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HDR and Colorspace: Just the Basics

Introduction

- **HDR (High Dynamic Range) and WCG (Wide Color Gamut) represent the next major advancements in display technology.**
- The concept of HDR has been around for many years, but it is now becoming commonly available.
- In order to see the full benefit of HDR and WCG, **both** the display and content must support and provide the required information.
- All major display manufacturers are introducing mid- and high-end display products with these capabilities, and content is becoming more common (UHD Blu-Ray, Netflix, etc.).
- **Are these technologies worth the hype? Yes, but you need to know the basics to understand why.**



Understanding HDR

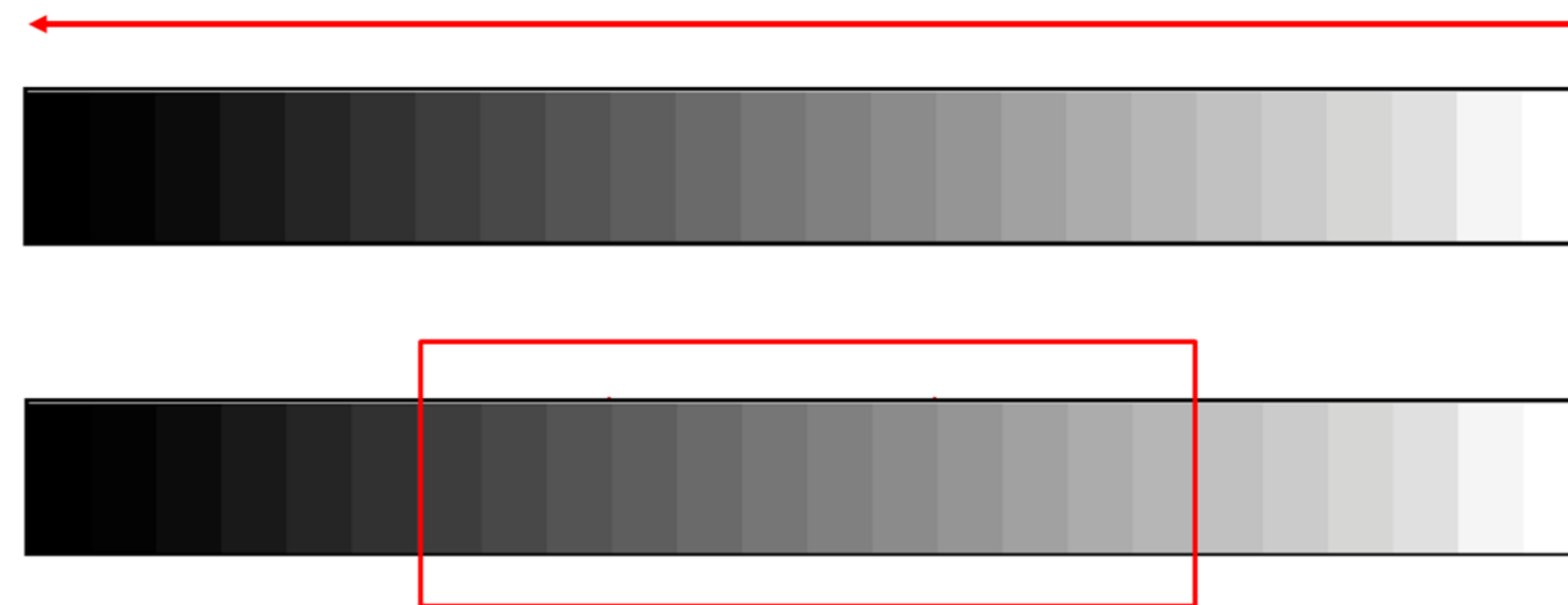
What is HDR?

- **HDR**, or **High Dynamic Range**, is a set of imaging techniques used to record and reproduce a much greater range of luminance values than traditional video.
- The goal of HDR is to record content, and play it back in a way that more closely replicates the capabilities of the human eye, and to provide a greater level of detail.



What is HDR?

- For a display to reproduce HDR, it has to provide a higher level of peak luminance, greater contrast (difference between light and dark) and a deep level of black.
- However, just expanding the difference between light and dark parts of the image is not enough to truly create HDR. The **source content and the display** must be able to process and replicate a greater number of shades of grey in between the highest level of white and darkest black to more closely replicate what our eye naturally sees.



What is HDR?

- The result is removing the limitations presented by older types of video signals and providing a much more natural and vivid appearing image.
- HDR ultimately means that very bright objects and very dark objects can be displayed on screen at once, without losing quality in either.
- Because of the greater ability to produce shades of grey, more details can be seen in both shadows and highlights.



Side by Side Comparison



Standard Dynamic Range



High Dynamic Range

HDR Content

- Because HDR requires much more data present in both the content and video signal, not all current media supports it.
- Standard Blu-Ray discs do not provide HDR information, only Ultra-HD Blu-Rays.
- Online streaming services can also offer 4K HDR video, but this must be specifically encoded. This will use greater bandwidth than standard video.
- **To enjoy the full HDR experience, you need a display that supports it, content built for it, and a signal path that preserves it.**



HDR Standards

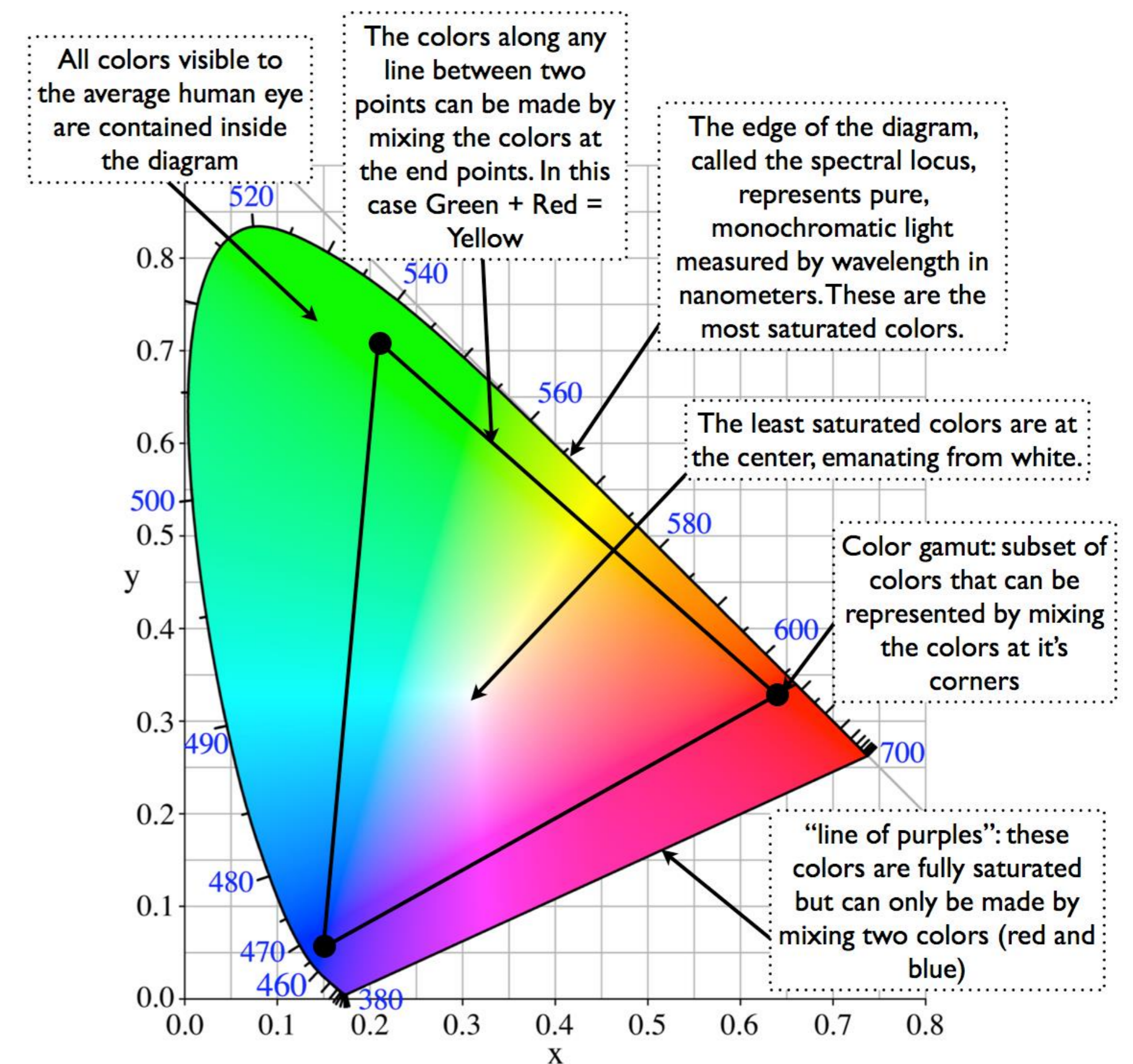
- Currently HDR content is split into two dominant standards: **HDR10/HDR10+** and **Dolby Vision**.
- HDR10 and more recent HDR10+ is the standard of the UHD Alliance. It's a technical standard with specific, defined ranges and specifications that must be met for content and displays to qualify as using it. HDR content available on Ultra HD Blu-ray discs are generally HDR10. Televisions that support HDR10 are allowed to display the UHD Alliance's Ultra HD Premium logo.
- Dolby Vision is Dolby's own HDR format. While Dolby requires certification for media and screens to say they're Dolby Vision compatible, it's less of a true standard than HDR10.
- Both formats contain much more information about light and color for each pixel. However, Dolby Vision media is calibrated to fit the profiles of individual Dolby Vision displays to produce the best picture based on each panel or projector's limitations and range.
- With either one, the end result is still a picture that has wider, more varied colors than standard dynamic range video.



Understanding WCG

What is Colorspace?

- A **colorspace** is a standard that defines a specific range of colors that a particular display technology is able to produce.
- This is charted as a triangle, with each point representing the maximum red, green, or blue.
- The triangle is drawn on top the CIE Chromaticity Diagram, a graph used to represent the total range of color the human eye can see.



Anatomy of a CIE Chromaticity Diagram

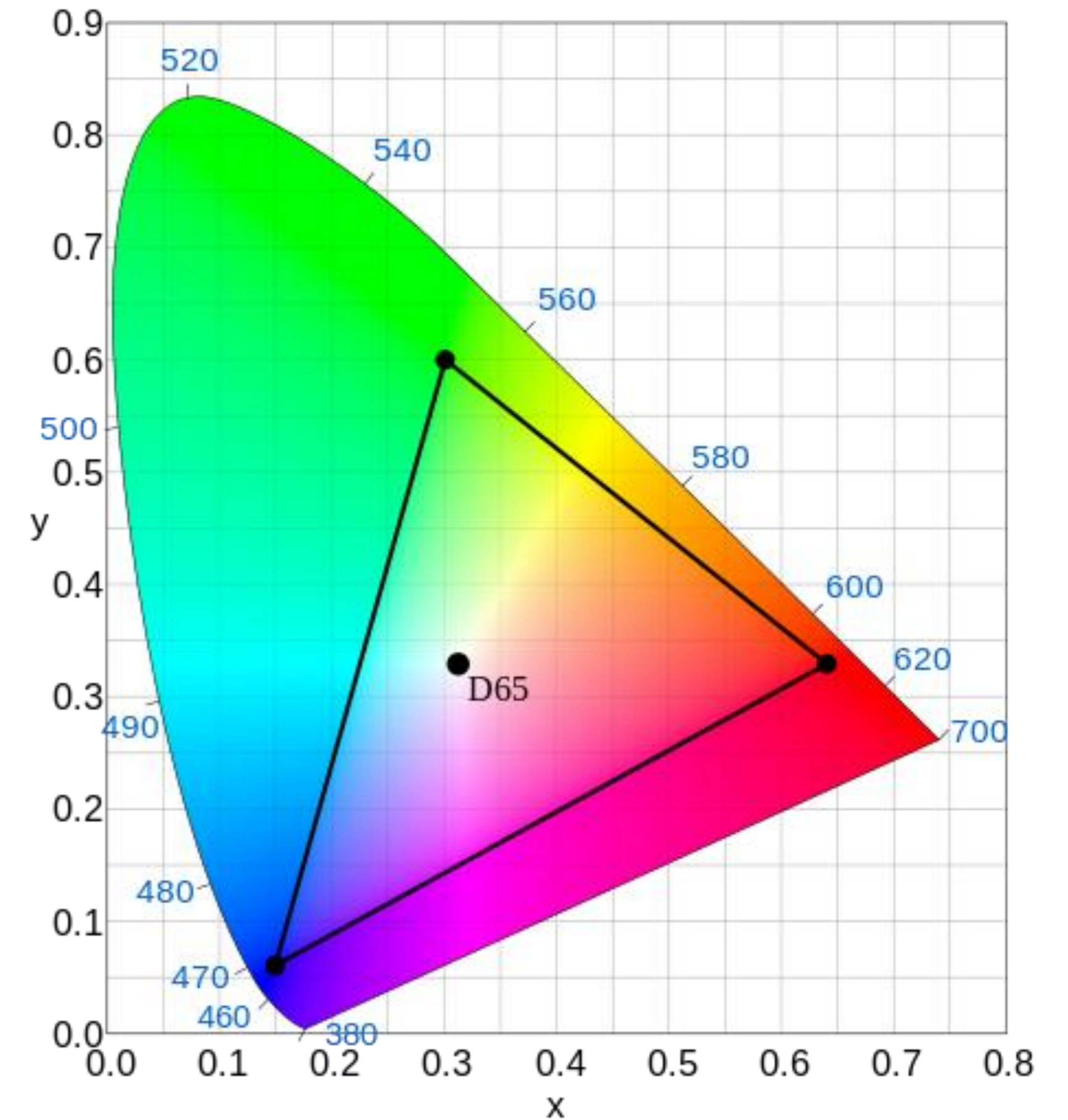
What is Colorspace?

- All imaging based applications need a well defined colorspace to accurately reproduce the colors in the content.
- Over the years, this has resulted in many different standardized colorspace being placed into use, based on what the currently available displays at the time could reproduce.
- Displays and content have evolved over time, and many different colorspace are currently in use, but they are not all created equal...



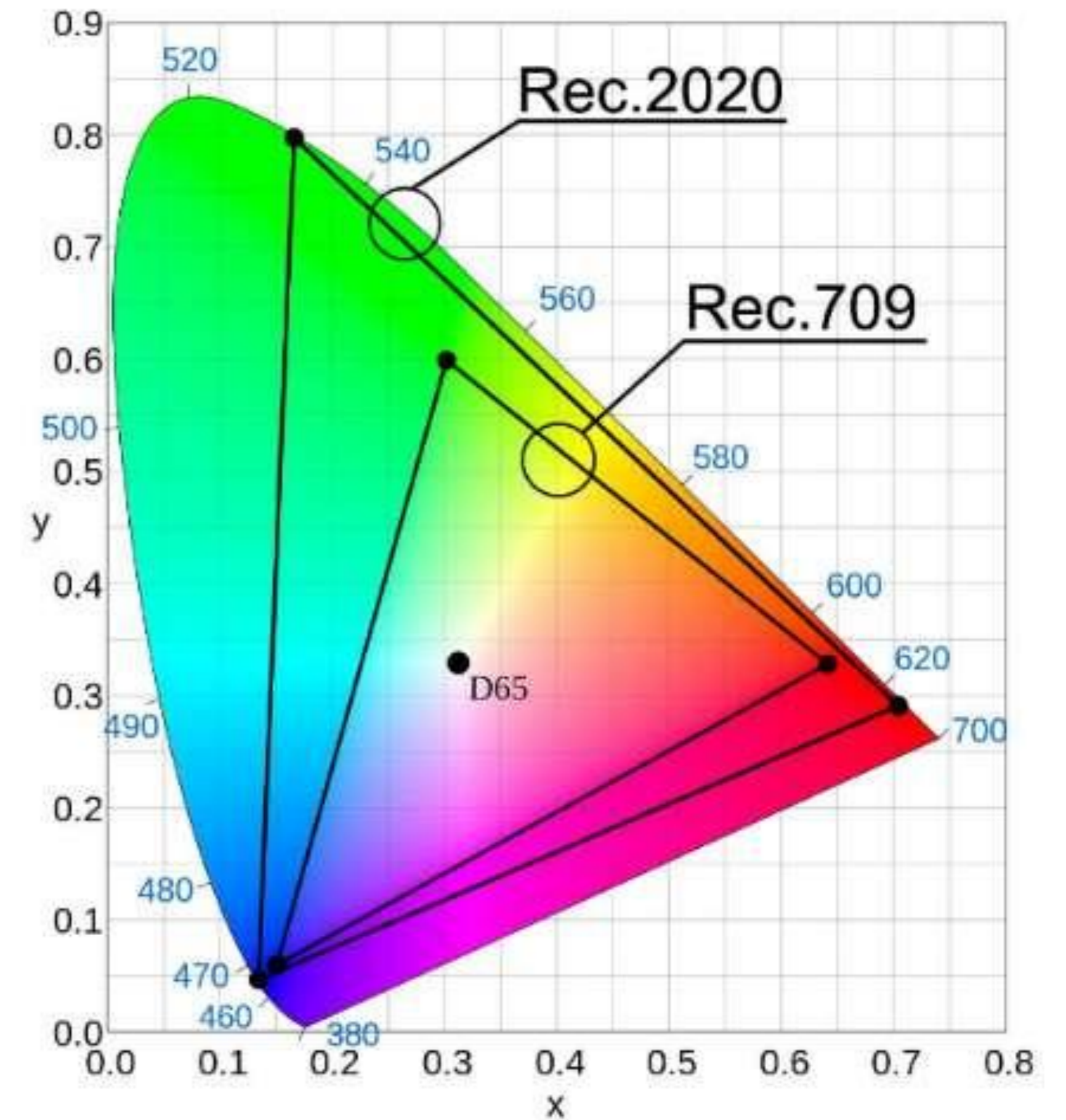
Rec. 709 - HDTV Color Space

- **Rec. 709** is the international recognized standard video color space for HDTV.
- Rec. 709 replicates 35.9% of the total colors the human eye can see.



Rec. 2020 – UHD and HDR Colorspace

- High quality HDR and UHD capable displays adhere to the new **Rec. 2020** standard.
- Rec. 2020 reproduces 77.6% of the colors the human eye can see.
- This is why it is called **wide color gamut**, as it covers a wider range of color values.
- This is sometimes also represented using the term **color volume**.





ANY QUESTIONS?

“ Successful people ask better questions, and as a result, they get better answers. ”

Tony Robbins

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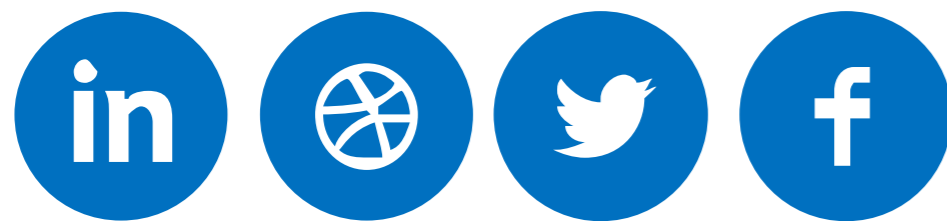
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Thank You!