

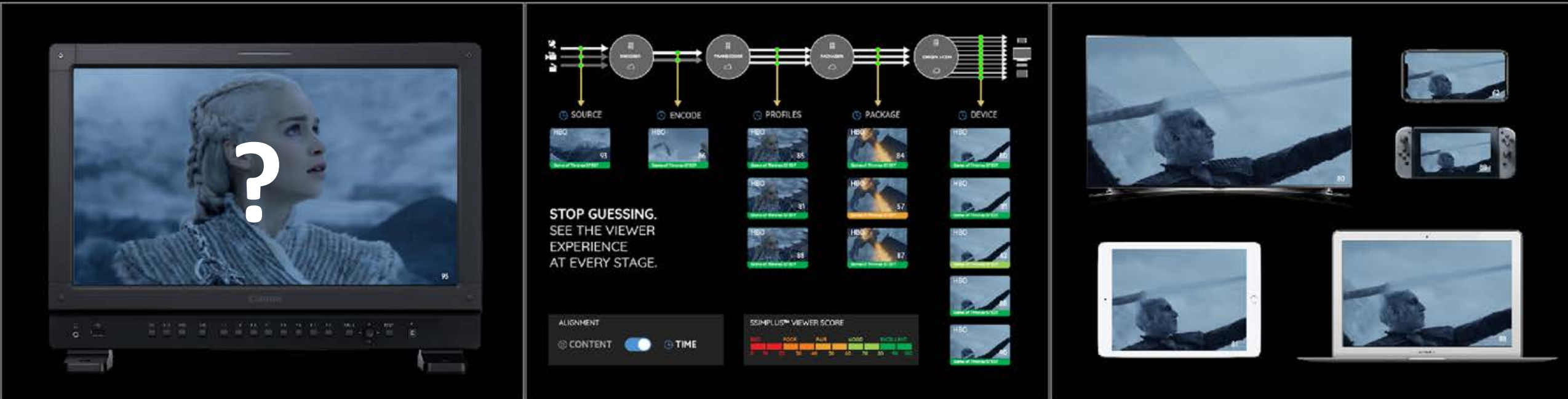


Challenges in High-Quality HDR Content Distribution

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PRESERVATION OF ARTISTIC INTENT DURING VIDEO DISTRIBUTION



Tracing quality degradation from source (content producer) to playout (consumer devices)

On-Going Project – SSIMWAVE and ASC

American Society of Cinematography (ASC)
Motion Imaging Technology Council

SSIMWAVE HDR Evaluation Working Group

Objective: To assess, evaluate, and improve the preservation of the original creative intent of HDR, wide color gamut, ultra high resolution digital motion picture imagery during its distribution and delivery, from grading to consumer devices.

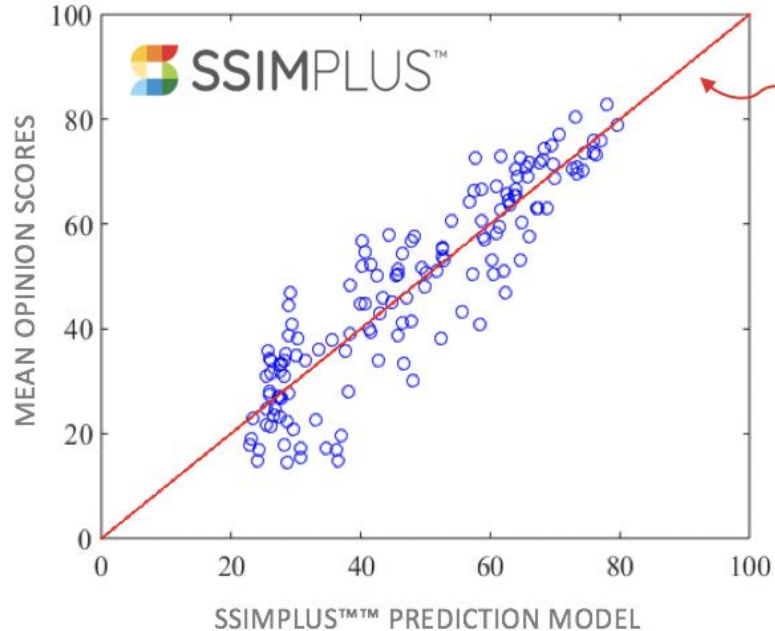
SSIMWAVE HDR Evaluation Working Group Study

- Subjective & objective evaluation
- SSIMPLUS as the quality metric
- As-graded vs as-delivered videos
- User interface
- Testing methodology
- Data analysis



THE SSIMPLUS METRIC

Algorithm that watches video (pixels) like human eyes, and predicts viewer experience in real-time

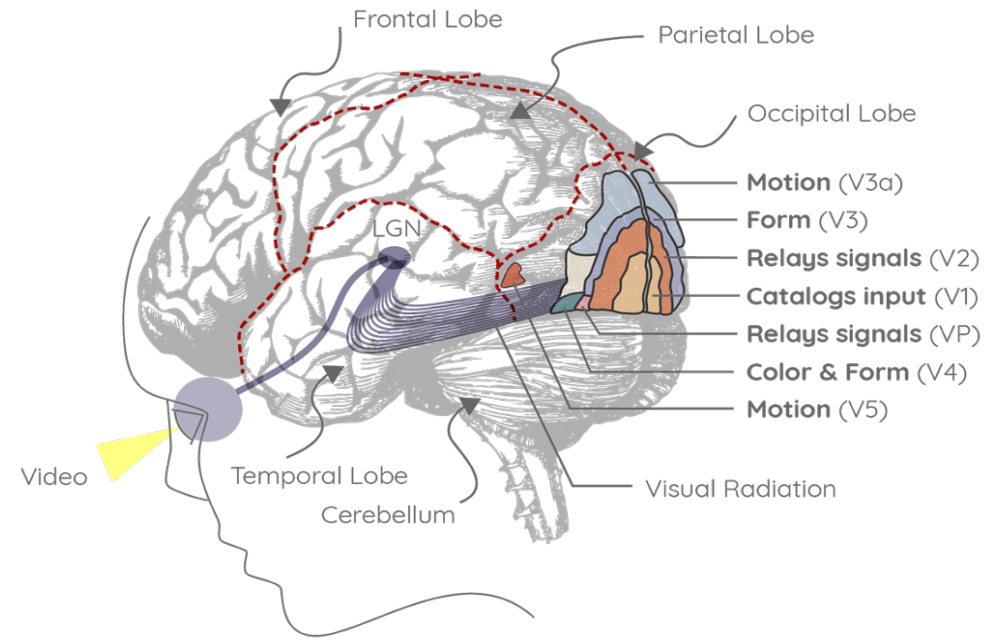


Red line represents 100% accuracy of model to human visual system.



Measured using CSIQ Video Database. An independent publicly available subject-rated video database

Modeling the Human Visual System

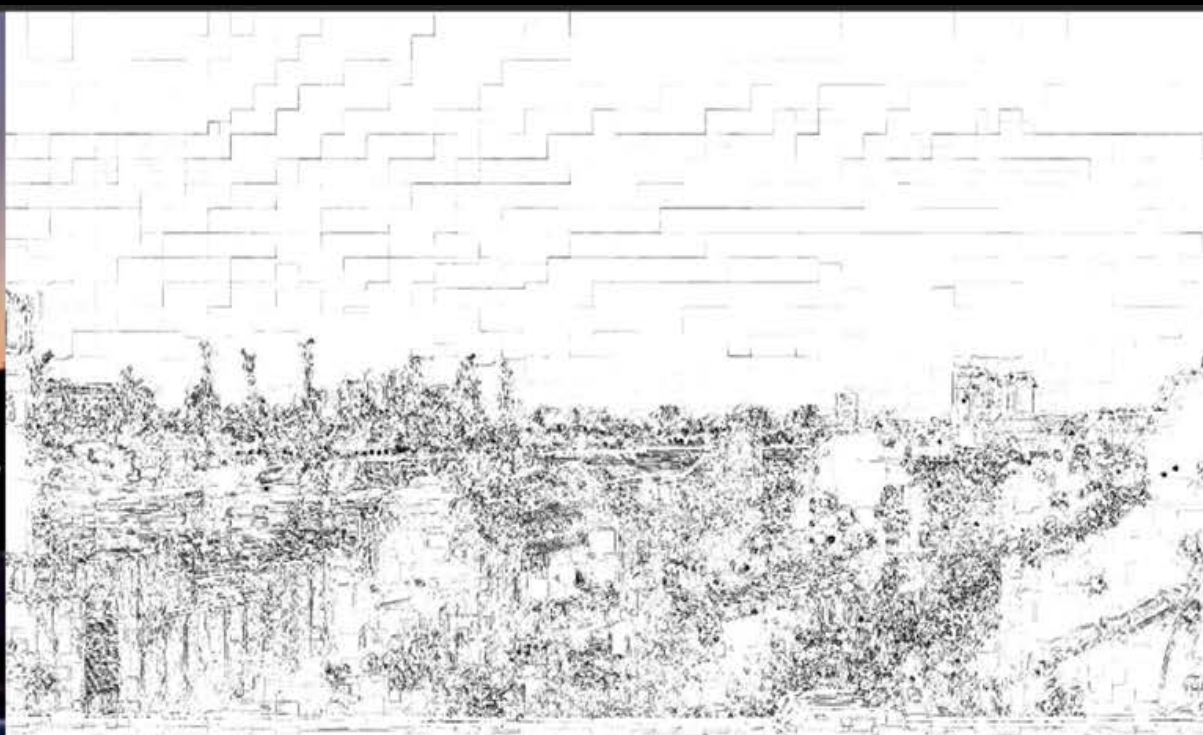


THE SSIMPLUS METRIC

Quality maps up to pixel-level precision



A compressed video frame



SSIMplus quality map

THE SSIMPLUS METRIC

Example: quality evaluation for image tone mapping



Which tone-mapped image better preserves the info contained in the source image?



(a) $S = 0.9288$ ($S_1 = 0.9371$; $S_2 = 0.9642$; $S_3 = 0.9524$; $S_4 = 0.9158$; $S_5 = 0.8286$)



(b) $S = 0.7980$ ($S_1 = 0.8419$; $S_2 = 0.8573$; $S_3 = 0.8330$; $S_4 = 0.7795$; $S_5 = 0.6361$)

Test image



Multi-scale decomposition



Multi-scale structural detail preservation assessment



Cross-scale cross-space perceptual weighting



Score aggregation

AS-GRADED VS AS-DELIVERED VIDEOS

AS GRADED

ACES 2065 AP0
openEXR half-float

PQ-Encoded RGB 444 Rec 2020
16-bits per component TIF

PQ-Encoded RGB 444 Rec 2020
12-bits per component

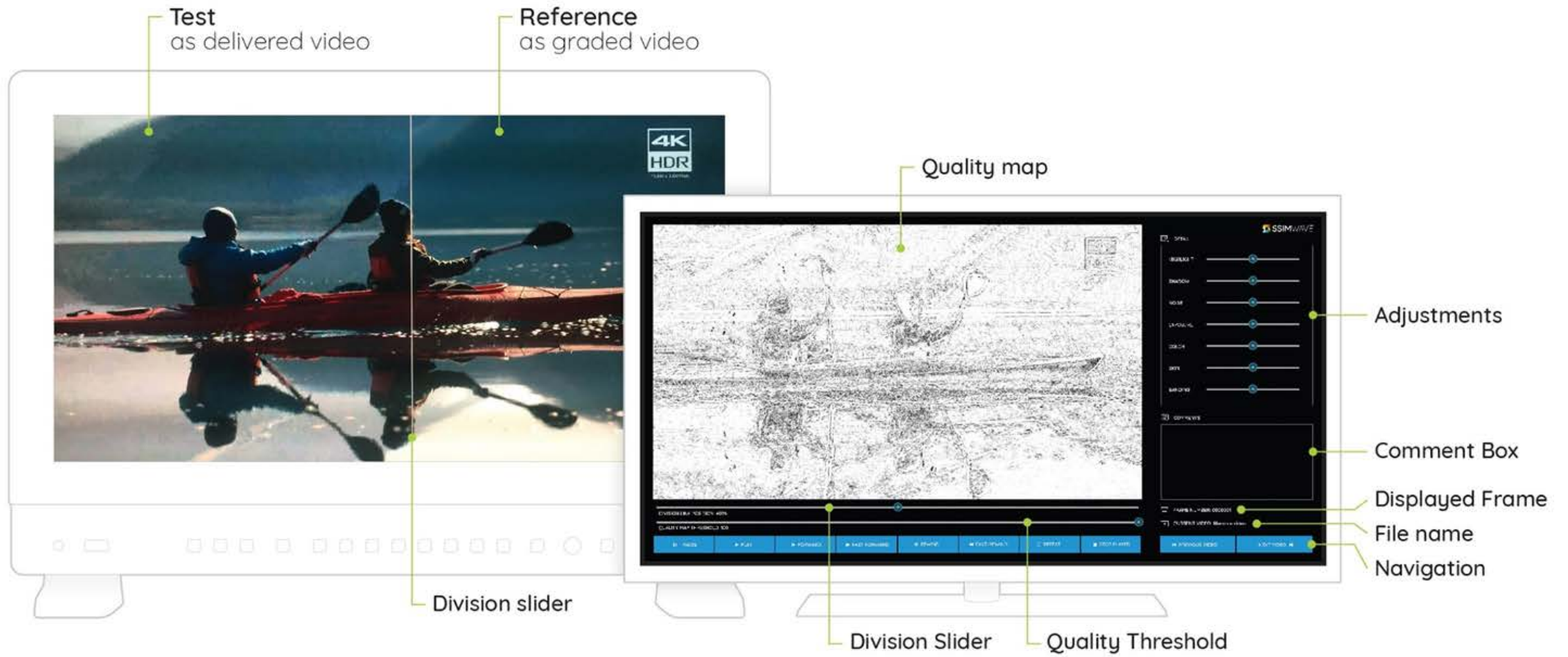
AS DELIVERED

PQ-Encoded RGB 444 Rec 2020
12-bits per component

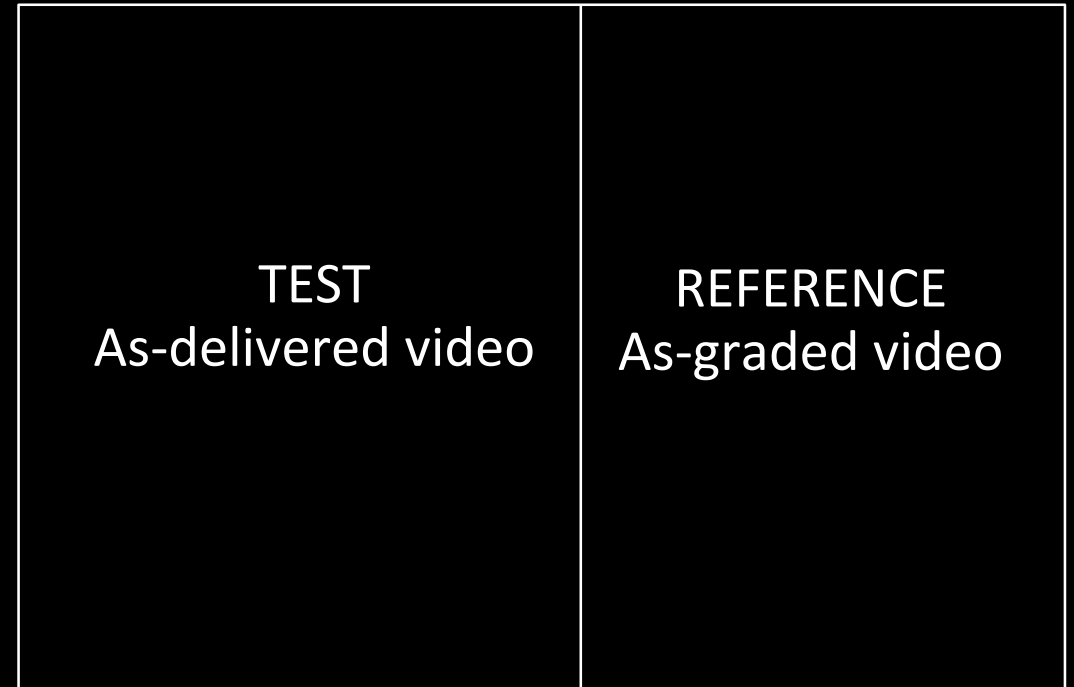
Quality Degradations
RGB to YCbCr 420 10-bits,
Compression, etc.

YCbCr 420 to YCbCr 444 to RGB 444, 12-bits

USER INTERFACE



USER INTERFACE



Division Slider
User-controlled

TESTING METHODOLOGY

Initial Viewing	View video clip (1 or more times)
Interactive Viewing	Free pause/replay Compare reference and test videos Compare quality and color distortion maps
Assessment	Video quality assessment Quality/color map assesement

CURRENT RESULTS

- Detection of texture distortions
e.g., loss of texture details, compression artifacts, banding
- Detection of color distortions
e.g., skin tone changes, effect of color format and gamut changes, etc.
- Detection of highlight detail loss
e.g., by brightness saturation
- Detection of shadow detail loss
e.g., info loss in dark shadows
- Detection of pixel format conversion effect
e.g., info loss by 4:4:4 to 4:2:0

Questions?

*Data, science,
algorithms are the tools
we use to solve
problems related to art,
colour and emotion.*

