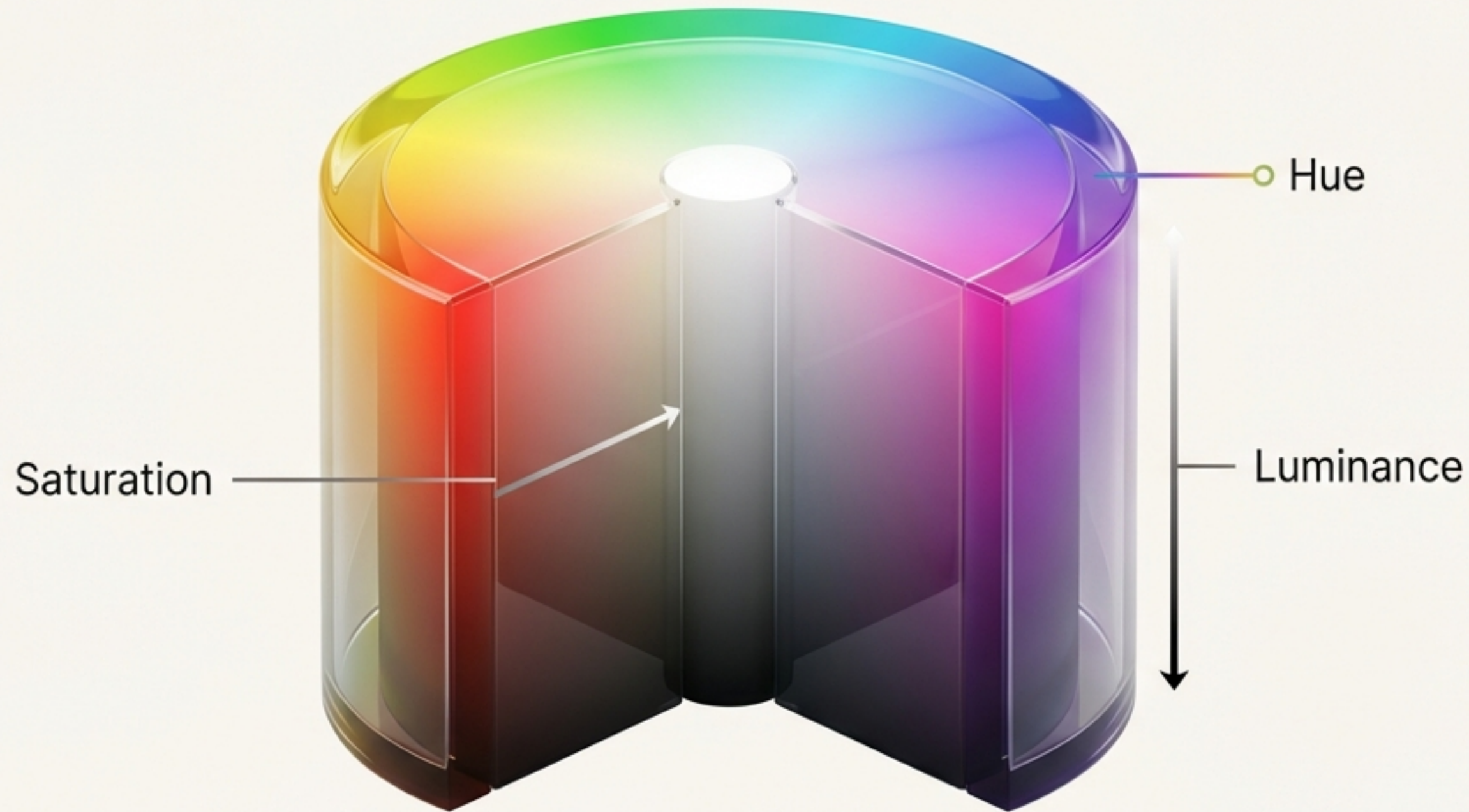


From Signal to Story: A Masterclass in Cinematic Colour

Understanding the science, craft, and art of digital video colour.

The Three Pillars of Colour Perception

Every colour we perceive can be described by three core attributes. Mastering these is the foundation of both technical correction and creative grading.



Hue (The Colour Itself)

The pure colour family, determined by the wavelength of light (e.g., red, green, blue). This is the 'what' of colour.



Saturation (The Intensity)

The purity or vividness of a hue. A fully saturated colour is pure; a desaturated colour approaches grey. This is the 'how much' of colour.



Luminance (The Brightness)

The relative degree of light in a colour, from dark (shades) to light (tints). This is the 'how bright' of colour.

Organising Colour: The Wheel and Its Harmonies

The colour wheel is a chart representing the relationships between colours. We use it to build palettes, or 'harmonies', that create specific visual effects and emotional responses. The system for digital work is the Additive RGB model (Red, Green, Blue), where mixed light creates white.

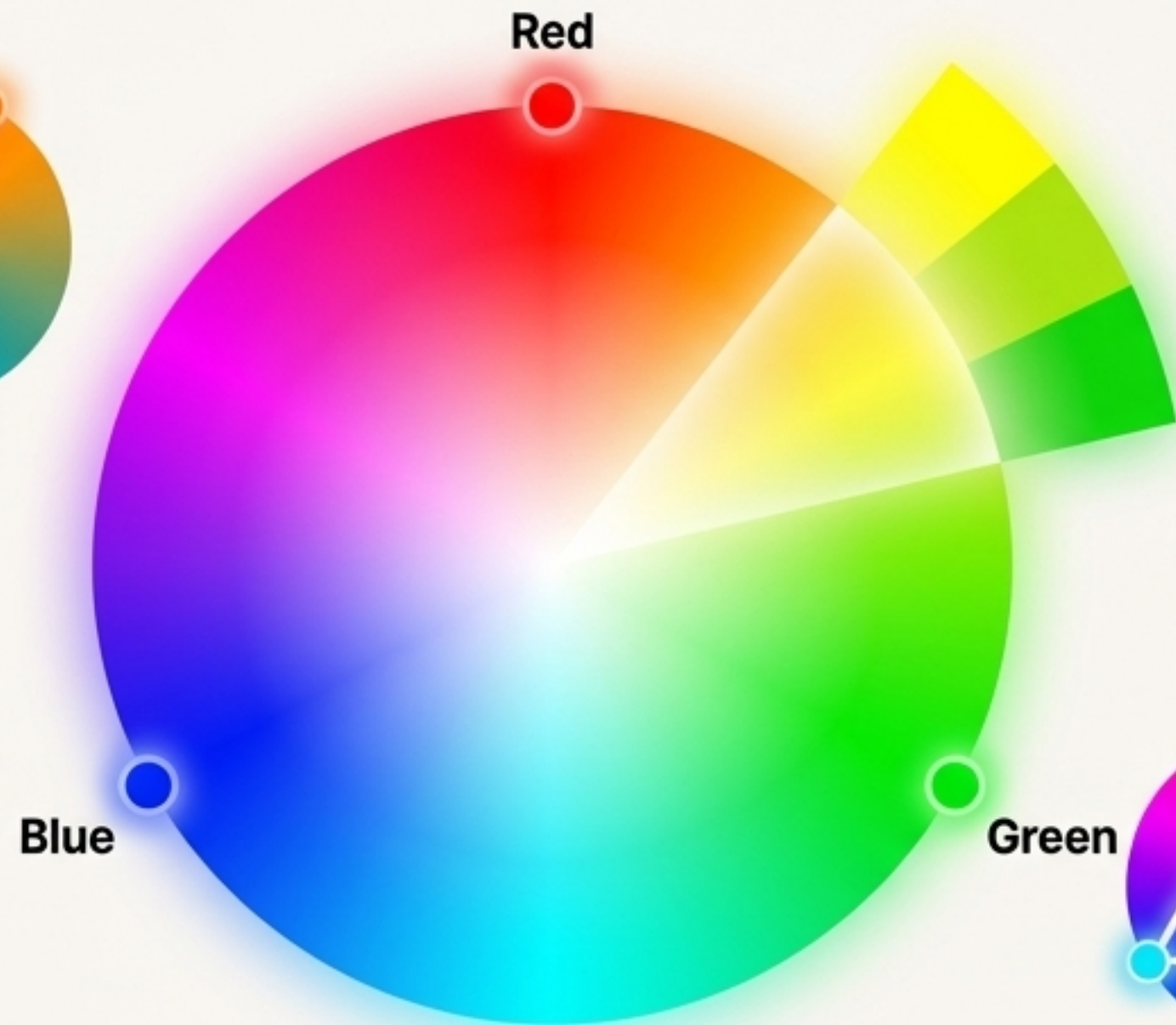
Complementary: Two colours opposite each other (e.g., blue/orange). Creates maximum contrast and visual energy.



Monochromatic: Variations (tints, tones, shades) of a single hue. Creates a subtle, sophisticated, and harmonious look.



Analogous: Three colours adjacent on the wheel. Creates smooth, natural, and calming transitions.



Triadic: Three colours evenly spaced on the wheel. Creates a vibrant, high-contrast palette.



The Digital Disconnect: How Machines See Colour

There is a fundamental disconnect between our intuitive, perceptual understanding of colour (HSL) and the way digital devices handle it. Cameras and displays are built on the RGB (Red, Green, Blue) model, while video compression and transmission rely on Y'CbCr, which separates brightness from colour information.

Perceptual Model (HSL)



Intuitive for humans.

We think in terms of 'a brighter, more intense blue.'

Display Model (RGB)



Built for screens.

A colour is a mix of three light values (e.g., ``rgb(63, 69, 146)``).
Not intuitive for creative adjustments.

Transmission Model (Y'CbCr)



Built for efficiency.

It separates the signal into Luma (Y') for brightness and two Chroma components (Cb and Cr) for colour. This separation is key to modern video compression.

"Luma Y' (with prime) is distinguished from luminance Y, meaning that light intensity is nonlinearly encoded based on gamma corrected RGB primaries."

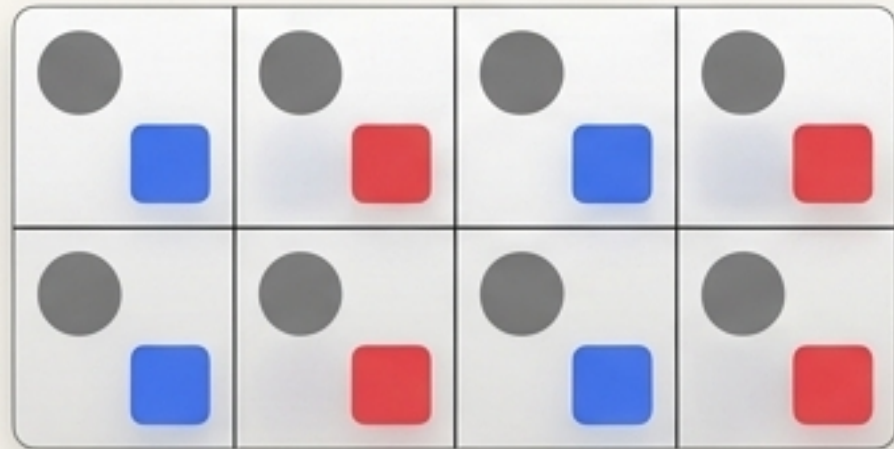
– Sourced from Wikipedia on YCbCr.

The Efficiency of Sight: Understanding Chroma Subsampling

Chroma subsampling is a compression technique that leverages a quirk of human vision: we are far more sensitive to changes in brightness (Luma) than in colour (Chroma). By recording colour information at a lower resolution than brightness, we can significantly reduce file size with minimal perceived loss in quality.

Chroma Subsampling Ratios

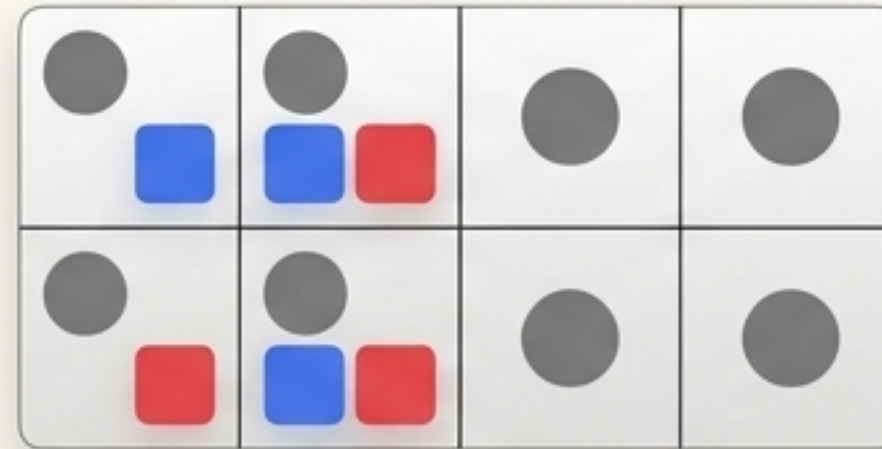
4:4:4 (Uncompressed)



For every 4 Luma samples, there are 4 Chroma samples. No subsampling.

Maximum colour detail, required for high-end VFX and post-production.

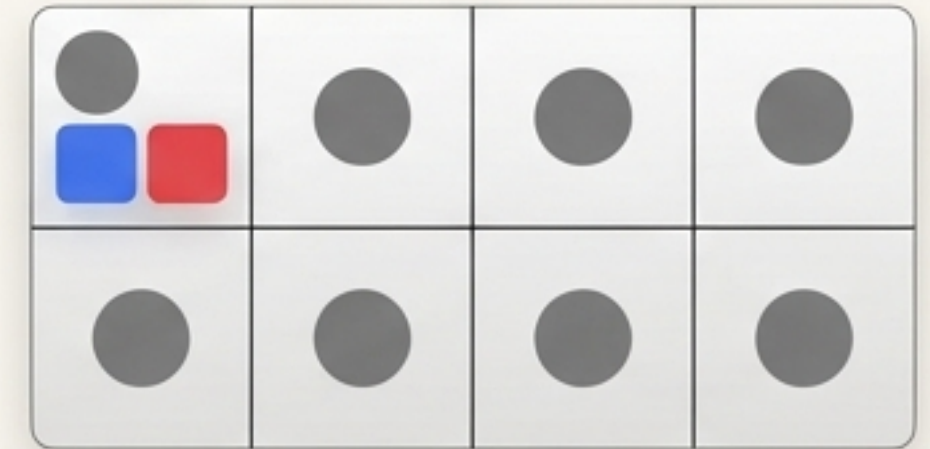
4:2:2 (Professional Standard)



For every 4 Luma samples, there are 2 Chroma samples. Horizontal colour resolution is halved.

Standard for professional broadcast. Reduces bandwidth by one-third compared to 4:4:4.

4:2:0 (Streaming/Consumer Standard)



For every 4 Luma samples, there are 2 Chroma samples on the first row and 0 on the second. Horizontal and vertical colour resolution is halved.

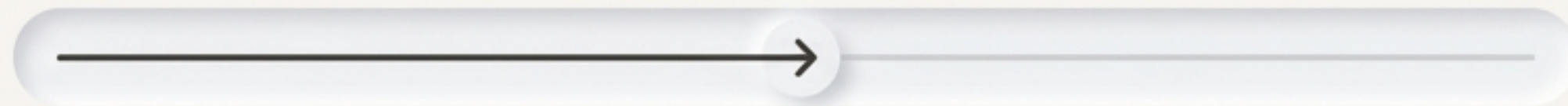
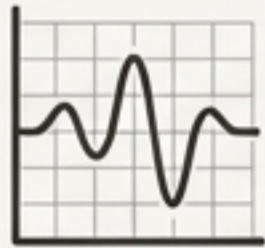
Standard for Blu-ray, DVD, and online streaming.

The Ratios Explained (J:a:b notation):

The scheme is expressed as a ratio describing Luma and Chroma samples in a 4x2 pixel block.

Two Halves of a Whole: Correction vs. Grading

While often used interchangeably, colour correction and colour grading are two distinct and sequential processes. Correction is the technical foundation; grading is the creative expression built upon it.



Correction: Technical Integrity

Grading: Narrative Intent

Colour Correction (The Science)

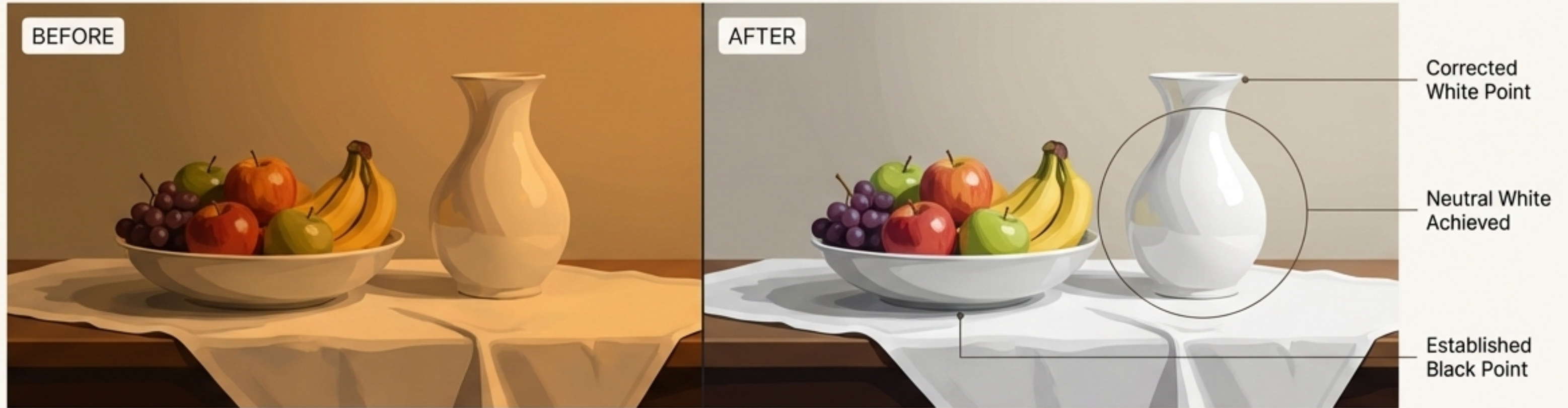
- **Goal:** Technical Integrity. To fix issues and make footage appear natural, consistent, and accurate—as the human eye would see it.
- **Process:** Adjusting exposure, balancing colours (white balance), matching shots, and ensuring technical standards are met.
- **Analogy:** Foundation Work.

Colour Grading (The Art)

- **Goal:** Narrative Intent. To stylise the footage to create a mood, evoke emotion, and enhance the story's visual tone.
- **Process:** Creating an aesthetic, applying a 'look,' manipulating colour palettes, and influencing the audience's psychological response.
- **Analogy:** Artistic Expression.

The Craft of Correction: Establishing a Neutral Foundation

The primary goal of colour correction is to achieve a **uniform look** across all scenes, regardless of lighting conditions during filming. This involves two main adjustments: managing **Luminance** and balancing **Hue**.



1. Luminance Correction: Exposure & Contrast

Objective

- To ensure a full and proper tonal range.

Actions

- Adjusting overall brightness to fix overexposed or underexposed shots.
- Setting the black point (the darkest part of the image) and the white point (the brightest) to optimise dynamic range.

2. Hue Correction: White Balance

Objective

- To render neutral colours correctly and remove unwanted colour casts.

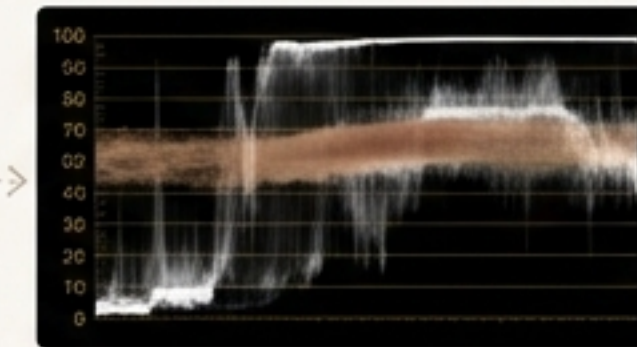
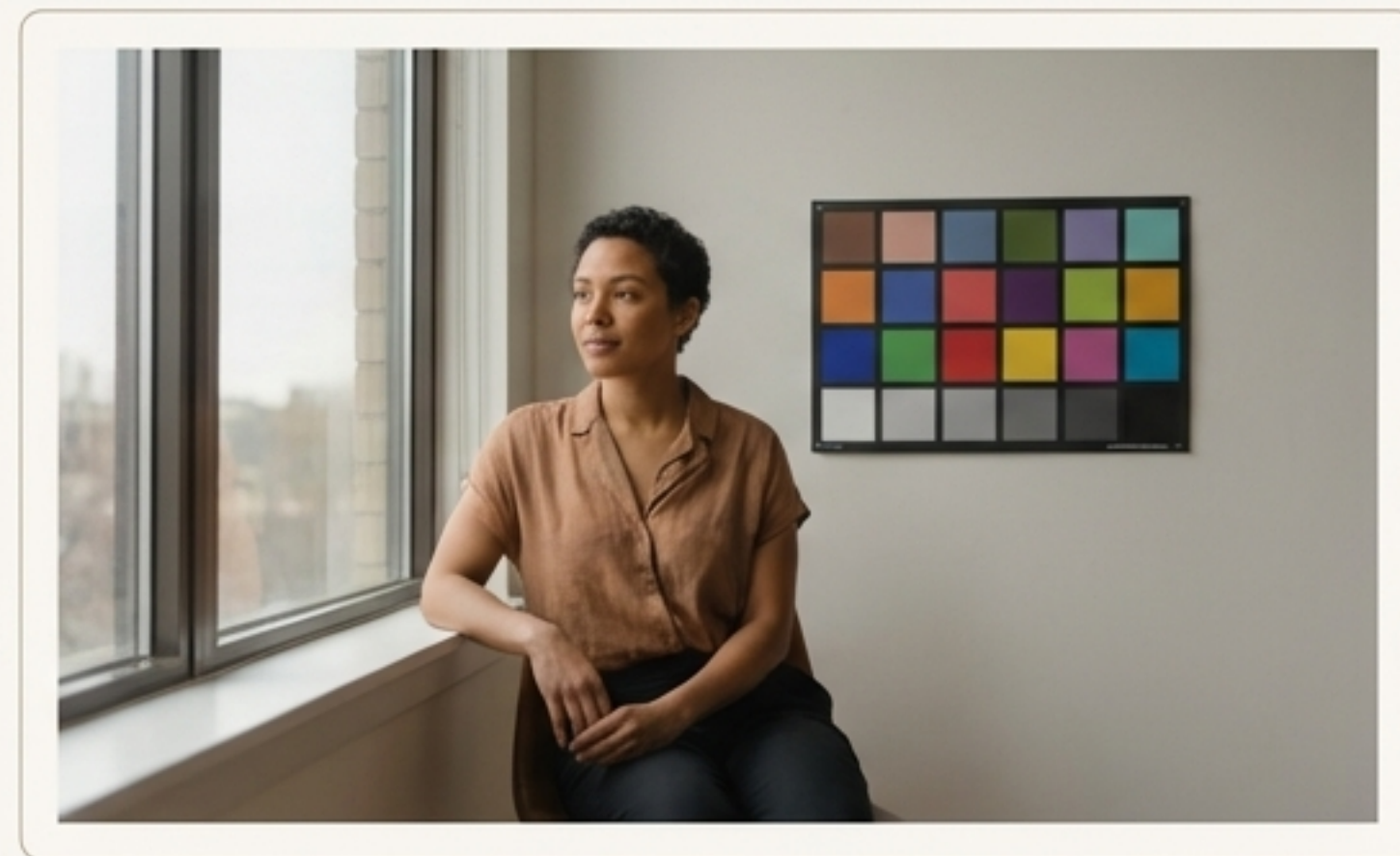
Actions

- Using **Colour Temperature** (Kelvin scale) to correct the blue-orange axis (e.g., counteracting the orange cast of tungsten light).
- Using **Tint** to correct the green-magenta axis (e.g., removing the green cast from fluorescent lights).

Pro Tip: "Getting [white balance] right is therefore critical for accurate skin tones, and can improve colour saturation dramatically even though saturation isn't being adjusted directly." – Sourced from RED Cameras.

Seeing the Signal: Diagnostic Scopes for Objective Analysis

You can't always trust your eyes or your monitor. Video scopes are essential diagnostic tools that provide objective, quantifiable measurements of the video signal, ensuring technical accuracy and broadcast compliance. Each scope directly relates to a pillar of colour.



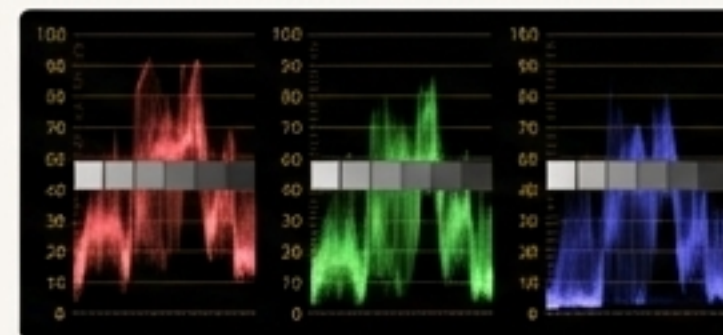
Waveform Monitor (Measures Luminance)

Displays brightness levels from left to right across the image. Used to set exposure, check for clipped highlights and crushed blacks. Ensures skin tones fall within the correct range (typically 50-75 IRE).



Vectorscope (Measures Hue & Saturation)

A circular graph showing colour information. The angle indicates the Hue, and the distance from the centre indicates Saturation. Used to check for colour casts and ensure colours are within the legal broadcast gamut.

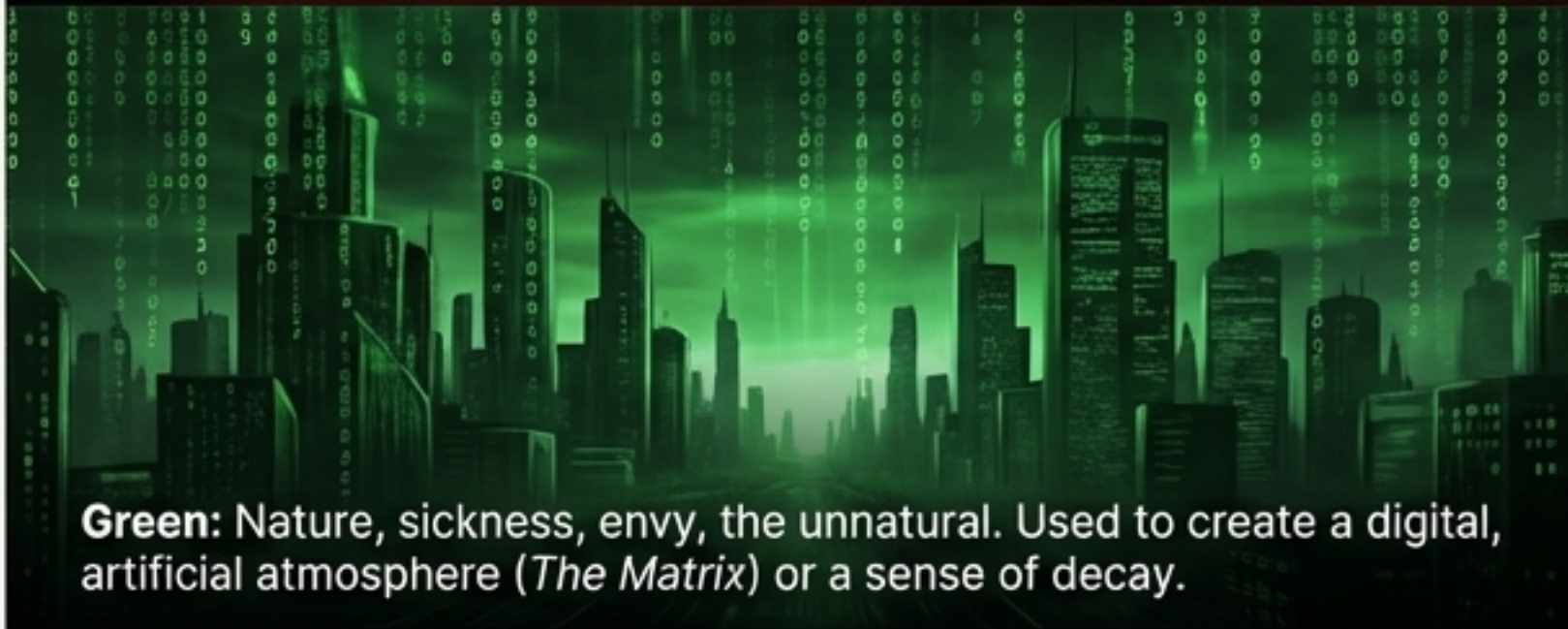


RGB Parade (Measures Colour Balance)

Displays the intensity of the Red, Green, and Blue channels separately. Used for precise white balancing—when the three waveforms are aligned at similar levels, the image is neutral.

The Art of Grading: Painting with Emotion

With a corrected, neutral image as our canvas, colour grading transforms the footage into a visually compelling story. This is achieved by applying a deliberate colour scheme to evoke specific psychological responses.



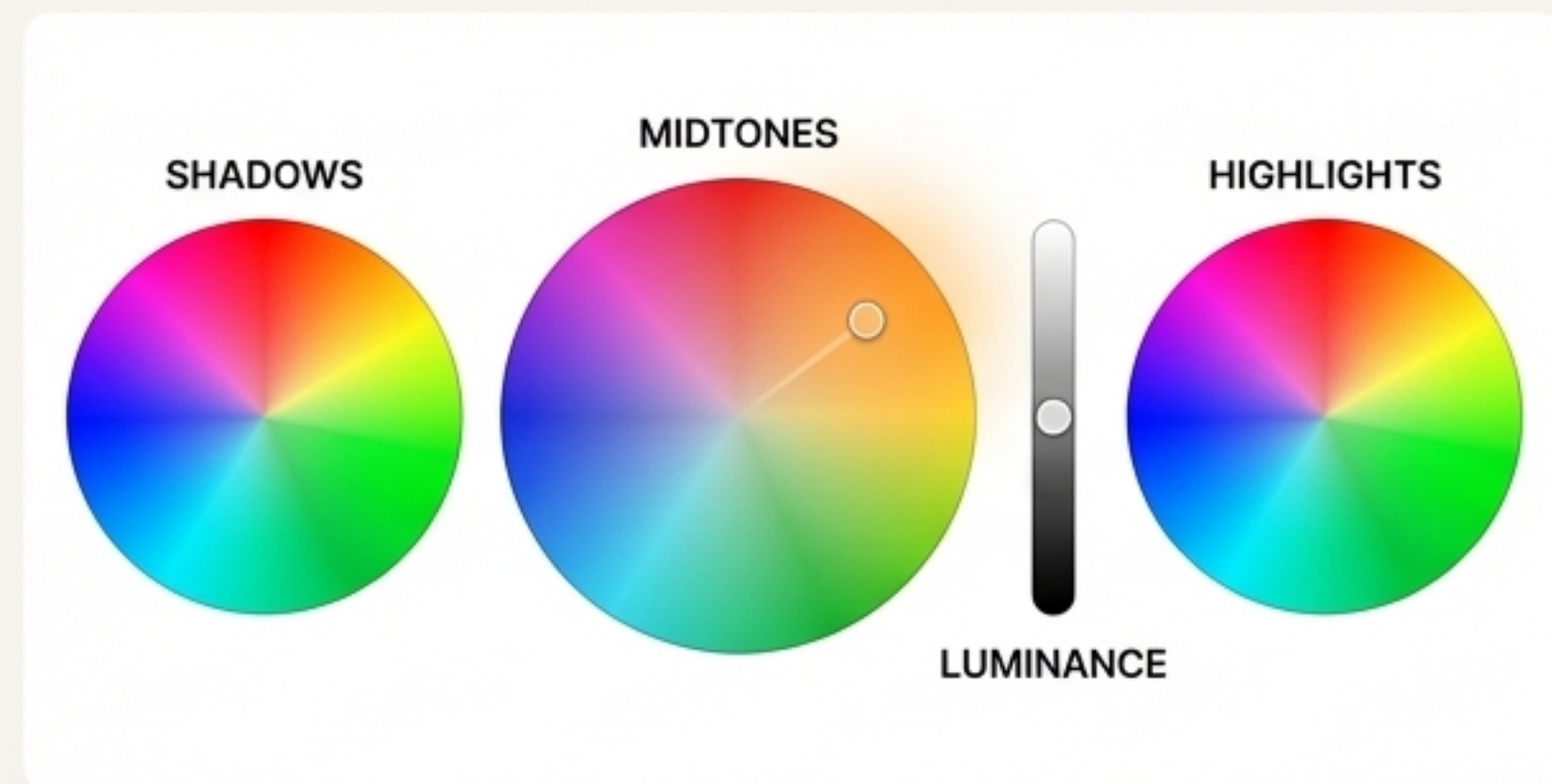
‘Colour in film is not just what you see, it’s what you feel. Every hue should serve the story’s emotional core.’

– Roger Deakins (as quoted in Morph Studio)

The Grader's Toolkit: Precision Tools for Creative Control

Creative grading requires tools that offer targeted control over different parts of the image. These tools allow artists to manipulate Hue, Saturation, and Luminance with precision to build a distinct look.

Colour Wheels (Primary Grading)



- Allows independent adjustment of colour balance for **Shadows, Midtones, and Highlights**.
- Dragging the control point adjusts Hue and Saturation. An adjacent slider controls Luminance.
- Example: Pushing shadows towards blue cools down dark areas, while pushing highlights towards yellow warms up bright areas.

HSL Tuning / Secondaries (Secondary Grading)



- Allows for fine-tuning of **specific, individual colours** within the video.
- An artist can select a narrow range (e.g., 'just the reds in this shirt') and adjust its Hue, Saturation, or Luminance without affecting the rest of the image.
- Essential for drawing audience focus, colour matching, or creative effects like desaturating all colours except one.

Case Study in Harmony: The Teal and Orange Look

Perhaps the most prevalent look in modern cinema, the "Teal and Orange" grade is a powerful application of complementary colour theory. It creates immediate visual separation and depth.



The Theory

It leverages the complementary relationship between orange and blue/teal on the colour wheel.

The Psychology

It's effective because human skin tones naturally fall within the orange range. By pushing the background and shadows towards the complementary cool tone (teal), the warm-toned subjects 'pop' out of the frame, drawing the viewer's focus.

The Technique (Split-Toning)

- **Shadows:** Cool tones are introduced (e.g., RGB: 44, 66, 81).
- **Midtones:** Preserved and enhanced to keep skin tones natural and warm.
- **Highlights:** Warm accents are added (e.g., RGB: 255, 214, 170).



Gallery of Masters: When Colour Becomes Character

The most memorable cinematic worlds are defined by their deliberate and masterful use of colour. Here, the grade is not just an effect; it is integral to the narrative.

Mad Max: Fury Road (2015)



Technique: Extreme Teal and Orange contrast, with hyper-saturated midday scenes (over 30% saturation increase) and deep blue/green night scenes.

Effect: Creates a brutal, high-energy, and graphic apocalyptic world. The grade required over 150 unique colour transformation nodes per scene.

La La Land (2016)



Technique: Use of vibrant, saturated primary colours, mimicking the classic Technicolor musical.

Effect: Evokes a dreamlike, optimistic, and fantastical version of Hollywood, where colour reflects the characters' romantic and artistic dreams.

The Matrix (1999)

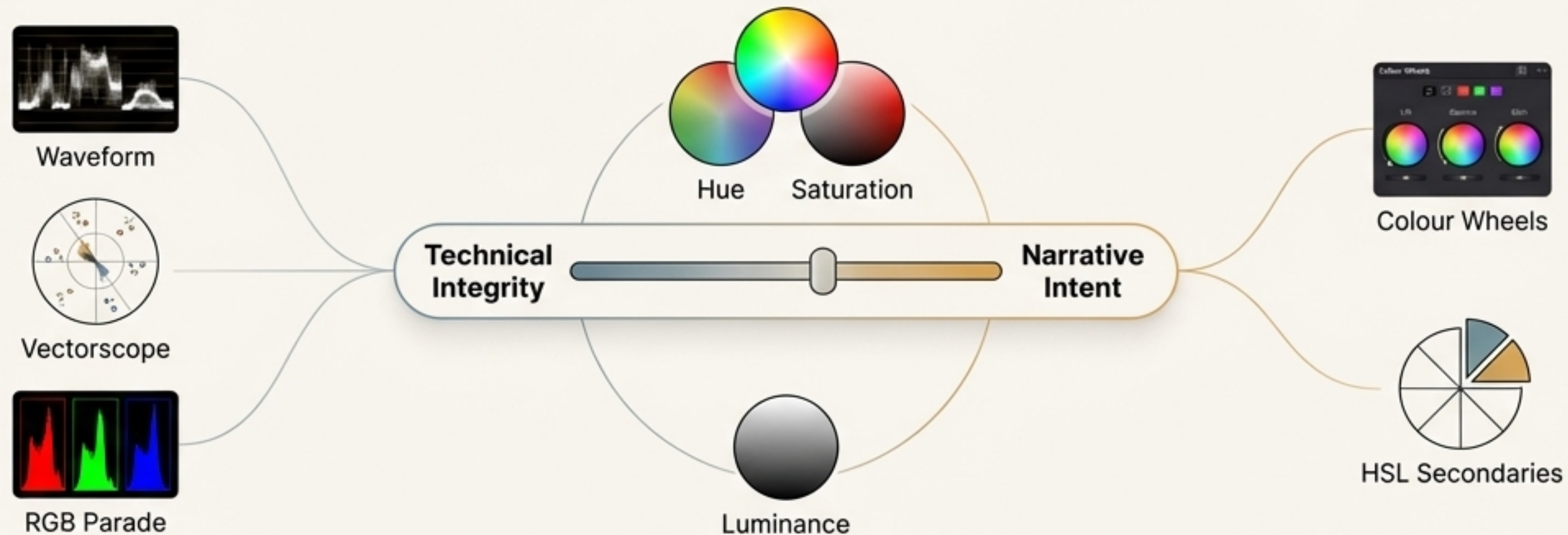


Technique: A pervasive, monochromatic green tint permeates the digital world of the Matrix.

Effect: Creates a sense of sickness and artificiality, visually distinguishing the simulated reality from the neutral, desaturated look of the real world.

The Complete Spectrum: From Technical Integrity to Narrative Intent

Mastering cinematic colour is a journey across a spectrum. It begins with the scientific precision of correction to build a stable foundation and culminates in the artistic expression of grading to tell a story. The process is a constant, deliberate manipulation of the three pillars of colour to serve a single purpose.



The HSL Trinity in Action (Recap)

- **Luminance:** Corrected with the **Waveform**, then creatively shaped with **Curves and Colour Wheels**.
- **Hue & Saturation:** Balanced with the **Vectorscope & RGB Parade**, then stylised with **HSL Secondaries and grading techniques** to evoke emotion.

The Core Principle

Always start with proper colour correction before moving to creative colour grading. The best grades are built on a foundation of technically sound footage.