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Poynton's Vector 2 Colour, tint, and the naming of things

In the previous column, I explored the controls called contrast and brightness. This time, I'd like to explore colour and tint. As before, I'll typeset the names of controls in small capitals.

You may find it idiosyncratic, but I'll spell *colour* the way I did as a child – and in the manner that my wife and daughters insist – instead of the way I spelled it when I lived in California. Hey, we're all quirky in one way or another!

Colour and tint controls arose historically from the mechanism of NTSC encoding. In analog NTSC, poor frequency response characteristics and differential gain errors often led to reduction of the amplitude of the modulated chroma signal. Broadcast technicians corrected those impairments manually by increasing chroma gain. Comparable facilities were introduced to consumers, labelled as colour.

I argue that colour is misnamed because the consumer can't be expected to know whether colour means *which* colour or *how much* colour! Some professional equipment uses the name saturation. That name is a poor choice in my opinion because *saturation* refers to many other phenomena – for example, clipping of overexposed scene elements in a camera's image sensor. It seems to me that we should adopt the name chroma, as is used on some receivers: This name clearly suggests the amount of colour. It is intuitive that setting chroma to zero yields a greyscale image.

Going back to analog NTSC, differential phase errors often led to shifts in phase of the modulated subcarrier. Such shifts produced visual hue errors. In the worst cases the intended hue could only be established by manually rotating the decoder's subcarrier phase reference. Some professional decoders still today have phase adjustment; in consumer equipment the control came to be known as tint.

Wikipedia (2010), *Tints and Shades*, <http://en.wikipedia.org/wiki/Tints_and_shades>).

I argue that tint is misnamed: To an artist, "to tint" means to add white, thereby lightening a colour *without* changing its hue! A quick check on Wikipedia or Google confirms the popularity of that interpretation. Phase refers to the underlying technical mechanism, but we should not burden the consumer with a term dependent upon the implementation; rather, we should use a perceptual term. The obvious perceptual name appropriate for this function is hue.

So, although colour and tint are popular among consumer receivers, chroma and hue are, in my view, far preferable.

The BLUE ONLY feature of professional NTSC displays provided the video technician with a simple way to disable the red and green components of the displayed colours. In the colourbar test signal, the cyan and magenta bars both contain the same amount of the blue primary, and when displaying BLUE ONLY they should display identically. However, modulated subcarrier phase differs between the two; only if HUE is set correctly will the decoded blue component values match. The white and blue bars both contain the same amount of the blue primary, but white has no modulated subcarrier. Only if chroma gain is set correctly will the blue decoded from the blue bar match the blue decoded from the white bar.

The HUE adjustment is meaningful only when decoding composite video. In a professional broadcast video monitor – "BVM," the subject of a future note – the CHROMA (or SATURATION) and HUE (or PHASE) controls are typically disabled when viewing a component input.

Providing a HUE control may be useful in program creation, but is highly unlikely to be useful as an expression of a consumer's viewing preference. My recently purchased LCD computer display has only *R'G'B'* digital inputs. There's no composite NTSC input, and therefore no modulated chroma signal to correct; however, the display provides not only a CHROMA adjustment (there labelled SATURATION) but also HUE (labelled TINT)! Apparently this display's signal processing chain takes perfectly good *R'G'B'*, encodes to $Y'C_BC_R$, applies chroma gain and C_B/C_R rotation, then matrixes back to *R'G'B'*! In my view this "feature" is design engineering gone amok, or perhaps symptomatic of poorly informed marketing. HUE should simply be made correct by design. No useful perceptual attribute is addressed by rotating hue, and in component or digital video, no useful purpose is served by providing the consumer with a HUE control.

Poynton's Fourth Law:
Once a program is mastered, errors in mastering are indistinguishable from expressions of creative intent.

Some people may argue that a HUE control enables correction of poorly mastered program material. To them, I assert Poynton's Fourth Law (in the margin). If you "corrrect" hue, what are you correcting to? In *The Hulk,* the protagonist's face is supposed to be green. Admittedly a HUE control could be used to render Hulk's face with normal skin tone, but isn't that detrimental to creative intent?

There is a minor reason that argues in favor of providing a CHROMA control to the consumer. A bright display (more than 100 nt), a bright ambient, and/or a bright surround may cause a systematic increase in colourfulness. If the consumer's viewing situation differs from that at mastering, maintaining creative intent may require dialing-back some of the colourfulness increase. This topic will be the subject of a future piece. I welcome your comments and suggestions! ■