Visual Expectations

Last year, just before baseball season began we got a 40-in. high-definition television (HDTV) with 1080p resolution. Although it did a beautiful job with the Atlanta Braves games, it was most impressive during episodes of the BBC production, "Planet Earth." Because of the quality of such images, you are immediately aware of the limitations of this new technology when the news anchor hands the story off to an announcer on location. High-definition cameras haven't made it out of the studios yet, so the viewer is treated to fuzzy, 4:3-sized TV feeds.

With the advent of HDTV, our visual expectations for television displays have been boosted far beyond what we have grown accustomed to since the advent of color television. That is, if you were born before 1960. Since then we are used to seeing a color picture consisting of 486 visible scan lines. As computer monitors began to be used, the idea of images made of pixels became commonplace. Users chose their computers and displays (VGA, SVGA, SXGA, etc.) based on the number of lines and aspect ratio. This progressive increase in image lines on the desktop and the advances in image compression strategies (MPEGs, AVI, etc.) and codecs has resulted in these impressive HDTVs and our awareness of how little content is available to take advantage of this new technology. We are victims of visual expectations. Beyond the exquisite video, we expect panoramic windows in a 16:9 ratio. Far too often we are shown a 4:3 window with some goofy backdrop to fill out the screen. Many times the fill area contains repetitious animation that can induce anything between sleep and vertigo.

But it's not just in our living rooms that our visual expectations have grown. Almost every movie these days is reviewed not only for its entertainment value but also for the quality of the computer-generated images (CGI) used in special effects. In earlier films the audience accepted certain scenes that were all too obviously shot in front of a back-projected image, but these days any failure to produce the right amount of reality (or unreality in the case of movies like those in the *Harry Potter* and the *Lord of the Rings* series) are as quickly dismissed by full-time movie reviewers as they are by finicky fans.

It's not just optical engineers and other technical workers who are aware of the technology and establish their visual expectations. Anyone with a digital camera who makes his or her way up the ladder of technical features such as image stabilization, RAW image output, and detector pixel count is affected by the rapid advance of technology.

But this intense involvement in optical technology has also taught them something about device limitations. No one expects cell phone images to be very good. The same can be said of videos from digital cameras. But sometimes it's all you have to capture an event. (An example is a digital camera video of a pod of 18 whales during a bubblenetting episode that I captured last August, available at http://web.mac.com/donoshea/Alaska/Movie.html.) Not great, but still compelling. Sometimes the results can be magnificent. Other times, there's YouTube.

But the understanding of the limitations of optical technology is usually confined to features of single devices and does not extend to entire systems. For example, people will buy a digital camera that has far more features than they can ever use and is far more expensive than is needed. Buying a $1000 10MP Nikon camera to take pictures to be printed out on an inkjet printer on 4×6-in. paper is not a prudent use of money. Nor do many buyers standing 4 ft away from HDTVs comprehend the limitations of their vision when they choose an HDTV in the store that will be located two to three times farther from their couch in the den. These experiences can temper their expectations.

There is, however, one CGI effect in a movie released 30 years ago that has raised popular visual expectations beyond current or near-future resources. At the beginning of first *Star Wars* movie there is a 3D image of Princess Leia projected in midair. Later there is a chess game with holographic pieces on the Millennium Falcon. These sequences have bedeviled optical designers, engineers, and particularly holographers ever since.

In recent years I have seen 3D television presentations, some without special glasses, that are quite satisfying, provided your head remains in the "sweet spot" for viewing. I believe that once hubbub surrounding HDTV has settled down to a low roar, the development of 3DTVs will raise our visual expectations again. Still, there will be those who, when an optical engineer boasts about the newest 3DTV screen, will ask why they can't snap a hologram like those of Princess Leia on their cell phone?

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