Photographic quality : Pushing the boundaries

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ABSTRACT: Image size vs image quality is one of the great debates in the age of digital photography. This paper is about the technical and quality improvements in the image quality in the last recent years. With the advance in technology and with pricing decreasing time by time, we are reached today a situation where high quality photographic quality has topped user needs and so image quality. Perfect photographic quality print means starting with a well exposed negative or a good balanced digital photo. High dynamic range (HDR) can help to extend our dynamic range and the middle tones by stretching and adapting the curve to match (and sometimes exceeding) the final print. However, to find the best solution and the most balanced final output, it is always important to consider the human fine-tuning of the photographic operator and use and not" abuse with technology or by interpolating too much our picture. In essence, photography should always be considered a medium of inspiration, an art of vision and creativity.

1. INTRODUCTION

When it comes to getting the best image quality from your camera, metering is one of the most crucial ingredients. A series of camera metering techniques designed to give you the most accurate exposure possible are essential also to get a perfect print and image quality.

For effective metering, one option is to stick with the Evaluative mode and to dial in an appropriate amount of +/-EV (Exposure Value) bias. The usage also of high dynamic range is a good approach as it can help to easily

Pushing print to the limit requires to use technology and know how together in the best manner. However, as said in the introduction, do not be fool. Do not go for interpolation or exceeding your limits. In the museum and cultural heritage sector, for example, other features might be more important such as image longevity, photographic conservation, image fidelity to the original scenery.

There will be over 2bn iPhone and Android smartphones on earth by the end of 2015: with perhaps 4bn people on earth with mobile phones, there are at least 3bn camera phones and probably over 3.5bn. Over 1.5bn new photos are shared every day on Facebook, WhatsApp and Snapchat alone, which equates to about 550bn a year, and this is growing fast. The number of photos we take each year has sky rocketed. In fact, in a recent presentation by Yahoo!, it was claimed that as many as 880 BILLION photos were taken in 2014.

With so much available content, fine art print and fine art photography can access a great wealth and variety of images that are ready to be printed from small passport size up to gigantic posters and billboards.

PHOTOGRAPHIC QUALITY TODAY

A 320-gigapixel image taken from top of London's BT Tower has set the world record of the largest panoramic photo. It breaks the previous record set by a 281-gigapixel electron micrograph of a zebrafish embryo taken in 2012. The London image was shot by panorama specialists 360 Cities and is made up of 48,640 individual frames. To get an idea of just how large this photograph is, BT says if it was printed at 'normal resolution' the photo would measure measure 98 x 24 metres. The photo was taken with four Canon EOS 7D cameras and EF 400mm f/2.8L IS II USM lenses plus Extender EF 2x III teleconverters. The cameras were mounted on Rodeon VR Head ST robotic panorama heads. The team took three days to shoot the individual photos and three months to process the final image [1].

Figure 1: The image shows a full 360 degree view of London in incredible detail.

Figure 2: If printed, the BT Tower panorama would be 98 meters across and 24 meters tall, 'almost as big as Buckingham Palace.'

TECHNICAL HIGHLIGHTS OF THE PROJECT:

- Working over a period of three chilly days in 2012, the 360Cities team spent hours on the 29th floor outdoor platform of the BT Tower working with four cameras to record the 48,640 images comprising the panorama.
- Four Canon EOS 7D cameras with EF 400mm f/2.8L IS II USM lenses and Extender EF 2x III teleconverters were mounted on Clauss company Rodeon VR Head ST robotic panorama heads and positioned in four secure locations around the 29th floor platform.
- The Clauss company robotic panorama heads are capable of 72,000 steps in a single 360 degree arc, and in this case were set to fire four frames a second.
- Laptops monitored a live preview of the progress of the shoot, which was accomplished in the teeth of sub-

freezing temperatures and occasional 50 mph winds high above London.
- The 360Cities photography team of Jeffrey Martin, Tom Mills and Holger Schulze ensured that not a single individual frame from the more than 48,000 planned was missed.
- The raw images were then processed over a multi-week period using Fujitsu Technology Solutions' Celsius R920 workstation with 256GB of RAM and 16 cores at 3.1GHz, and Autopano Giga panorama stitching software from Kolor.

The resulting online interactive version of the photo is presented in multi-layered, tiled resolution that permits zooming in to view extreme details, and is composed of millions of individual image tiles.

However this is not the only case of pushing photography to the extremes.

Extremely high resolution images of our planet exist (i.e. ones that can resolve a dime (with sub-1mm ranging accuracy from~750,000 ft above the Earth's surface)). The images were captured, stored, and processed (using classified hardware and software). The (3D, color) images use spectral information gathered from telescopes (whose *focusing* mirrors are larger and 100x smoother than the Hubble) to "pain"color onto each point of a 3D LiDAR scan (these are point clouds with approx. 1 billion points per square foot). These (terabyte-sized) images are captured at 1/5,000 s intervals and motion deblurred during post-processing. They are not publicly available for obvious reasons.

NASA, satellite images (in most cases) and military images are in many cases also good example where high image quality is needed or available thanks to today's technology.
In NASA case for example, the Andromeda galaxy (or M31 as NASA scientists call it) is 2.5 million light-years away and contains one trillion stars, but these figures did not prevent NASA Hubble Space Telescope to capture a section of it in the largest composite image ever taken. The 1.5 billion pixel picture is actually made of 411 images (taken over 3 years) that sweep over 100 millions stars and manage to focus on individual ones in the same way as one would focus on one grain of

sand when taking a picture of a beach, NASA explains.

So technology is available today, easily and cheaply also in popular smart phones capable to take up to 40 megapixels images in 1 single shoot! This is much better than most consumer digital cameras! And for this reason, there is today a very serious threat that by year 2020, camera phones will surpass sharply compact/consumer digital cameras.

BEST PRINTING IN MUSEUMS TODAY

Epson America, Inc. announced on October 26th, 2015 another milestone in photographic ink technology and print longevity with preliminary print permanence ratings for its new Epson UltraChrome HDX pigment ink technology. Featured in the new SureColor P7000 and SureColor P9000 printers, data accumulated to date indicates that – depending upon the type of paper – the new inks can provide print permanence ratings of up to 200 years for color prints, and likely in excess of 400 years for black and white prints when printed with Epson's "Advanced Black and White Print Mode." According to comprehensive tests conducted by Wilhelm Imaging Research, Inc. (WIR), the world's leading independent permanence testing laboratory, Epson UltraChrome HDX pigment inks can provide up to twice the Display Permanence Ratings of earlier generations of Epson UltraChrome inks with most Epson photo and fine art papers, including the new line of Epson Legacy Fine Art Papers.

The permanence of displayed prints created with new UltraChrome HDX and HD inks far exceeds that of the very best silver-halide color (chromogenic) papers – including silver-halide color papers that are face-mounted to UV-filtering acrylic sheet. The result is a new level of color print permanence for the fine art, museum, documentary, portrait/wedding, and commercial photography markets that have been relying on silver-halide color papers for their customers. The enhanced display permanence ratings of the new Epson UltraChrome HDX pigment inks set a new benchmark that the comparatively low-stability chromogenic dye images of traditional silver-halide color papers simply cannot deliver. Prints made on Epson fine art photo papers and canvas with the new UltraChrome HDX pigment inks are expected to have WIR Album and Dark Storage Permanence Ratings in excess of 200 years, with many of the papers expected to achieve a rating of greater than 400 years in dark storage; the prints exhibit high resistance to atmospheric ozone; have very good water-resistance properties; and the pigment images are extremely resistant to damage caused by storage or display in high-humidity environments. In addition, preliminary data from ongoing tests indicate that, depending on the specific paper, WIR Display Permanence Ratings for black and white prints made with both the UltraChrome HDX and HD inks using Epson's "Advanced Black and White Print Mode" will likely exceed 400 years. [2]

3. BEST IMAGE CAPTURE TODAY

Today to get great images you can often rely on mega pixels cameras. Like with computers where there has been sometime an insane war of gigahert and clocks to speed up computers, today photography is facing the same race in the megapixel sensor. Not alway a bigger sensor is however better. It is important to consider your budget, your objectives to use a bigger sensor in your daily life, the real quality resuslts such as noise, PSNR, lens quality, overall system performance, pixel optimization, color fidelity. Beyond that, though, larger sensors also make it easier to shoot with a shallow depth of field, in which backgrounds blur away to direct attention to the in-focus subject. Portrait photographers love shallow depth of field, but product photographers taking close-up "macro" shots of subjects like watches and jewelry like the opposite. There, medium-format image sensors let you shoot with your lens set at a smaller aperture before the photo suffers from the blurring effects of what's called diffraction limiting.

Now talking about a specific camera solution, we should consider for this paper PhaseOne. The reason is because PhaseOne has created recently a specific initiative and marketing focus in the cultural heritage sector and their newest CaptureOne 8.x software can sport also the CH version which provide several and specific advantages for museum curators, photographers and people involved in fine art imaging.

So let's briely introduce to this paper the latest digital camera from PhaseOne, the XF.

The XF system features a new 'Honeybee' autofocus platform (created in-house) and

'Flexible One Touch UI' interface that the company says is based on 'clean Scandinavian design'. Phase One states that the user interface is highly customizable and can 'evolve in accordance with customer needs and feedback'. The XF supports modular viewfinders, including 90 degree prism and waist-level models. The body supports both IQ1 and the new IQ3 digital backs.

Speaking of the IQ3, these new digital backs come in three flavors: 50, 60, and 80MP. The 50MP version is a CMOS with a claimed 14 stops of dynamic range, while Phase One opted for CCD-based 60 and 80MP sensors that each offer 13 stops of DR. All three backs can take 60 minute exposures, sport 3.2" touchscreen LCDs, and have built-in 802.11n Wi-Fi. The company also says that the IQ3 backs are capable of faster data transmission and power sharing between their two batteries. Along with the XF and three new backs are a pair of Schneider-Kreuznach leaf shutter lenses. These 120mm F4 and 35mm F3.5 lenses can resolve to 100MP according to the company, and offer shutter speeds of up to 1/4000 sec.

Figure 3: *PhaseOne XF medium format system [3]*

The new Cultural Heritage edition of CaptureOne 8.x offers a highly specialized feature set that delivers a significantly faster reprographic workflow during both capture and post-production."

Capture One CH 8 main features:

1. Auto Crop for flat art reproduction or books with selectable alignment points
2. Negative Film Reproduction Tool for black & white and color transparent material
3. LAB Color read out for precise verification of colors (1976 CIE L*a*b*)
4. AppleScript support for quick and efficient workflow with feature automation

5. ICC Profiles for Cultural Heritage optimized for both color precision and three dimensional gradients

Figure 4: *CaptureOne 8.x, picture credits Digital Transitions [4]*

3. CONCLUSION

Traditional photography is not dead. Long life to analog photography! However digital photography, digital imaging and digital prints is the standard solution for imaging today and probably for the future. However save our data in a reliable and harvested and compatible solution is truly a must for everyone. Plus print our memories is indeed important. Memory and data can be volatile. Prints are not.

The truth about mega sensors is that it's always going to be a balancing act between the efficiency of sensor technology, lens quality, image sensor size and ultimately what you want to do with your photographs. If you're going to heavily crop images or print them very large, extra resolution could be useful, if you're only sharing them online or producing normal prints, not so much. What we can conclusively say is that you can only make a call on megapixels in conjunction with considering sensor size.

4. REFERENCES

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[3] http://www.phaseone.com

[4]   http://dtdch.com/capture-one-ch/