Adding HDR imagery to HTML Canvas

CSS requirements

Pierre-Anthony Lemieux
Co-chair, Color on the Web CG
pal@sandflow.com

What is HDR imagery?

SDR images are intended to cover a luminance range of 0 to 100 nits

- 8 bits per color per pixel (some banding is visible at low luminance)
- Power law (gamma) transfer function between pixel values and emitted light

HDR images are intended to achieve a broader dynamic range (0 to 10,000 nits) without contouring and banding

- Higher pixel bit depths
- Optimized transfer functions (not gamma)

HDR imagery is widespread in media and entertainment, and now making its way into PCs

Ultra HD Blu-ray Format Video Characteristics (Michael D. Smith): https://ieeexplore.ieee.org/document/7514362

HDR Canvas strawman

Color on the web CG has developed a recommendations for adding HDR imagery to HTML Canvas

- add HDR colorspaces to Canvas (beyond sRGB)
- add higher bit depth capabilities to Canvas (beyond 8-bit per color per pixel)
- add image color volume information to Canvas (to assist with mapping HDR pixels to a limited display)
- add display color volume information query (to assist with mapping HDR pixels to a limited display)
- recommendations for mapping to/from HDR pixels

Seeks feedback from the community

https://github.com/w3c/ColorWeb-CG/blob/main/hdr_html_canvas_element.md

Areas of collaboration

HDR colorspaces

Fulfills two objectives

- Mapping between pixel values and emitted light
- Reference viewing environment (ambient light and reference display)

Rec. ITU-R BT.2100 is the most widely deployed standard

CG recommends three colorspaces based on Rec. ITU-R BT.2100

- "rec2100-hlg" (uses the HLG transfer function)
- "rec2100-pq" (uses the PQ transfer function)
- "rec2100-display-linear" (linear light where (r, g, b) = (1, 1, 1) corresponds to reference white)

Same color primaries and reference viewing environment, but different mapping between pixel values and luminance

https://github.com/w3c/csswg-drafts/issues/553

Rendering HDR images

Many different algorithms for rendering HDR images onto displays with narrower dynamic range (tone mapping)

- Should a single algorithm be mandated or recommended?
- How should such a single algorithm be selected?
- The CG has been considering doing a call for proposals

(Optional) advanced applications can use knowledge of the display's dynamic range to apply their own HDR image rendering techniques

- Add a new screenColorInfo attribute to the Screen interface
- Provides information on minimum and maximum display luminance, and luminance of reference white (headroom)
- Increases fingerprinting surface and introduces privacy concerns

https://github.com/w3c/csswg-drafts/issues/9306