The Relapse of Chroma Phobia

By David Ranada

Precisely one year ago in this column I ran "The Story of S, or Chroma Phobia," in which I stated that videodiscs would not benefit from the separated luminance (Y) and chrominance (C) signals carried by the Y/C, or S, connectors first encountered on Super VHS machines. However, I've been proven wrong on this point by the Philips CDV-488 (see test report, p. 19). The benefits of its Y/C output are not always visible, but they do exist and can be quite striking at times.

A Y/C connection prevents the interference between luminance and chrominance that can result in "dot crawl" (color being decoded as fine detail) and moiré effects (fine detail being decoded as color). Because a videodisc carries a composite-video signal—one in which the luminance and chrominance spectra have been overlapped—I had thought that a Y/C connector would not confer any image-quality improvements, since the cross-interference caused by the spectral overlap could not be completely undone. VCRs, on the other hand, record luminance and chrominance in different spectra, and S-connector hookup maintains that separation.

However, in direct comparisons between the CDV-488's composite and Y/C outputs, the latter was often distinctly better. Even though dot crawl did not seem to be reduced, on the well-known color-bar test pattern the Y/C output provided much sharper and cleaner boundaries between colors. Moiré effects were reduced in the resolution-wedge and multiburst patterns. Images with a lot of color detail (such as a multicolored field of flowers) seemed clearer with the CDV-488's Y/C output.

A Philips white paper says that the player's comb filter—which separates the chrominance and luminance out of a composite-video signal—is of higher quality than that normally found in home video monitors. Since the player's comb-filter operation is locked to the same crystal oscillator as the disc-rotation rate, it can provide more accurate color decoding than a monitor's filter. The Y/C connection "avoids the vagaries" of a monitor's other composite-video circuitry as well as its comb filter.

Philips's paper also restates the important but little-appreciated point that the videodisc is the only consumer video medium that is capable of storing a full-bandwidth chrominance signal. A standard NTSC chrominance signal takes up about 1.5 MHz in bandwidth, which is equivalent to about 120 lines of horizontal resolution. Only the videodisc and some professional video formats are capable of storing this much color detail. All three high-luminance-resolution video formats (S-VHS, ED-Beta, and Hi8) have color resolutions unchanged from their original, low-resolution formats: 50 lines. Moreover, this is a theoretical maximum; because of noise problems, color resolution is typically only 30 to 40 lines.

Back when standard Beta, VHS, and 8mm were the only systems available, their limited luminance resolutions formed a close visual match to their limited color resolutions. While the recordings made on these systems have always been inferior to videodisc reproduction, their pictures were nonetheless visually "balanced." Noise levels and resolution for both luminance and chrominance were cannily gauged so that deficiencies in one area covered up faults in others. The low-luminance bandwidth typical of standard VCR formats (at best around 160 lines) helps disguise their high video-noise levels. The color bandwidth of a standard-format VCR is proportionately as inferior to a full-bandwidth NTSC signal as its luminance bandwidth. Both are less than half of what the videodisc is capable of delivering.

The three high-luminance-resolution home VCR formats do not embody such an elegant series of visual trade-offs. Obsessed with horizontal-resolution performance, VCR-format standardizers have gone overboard in obtaining improved *luminance* resolution specs for their new systems. The color performance remains basically unchanged and, in some ways, has become worse.

To me, the most important visual artifact made more obvious by the high-luminance-resolution VCR systems is what I call color fringing. This manifests itself as a tinted aura around a brightly colored object, especially when seen against a white or gray background. It's as if the color in that object somehow leaked outside its area on the image—the so-called "paint by the numbers" effect. Fringing has been exacerbated by the improvement in luminance resolution without a corresponding increase in chrominance resolution. With the new VCR systems, the edge of an object can be positioned with a horizontal luminance resolution of more than 300 lines. The color, however, still has a 40-line resolution; it can be positioned with ten times less precision than the luminance detail (it used to be only about three times less).

The situation is made worse by the use of certain types of processing in the decoding of videotapes. On top of the fringing effect, the use of unequal-length delay lines for luminance and chrominance causes the fringing to start "late" (a scan line or two beneath where the object starts), thus smearing the color even more. Just try to tape disco lights or a Christmas tree and not get these effects! Even Y/C connnections won't help.

Now, don't get me wrong; I'm not going to recommend that any videophile stick with standard VHS, Beta, or 8mm. S-VHS, ED-Beta, and Hi8 all give image reproduction far superior to that of the standard formats. But in their race to improve luminance-resolution figures—because this is the one spec that seems to sell products—VCR manufacturers have again exposed their phobias about dealing squarely with chrominance. As seems to happen regularly in video, technical decisions made long ago are now coming back to haunt us. For high-quality playback of a movie, I'll take the videodisc any day! □