Addendum to *Light Exposure to Sensitive Artworks During Digital Photography*

Recent developments in lighting and scan back technology

In the same issue of Spectra in which this article appeared, Norbert Lossau and Martin Liebtruth at the Gottengen State and University Library published *Conservation Issues in Digital Imaging*,[1] in which they reported on their project to digitize a Gutenberg bible on vellum, using a PictureGate 8000 scan back with fluorescent lights. Conservators monitoring that project recorded 9000 lux at the copy stage for a duration of ten minutes, yielding a total exposure of 1500 lux-hours. They also cited the reciprocity law and extrapolated the exposure of a single page to its equivalent of four days in an exhibition. Although their light level was somewhat higher than any I had encountered, the total lux-hours and the equivalent gallery time was the same as mine, a coincidence I welcomed with satisfaction and some relief.

There have been two significant technological developments since these articles appeared. A new light source is now available as photographic lighting, and one scan back manufacturer, Better Light, Inc. of San Carlos, California, has announced models using an improved Kodak CCD, claimed to be twice as sensitive as the previous chip.

Ceramic high intensity discharge lamps used in instruments made by Buhl Industries and De Sisti now provide another lighting option for scan back capture. This technology has been around for awhile for display lighting, but I wasn't aware of anyone using it for photography two years ago. Like fluorescent, ceramic HID is an efficient source of light: a 150 Watt lamp produces as much visible light as a 650 – 800 watt tungsten bulb, depending on reflector design, but much less heat. Lamps are available with color temperatures of 3000˚ and 4200˚Kelvin, and both IR and UV emissions are low. Steven Weintraub of Art Preservation Services measured the UV output of Buhl Softcubes at the American Association of Museums Conference in May. He got a reading of 150 µWatt Lumens, twice the level of conventional tungsten incandescent bulbs, but about the same as quartz halogen. UV can be virtually eliminated with 12-inch square UF3 plex filters dropped into the filter slots on the face of the unit. The lights produce so little heat that an air space between the instrument and the filter isn't necessary.

Ceramic HID lamps can't be switched on and off to lessen exposure during operations that don't require full light. Like fluorescents, they require about five minutes to get up to full output and stabilize, but unlike fluorescents, once turned off, they can't be restarted until they've had five to ten minutes to cool down. Gobos or cover boards can be used to minimize exposure instead. I've been using Buhl Ceramic HID lights at the Berkeley Art Museum for several months and they seem like a reasonable alternative to fluorescents from a conservation standpoint. They produce a somewhat harder, more specular light than fluorescent tubes, something like a tungsten lamp in a large shallow reflector.

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[1] Spectra Volume 26 No. 2 available in PDF format at http://www.mcn.edu/spectra.htm

Electronic sensors produce good color fidelity with these lights, especially with the 4200˚K lamps.

I haven't had the opportunity to test the De Sisti HID lights, which are quite different in design and use a different 150 Watt HID lamp, but would expect the IR and UV characteristics to be similar. The De Sistis use a two-pin base tube in a small reflector with a glass shield, which might affect the UV output, glass being a good filter of some UV wavelengths.

The museum's scan back was equipped with the improved Kodak CCD in May, through Better Light's normal upgrade policy, which states that they will upgrade any of their scan backs for the price difference between the two models plus a reasonable labor charge. After several months using the new chip I can report that it performs better than advertised. With the old model I tried to avoid ISO settings above 400 because at higher settings noise began to be noticeable, especially in the blue channel. If the new chip performed as claimed, it should be possible to go as high as ISO 800, one stop faster, with the same results. In practice I've found it possible to push the ISO well beyond 800 before noise becomes apparent. Other users have reported this as well. The new chip just seems to be "cleaner" at all settings. This means that I can use either half the intensity of light or half the scan time as before if I stay within ISO 800, but in practice I can usually reduce the light or scan time even more than that and still get clean scans.

According to Kodak, this increased sensitivity was achieved through improvements in the filter coating of the CCD. I haven't heard of any other scan back manufacturer adopting this new Kodak chip, but it's reasonable to expect eventual improvements in light sensitivity in all scan backs since high light requirements have been one of the disadvantages of this type of digital camera. For now it's probably best to retain "4 days at 50 lux" as a benchmark, because there are scan backs of so many different vintages and designs in use.

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