

Online Training Conference

# DIGITAL DIRECTIONS

Fundamentals of Creating and Managing Digital Collections

**PRESENTED BY NEDCC**

## Session 6.1

# Advanced Digital Imaging

presented by  
Terrance D'Ambrosio  
Director of Imaging  
NEDCC, Andover, MA  
tdambrosio@nedcc.org

nedcc.org

Tuesday, November 16, 2021



## Preservation and/or Access?

### Digitization for Preservation

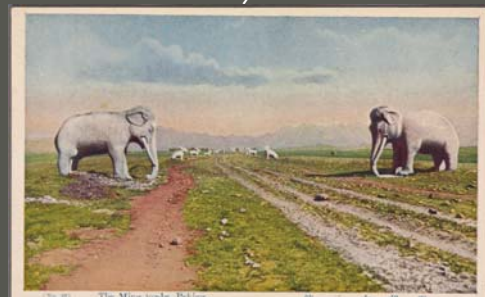
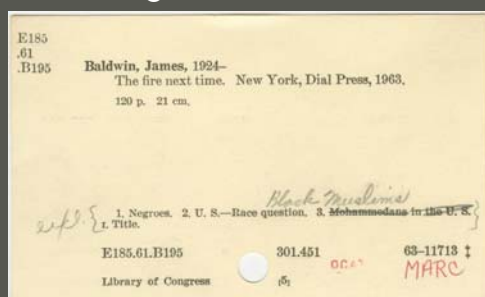
- IS for access
- But also goes further
- Requires technical rigor
- To capture all relevant information
- For an authentic representation
- Intended for long-term use

### Digitization for Access

- Helps w/ preservation
- Generally 'good enough'
- Easy to DIY
- Satisfies immediate need
- May not be fully faithful
- Long term value is ???

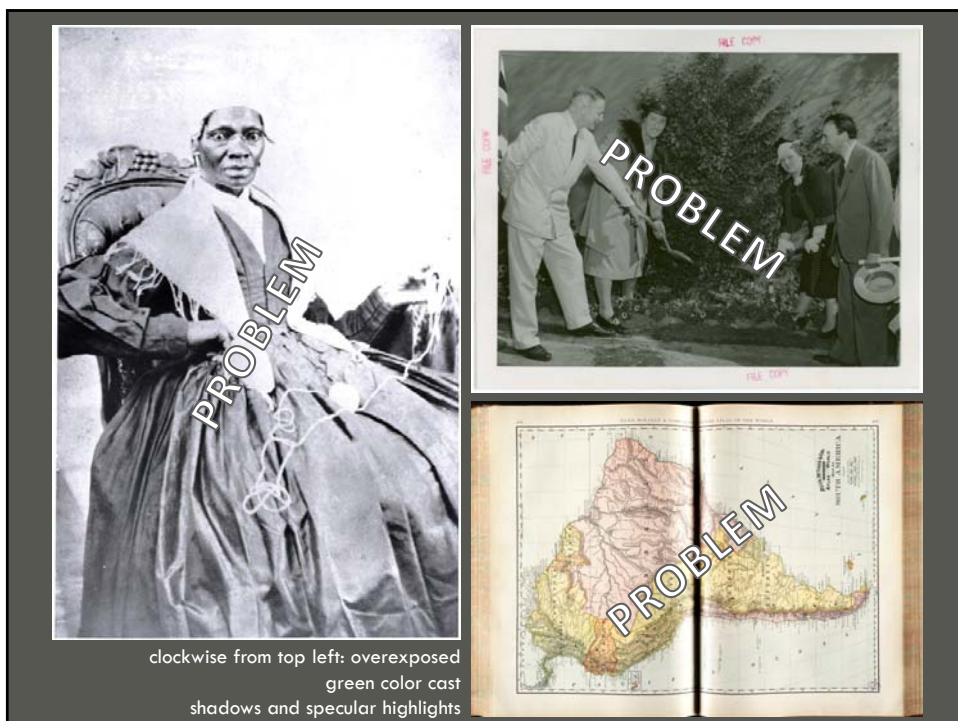
(113) Places.	Lat. N.	Lon. W.	(114) Places.	Lat. N.	Lon. W.
St. Nicholas Mole Pt.	19 49 20	73 27 30	St. Croix or Sta. Cruz.	17 44 8	64 43 30
Port à Pinet . . .	19 35 0	72 57 3	— Christianstad . . .	17 44 8	64 43 30
St. Mark's Point . .	19 2 18	72 50 0	Sombro . . .	18 38 0	63 20 30
Arcadia, South end	18 45 0	72 58 30	Anguilla, S.W. Point	18 11 0	63 16 0
Port au Parais . .	18 33 42	72 23 45	— North East Point	18 10 0	63 2 30
— The Road . . .	18 48 25	72 49 47	St. Martin, N.W. Pt.	18 4 0	63 14 0
Comare L. N.E. Pt.	18 57 0	73 19 0	St. Bartholomew, E. Pt.	17 53 25	62 52 30
— West Point . .	18 57 0	73 19 0	Saba, middle . . .	17 59 30	63 19 0
Petite Goave, . . .	18 26 51	72 50 30	St. Eustatius, Road	17 29 30	63 4 30
— Hammock . . .	18 26 51	72 50 30	St. Christopher, . .	17 19 30	62 49 15
Rochelle Reef, . .	18 37 20	73 12 0	Navis, Town . . .	17 10 30	62 43 0
— Pirogues . . .	18 37 20	73 12 0	Barbuda, N. Point	17 42 0	61 52 0
Point Jérémie . . .	18 37 25	74 25 0	— St. John's Road	17 9 40	61 57 0
Cape Donna Maria	18 22 23	74 30 30	— English Harbour	17 2 0	61 50 0
Point des Irois . .	18 19 25	74 27 32	Redonda . . .	16 44 30	62 20 0
Point à Gravois . .	18 1 3	73 55 0	Montserrat, N.E. Pt.	16 48 0	62 16 40
Isle à Vache, E. Pt.	18 4 0	73 31 30	Gundaloupe, . . .	15 59 30	61 47 30
Les Cayes, Town . .	18 11 10	73 44 0	— Old Fort . . .	15 56 0	61 45 30
St. Louis, Old Fort	18 14 27	73 31 30	— Chateau Point . .	16 12 30	61 12 0
— Aquin Bay . . .	18 13 48	73 20 0	— North Point . . .	16 30 0	61 37 0
— Diamond Rock	18 11 20	72 32 30	Aves or Bird's I. . .	15 40 56	63 35 0
Cape Jaquemel . .	17 29 11	71 40 30	Desuda, N.E. Point	16 20 0	61 9 30
Alto Vais Rock . .	18 12 40	70 49 30	Marigalante, . . .		
Point Saline . . .	18 28 40	69 59 37			
St. Dismas, City	18 28 40	69 59 37			

## Digitization for Preservation is Relative!





## Details that Might Matter





## Early Film-Based Negatives (Pt. 1)



e.g. nitrate film,  
manufactured from the  
1890s into the 1940s

mirrored (top left) and  
shattered (bottom right)  
nitrate negatives



## Early Film-Based Negatives (Pt. 2)



e.g. acetate film, manufactured  
from the 1910s into the 1960s

negatives showing increasingly  
severe acetate deterioration



## Color Negatives and Slides/Transparencies

color still film,  
manufactured from the  
1930s into the 2000s



color negative in good  
condition (top right) and  
Kodachrome slide with  
'shifted' color due to  
unstable dyes (bottom  
left)

## Color Photographic Prints



color photographic  
prints with 'shifted' and  
faded color,  
due again to unstable  
dyes

color photographic prints were widely  
produced from ~1940s-2000s



## Large and/or Complex Objects

e.g.  
architectural and design  
drawings (including  
manuscript drawings,  
blueprints, diazotypes,  
etc.)  
printed and manuscript  
maps  
artwork on paper

panoramic photographs

atlases

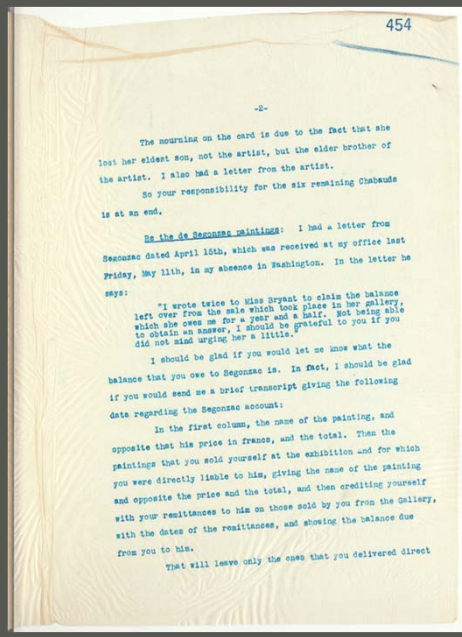
scrapbooks

etc.



## Objects w/ Fragile Substrates

e.g.  
many papers manufactured  
from ~1860-1960  
virtually all newsprint  
copy press books or any  
documents on tissue paper  
or onion skin



## Objects w/ Fugitive Media



e.g.

iron gall ink

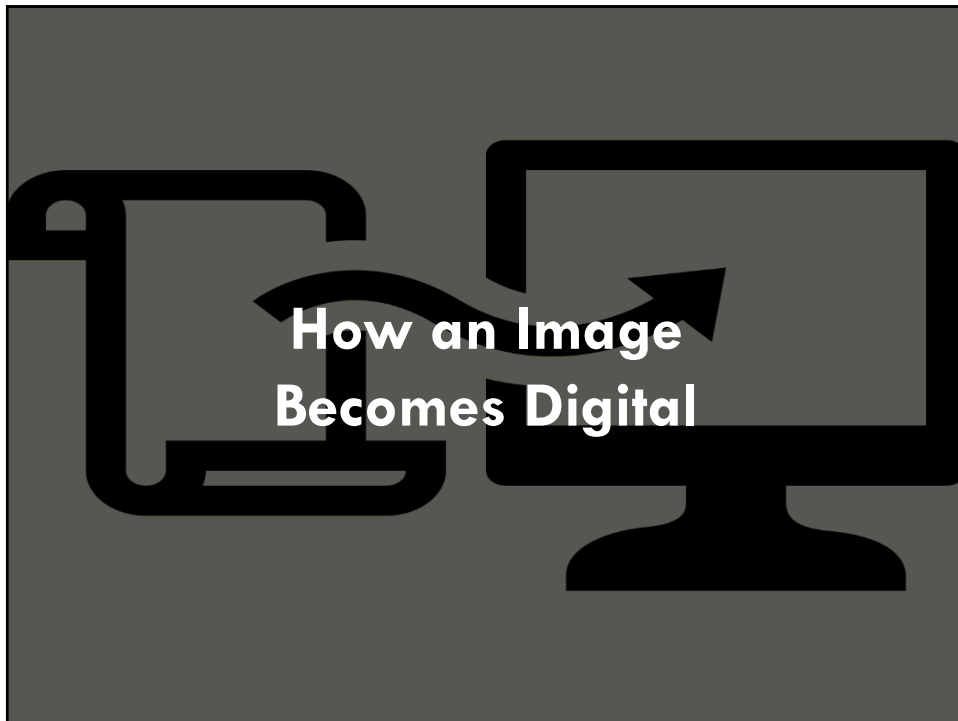
flaking or friable  
media (pastels,  
damaged emulsion)

photosensitive  
processes  
(blueprints,  
diazotypes)

etc.

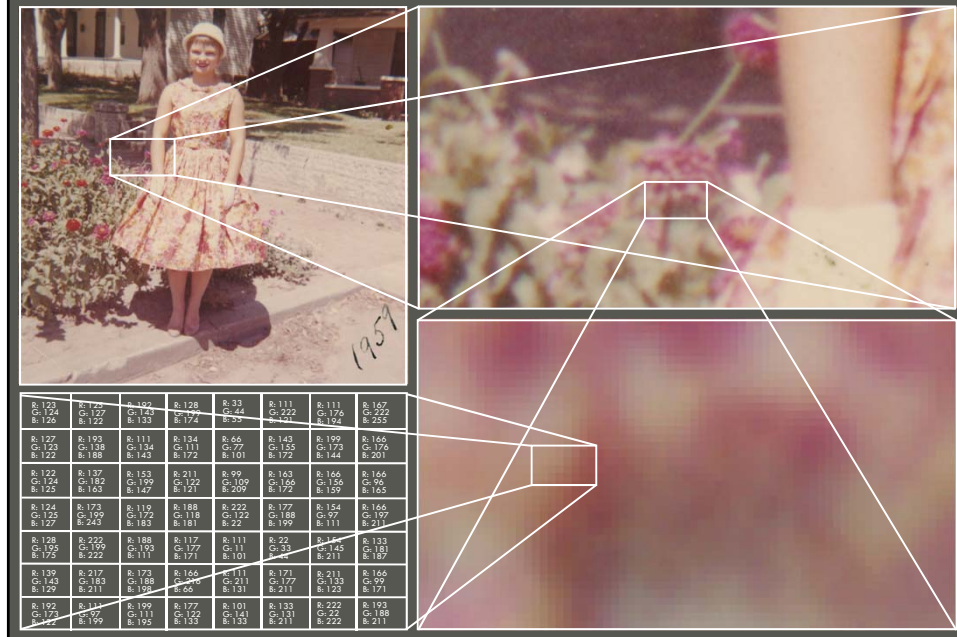


## How an Image Becomes Digital





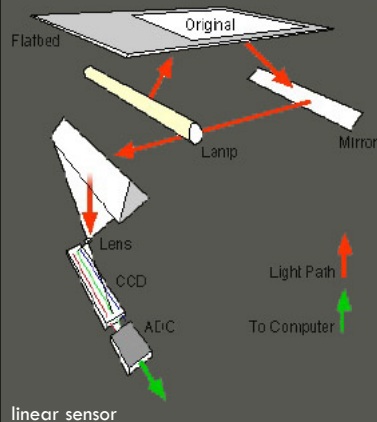
## What is a Digital Image?



## Image Sensors

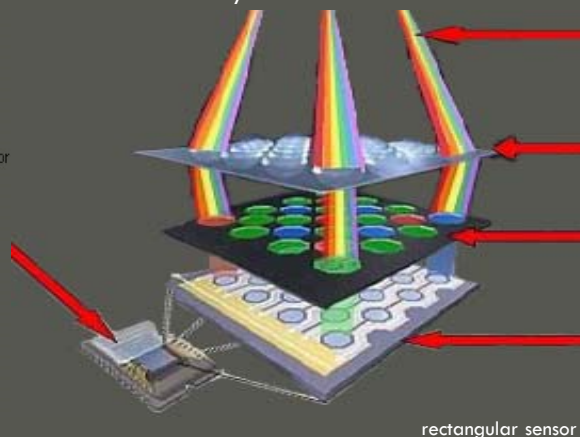
### Linear Sensor

- flatbed & slide scanners
- “scanning backs” (nearly obsolete)
- high-res for relatively low cost
- less active R&D
- relatively slow



### Rectangular Sensor

- all cameras: cell phone, DSLR, etc.
- low res = low cost
- high res = high cost
- active R&D
- relatively fast



## Light Sources



continuous tungsten lights



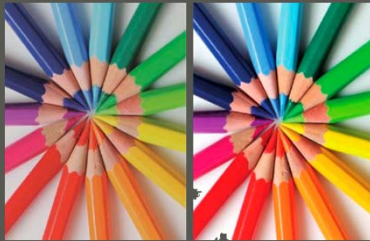
xenon strobes



continuous LEDs

Quality of Light Source Matters;  
Type of Light Source Doesn't Matter

- xenon, fluorescent, LEDs, incandescent, tungsten are all ok
- their color temperature can vary
- but they must render color well: Color Rendering Index (CRI) > 90

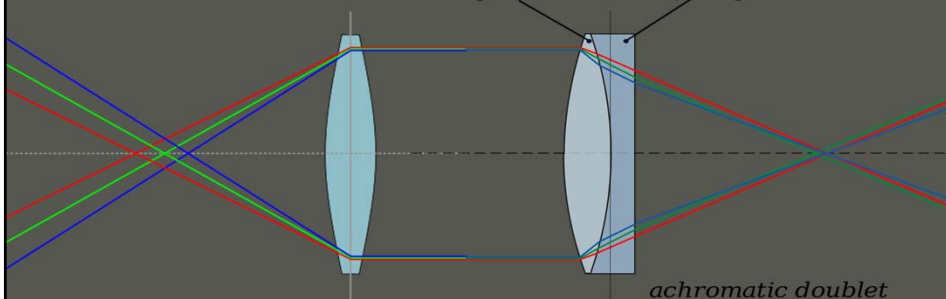


left: CRI of 70; right: CRI of 93

## Lenses

*crown glass*

*flint glass*



simple lens design

apochromatic lens design

Essential Lens Qualities for Digital Reformatting

- Apochromatic Flat Field (designed to reduce chromatic aberration)
- Prime (meaning, fixed; meaning, not a zoom lens)
- Macro (50-100mm for most copy work)
- Good (well engineered, well built)

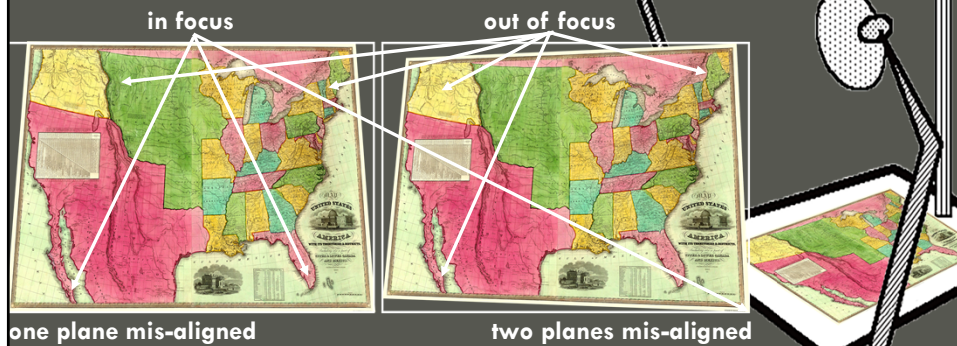
## Imaging Platforms

Digitization for preservation typically occurs on a copy stand:

- surface to support the object
- column/arm to support the camera

This maintains parallelism among sensor, lens, and material; otherwise you get:

- geometric distortion
- focus fall-off



## Assessing Image Quality for Preservation-Oriented Digitization



## Standards & Guidelines for Preservation-Oriented Digitization (Pt. 1)

### FADGI (Federal Agency Digitization Guidelines Initiative)

- Developed by Federal Agencies (including LOC & NARA)
- General quality standards and best practices
- 4 tiers of quality *for each metric*:
  - ★★★★★ (most rigorous) -> ★ (least rigorous)
  - Depends on content, significance, funding
  - *Measuring quality requires sophisticated tools & experience*
- Flexible, intended for diverse audience
- Guidance on capture environments, workflows, metadata, storage
- Widely known and used throughout US and abroad



**Federal Agencies  
Digitization Guidelines Initiative**

## Standards & Guidelines for Preservation-Oriented Digitization (Pt. 2)

### Metamorfoze

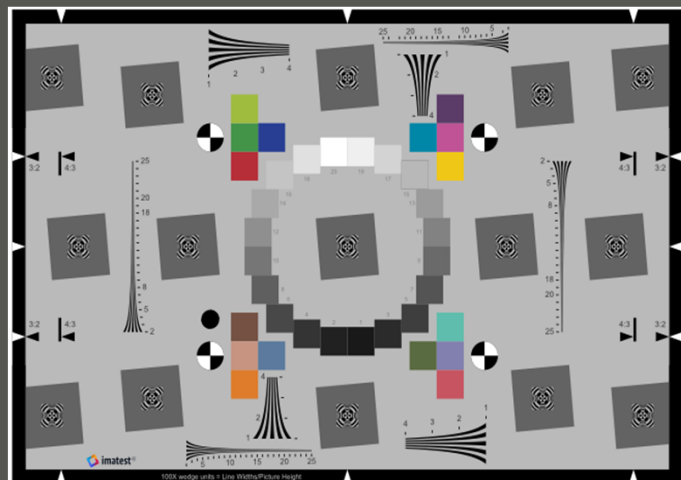
- Developed by National Library of the Netherlands
- Quality standards for national preservation imaging initiative
- 3 tiers of quality:
  - Metamorfoze (eg paintings, fine art photography)
  - Metamorfoze Light (eg diaries, literary manuscripts)
  - Metamorfoze Extra Light (eg newspapers, printed books)
- Quality standards ONLY – no guidelines for capture/storage
- Taken up in Europe, minimal adoption in US



**Metamorfoze Preservation Imaging Guidelines**

*Image Quality, version 1.0, January 2012*

## Targets & Testing (Pt. 1)



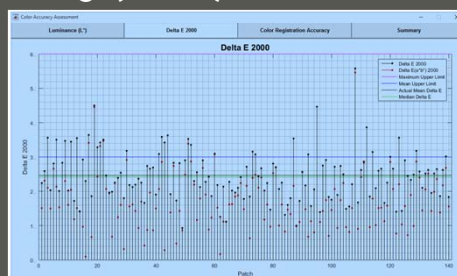
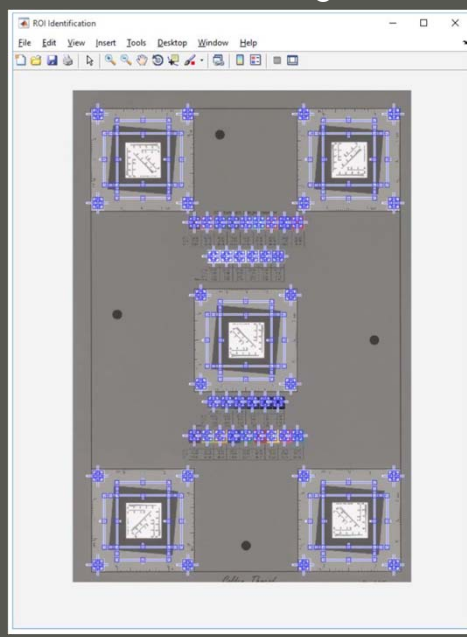
left: example of Device Level Target  
used for assessing imaging  
system performance

Imaging Targets  
Include Visual  
Features that  
Software Tools  
Analyze to Assess  
Various Aspects  
of Image Quality

below: example of Object Level Target  
used for validating imaging system performance



## Targets & Testing (Pt. 2)

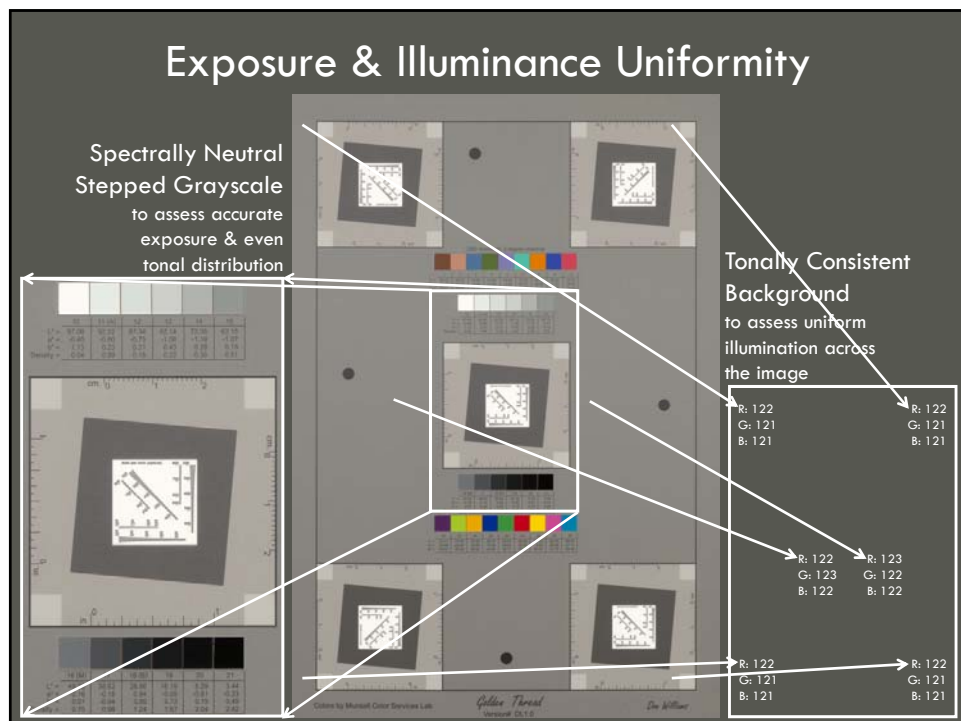


left & above: screenshots from  
OpenDICE

### Image Quality Assessment

Software options include:

- OpenDICE (open source, released by LoC)
- Golden Thread
- Imatest
- Image Quality Analyzer





## Color Cast & Color Encoding Errors

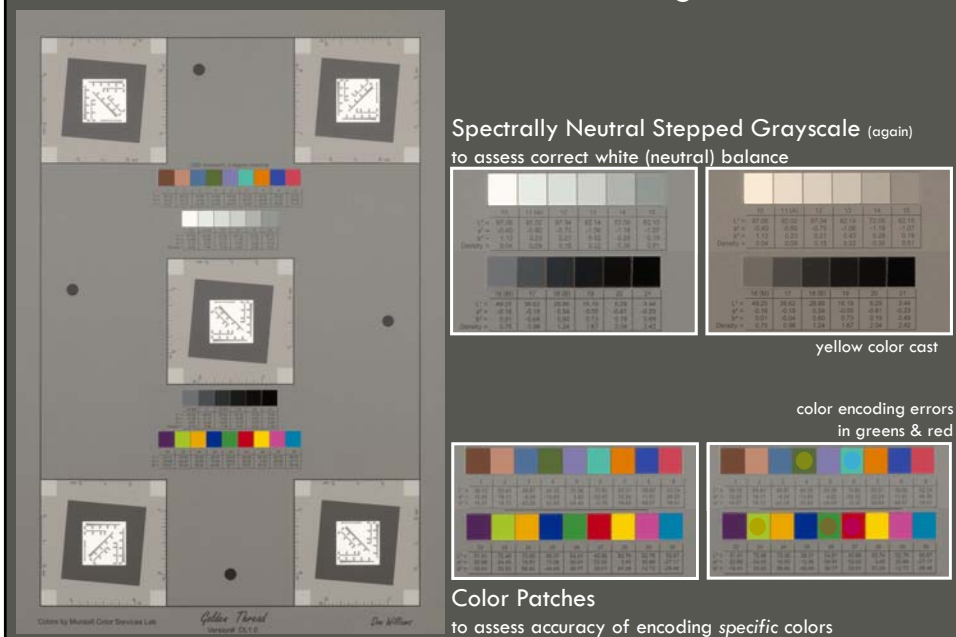


color cast: consistently inaccurate color capture across spectrum

color encoding error: inaccurate color capture in specific colors

Google Image search results of Gauguin's *Self Portrait with Portrait of Émile Bernard*

## Color Cast & Color Encoding Errors



## Noise (Pt. 1)

random variation of brightness or color  
information



## Noise (Pt. 2)

	10	11.04	12	13	14	15
$L^*$	97.06	92.02	87.34	82.14	72.05	62.15
$a^*$	-0.40	-0.60	-0.75	-0.98	-1.18	-1.07
$b^*$	1.13	0.23	0.21	0.43	0.28	0.19
Density	0.04	0.09	0.15	0.22	0.36	0.51

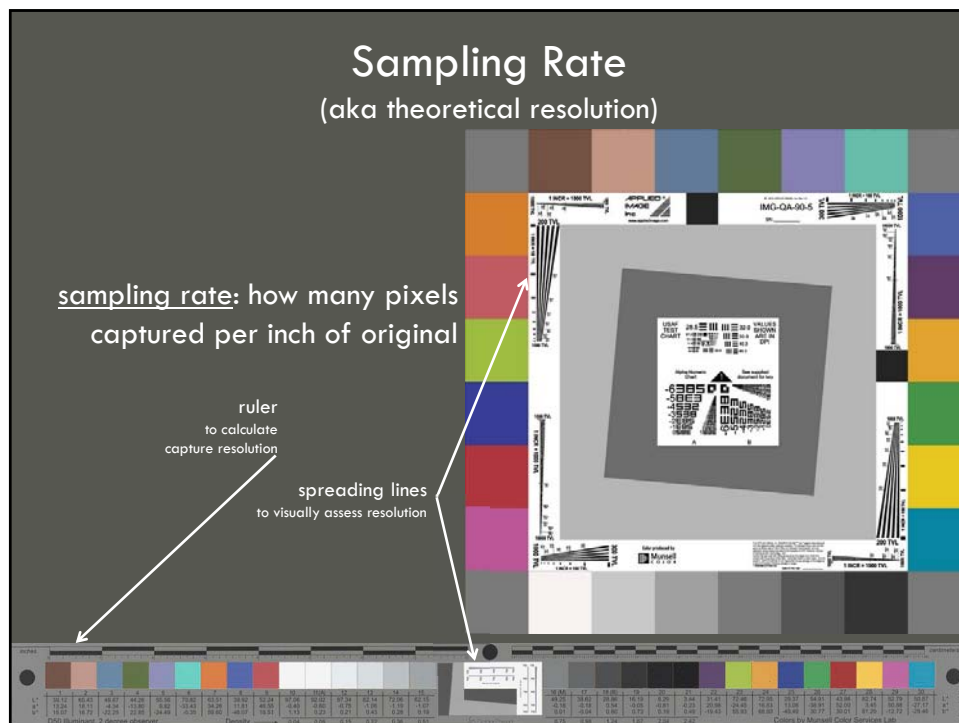
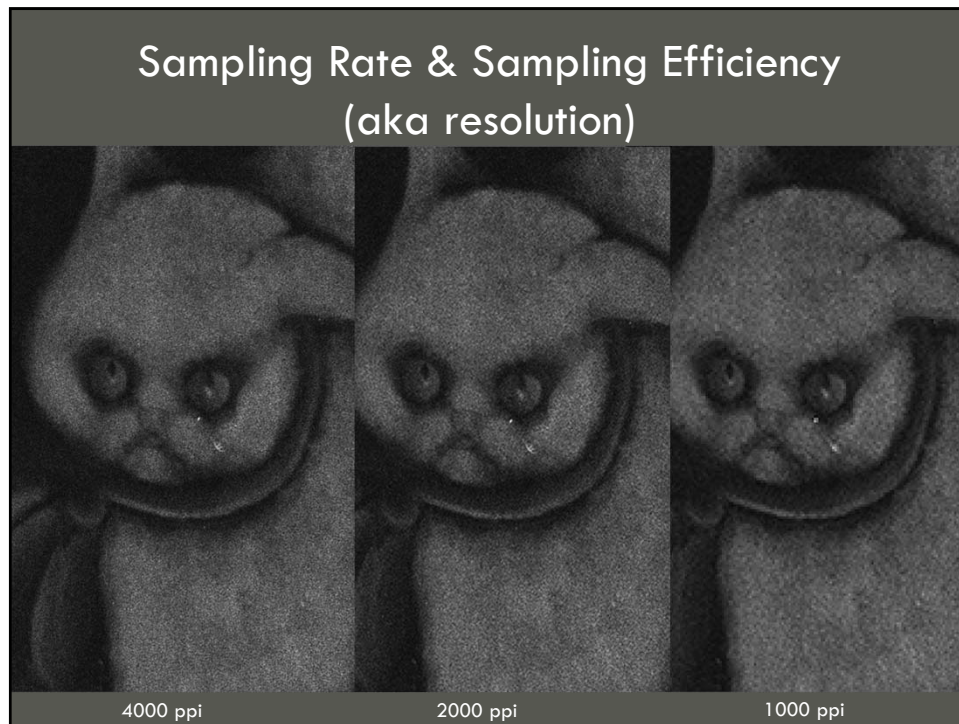
  

	16.1161	17	18.001	19	20	21.001
$L^*$	49.25	38.62	28.86	19.78	12.52	6.56
$a^*$	-0.16	-0.18	-0.18	-0.19	-0.21	-0.23
$b^*$	0.01	-0.04	0.00	0.03	0.05	0.05

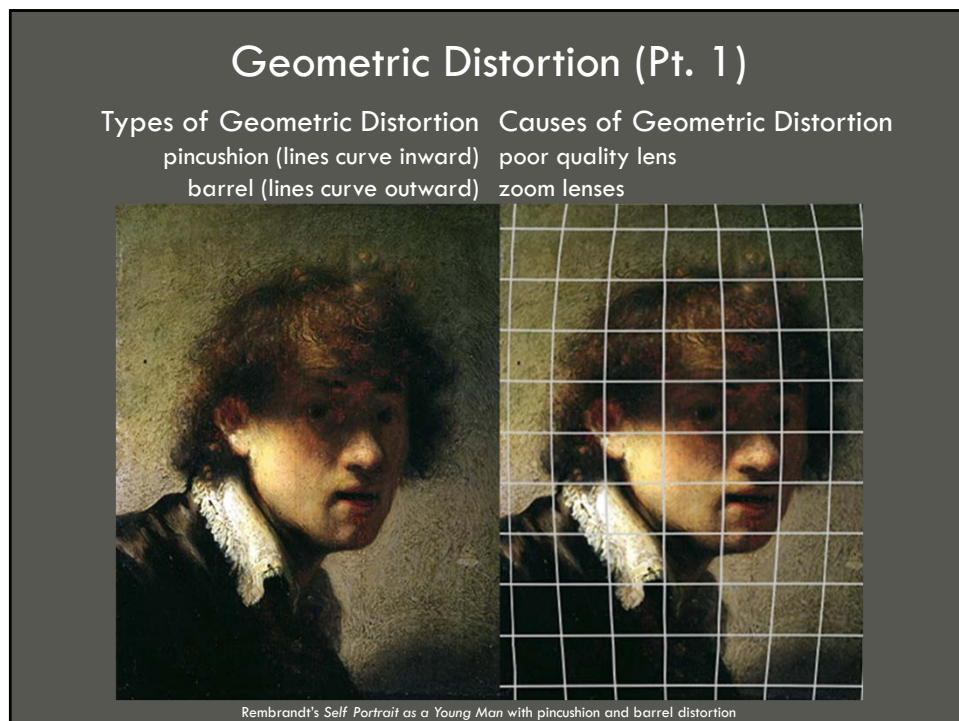
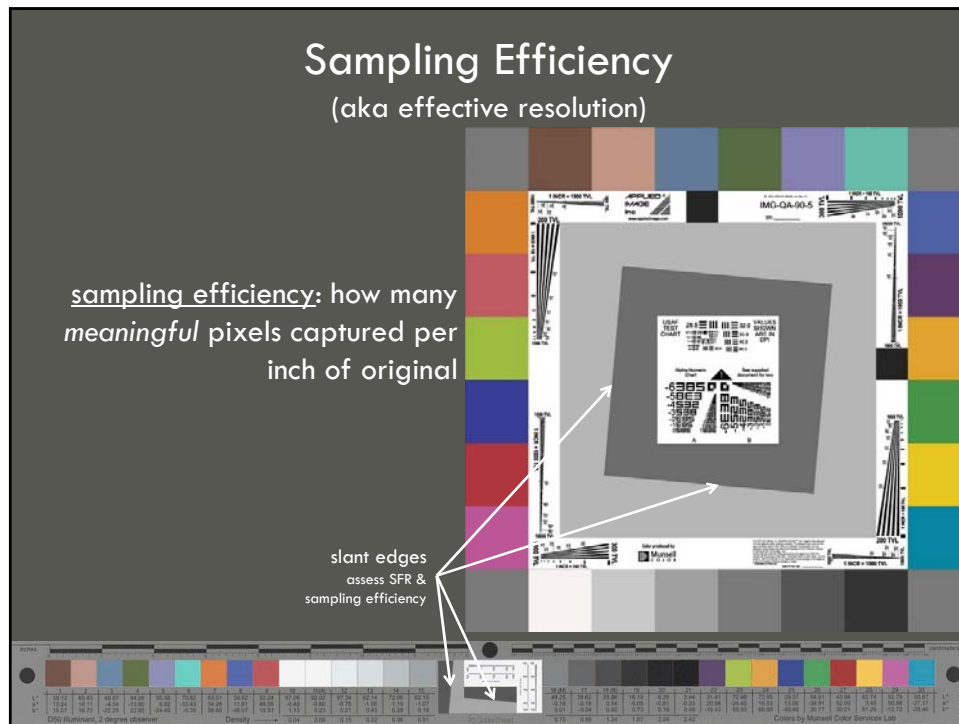
Spectrally Neutral Stepped  
Grayscale (again)  
noise is the standard deviation of  
RGB values within a sample from the  
grayscale

increasing amounts of noise →









## Geometric Distortion (Pt. 2)

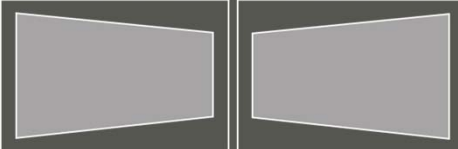
Types of Geometric Distortion

keystone (lines not parallel)

Causes of Geometric Distortion


incorrect setup

**NEEDS HORIZONTAL  
KEYSTONE CORRECTION**

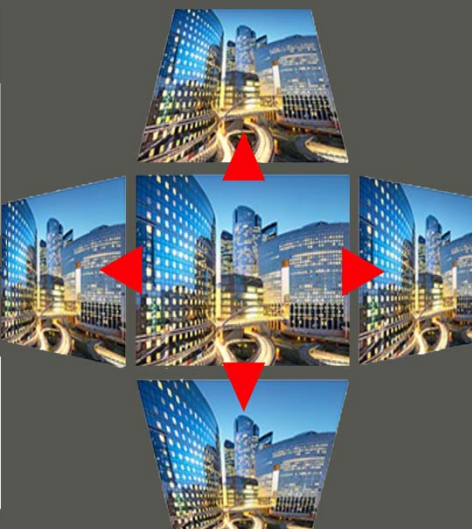


TO ACHIEVE A RECTANGULAR IMAGE

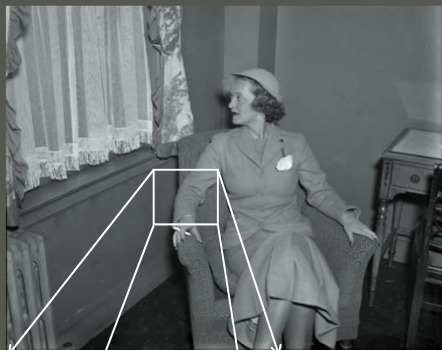
**NEEDS VERTICAL  
KEYSTONE CORRECTION**




TO ACHIEVE A RECTANGULAR IMAGE



## Artifacts and Human Error (Pt. 1)



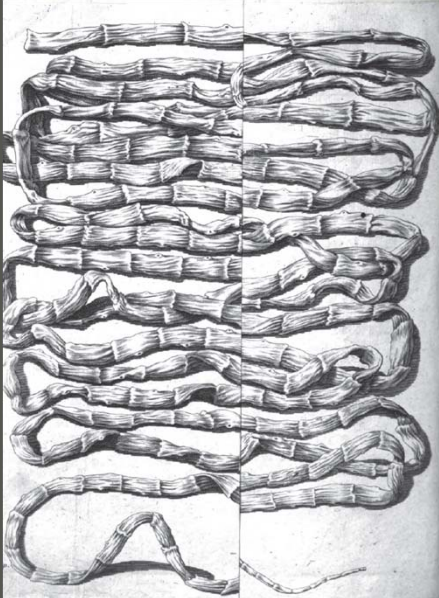
e.g. newton rings




e.g. specular highlights

Which Can Only be Identified During Manual Quality Inspection

## Artifacts and Human Error (Pt. 2)

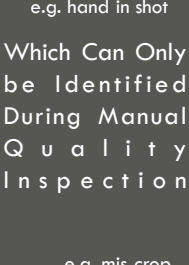


e.g. unfolded plate




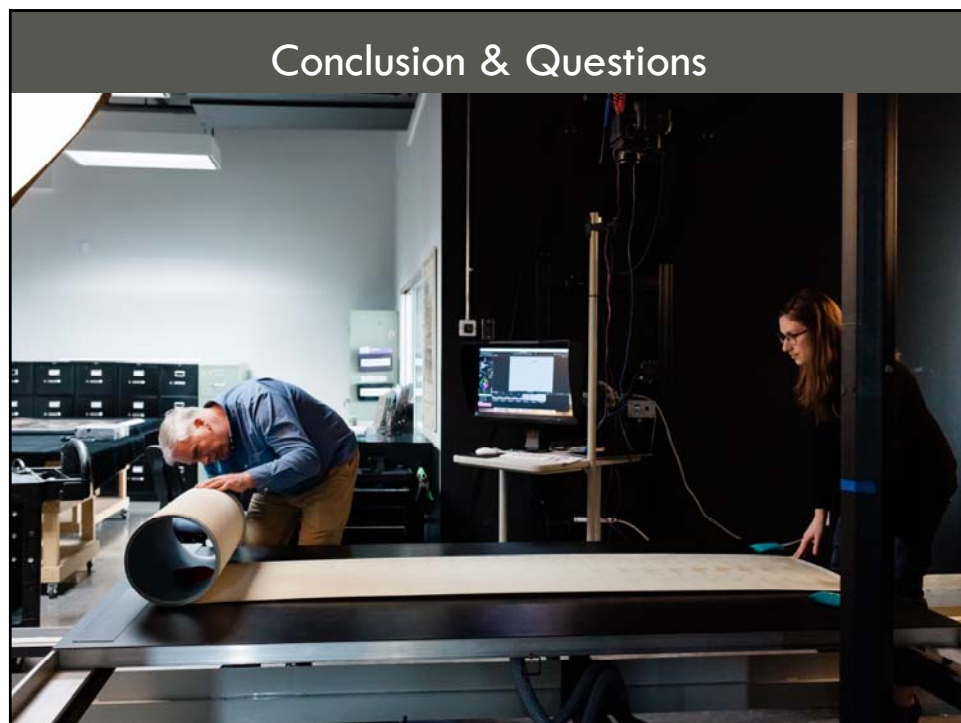
e.g. hand in shot

Which Can Only be Identified During Manual Quality Inspection



e.g. mis-crop







## Resources

### Information:

ImageMuse – listserve for cultural heritage imaging professionals

(<https://imagemuse.groups.io/g/main>)

dpBestflow – website with information about best practices in digital imaging workflows

(<http://www.dpbestflow.org/>)

FADGI – Federal Agency Digitization Guidelines Initiative: Creation of Raster Image Master Files

(<http://www.digitizationguidelines.gov/still-image/>)

Metamorfoze – National Library of the Netherlands Preservation Imaging Standards

(<http://www.metamorfoze.nl/english/digitization>)

### Vendors & Consultants:

Image Science Associates (ISA) – sells high quality imaging targets and analysis software

Imaging, Etc. – sells color management tools, and offers consultation services

B&H Photo & Video & Adorama – sell huge selection of imaging hardware, supplies, etc.

Talas, Gaylord, University Products, etc. – sell handling supplies, storage, tools, etc.

Online Training Conference

# DIGITAL DIRECTIONS

Fundamentals of Creating and Managing Digital Collections

PRESENTED BY NEDCC

## Thank you!

please complete the online evaluation form;  
a link was sent to your email address;  
you can edit your responses until you click submit.