THE CASE FOR A STANDARDIZED ELECTRONIC IMAGE VIEWING ENVIRONMENT

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INTRODUCTION

One of the major advantages of images in print form, such as the Canadian Camera publication, is that all viewers, regardless of place or time, or display device, see essentially the same image. For electronic image displays, this is not the case and there can be a very wide variation in what individual viewers see because of technological and environmental factors that often alter what the maker intended. This inconsistency in viewer experience makes critical evaluation of images difficult and unfair and creates serious problems with remote evaluation and judging. Likewise, use of a non standard viewing environment leads to erroneous judgements in editing images.

So what can be done to improve the situation? A standardized image viewing environment would go a long way to solving this problem. Benefits include

1. Consistent viewing experience independent of geographic location and time.
2. Consistent viewing experience whether using an electronic screen or projected image
3. Greater consistency and fairness in judging both the intent and perception of an image
4. Photographers using the same standard viewing environment will be able to make image edits that will be accurately shown in other standard viewing environments
5. A standardized viewing environment allow different equipment choices that meeting the standard rather than having to use a particular brand or model
6. Known viewing conditions aid in editing images through soft proofing

PROPOSED STANDARDIZED VIEWING ENVIRONMENT

So what should a standardized viewing environment look like? Here we take into account best practices, equipment availability and pragmatic issues such as ease of implementation.

i) Room brightness

Room brightness has a significant impact on the appearance of an image. High brightness tends to de-saturate an image, significantly reducing the richness of colour, particularly in the darker areas. This is why images look best in a darkened room (a light level below 70 lux}. Editing images in a bright room often leads to over-compensation, such as excessive colour saturation and harsh contrast, to compensate for the veiling

effect of high room brightness. These over-corrections lead to false judgements when viewed properly in a darkened room

ii) Display brightness

Professional and serious amateur photographers use a display brightness of between 80 and 100 nits (cd/sq m) for image editing A display brightness of about 100 nits is the recommended industry standard for electronic display brightness, whether that image be a projected image or a monitor image. This brightness allows prints/publications to be matched to the screen image. Most electronic displays are intended for high ambient light conditions and so the default brightness is usually far too high (200 to 600 nits) for accurate image viewing and editing in a darkened room. You can check your electronic display brightness with your camera exposure meter. 100 nits correspond approximately to a meter reading of 1/30 sec @ f6.3 @ ISO 200 off a pure white image .

iii) Display colour gamut

Joel Silver, the founder of the Imaging Science Foundation, amongst others, has stated that **"Resolution is actually the fourth and least important of the big four image parameters,"** "**The single most apparent thing you see in an image isn't detail but dynamic range, followed by colour saturation and fidelity**.

Another expert in calibration stated "You can scale resolution (change resolution), without actually impacting the artistic efforts of the content - you won't see as much detail, but the overall artistic impression remains. However, when you change the colors to a different gamut, the artistic impression may very well change"

Colour gamut refers to the range of colours that a display or capture device can produce. The human eye is capable of seeing a much larger range of colour than most current image capture and display devices. Scientific analysis has led to several defined colour spaces, such as ProPhoto RGB, Adobe RGB and sRGB. ProPhoto RGB is the default working colour space in Lightroom. This space captures the wide gamut colour space of many camera sensors that produce RAW data output. However, there are no commercially available display devices that can display the ProPhoto RGB gamut at present and so Lightroom maps the ProPhoto gamut into the output device colour gamut with a significant loss of colour range. The Adobe RGB colour space is smaller than the ProPhoto RGB colour space but there are high end projectors and monitors that can display this gamut. Many high-end cameras allow specification of the Adobe RGB colour space for JPG output. **However, considerable effort and knowledge of colour management is needed to effectively use the Adobe RGB colour space**. Finally, there is the sRGB colour space which covers about 70% of the Adobe RGB colour space and for very pragmatic reasons is proposed as the colour space for the standardized viewing environment:

a) sRGB is the default colour space for almost all digital cameras and for many cameras there is no other choice

b) Photo editing programs that do not have colour management capability assume sRGB as the input, working and output colour spaces
c) sRGB is the standard colour space for web images
d) While Adobe RGB compliant projectors and monitors are rare, sRGB compliant projector and monitors are less rare and have become relatively inexpensive. However, most business projectors and monitors are not sRGB compliant; so look carefully at the specifications
e) The color gamut of home theatre projectors is essentially the same as the sRGB colour gamut but the tone mapping is different
f) Most current Apple displays, including iPads and MacBook Pros, are sRGB compliant and so it is easy to have an sRGB compliant workflow on a MAC system

Unfortunately, except for recent Apple screens, most other screens and projectors in use today are far from sRGB compliant as they are intended for the business environment where color accuracy and accurate tone tonal representation are not as important as brightness to overcome high ambient light conditions. **Poor colour gamut and tone mapping is the major source of variance in the viewing electronic images and also causes users to inadvertently over-correct images when in reality they are trying to overcome display device deficiencies**. So photographers should examine this issue carefully for their image viewing and editing set-ups. If the colour gamut and tone mapping are not accurate, increasing the number of pixels will not reveal what is in your camera image files and post processing will never be correct

iv) Tone Mapping

Tone mapping refers to how highlights, midtones and shadow areas are handled by the display device and strongly affects the overall perception of an image . The sRGB standard includes a tone mapping profile as well as a colour gamut profile. Many displays are set up by default to favour mid tones, resulting in poor highlight and shadow detail, since business applications de-emphasize tonal gradations to make things like text look better. Tone mapping, by itself, is incapable of fixing this problem; so photographers should look for photography oriented displays capable producing of good highlight and shadow detail with true blacks (not dark gray).

v) Display Calibration

Although a display device may be specified to be a sRGB device, manufacturing variations may cause some inaccuracies. So a good quality calibration device is usually need to verify and adjust the brightness, colours and tone mapping more accurately.

It should be noted that display calibration devices mainly adjust the tone mapping and provide small colour corrections **but can not turn a non-compliant sRGB device into a sRGB compliant device.** In other words, if a display device is not capable of producing certain colours or deep blacks, as is the case with many LCD displays, there is absolutely nothing that a calibrator can do to produce those colours or a deep black. So, when buying a projector or monitor, you need to look for sRGB compliance and wide tonal range.

The lowest cost calibrators usually do not have capability for measuring and adjusting display brightness nor do they have enough sensors to measure colour accurately, so investment in a good quality calibrator is recommended

vi) Display resolution

There is a myth that "more pixels are better" with respect to viewing images for critical evaluation. More pixels may be better for immersive applications, such as Imax movies or TV viewing, but for critical evaluation of still images the physiology of the human eye determines the number of pixels needed.

One issue in human vision is the resolving power of the human eye. It has been shown that this resolution is about 53 pixels per degree of the visual field – a fact that Steve Jobs used in designing his now famous retina displays

Another issue is the size of the visual field of best acuity, or equivalently the area of static (non scanning) attention of the human eye. It is known that more than 50% of the cones that are used to distinguish fine detail in images lies within the central 10 degree visual field and there are virtually no cones outside a 20 degree field What this means is that while humans do have a large visual field larger than 10 degrees, the larger field of view only enhances ``presence`` or ``ìmmersiveness`` (e.g. for TV or movie viewing). Critical evaluation of an image occurs in the narrow central field; so more pixels is not always better. If we combine the 10 degree field of good acuity with the limit of the resolving power of the eye then we find that areas outside the 500 pixel range, that puts the eye is in immersive mode and not in the critical analysis mode. Even if we use the 20 degree containment region then the Jobs criteria gives about 1000 pixels. One can certainly discuss whether an image should be viewed in immersive or analytical mode but if analytical mode is chosen, then a large number of image pixels is not necessary for critical overall image evaluation. Perhaps this is why the most popular projectors have a resolution of 1024x768 pixels.

While many current displays have relatively high resolutions, this high resolution is generally used to put more items on the screen, but actual work, such as making a edit selection is done on quite a small part of the screen. For judging of images, having to scan an image should be avoided

It is also well know that small images require greater colour saturation and contrast to have the same impact as a larger image; so editing is ineffective on small displays such as cell phones.

SUMMARY

A standardized electronic viewing environment would improve consistency and fairness in judging and also allow photographers to have reasonable assurance that their images are accurately displayed on other displays that conform to the standardized viewing environment.

In summary, the proposed standard electronic image viewing environment is:

1. Well darkened viewing room
2. Electronic image brightness of 100 nits
3. Equipment with a specific sRGB mode
4. Use of multichannel calibrator (more than 5 channels) to verify sRGB compliance
5. For best display quality - match the image size to native resolution of display device