study intended



Summary, Conclusions, Outlook

- **Overview of ISO/IEC JTC 1/SC 29/AG 5 MPEG VQA**
  - Tasks along the development cycle of visual media specifications
  - Key contribution in CfE / CfP process, verification tests
  - Support for Working Groups in standardization process

- **Key task: provide measures for decision making**
  - Subjective quality assessments: “live” during meetings and/or formal laboratory tests
  - Provision of objective metrics suitable for the standardization process. Requirements / wish list:
    - Reproducible and understandable
    - Reliable ranking / discrimination of assessed video sequences
    - Resilient / consistent w.r.t. to unseen artifacts

- **Exchange, communication and cooperation with VQEG is welcome!**

Thanks for your attention!

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https://lists.rwth-aachen.de/postorius/lists/mpeg-vqa.lists.rwth-aachen.de/