

The
NOW
WHAT
Issue

*A new remote-work reality will
mean long-term changes for how
M&E gets business done.
Welcome to Hollywood's
new normal. P. 15*

M**AND****E**
JOURNAL
Media & Entertainment
Strategies. Solutions.

Workflows A New Work Mindset P. 34

Smart Content The Power of AI P. 86

Security Locking Down Your Remote Workforce P. 100

Working From Home What Now? What Next? P. 128

Get the Most Out of Your Color Grading Session, While Preserving Artistic Vision

Streamlined color grading workflow captures the quality and detail in HDR for an SDR deliverable



Abstract: The Dolby Vision content creation tools and workflow give filmmakers an efficient way to create both high-dynamic range (HDR) and legacy standard dynamic range (SDR) color grades and ensure that the look created in the color suite stays true when experienced by consumers. Our latest tools were the result of feedback from creatives worldwide based on the previous generation of the Dolby Vision workflow.

**By Thomas Graham, Head
of Dolby Vision Content
Enablement, and
Graef Allen, Manager, Technical
Operations, Dolby Laboratories**

Ray Dolby founded Dolby Laboratories in 1965. Since the earliest days of the company, Dolby's mission has been to harness science and engineering to improve media fidelity, enabling consumers to experience audiovisual content the way its creators intended. Ray Dolby's first invention was the Dolby Noise Reduction System, which reduced distracting noise present in early audio tape recordings.

Today, Dolby is known for more than just sound. We helped pioneer high-dynamic range (HDR) imaging as it exists for consumers today. Dolby invented a method of representing HDR video using the perceptual quantizer (PQ) transfer function, standardized as SMPTE ST. 2084, which underlies the open HDR10 standard as well as our proprietary Dolby Vision format.

HDR video for consumers is typically color graded and finished on high-end video mastering displays costing tens of thousands of dollars. Consumer

The goal is always to preserve the creative intent of the filmmakers all the way to the consumer. What a consumer sees at home should closely match the look the colorist created and approved on the mastering display during the color grading process.

HDR TVs, tablets and smartphones have come a long way over the last few years, but they still don't have the capabilities of professional reference displays when it comes to how bright and colorful they are. Nor should they — how many consumers would want to shell out \$30,000 for their living room TV? For this reason, consumer devices must accommodate bright and vibrant HDR content by translating the incoming video signal into a smaller container at playback using a process called display mapping (DM). The luminance and color decisions the colorist made on the original mastering display are “mapped” into the smaller dynamic range and color gamut capabilities of the consumer device. The goal is always to preserve the creative intent of the filmmakers all the way to the consumer. What a consumer sees at home should closely match the look the colorist created and approved on the mastering display during the color grading process.

Working for consumers

Consumer Dolby Vision video combines HDR images with metadata that changes from shot to shot. The dynamic metadata in a Dolby Vision video stream guides dynamic display mapping in a consumer device to optimize the amount of image detail preserved in each scene. Some scenes will be very bright, some will be very dark and others will fall somewhere in between. A generic display mapping transform in a TV that works well for very bright images is unlikely to be as successful when handling dark images. Using a static approach in which every scene in a movie or TV episode is mapped the same way would inevitably cause some of the original image

detail to be lost.

Dolby Vision dynamic metadata is generated in the color grading system, adjusted by the colorist and ultimately transmitted to a TV or other playback device in an encoded video stream. The metadata describes the original mastering display used by the colorist, luminance information calculated for each individual shot, and can incorporate dynamic trims chosen by a colorist to ensure the most accurate mapping from mastering display to playback device. The inputs to that display mapping process are the HDR video signal, the Dolby Vision metadata and information about the playback device's own display characteristics. Dolby Vision display mapping yields excellent image fidelity whether a display is capable of 300 nits of peak luminance or over one thousand nits.

When Dolby developed the post-production content creation tools for our Dolby Vision consumer format, we weren't just enabling the creation of compelling HDR images that maintain their integrity across a broad range of display types. We were also determined to develop an efficient workflow that would allow multiple “grades” to be derived from a single master. The Dolby Vision metadata isn't solely used by display

mapping; it can also enable a post-production process called content mapping (CM), which generates new video files that have the Dolby Vision mapping process baked in. Content mapping takes in the original HDR video and Dolby Vision metadata and outputs a new deliverable that is optimized for a specified luminance target, even down to 100 nits for SDR.

We believe this streamlined color grading workflow best captures the quality and detail in the HDR grade down into the lesser capable SDR deliverable. It also is extremely efficient in terms of time required in the grading suite. On a typical one-hour show, the Dolby Vision SDR trims can be accomplished in as little as an afternoon as opposed to another full round of regrading an SDR version. Netflix and other studios have adopted this as the primary workflow to deliver Dolby Vision, HDR10 and SDR versions of their original shows.

Feedback from content creators

When asked for his take on the Dolby Vision workflow, Dean Devlin of Electric Entertainment in Los Angeles told Dolby that “as spectacular as HDR is, we've basically ignored it because it was cost prohib-



Thomas Graham is head of Dolby Vision content enablement and a 29-year veteran of the post-production technology industry, working for Digidesign, Avid and Dolby, along with a variety of consulting and freelance work. He was one of the first to use Pro Tools to record and edit the orchestra on Hollywood scoring stages on more than 40 feature films. tom.graham@dolby.com @Dolby



Graef Allen is manager of technical operations for Dolby Laboratories, and has worked for Dolby for the last 16 years. She started her Dolby career as a 35mm film projectionist and now manages a technical operations department that handles consumer Dolby Vision color grading, mastering, and encoding. graef.allen@dolby.com @Dolby

itive for us to color time it as well as doing a second version in SDR. With the Dolby Vision tools and workflow, however, we find that we can spend our energy and money on creating the best version possible, and only have to do the process once.”

We have also considered feedback from content creators around the world as our product and engineering teams have refined Dolby Vision over time. We launched a more flexible CM/DM algorithm, v4.0, at IBC 2018. For v4.0 of the Dolby Vision content creation tools, we heard that it was important to introduce more flexibility to the trim controls, which are the means by which the colorist exerts creative influence on what is otherwise an algorithmic mapping process. In many cases, filmmakers and colorists want the look of their derived SDR grade to adhere very closely to the original

HDR grade. Other times, they may actually prefer a slightly different look in the SDR version. The original Dolby Vision color grading tools had 6 trim controls to adjust the mapped output at each defined luminance target. CM v4.0 has 9 primary and 12 secondary trim controls, including 6-vector hue adjustments to more precisely map hues, which can be especially important when shifting from P3 or Rec. 2020 to the more limited Rec. 709 color gamut.

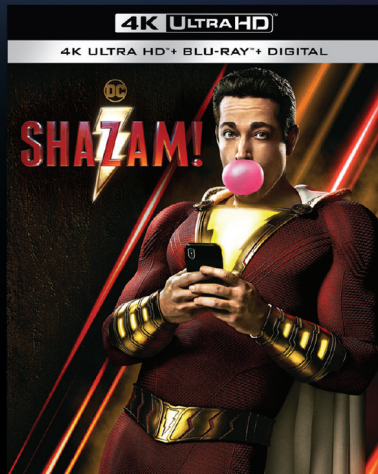
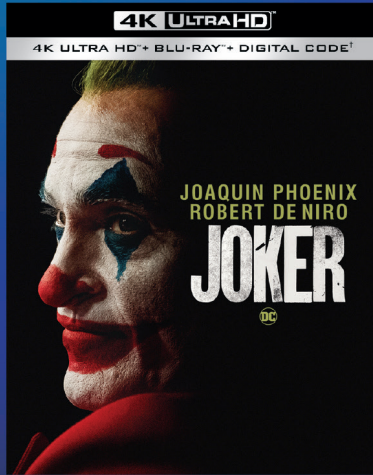
We’re encouraged by the feedback we’ve received from the post-production community so far. Keith Shaw is a colorist at Keep Me Posted in Burbank, Calif. Shaw has been the final colorist on Showtime’s *Ray Donovan* for multiple seasons. He graded a demo clip from *Ray Donovan* in Dolby Vision, although the show itself was graded in SDR only. About CM v4.0,

Shaw says, “The improved and additional SDR trim tools available in 4.0 gave me the ability to produce an SDR image that more accurately represented the original HDR version. During the process I noticed that in certain scenes where I had struggled to maintain highlight detail during my original SDR color session, the Dolby Vision SDR version now yielded a more detailed image on the top end, and I even decided to insert those scenes into my original SDR deliverable for Showtime.”

Like most MESA members, we have multiple constituencies to please, from the post-production vendors who rely on our technology to do their jobs to the clients and consumers who enjoy the fruits of that effort. That has always been at the heart of Dolby’s mission, and continues to be true with Dolby Vision. ■



Look for these movies from Warner Bros. Home Entertainment in Dolby Vision™ and Dolby Atmos™, now available on 4K Ultra HD.



See. Hear. Spectacular.