

A young child, likely a girl, is smiling broadly and holding a glowing light stick high in the air. The background is a dark night scene with many out-of-focus lights in various colors (blue, green, yellow, red), suggesting a festival or fair. The child is wearing a light-colored t-shirt with a graphic design. The overall mood is joyful and festive.

High Dynamic Range Viewing Preference Test

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PHILIPS

Introduction

- Philips has been active in television for more than 70 years and has always been at the forefront of television technology.
- We have been working on high-brightness high-dynamic-range (HDR) television for more than 8 years.
- We showed our first HDR display with a peak luminance of 3 000 cd/m² to selected customers during the 2009 IFA in Berlin, after which we have continued to further develop all required elements of the future HDR-TV chain.
- We produced the world's first HDR short movie "Missing Minny" in 2011 (see Appendix). Having available a real-time HDR chain on the set enabled the director and DOP to immediately see the scenes on the HDR display.
- We currently have optimized solutions available for HDR video encoding, dynamic range conversion (tone mapping), and color gamut mapping.

Image dynamic range preference test

- Philips performed a viewing test to assess the preference of 5 000 cd/m² peak luminance High Dynamic Range (HDR) versus 400 cd/m² peak luminance Low Dynamic Range (LDR) content in a daytime television viewing environment.
- The level of 400 cd/m² was selected since this is approximately the average peak luminance of LCD TVs that are currently on the market.
- The test materials were extracted from a number of HDR video sources.
 - The test material was first colour graded on a 5 000 cd/m² peak luminance HDR monitor, the SIM2 HDR47ES4K (see Appendix).
 - An LDR grade was derived from the HDR material. For this purpose, the same monitor was used, but set to a peak luminance of 400 cd/m².
- 12 sequences of 10 seconds each were selected:
 - 7 sequences were used for observer training and test score calibration.
 - 5 other sequences were used for the actual test.

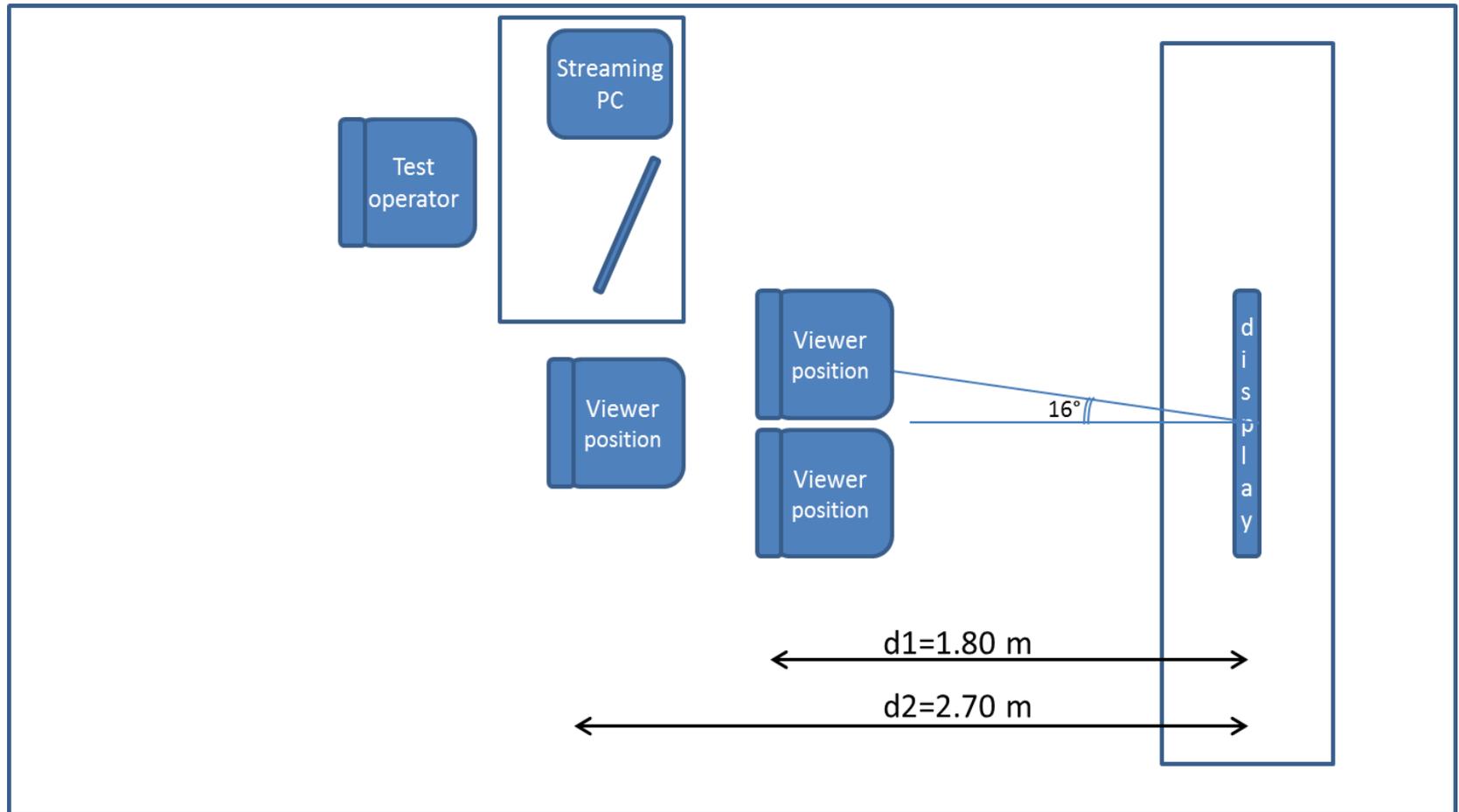
Viewing conditions

Daytime viewing

- Two levels of background wall luminance were tested, based upon measurements of the luminance reflected by a non-directly illuminated indoor wall under various outside weather conditions:
 - We have measured the wall luminance to be 250 cd/m² on a very cloudy day and 2 500 cd/m² on a sunny day.
 - We have selected 300 cd/m² and 750 cd/m² as representative daylight television viewing environmental luminance levels for our viewing tests (using a D₅₀ floodlight on the wall behind the HDR display).

Viewing conditions

Test room layout



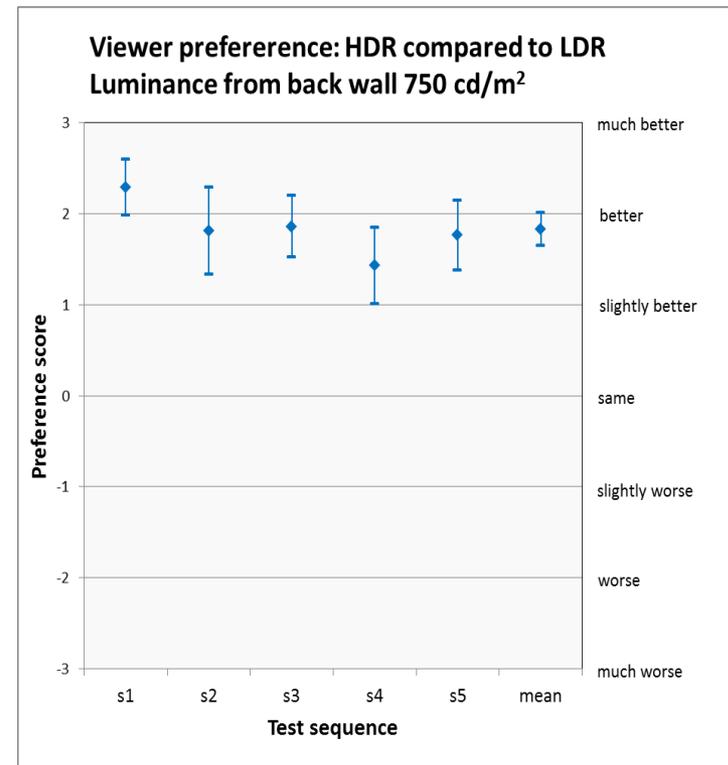
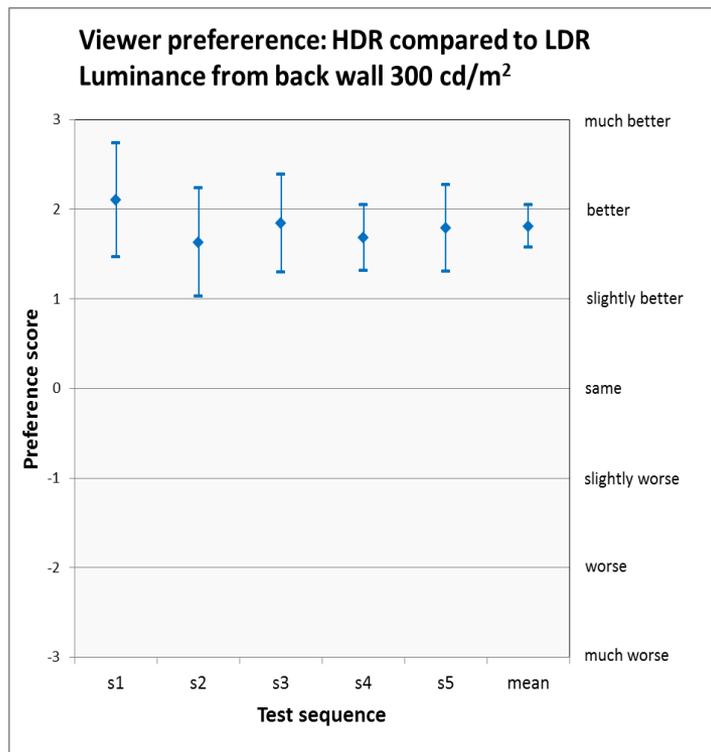
Test procedure

- One test presentation consisted of:
 - 3 seconds mid-grey
 - 10 seconds reference sequence A (LDR or HDR, randomly selected),
 - 3 seconds mid-grey
 - 10 seconds test sequence B (HDR or LDR),
 - The above sequences presented again in the same way/order.
 - 10 seconds voting period.
- 19 non-expert observers participated in the first test, 20 in the second test.
- Paper forms were used to record the ratings. The ITU-R comparison scale has been used:

-3	Much worse
-2	Worse
-1	Slightly worse
0	The same
+1	Slightly better
+2	Better
+3	Much better

Test results

- The figures show the mean and 95% confidence interval for the 5 test sequences as well as the overall mean and confidence interval.



Conclusion

- Philips performed a viewing test to assess the preference of 5 000 cd/m² peak luminance High Dynamic Range (HDR) versus 400 cd/m² peak luminance Low Dynamic Range (LDR) content in a daytime television viewing environment.
- The test results show that the content shown with a 5 000 cd/m² peak luminance level is clearly preferred over the content shown with a peak luminance level of 400 cd/m².
- There was no significant difference in test results between the 300 cd/m² and 750 cd/m² background illumination levels.

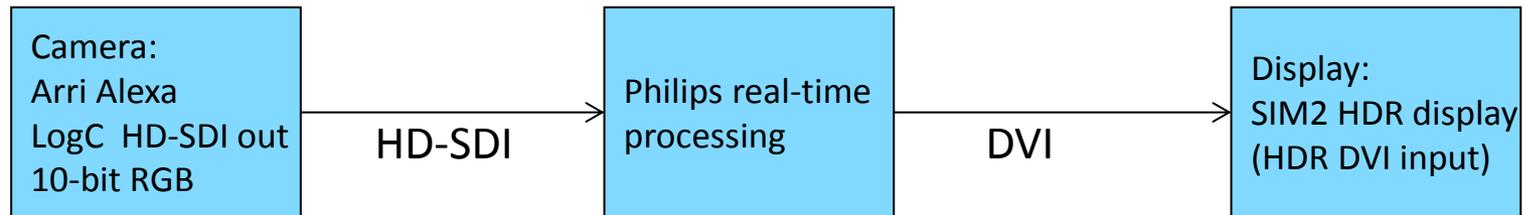
Appendix: HDR production

Missing Minny short movie

- The “Missing Minny” movie was post-produced in two versions: a high-dynamic range grade (5000 cd/m² peak luminance) and a standard dynamic range grade.
- The standard dynamic range grade of the “Missing Minny” movie won two awards in the 2012 New York Festivals international Television & Film Awards category:
 - **Gold** World Medal - best Cinematography
 - **Silver** World Medal - best short film
- The standard dynamic range movie can be seen at
 - <https://www.youtube.com/watch?v=XdclzsiL-Hs>
- Behind the scenes production:
 - <https://www.youtube.com/watch?v=pUu6Tp-ea7A>

Live HDR chain

Calibrated end-to-end chain:

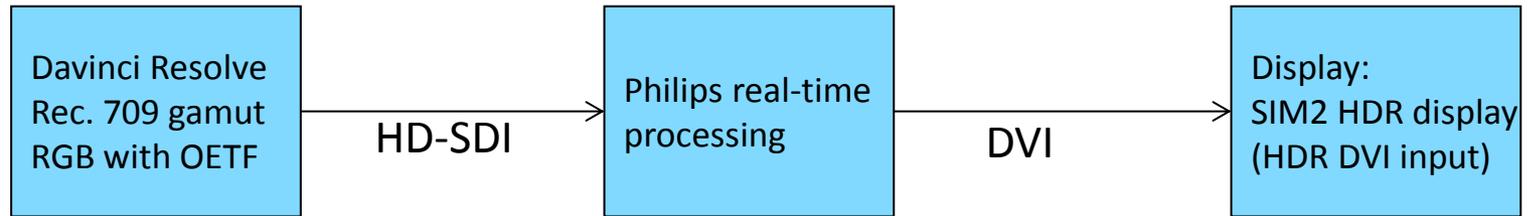


Real-time processing:



HDR post-production colour grading

Calibrated chain:



Real-time processing:

