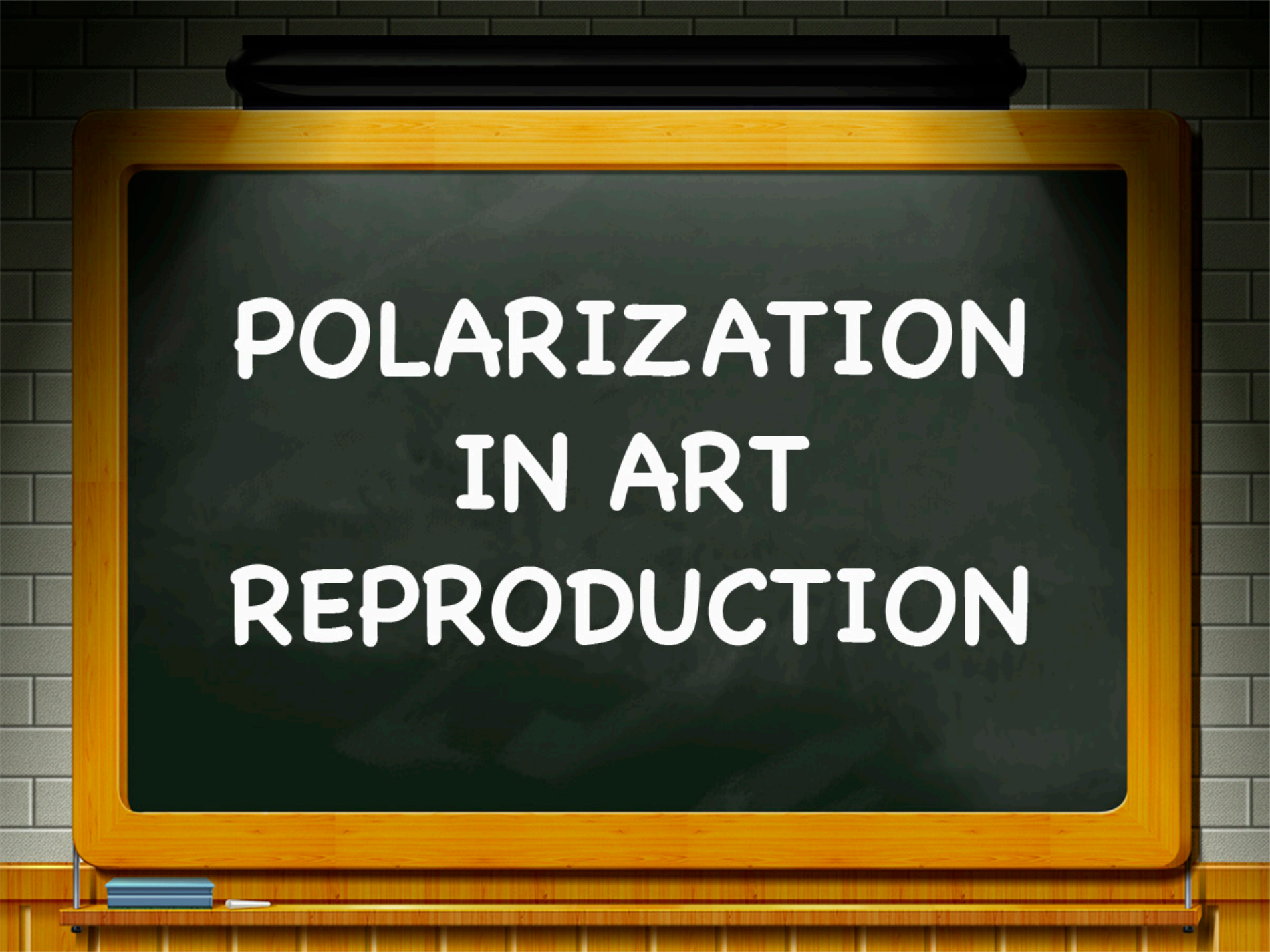

POLARIZATION
IN ART
REPRODUCTION

Cross-Polarization

Or…

Observations,
Intuition and
Curiosities
REGARDING
Cross-Polarizing

Cross-Polarization

An expert is someone who has made every possible mistake in a narrow field.

—Neils Bohr

Cross-Polarization

A Quest for Information…

- We all have questions, concerns and objections to the results with polarization.

- There is almost no information available on cross-polarization related to art copy work.

…..so inquiring minds want to know!

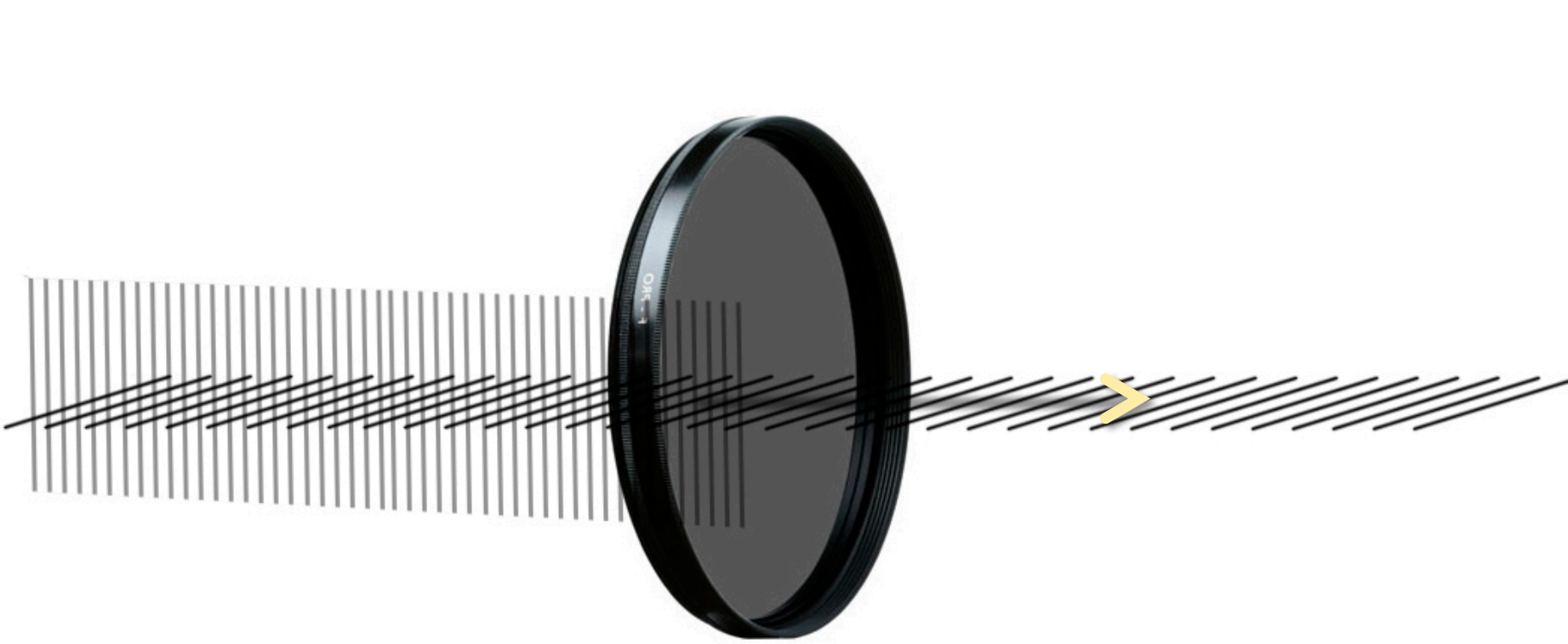
Cross-Polarization

A WORK IN PROGRESS

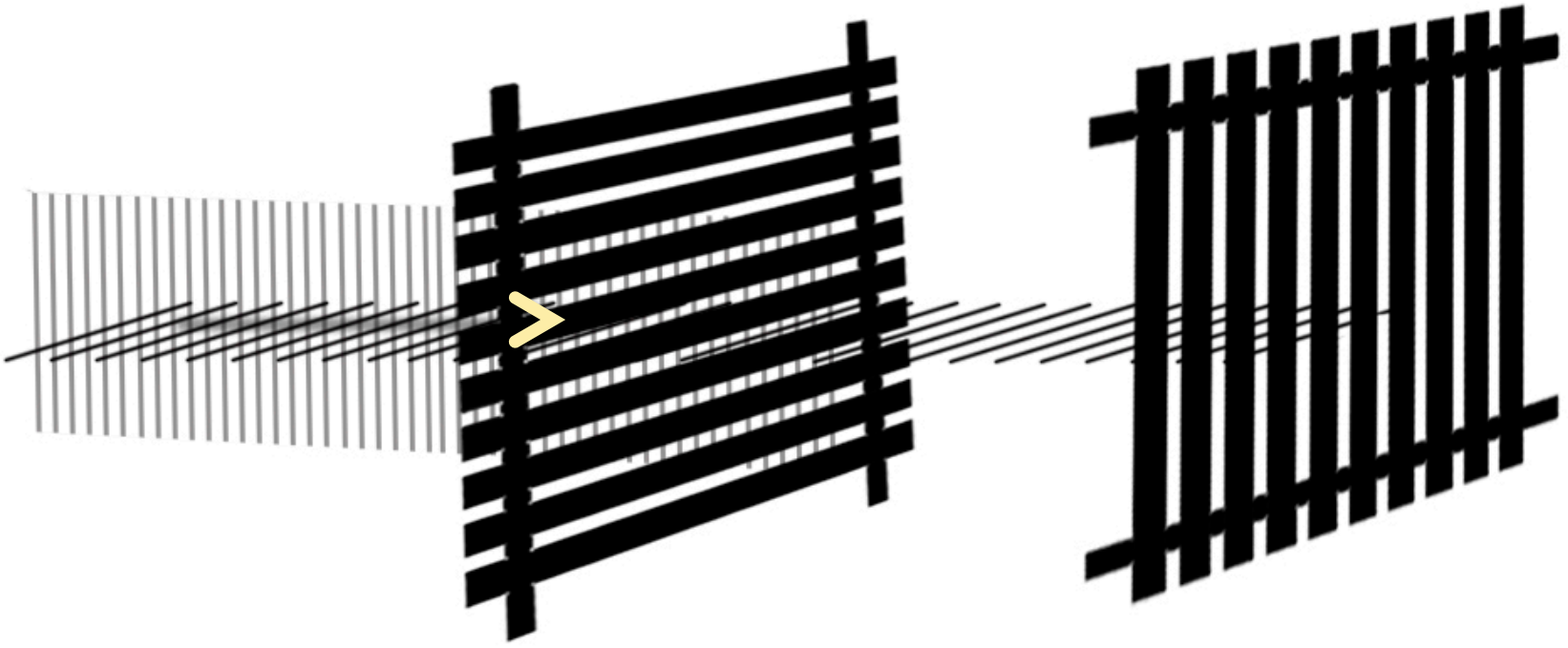
Why Polarizing is Needed

Why Polarizing is Needed

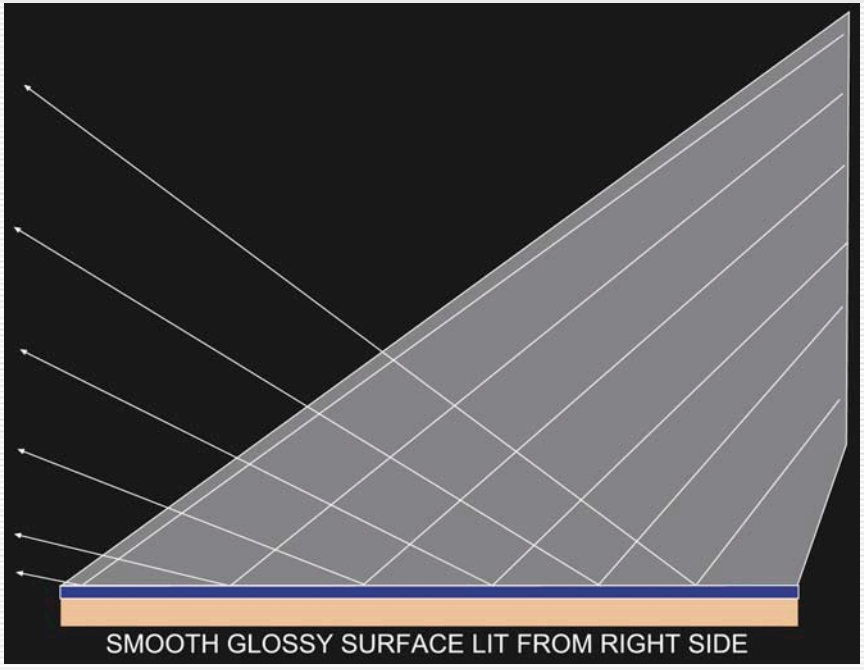
Cross-Polarization

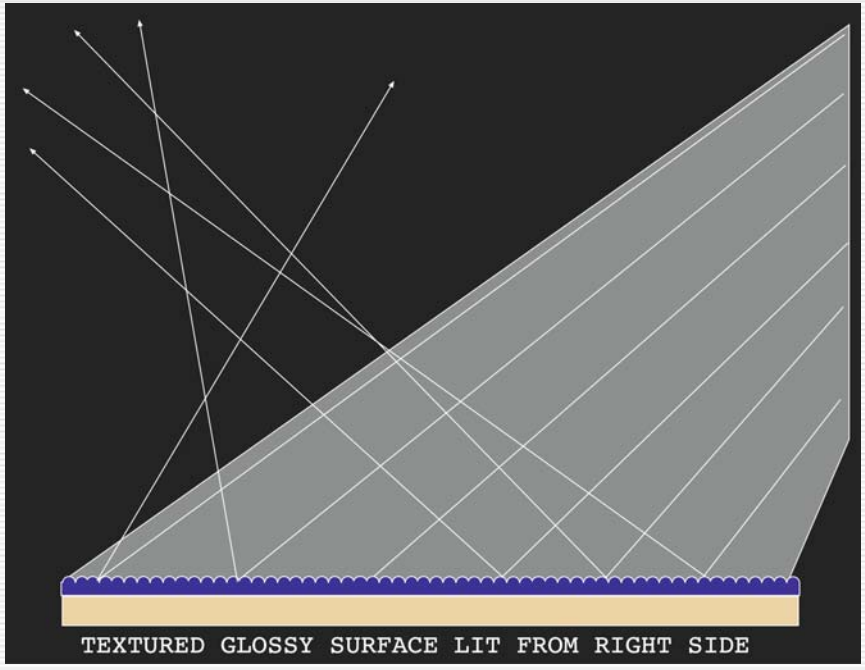


Cross-Polarization



Why Polarizing is Needed

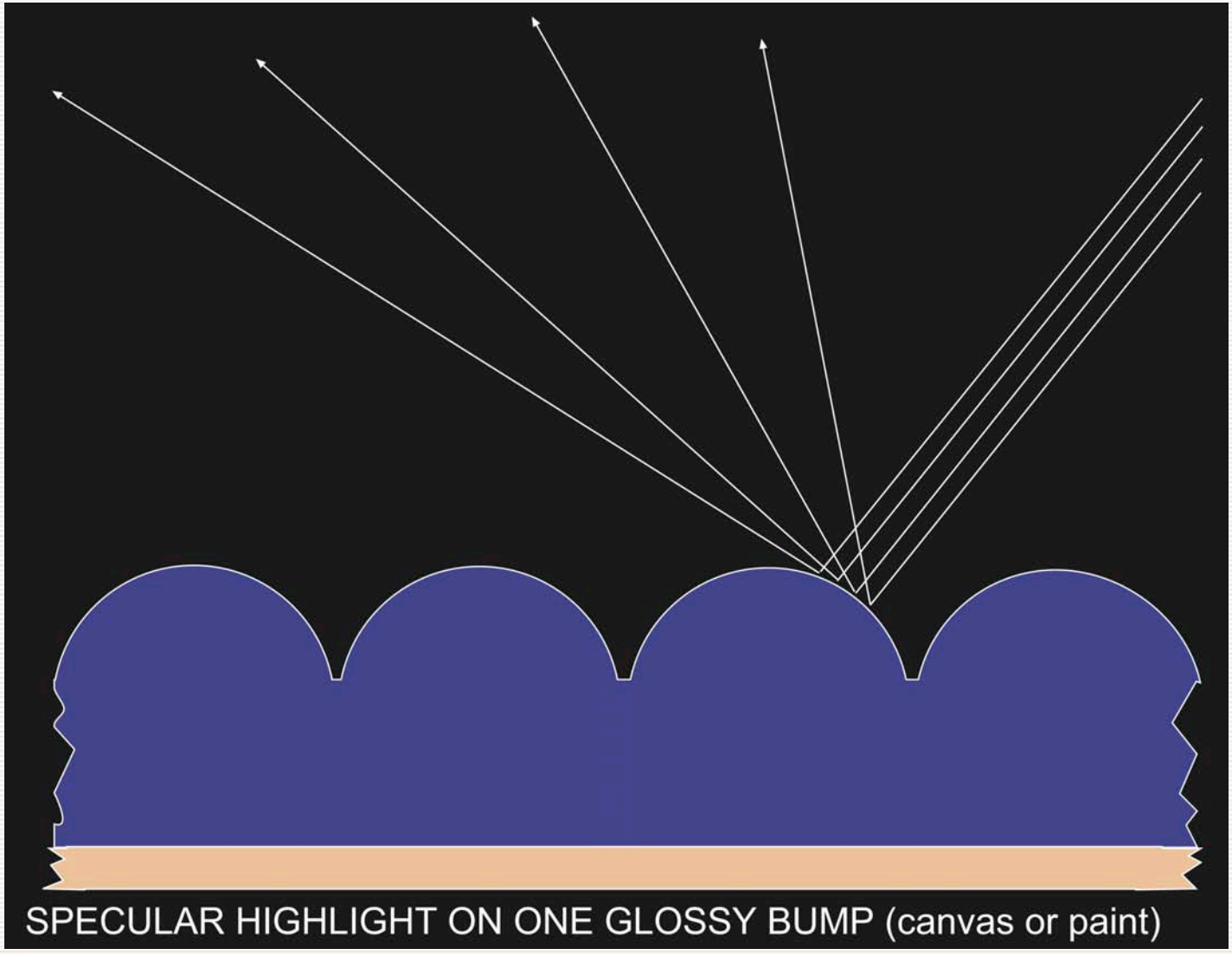




SPECULAR REFLECTIONS
The best controlled by polarizers and the type we most often have to supress

DIFFUSE REFLECTIONS
Light scatters and changes polarity which passes the camera polarizer aiding in the exposure of the image.

Why Polarizing is Needed



Aligning the Polarizing Filters

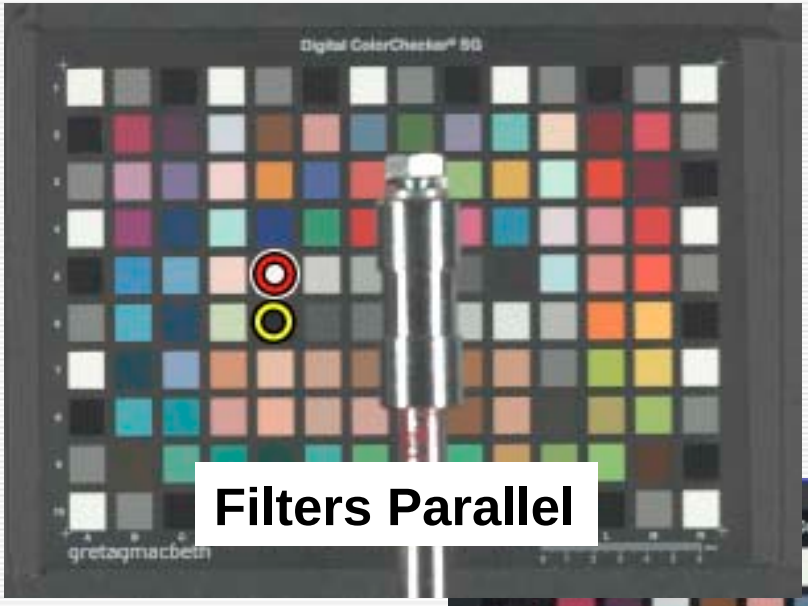
Filters Parallel

Partially Crossed

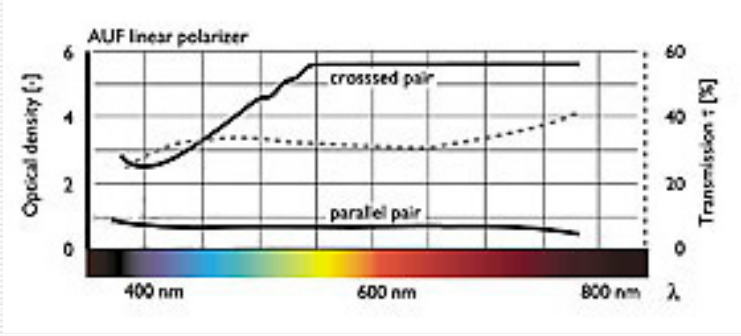
Filters Crossed

Polarizing filters on each of two copy lights and glass Polarizing filter on lens

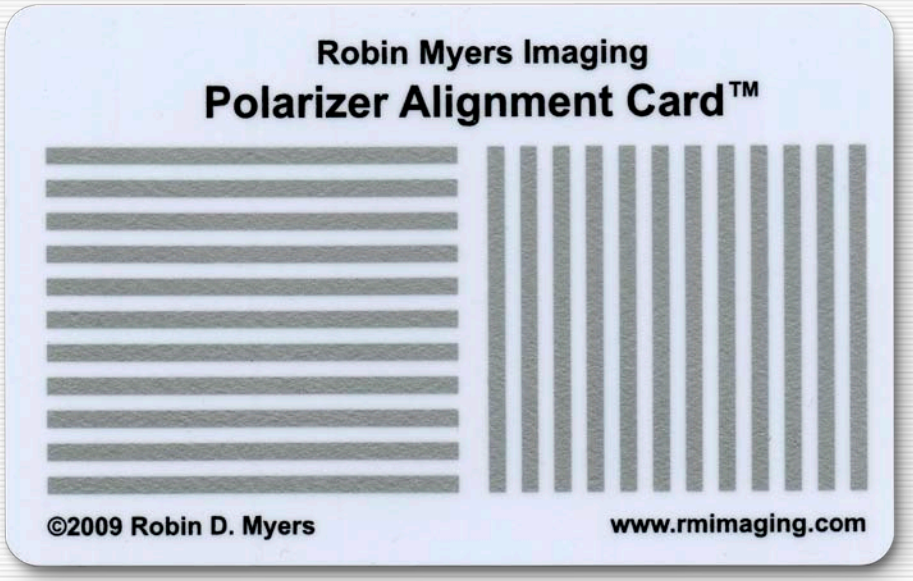
Aligning the Polarizing Filters



Why Polarizing is Needed

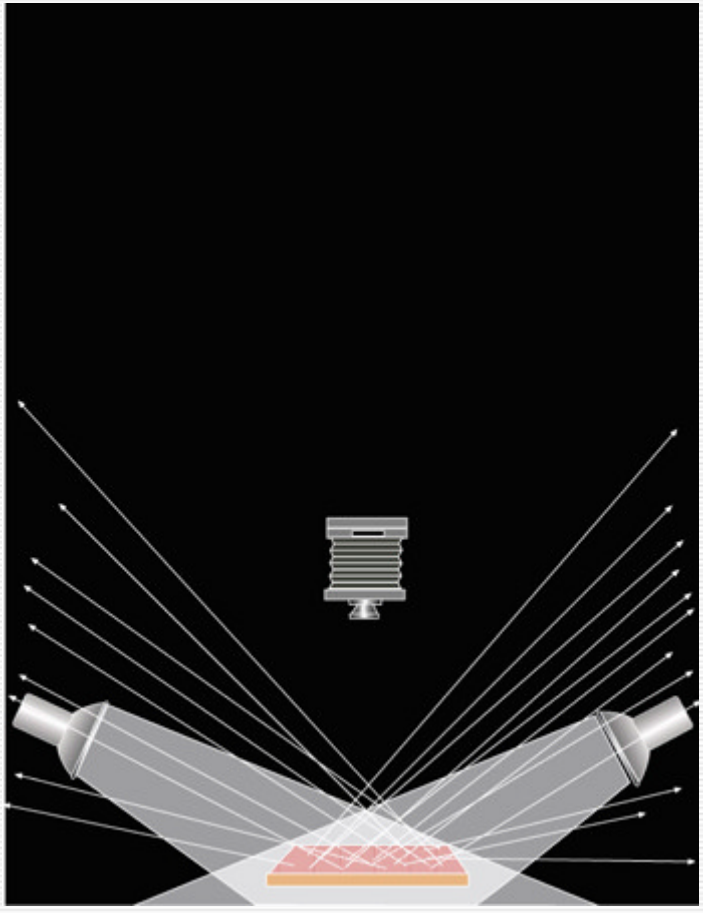


Aligning the Polarizing Filters

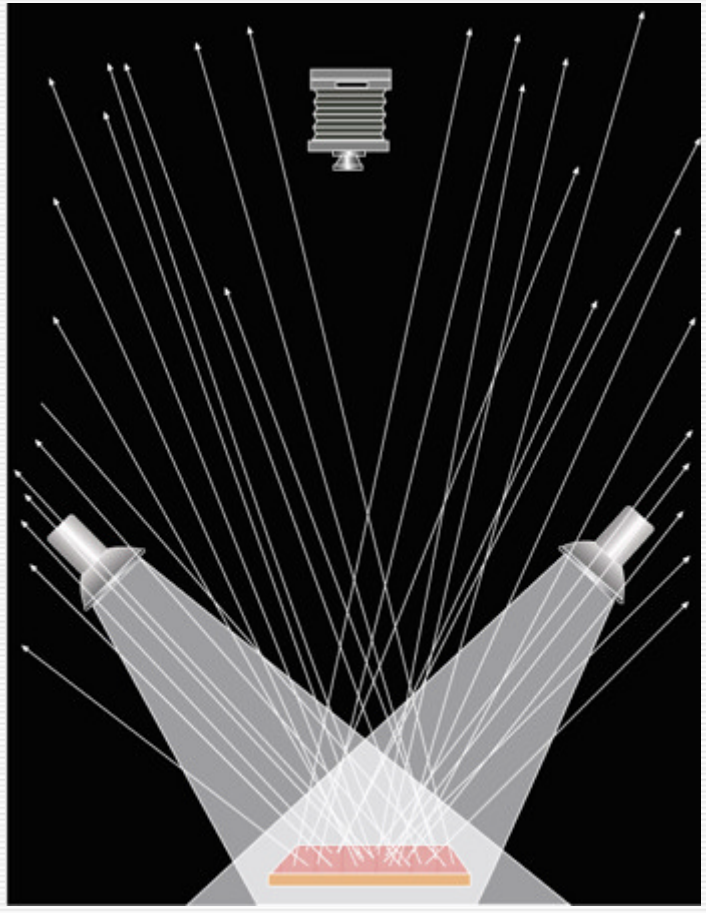


2 Cards $14.95
www.RMimaging.com

Cross-Polarization

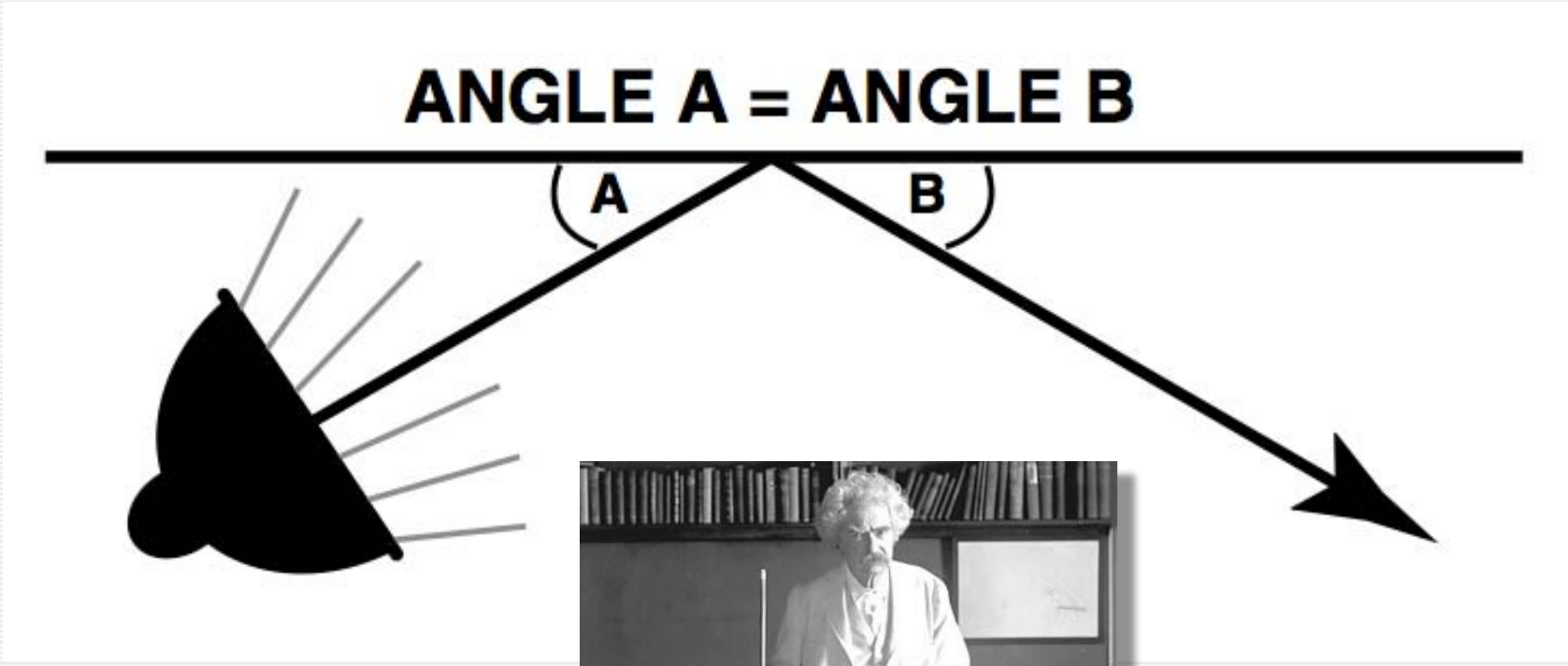


Change the angle of the lighting to avoid influence of stray light



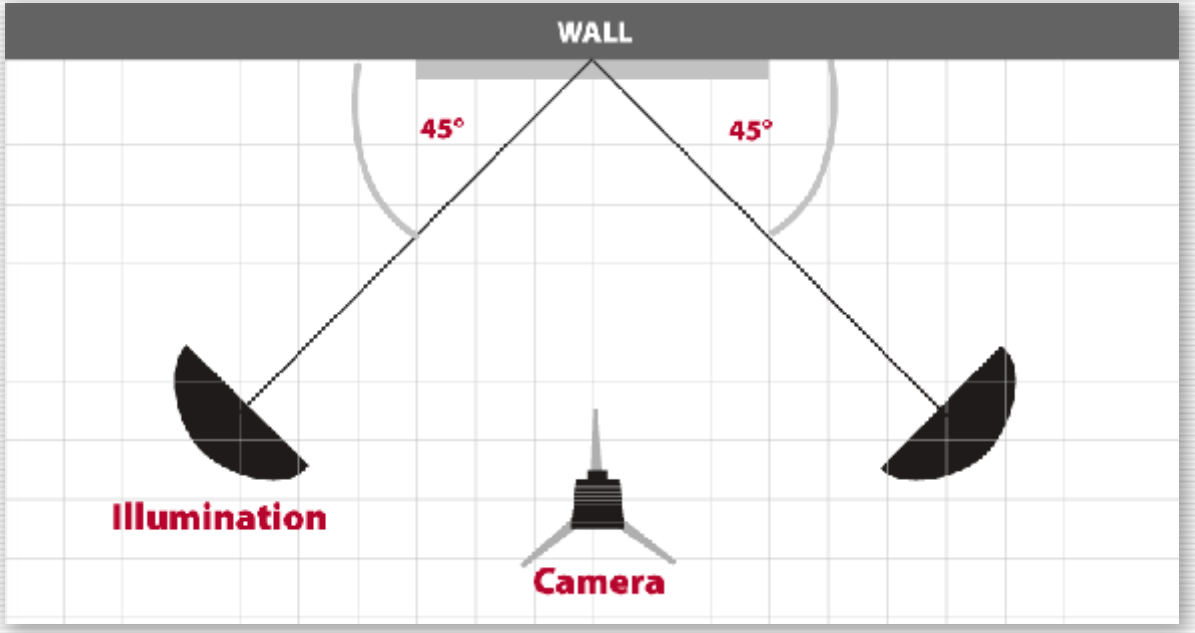
Move the camera back so the angle of view with a longer lens can avoid the stray light

The Physics of Lighting



Sam Clemens calculates the angle of reflectance

Lights at 45° is the Best Compromise



Copy lights are setup at 45° to compromise between the intensity of incident light to the lens and elimination of reflections.

Intensity of Reflections: **90° = 100%**
60° = 75%
40° = 44%
20° = 13%

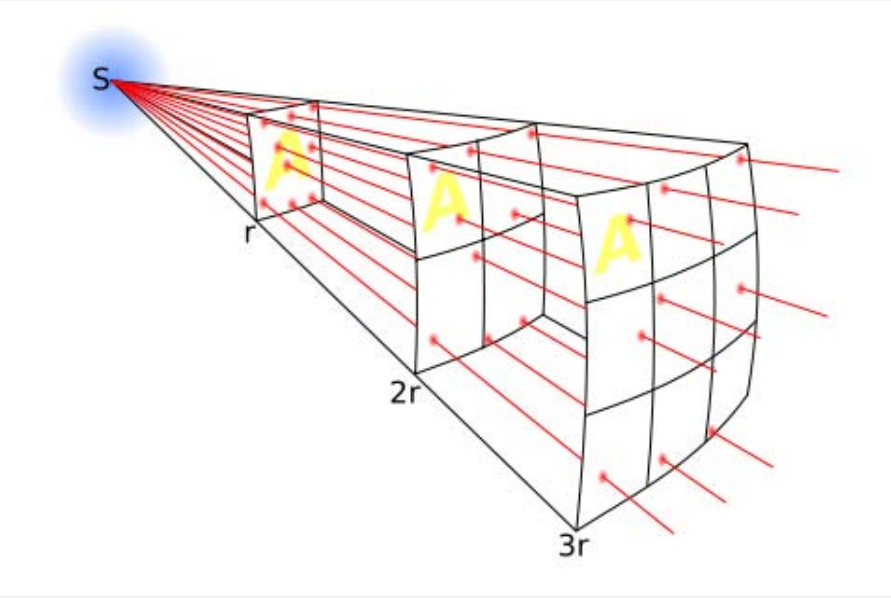
Lighting

INVERSE SQUARE LAW

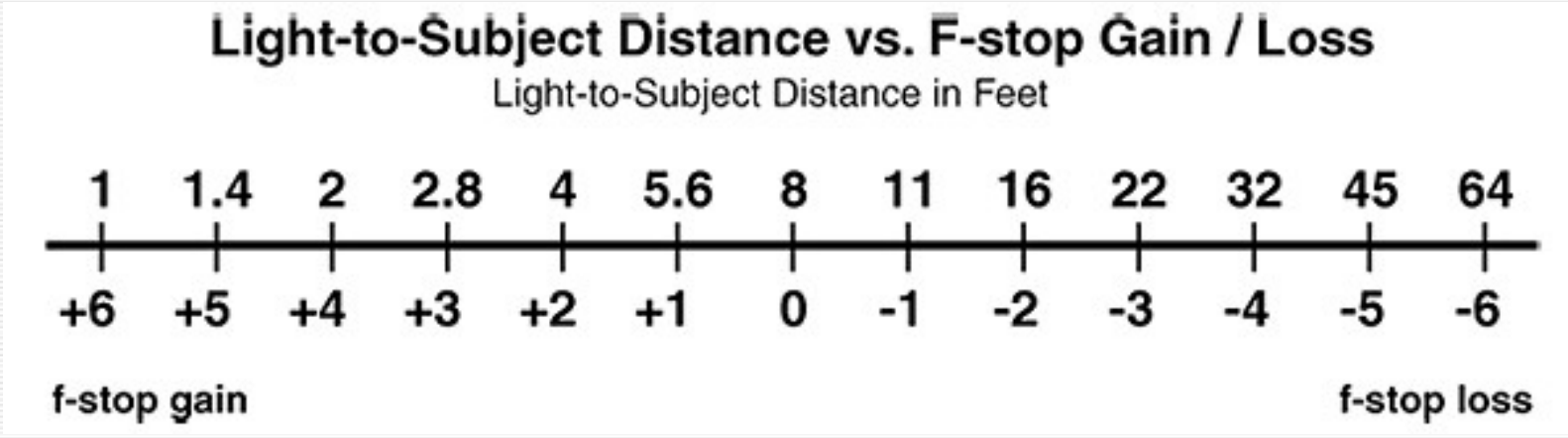
DOUBLE THE DISTANCE = OPEN 2 F-STOPS

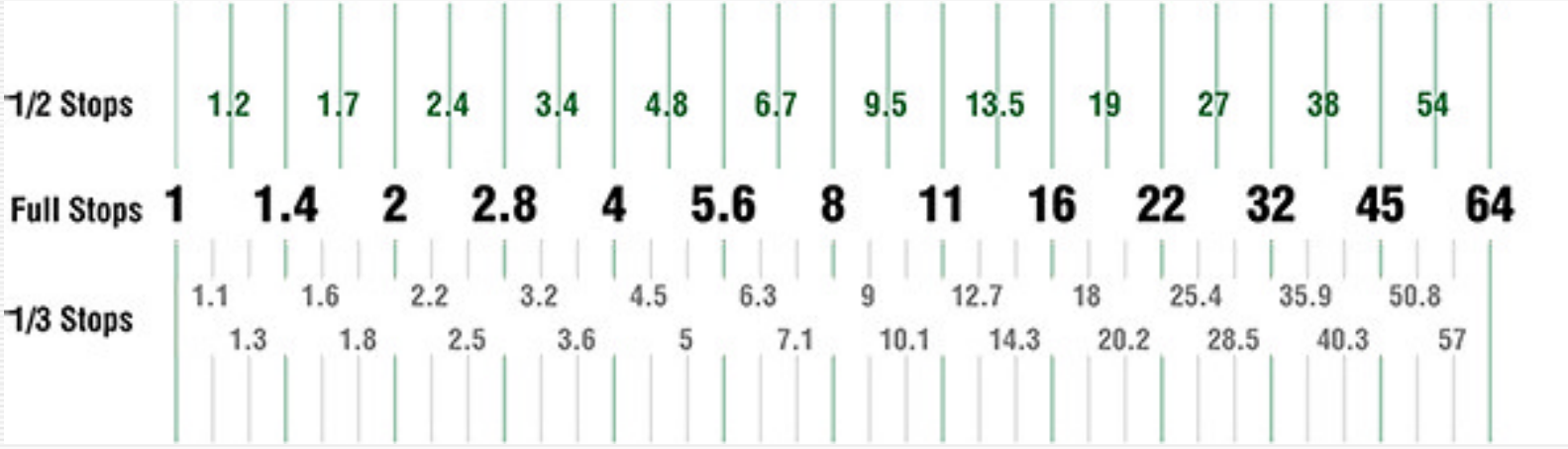
Therefore: HALF THE DISTANCE = CLOSE 2 F-STOPS

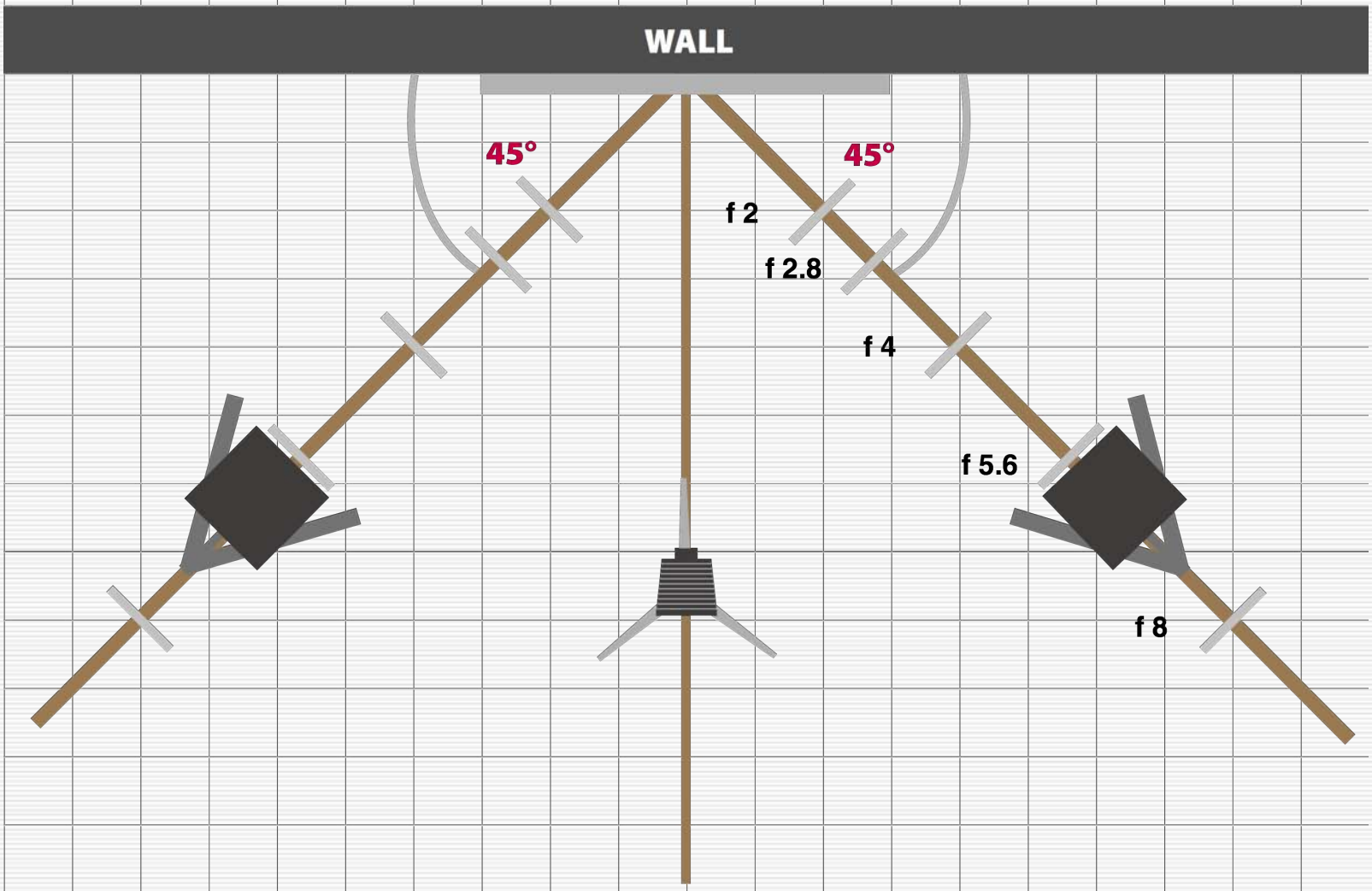
And: ONE QUARTER THE DISTANCE = CLOSE 1 F-STOP



The 2X Factor

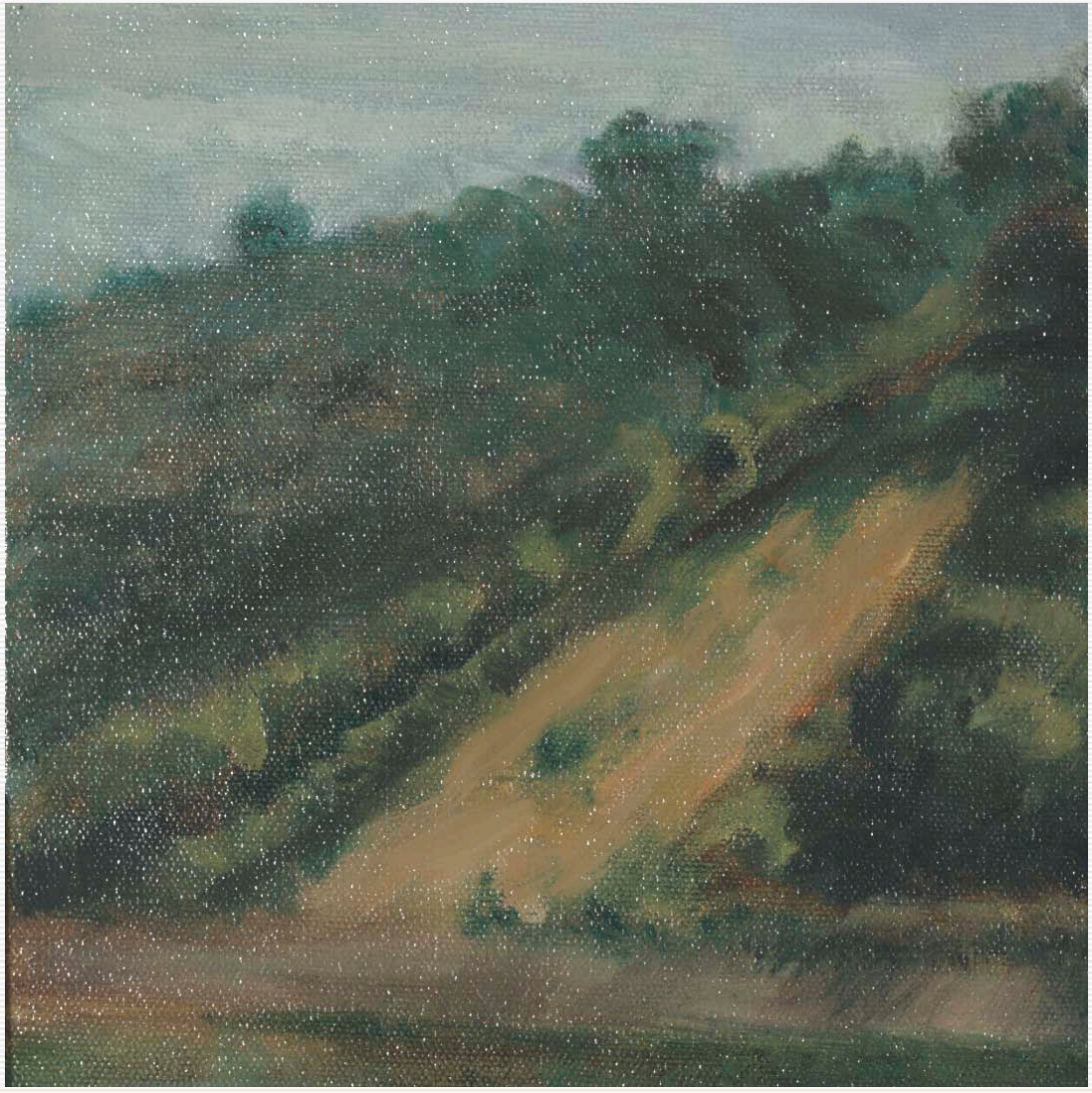




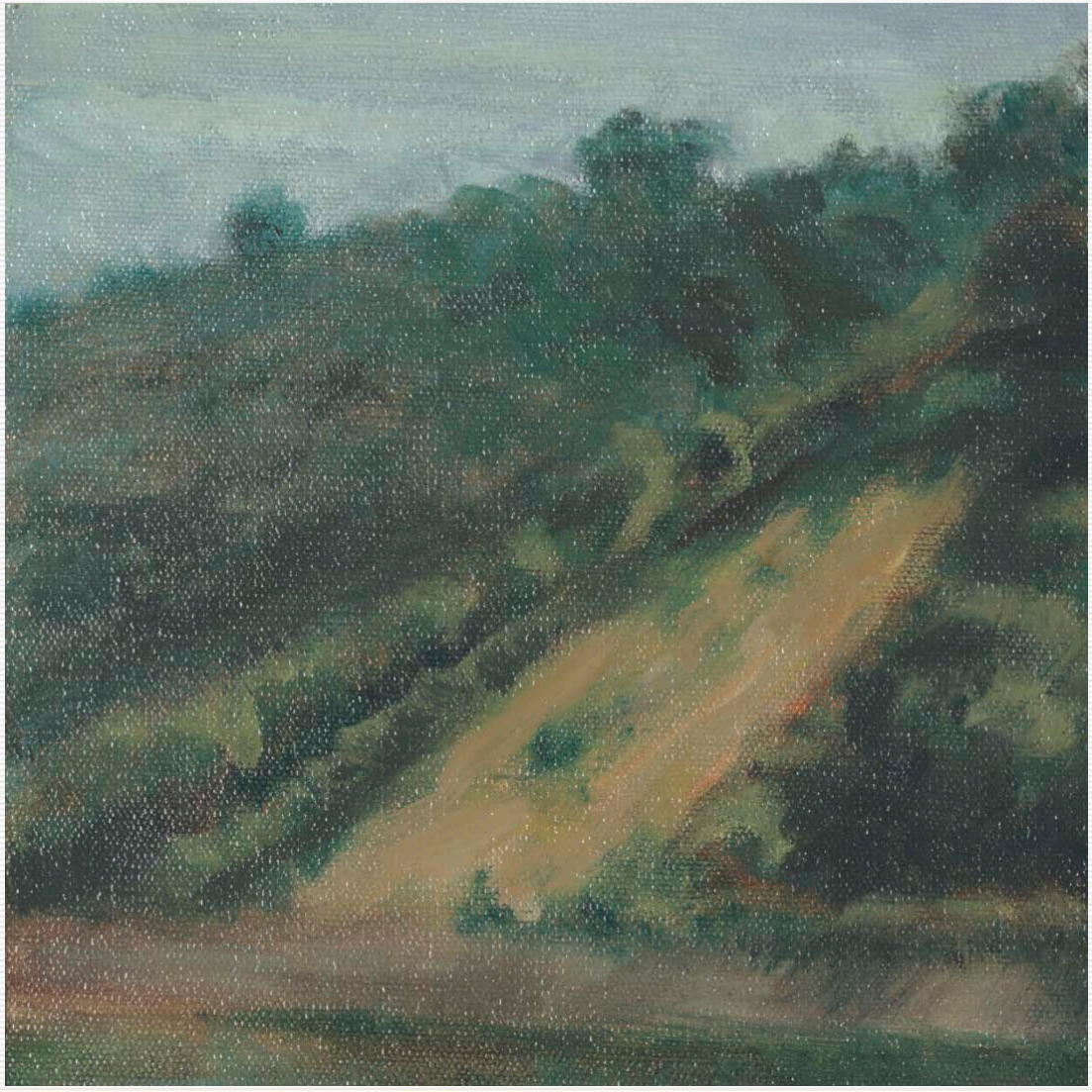


Put Lines on floor at **90°** and **45°** to have reference angle for light and camera positions and marks at **1 f-stop increments**.

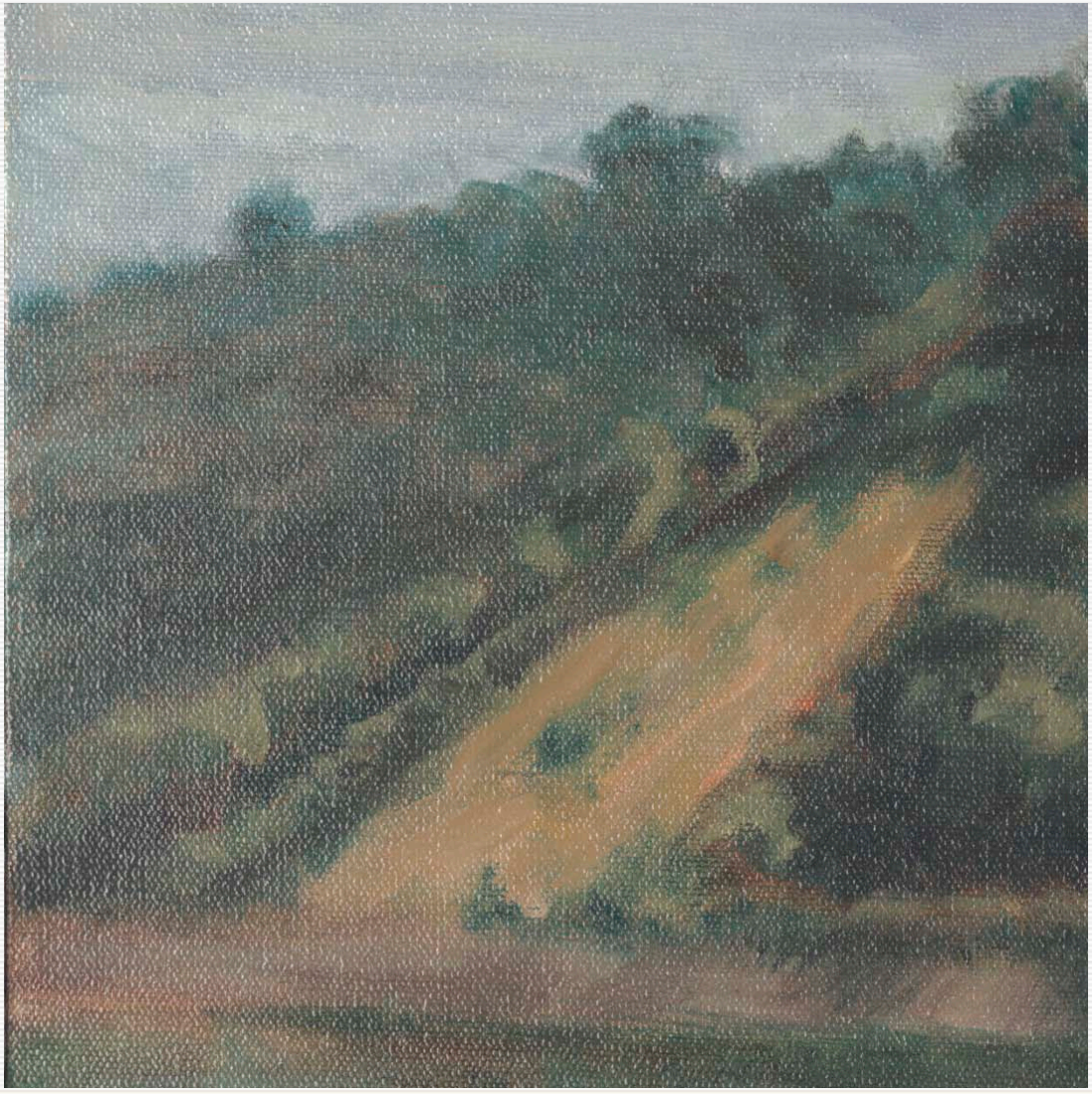
Lighting Options – 16” Parabolic



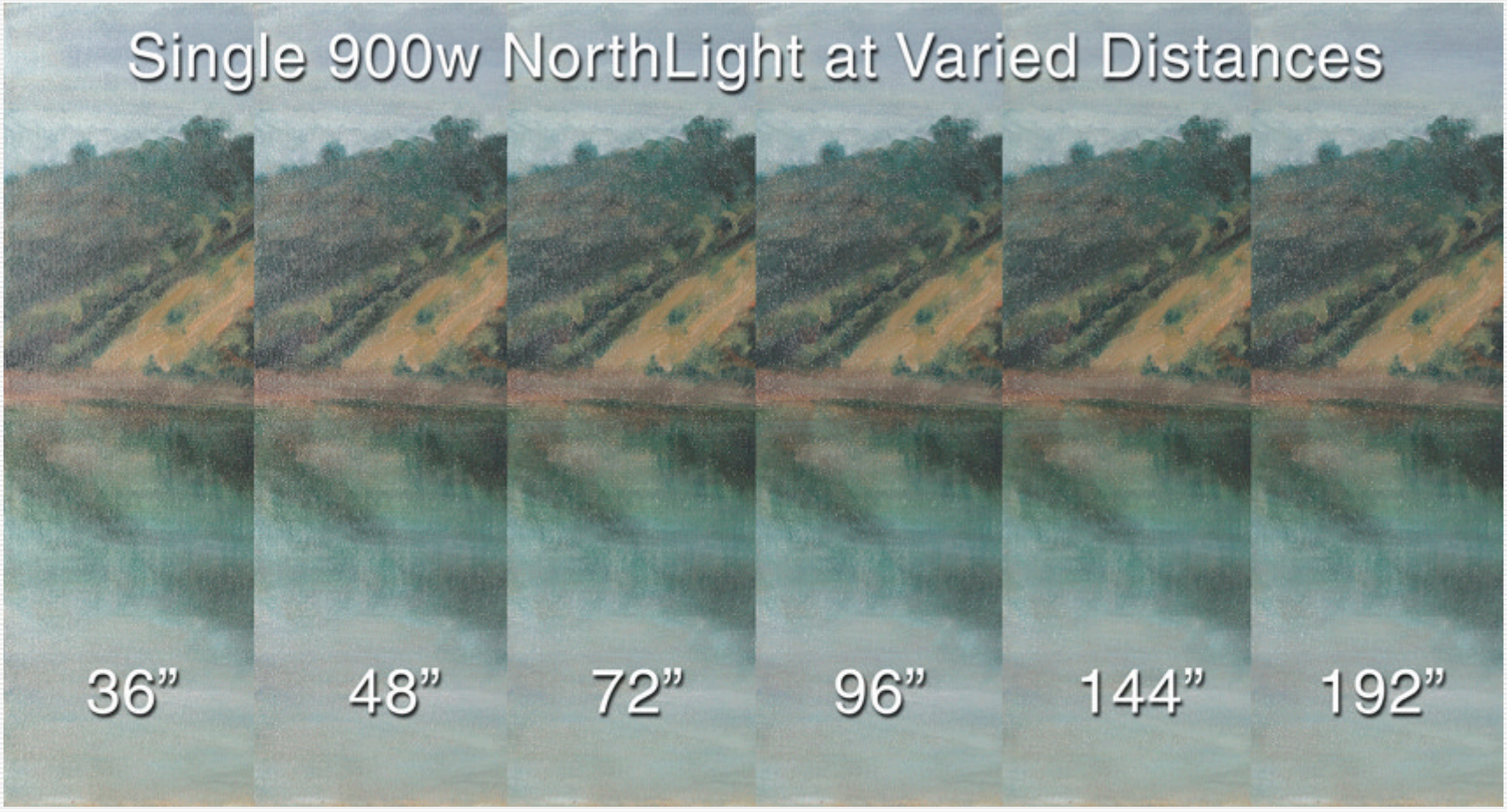
Lighting Options – 2’x3’ Fluorescent



Lighting Options – Diffusion Panel



Problems with Veiling Glare



Problems with Veiling Glare

TO VARNISH…
OR NOT TO VARNISH!

Contrary to what you might expect the varnished side has fewer glare problems than the side that is not varnished.

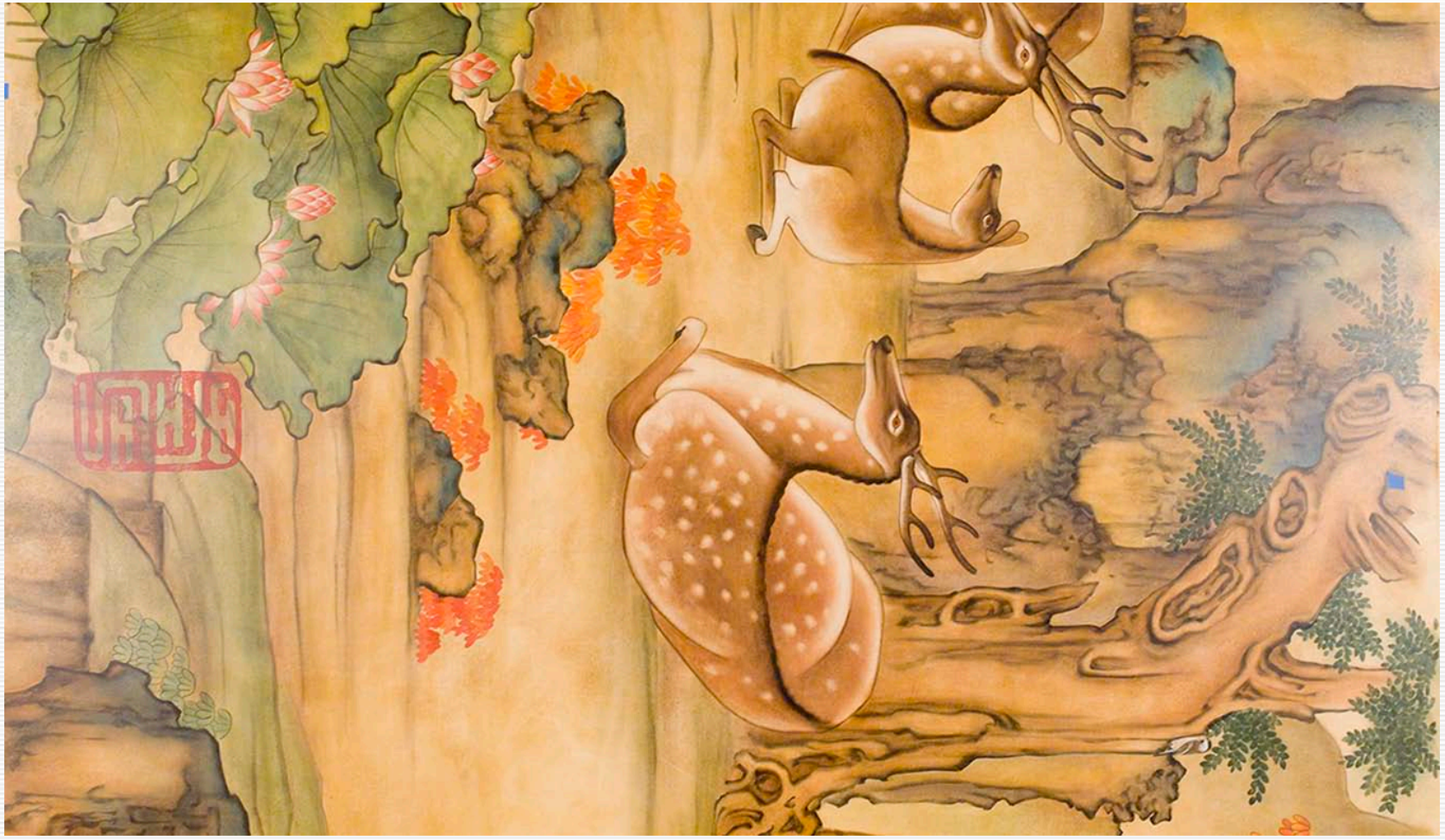
The varnish is filling the gaps in the canvas texture making a smoother surface.

Problems with Veiling Glare

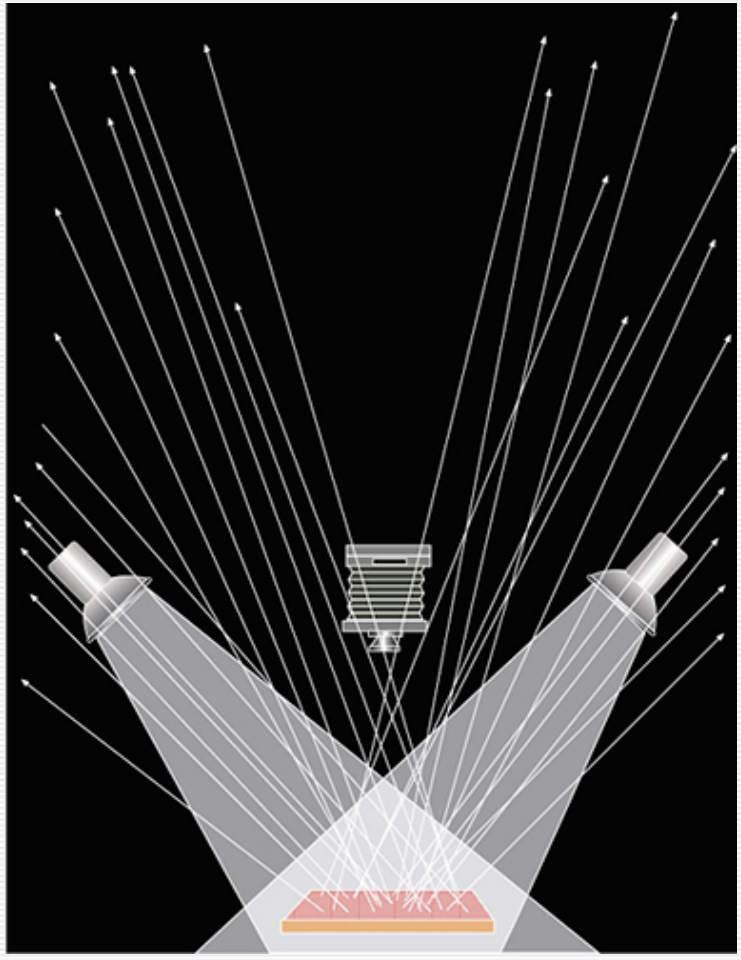
- ✓ **Original Canvas 8 ft. x 50+ ft.**
- ✓ **13 Segments @ 450 MB 8-bit files**
- ✓ **2 – NorthLight 900 watt Copy Lights**
- ✓ **No EquaLight or Photoshop Corrections**

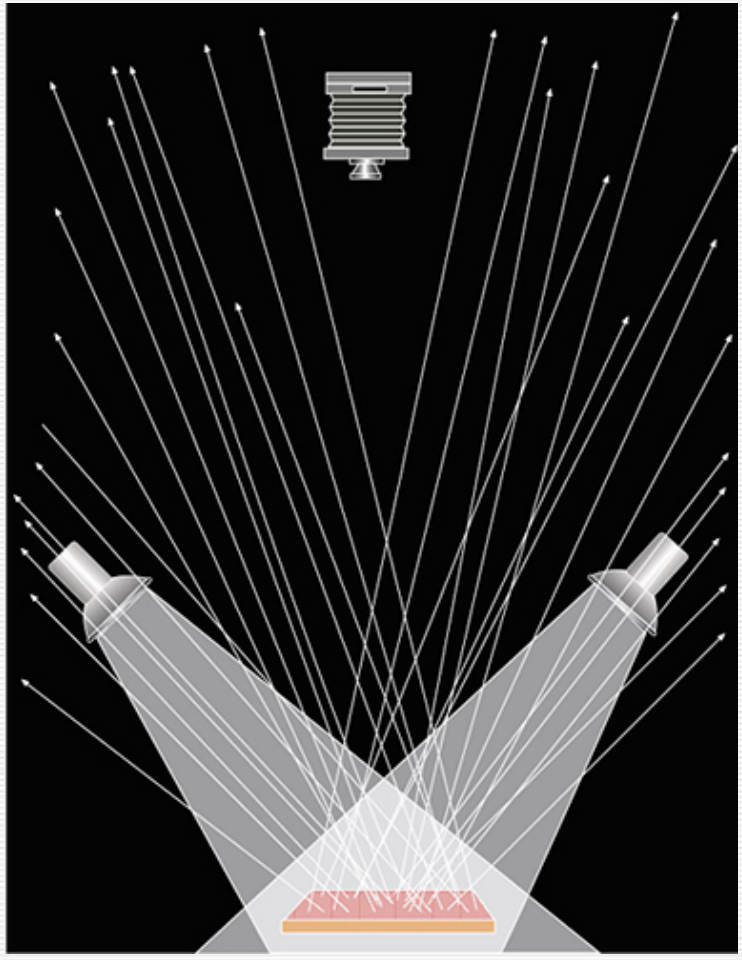
Problems with Veiling Glare

Problems with Veiling Glare



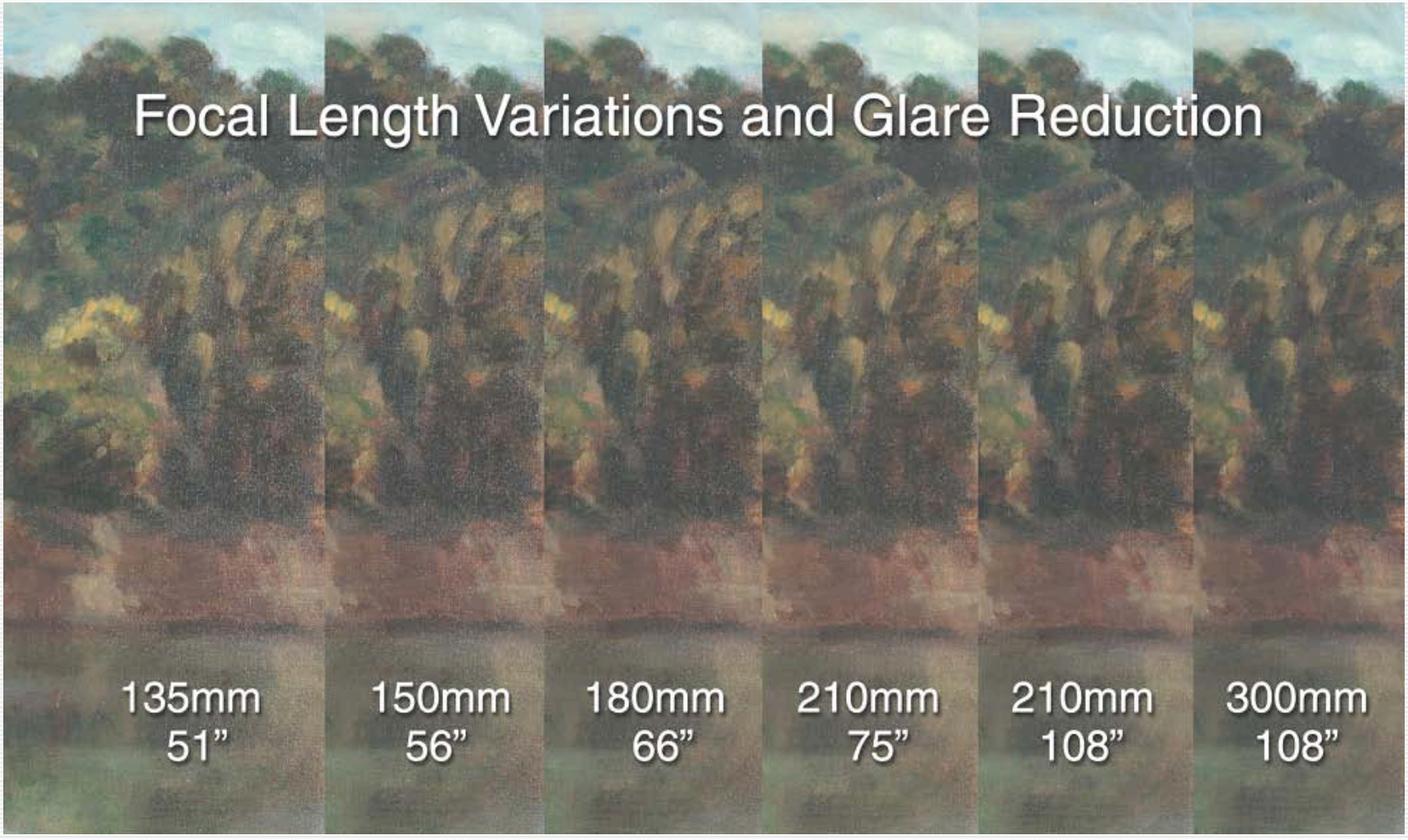
The Physics of Lighting





Short focal length lens has camera too close to subject and in path of stray reflected light.
Moving back and using lens with narrow angle of view can avoid issues of veiling glare.

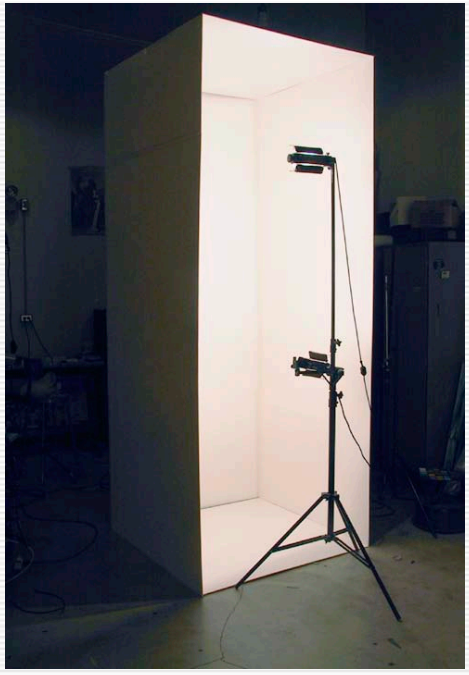
Problems with Veiling Glare



Alternatives to Polarizing

Alternatives to Polarizing

Alternatives to Polarizing



Alternatives to Polarizing

If It Can Go Wrong…It Will Go Wrong!

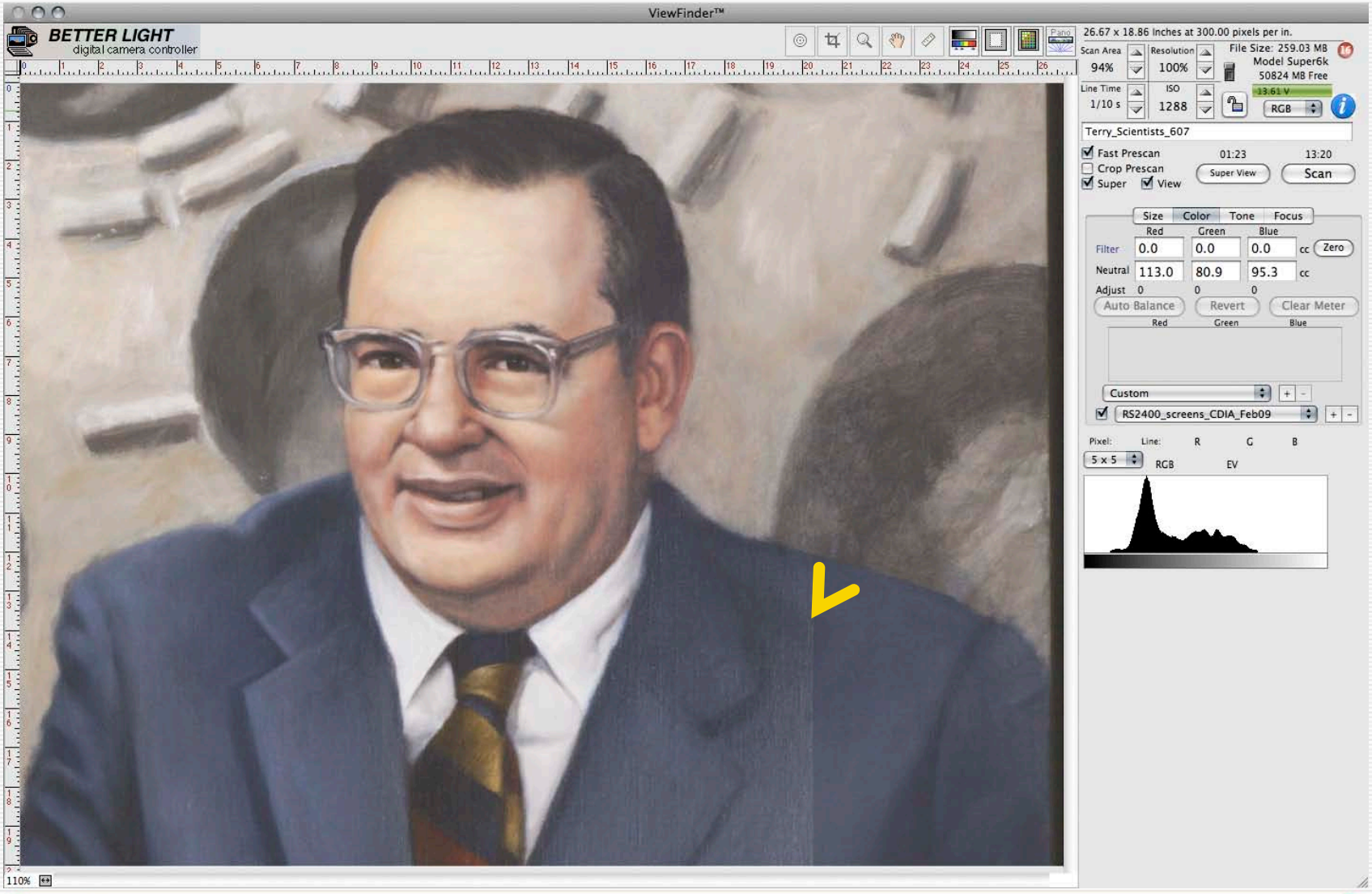
If It Can Go Wrong…It Will Go Wrong!

Two Wrongs Can Make a Right!

If It Can Go Wrong…It Will Go Wrong!

If It Can Go Wrong…It Will Go Wrong!

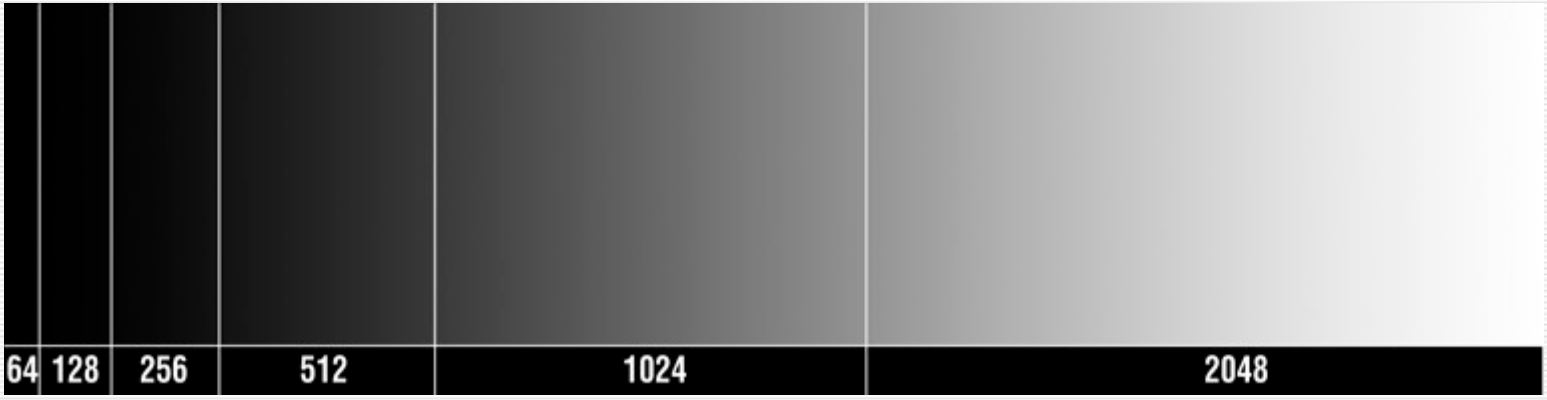
If It Can Go Wrong…It Will Go Wrong!



Two Wrongs Can Make a Right!

Elements of Quality in SCAN

Exposure is critical to maintain maximum detail.

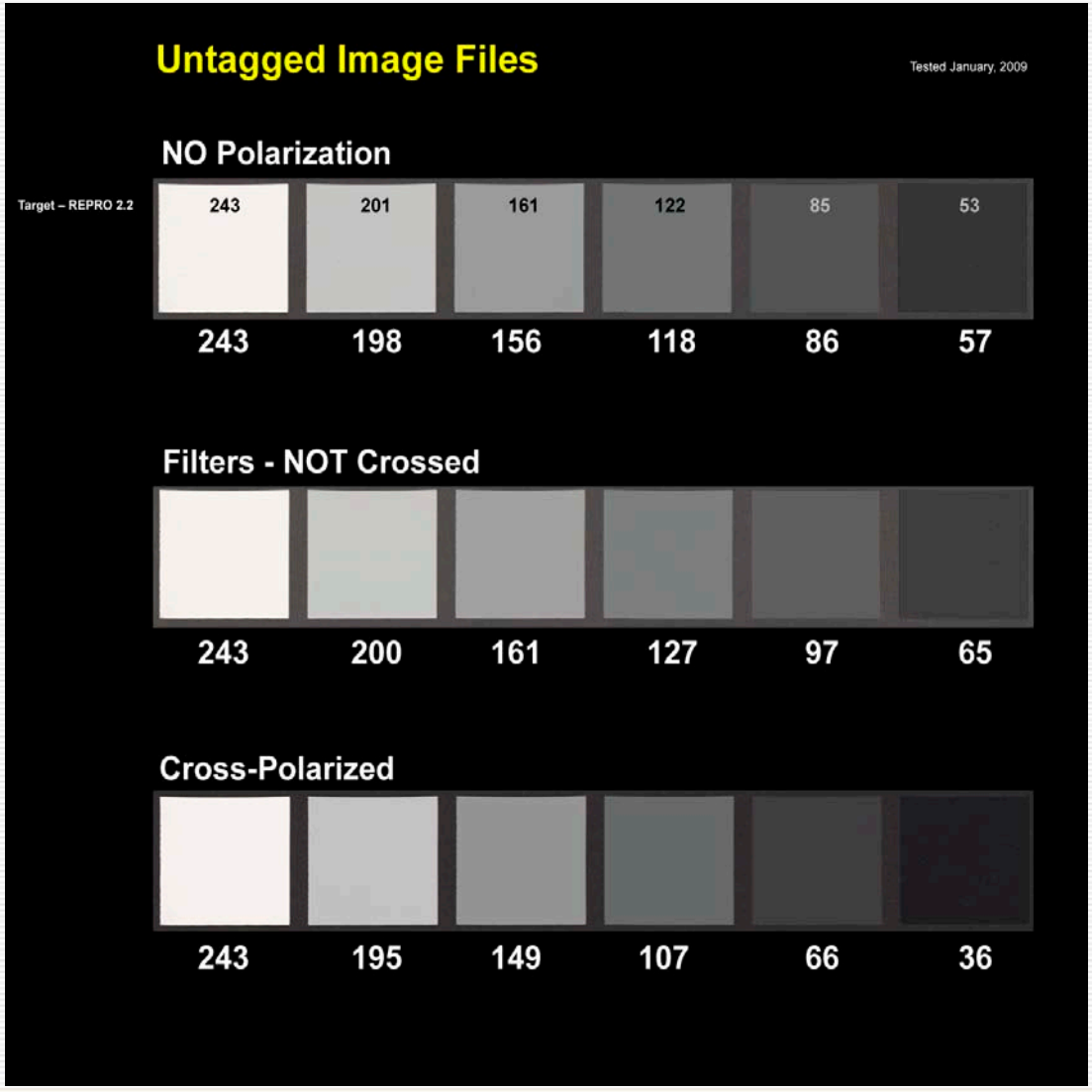


Representation of Linear RAW file with 6 f-stops of tonal range and 4,096 bits from black (1) to white (4,096).

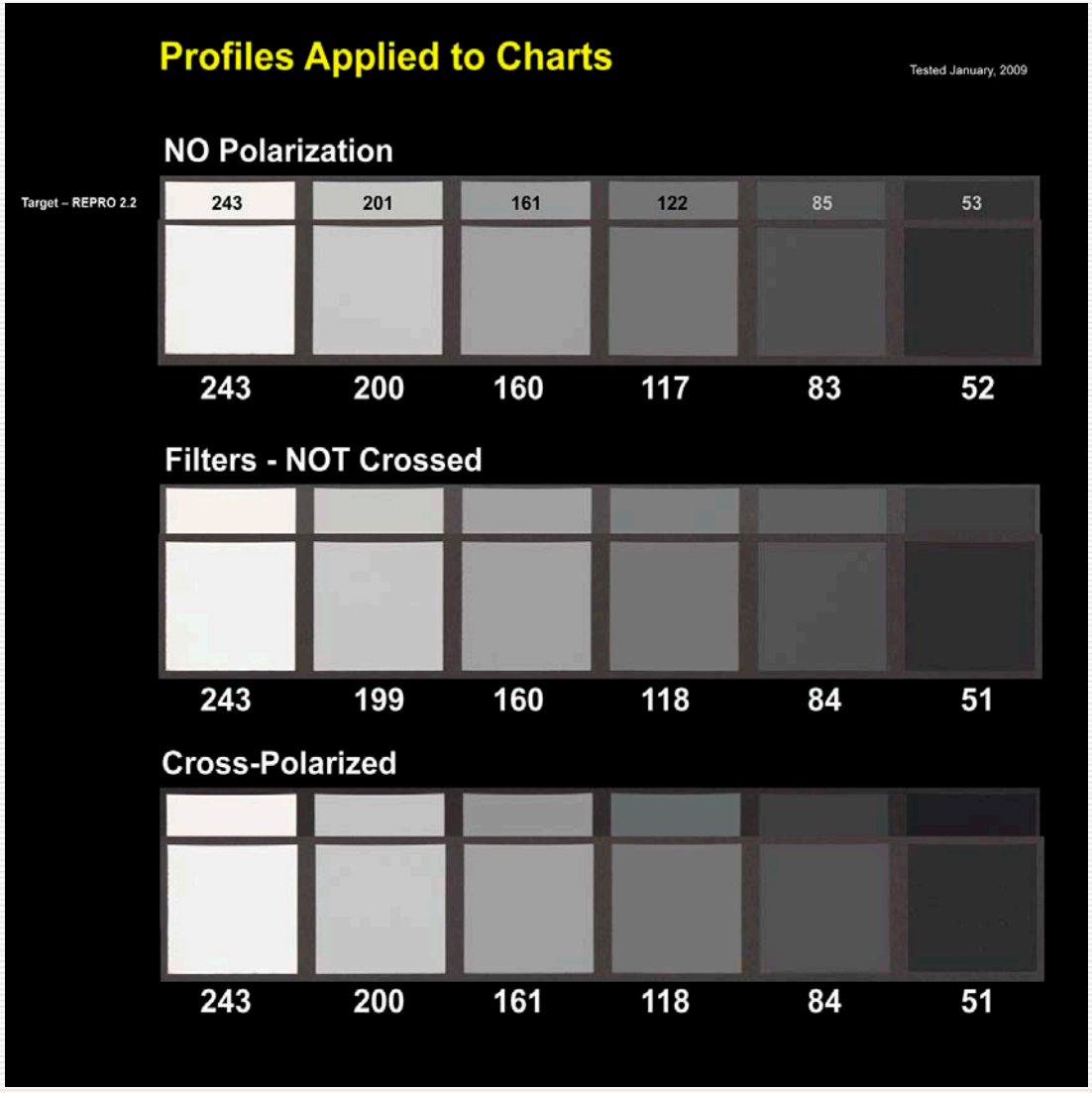
The first stop of highlight values contains 2,048 tones – half of the data!

The last stop has only 64 bits of data, so the shadows will compress tones and have far more noise than usable data.

Profiling Polarized Images



Profiling Polarized Images



Matte vs. Gloss Surfaces

Matte vs. Gloss Surfaces – No Polarizing

Matte vs. Gloss Surfaces – Polarized

Matte and Gloss Materials

Not Polarized

Very matte look with matte inks on watercolor paper.

Veiling glare washing out blacks and loosing color saturation.

No profile
Repro 2.2 tone curve

Cross Polarized

Polarization removed veiling glare and incresed saturation and contrast.

Closer to visual perception of original.

No profile
Repro 2.2 tone curve

Profiling Polarized Images

Not Polarized

Both profiles match quite closely with exception of background detail which seems a bit hazy.

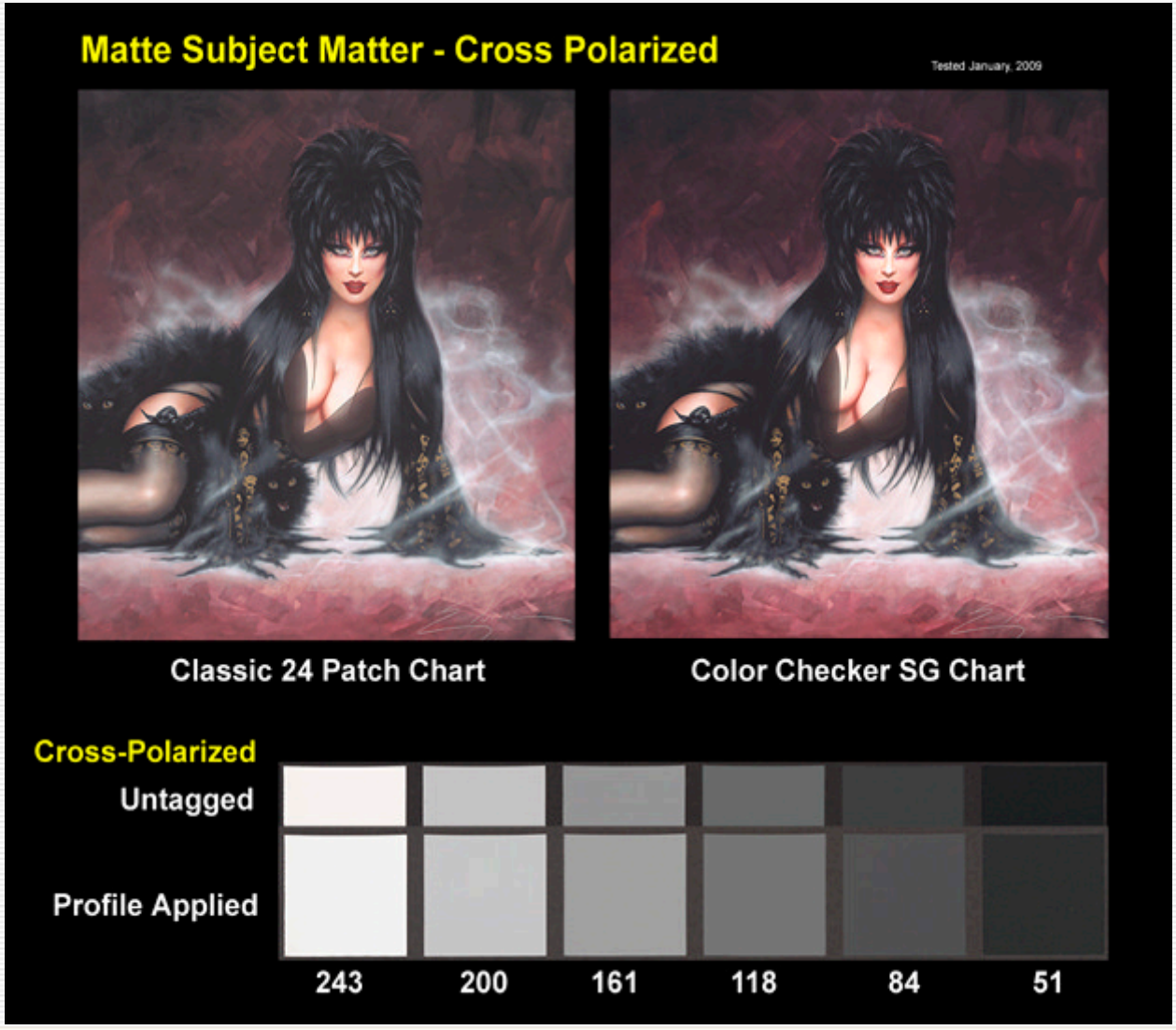
No Polarizing Profile #101
Repro 2.2 tone curve

Cross Polarized

Polarized image seems to retain some additional subtle detail in back-ground brush strokes.

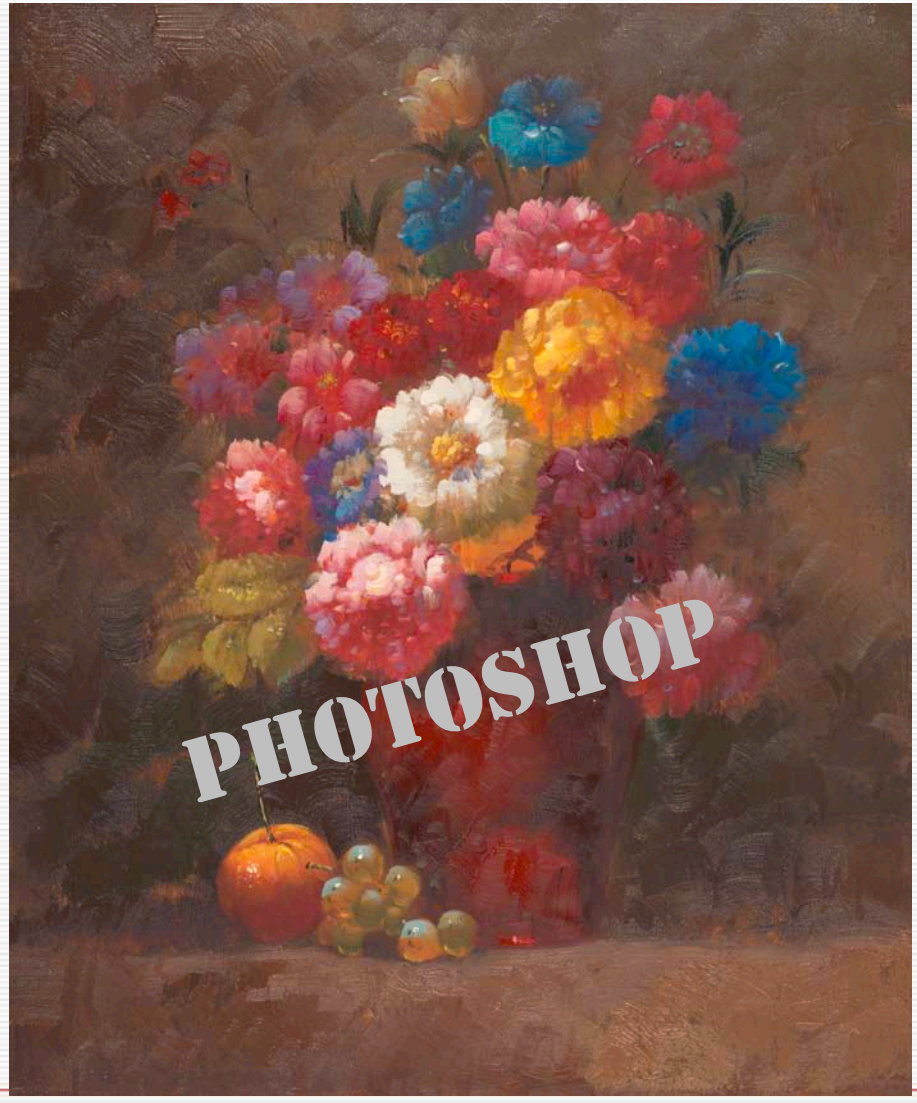
Polarization Profile #107
Repro 2.2 tone curve

Profiling Polarized Images



Profiling Polarized Images

Why Polarizing is Needed



Why Polarizing is Needed

Section of painting:
UNPOLARIZED

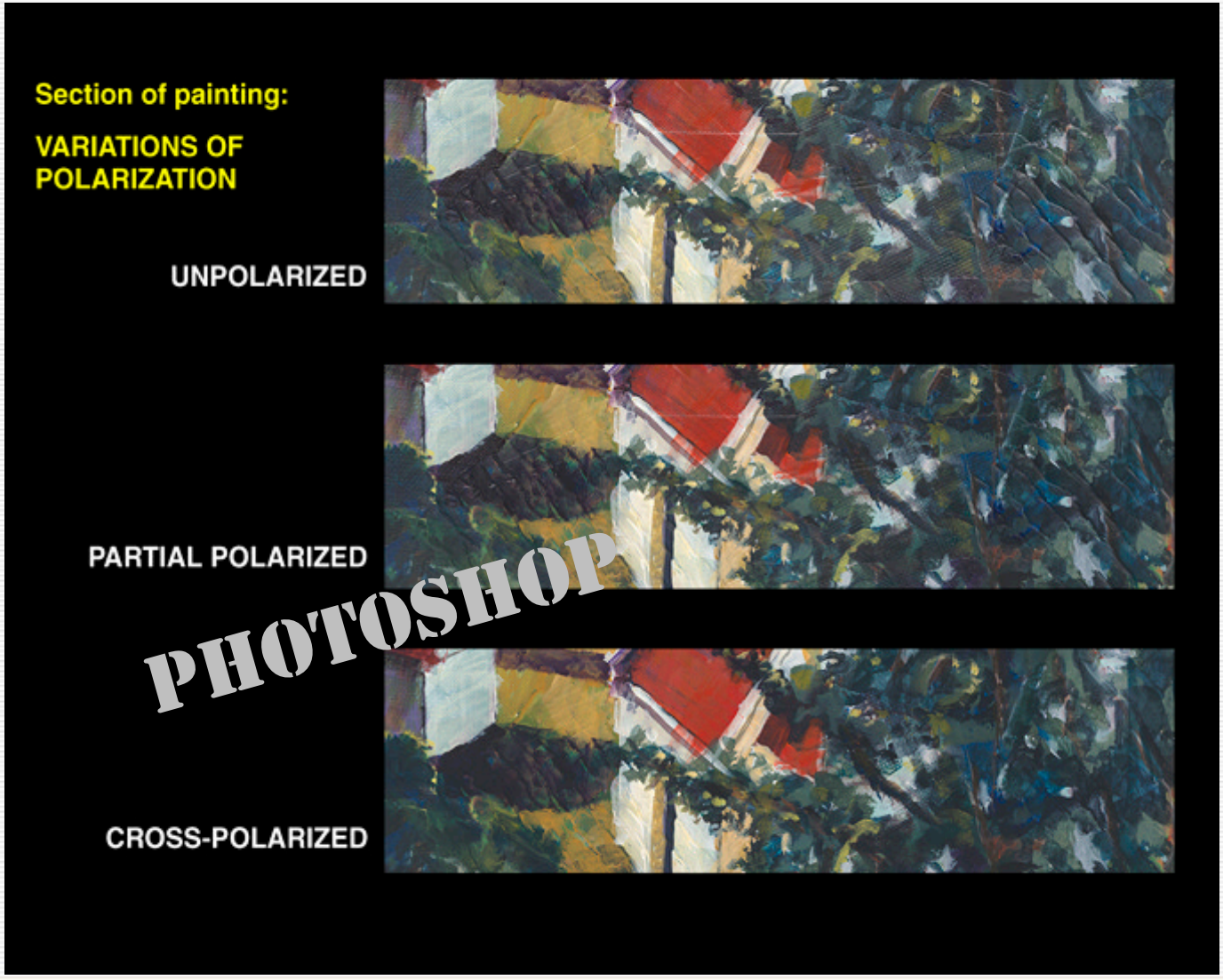
Using same unpolarized profile increases contrast and saturation which a good profile can correct.

Polarization "eliminates" highlights and shadows of texture by blocking specular highlights and compression of dark tones.

Section of painting:
CROSS-POLARIZED

Profile (on both images):
"color checker SG 9-06"

Why Polarizing is Needed



Why Polarizing is Needed

Section of painting:
Cross-Polarized

Top image had embedded profile of "color checker SG 9-06", and was OPENED and CONVERTED to Adobe RGB 1998 on opening.

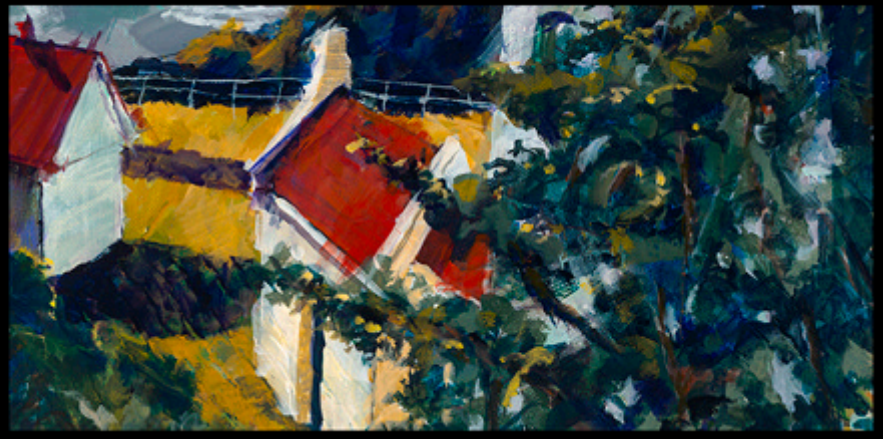
Then, the correct profile was APPLIED and then CONVERTED once again to Adobe RGB.

Bottom image was opened with the "color checker SG 9-06".

A cross-polarized profile was APPLIED and then CONVERTED to Adobe RGB 1998.

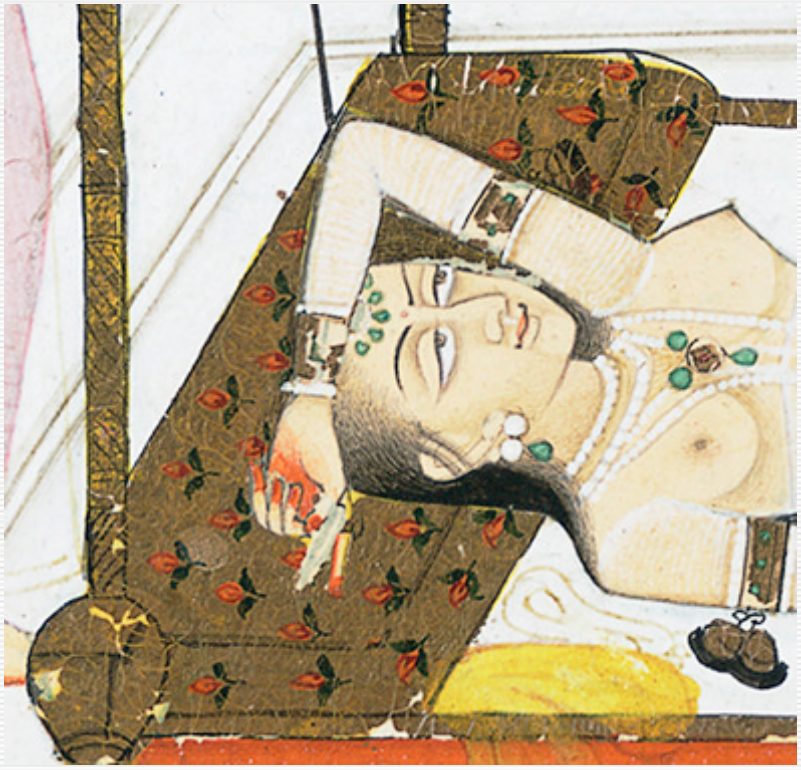
There is a noticeable color shift in grass, roof and trees resulting in some loss of detail in shadows and slight posterizing on the red roof.

Conclusion...only CONVERT once for best results!



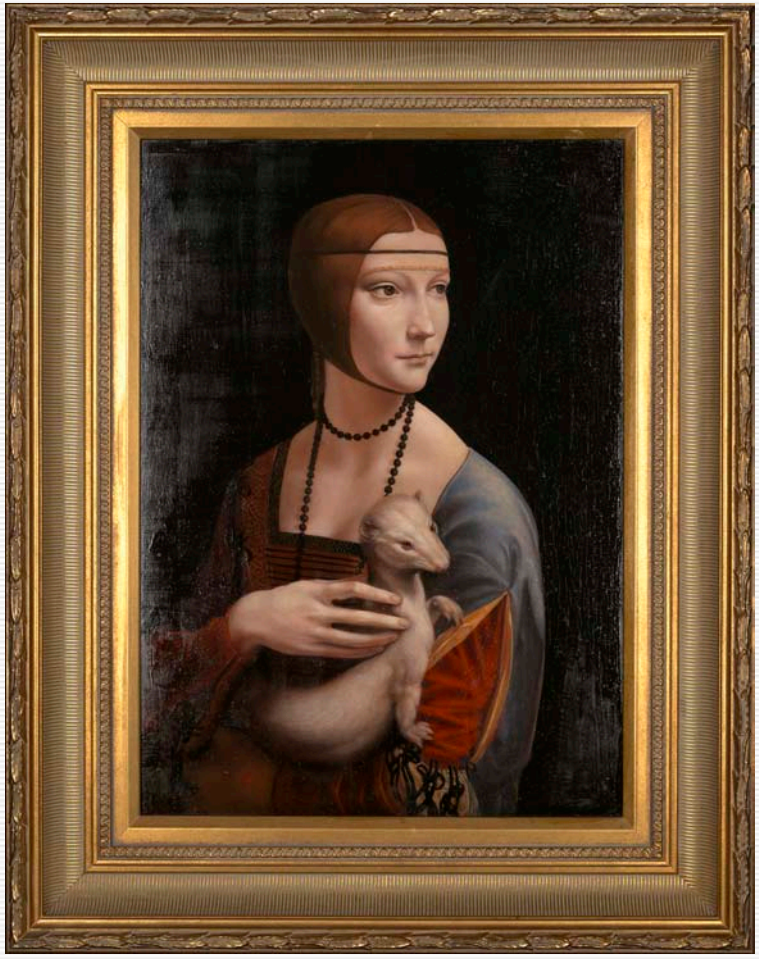
Metallics with Polarization

NO Polarization



Cross-Polarized

Metallics with Polarizations



NO Polarization

Cross-Polarized

Metallics with Polarizations

NO Polarization

Cross-Polarized

Conclusions & Assumptions

Use it when you need it…avoid it when you can!

- Cross-polarization will reduce light by about 3 f-stops (75%)
- Exposure conditions greatly increase chance of noise
- Less tone values are in darkest shades contributing to loss of dynamic range
- Contrast and color saturation will be increased
- Visual perception without polarization effects will differ from image capture
- Matte tones (especially dark) will record darker than equal glossy tone
- Cross-polarization can cut through glare of heavily matted surfaces
- Good ICC Profiles can match non-polarized and polarized results
- Lighting and exposure remain very critical for successful imaging
- Lighting can be “cheated” to boost amount of lumens on subject
- Partial polarization is sometimes needed to maintain texture and detail
- Cross-polarization will kill metallic gold in art and frames
- Using longer lenses and large diffuse light sources can avoid polarizing
- There will be a strong desire to find ways around polarizing

Cross-Polarization

I'LL BE BACK!