



DHPS | NY

DOCUMENTARY HERITAGE
& PRESERVATION SERVICES
FOR NEW YORK

Thanks for joining us! Today's presentation will begin shortly.

Please check your audio and video settings.
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LIGHTING: Beyond Standards

Image: Goreme Open Air Museum

Heather Hendry, CCAHA

Documentary Heritage and Preservation Services for New York is a five year initiative to deliver collections-related training, preservation surveys, archival assessments, and other services to the historical records community in New York.



New
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DOCUMENTARY HERITAGE
& PRESERVATION SERVICES

FOR NEW YORK

Website: dhpsny.org



*New York State
Archives*

CONSERVATION
CENTER

for art & historic artifacts

Heather Hendry

Senior Paper Conservator

Conservation Center for Art and
Historic Artifacts (CCAHA)

Paper conservation, collection
surveys and consultation

Meet with clients to assess
collection objects

Workshops, lectures, webinars

www.ccaha.org



CONSERVATION CENTER

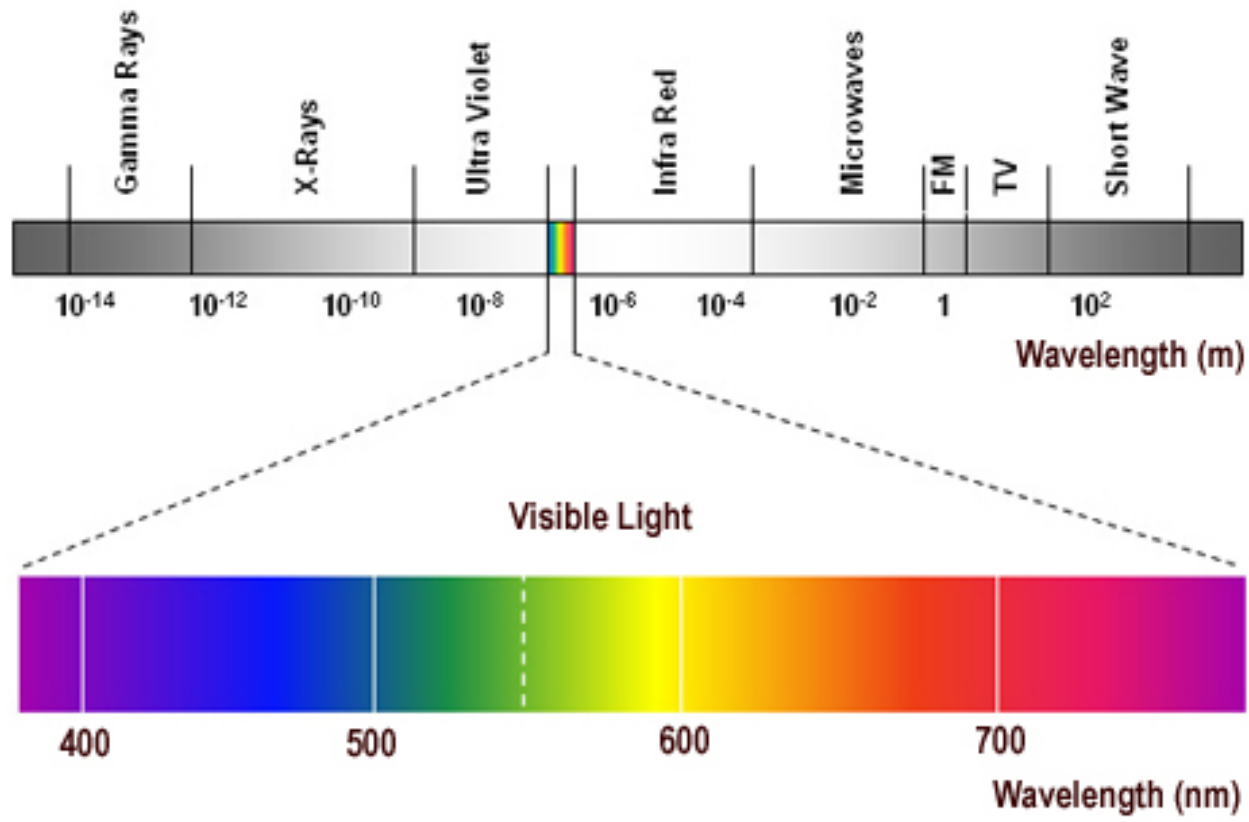
for Art & Historic Artifacts

Today's Topics:

- Introduce participants to how light works
- Light measuring tools
- Controlling light exposure
- Case studies



What is light?



What is light?

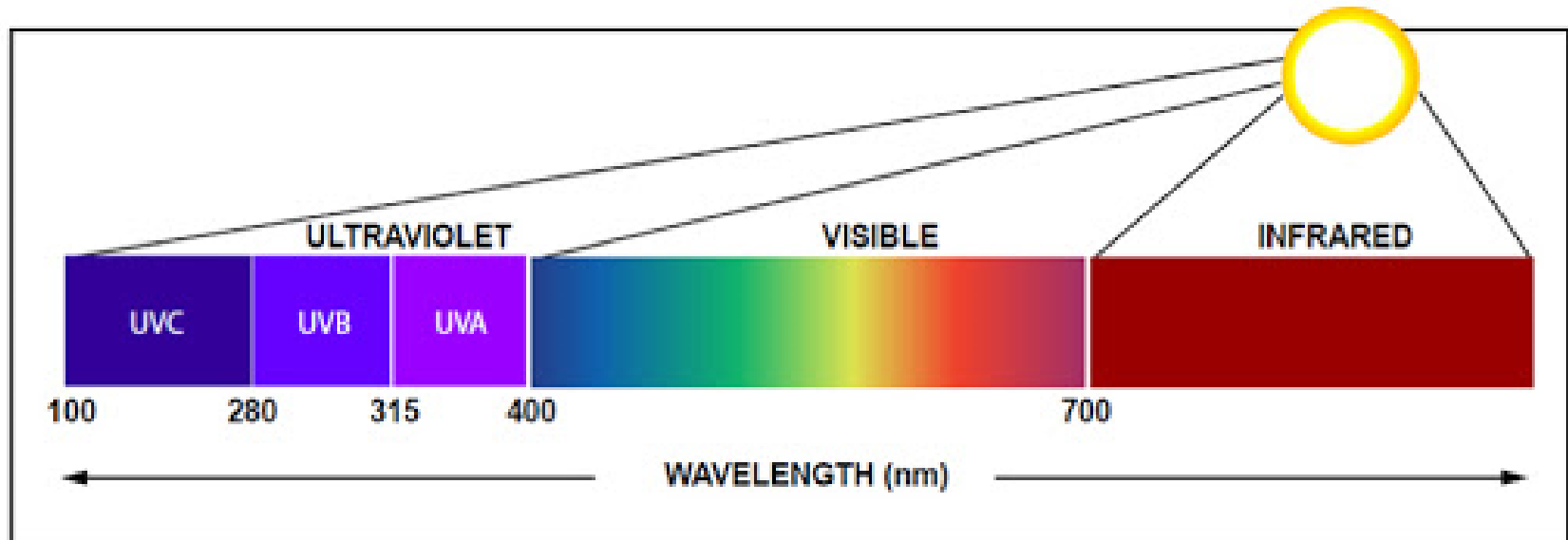
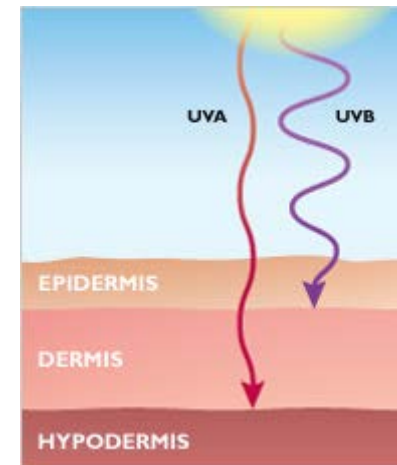
white light coming in



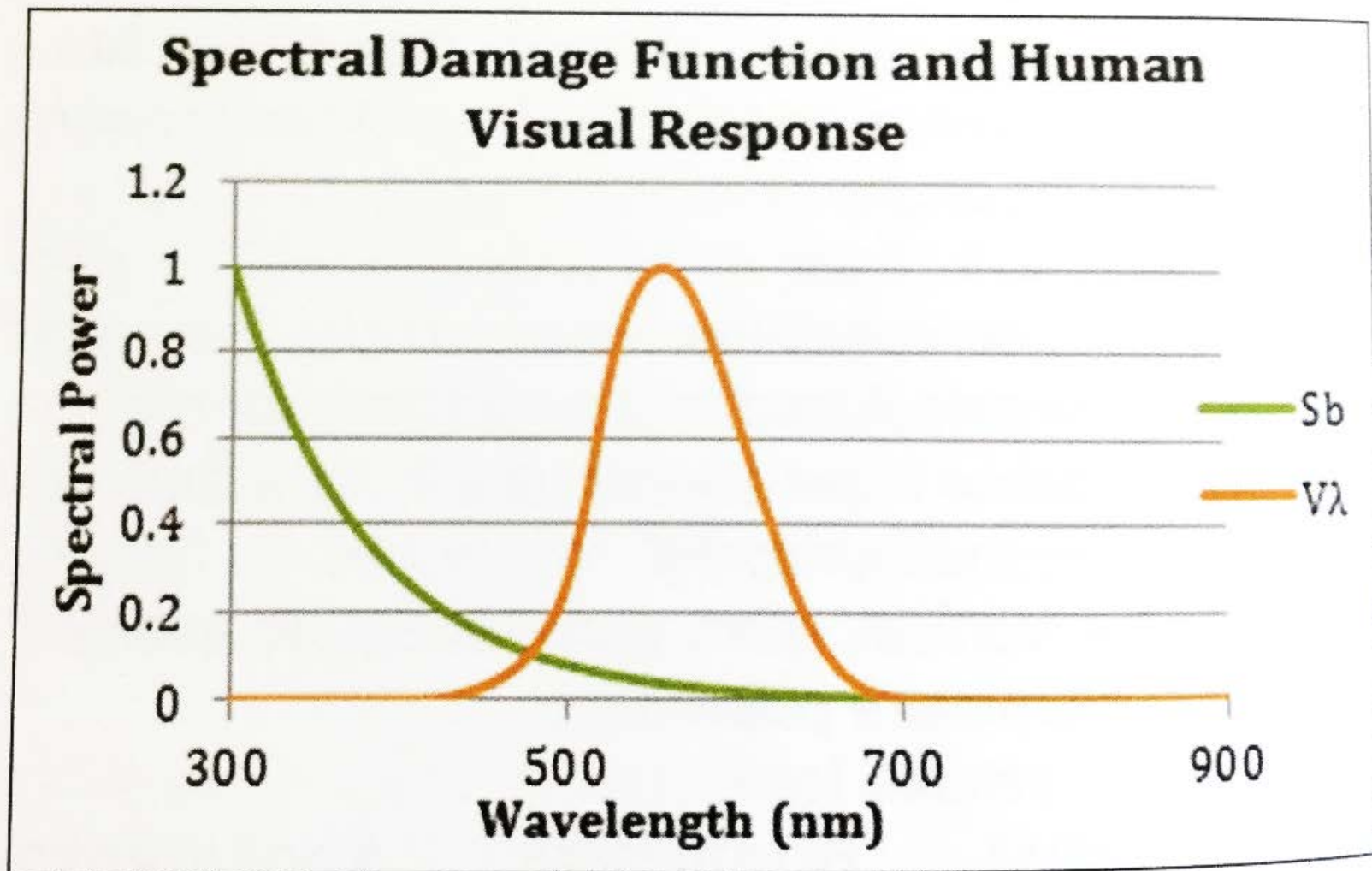
380-740 nanometers

green surface

Electromagnetic Spectrum



Light-induced damage



Light-induced damage

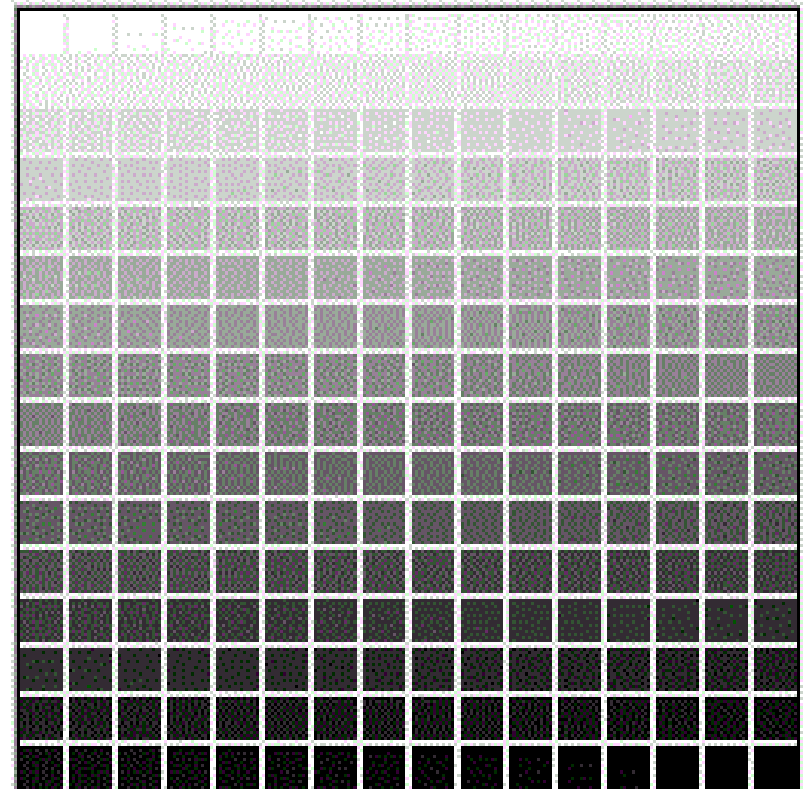
- Fading
- Darkening
- Photo-oxidation



Light-induced damage

- Fading
- Darkening
- Photo-oxidation

Noticeable/Acceptable/Unacceptable



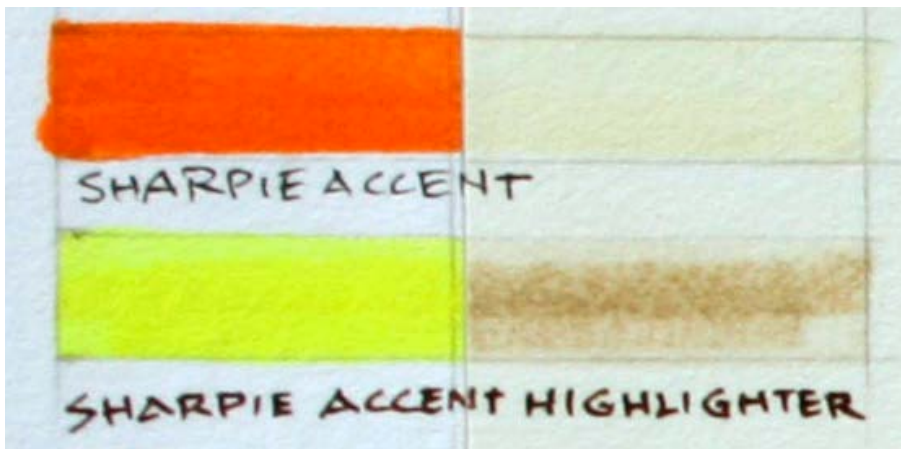
Just Noticeable Change (JNC)

~10 JNC = unexhibitable

~30 JNC = completely lost

Light-induced damage

- Fading
- Darkening
- Photo-oxidation



Light-induced damage

- Fading
- Darkening
- Photo-oxidation



Light-induced damage

- Fading
- Darkening
- Photo-oxidation
- Cumulative



Light-induced damage



- Overall yellowing of varnish
- Loss of red tones
- Irreversible

Differences

- Exposure history
- Materials
- Varnish applications and removals
- Conservation



Factors Affecting Visibility

Factors affecting visibility

- Amount of light
- Color Rendering Index (CRI)
- Color temperature
- Visual adjustment
- Level of detail
- Viewer

“Since all light is damaging to light-sensitive materials, excessive lighting causes damage with no justification, and under-lighting causes damage with no benefit.”

-ANSI/IES RP-30-17

Factors affecting visibility

- **Amount of light**
- Color Rendering Index (CRI)
- Color temperature
- Visual adjustment
- Level of detail
- Viewer
- Measured in lux or footcandles
- 50 lux is generally considered the lowest possible for viewing
 - This assumes:
 - Good vision
 - Good contrast
 - No fine details
 - Light surfaces

Factors affecting visibility

- Amount of light
- **Color Rendering Index (CRI)**
- Color temperature
- Visual adjustment
- Level of detail
- Viewer

- How well does a light source reveal the colors of various objects



2700K CRI 100



2700K CRI 90



2700K CRI 80



2700K CRI 70

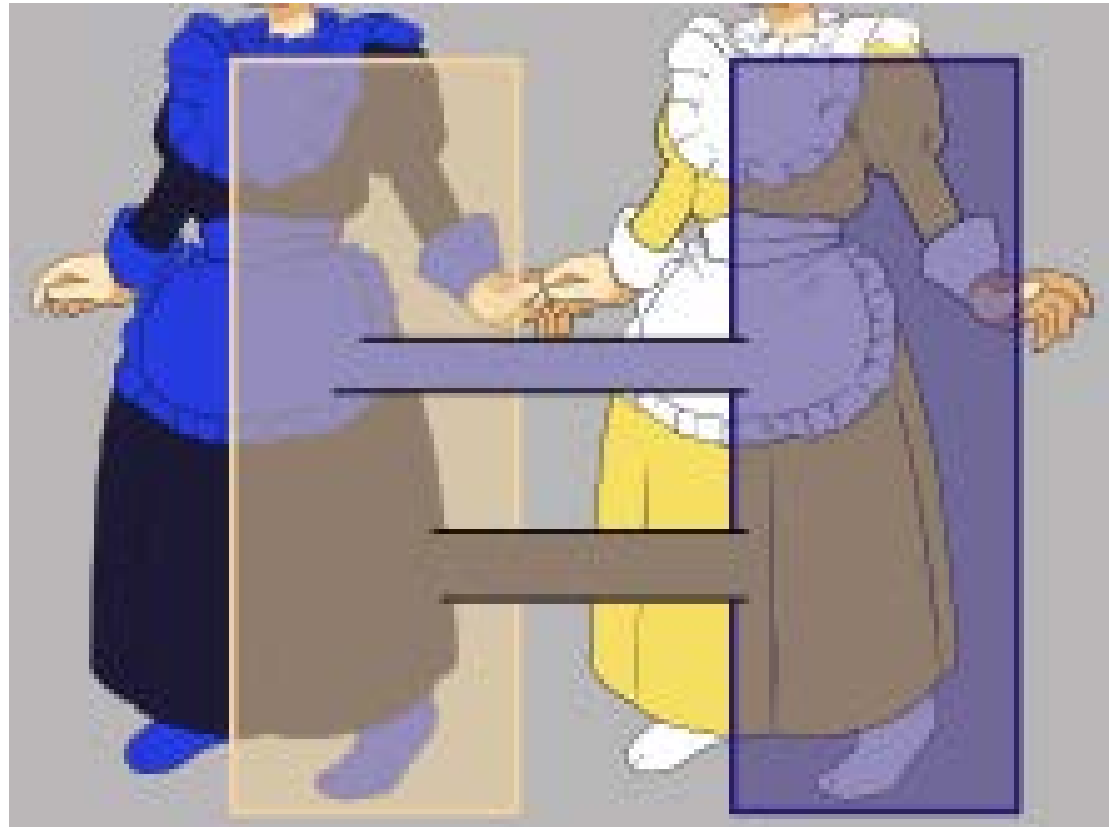
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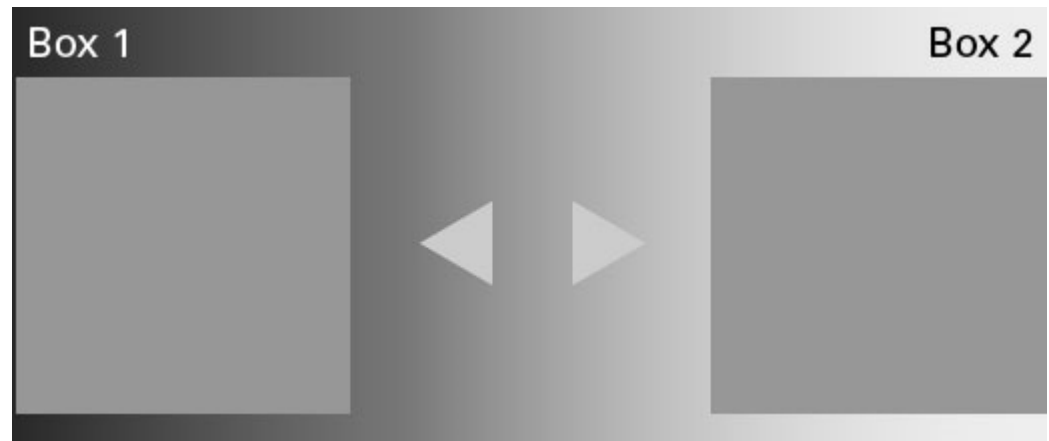
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Factors affecting visibility

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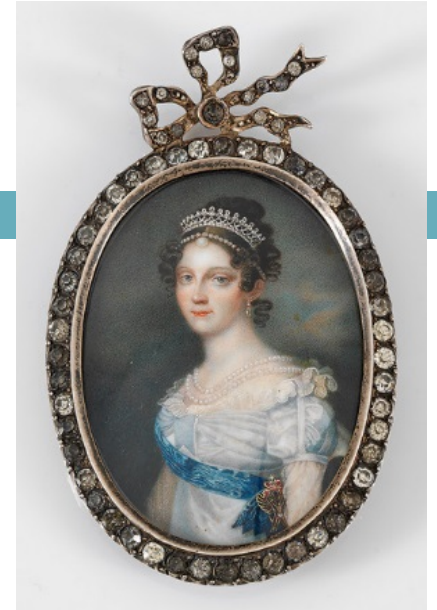
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Factors affecting visibility

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Factors affecting visibility

- Amount of light
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- **Viewer**





How sensitive is an object?

How sensitive is an object?

Factors

- Support
- Medium
- Environment
- History



How sensitive is an object?

Factors

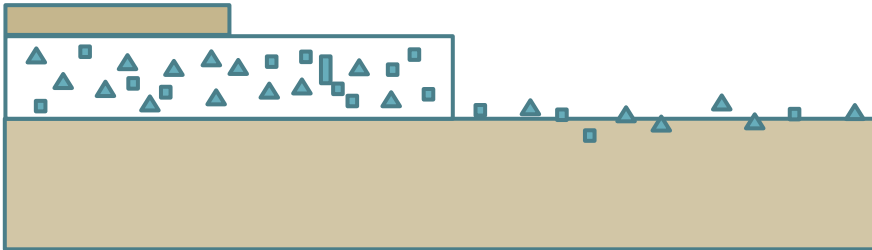
- **Support**
 - Medium
 - Environment
 - History
- Paper
 - ▣ Wood vs cotton or linen fibers
 - ▣ Acidic vs alkaline
 - Paintings
 - ▣ Canvas vs wood
 - ▣ Any unpainted areas?
 - Textiles
 - ▣ Silk, plant fibers, leather
 - Sculpture
 - ▣ Wood, stone, metal



How sensitive is an object?

Factors

- Support
- **Medium**
- Environment
- History
- Varnish
- Pigments, dyes, and lakes
- Binder: oil vs watercolor
- Drawing materials:
 - Charcoal
 - Graphite
 - Ink
 - Felt tip pens



How sensitive is an object?

 AS Naples Yellow Reddish (PW4, PY42, PO20)	 AS Australian Red Gold (PY83, PR101, PV19)	 AS Pilbara Red (PR101, PV19, PB7)	 AS Australian Grey (PB7, PY42)	 DR Transparent Red Brown (PR206)	 DR Mars Violet (PR101)
 DR Warm Sepia (PB7, PBk11, PR101)	 LUK English Red Light (PR101)	 LUK Burnt Sienna (PB7)	 LUK Caput Mortuum Deep (PR101, PBk11)	 LUK English Red Deep (PR101)	 LUK Burnt Green Earth (PY155, PR176, PBk7)
 LUK Burnt Umber (PY155, PR176, PBk7)	 LUK Raw Umber (PY155, PR176, PBk7)	 MB Burnt Umber (PB7)	 MC Burnt Sienna (PB7)	 REM Transparent Red Oxide (PR101)	 REM Burnt Umber (PB7)
 SEN Burnt Sienna (PB7)	 SEN Burnt Umber (PB7)	 SCH English Venetian Red (PR101)	 SCH Burnt Umber (PB7)	 SCH Sepia Brown (PB15:1, PBk9, PB7)	 WN Light Red (PR102)
 WN Venetian Red (PR101)	 WN Burnt Sienna (PR101)	 WN Burnt Umber (PB7, PR101, PY42)	 WN Vandyke Brown (PBk6, PR101)	 WN Sepia (PBk6, PR101)	 WN Indian Red (PR101)

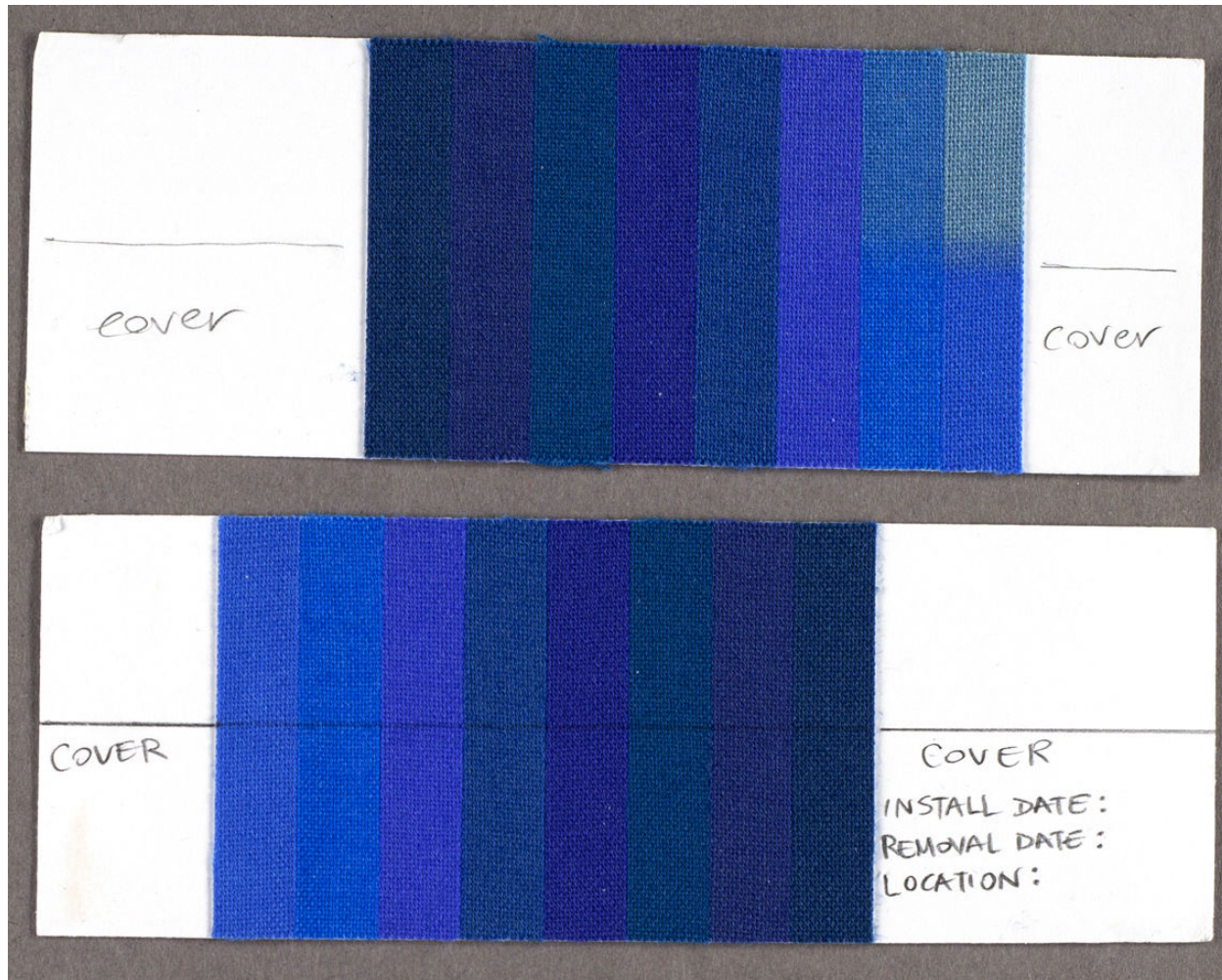
How sensitive is an object?

					
AS Coral (PR192, PY83)	DR Cadmium Orange Hue (PO62, PY65)	DR Cadmium Red Pale Hue (PR254, PO73)	DR Permanent Red (PR254, PO73)	DR Perylene Red (PR179)	LUK Permanent Orange (PO71)
					
LUK Cadmium Red Light (PO20)	LUK LUKAS Red (PR254)	LUK Permanent Red (PR242)	LUK Cadmium Red Deep (PR108)	LUK Alizarin Crimson (PR176)	MG Cadmium Red Light (PR108)
					
OH Golden Barok Red (PO65)	REM Permanent Red Medium (PR255)	SEN Cadmium Red Light (PR108)	SEN Alizarin Crimson (PR43)	SCH Cadmium Red Light (PR108)	SCH Permanent Carmine (PV19)
					
WN Cadmium Orange (PY35, PR108)	WN Winsor Orange (PO62)	WN Winsor Red (PR254)	WN Winsor Red Deep (PR264)	WN Guinacridone Red (PR209)	WN Cadmium Red (PR108)
					
WN Alizarin Crimson (PR 83)	WN Permanent Alizarin Crimson (PR206, ?)	WN Scarlet Lake (PR188)	WN Bright Red (PR188, PY65)	WN Cadmium Scarlet (PR108)	

How sensitive is an object?



How sensitive is an object?



How sensitive is an object?

Factors

- Support
- Medium
- **Environment**
- History



How sensitive is an object?

Factors

- Support
- Medium
- Environment
- **History**



Museum Lighting Standards

	Visible Light	Ultraviolet Light
Sensitive Collections: Watercolors, photographs, textiles	50 lux maximum Restrict exhibition to three months every five years	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumern
Less Sensitive collections: Oil Paintings, wood, leather	150 lux maximum	Same
Least sensitive collections: Metal, ceramics, stones, glass	300 lux	Same

How sensitive are archival materials?

Extreme

- Salted paper prints
- Early purple dyes

High

- Newprint
- Wood pulp papers
- Colored markers
- Organic dyes
- Lake pigments
- Architectural reproductions (not blueprints)
- Digital prints

Medium

- Most watercolors
- Mixed paper
- Iron gall ink
- Blueprints

Low

- India ink
- Charcoal, graphite
- Xeroxes
- Earth pigments
- Pigment-based ink jet prints
- 100% rag paper

What do light levels mean?

Light level	Examples	Light level	Examples
0.001 lux	Starlight	200 lux	Restrooms, stairs, hallways
0.1-1 lux	Full moon	300 lux	Sculpture exhibition
0.2-.05 lux	Airplane emergency exit lighting	500 lux	Kitchens, Offices, Gyms, Daycares
11 lux (average)	Emergency exit lighting	750 lux	Supermarkets
50 lux	Works of art on paper exhibit standards	1000 lux	Overcast skies; Operating Rooms, Drawing
150 lux	Painting exhibition standards	10,000 lux	Full Daylight
		100,000 lux	Direct Sunlight

What do UV levels mean?

Source	UV level ($\mu\text{W}/\text{lumen}$)
Incandescent bulbs	60-80
Fluorescent tubes	30-150
Compact fluorescent bulbs	70-150
White LED's (blue pump)	<1
Daylight	300-600

Traditional Museum Standard: < 75 $\mu\text{W}/\text{lumen}$

Measuring Light: Traditional



Measuring Light: On a shoe string

Blue wool zone	Photo unexposed left, exposed right
8	
7	
6	
5	
4	
3	
2	
1	



Controlling Light Exposure



Controlling Light Exposure

Exposure = time x intensity

- Reduce intensity
 - Reduce the most damaging components
- Reduce time
- Select objects that are impervious to light

Controlling Light Exposure

- Avoid
 - Block
 - Detect
 - Respond
 - Recover
- Establish rules for light and UV levels.
 - Bring outdoor objects indoors.
 - Switch off lights whenever no one is present. Use motion sensors whenever possible.
 - In historic houses, select lower light locations in the house and in each room. Place objects where no direct light from the window can reach them.
 - Rotate exhibitions.
 - Use facsimiles as appropriate.



Controlling Light Exposure

- Avoid
 - Block
 - Detect
 - Respond
 - Recover
- Use UV filters and films.
 - Use shaded areas for outdoor display.
 - Use screens, louvers, blinds, neutral filters, paint, etc. to block windows.
 - Separate bright public access areas from display areas and provide adaptation paths between the two.
 - Close curtains, blinds, shutters, etc. when the museum is closed. Cover cases when no viewers are present.



Controlling Light Exposure

- Avoid
 - Block
 - **Detect**
 - Respond
 - Recover
- Look for signs of light and UV damage in the museum.
 - Place blue wool cards in exhibits.
 - Use light meters or monitors.
 - Use smartphone apps or UV beads.

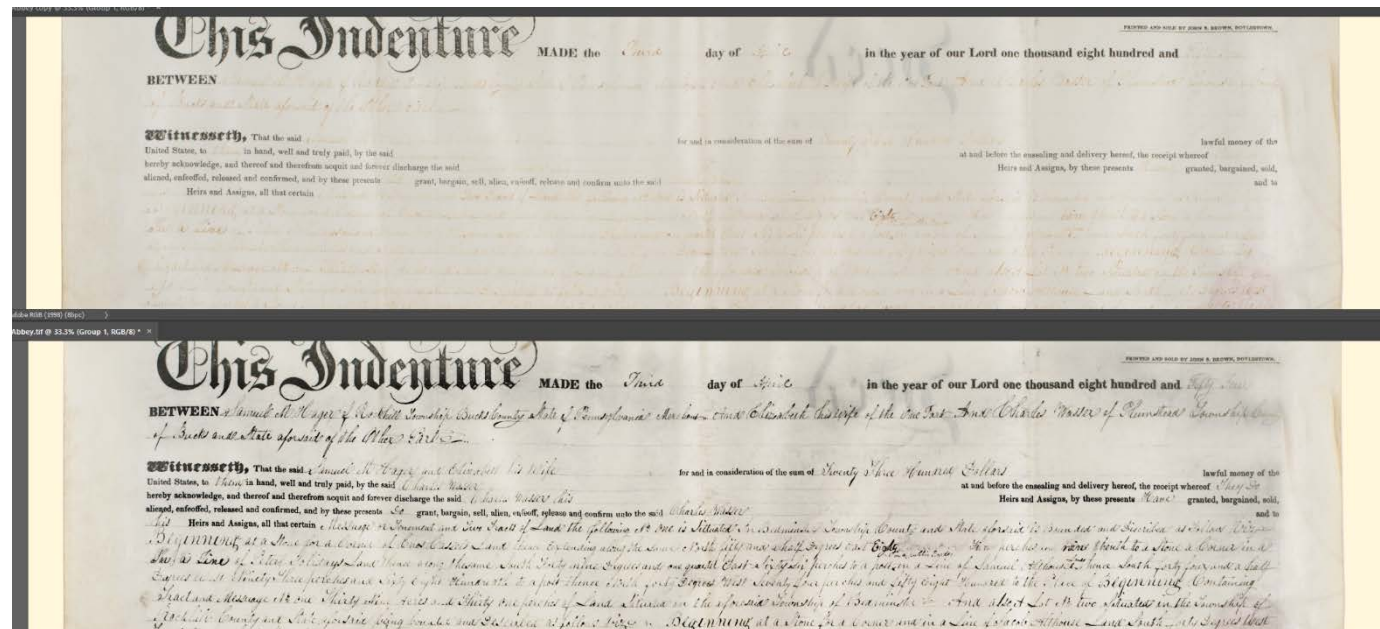


Controlling Light Exposure

- Avoid
 - Block
 - Detect
 - Respond
 - Recover
- When faded objects are noted, determine causes and possible solutions.
 - When light meters and UV meters show unexpectedly high values in a location, determine causes and solutions.

Controlling Light Exposure

- Avoid
 - Block
 - Detect
 - Respond
 - Recover
- There is no true recovery possible from faded colors or disintegrated surfaces. Restoring such losses requires replacement by new material.



Controlling Light Exposure

Exposure = time x intensity

- Reduce intensity
 - Reduce the most damaging components
- Reduce time
- Select objects that are impervious to light

Case Studies

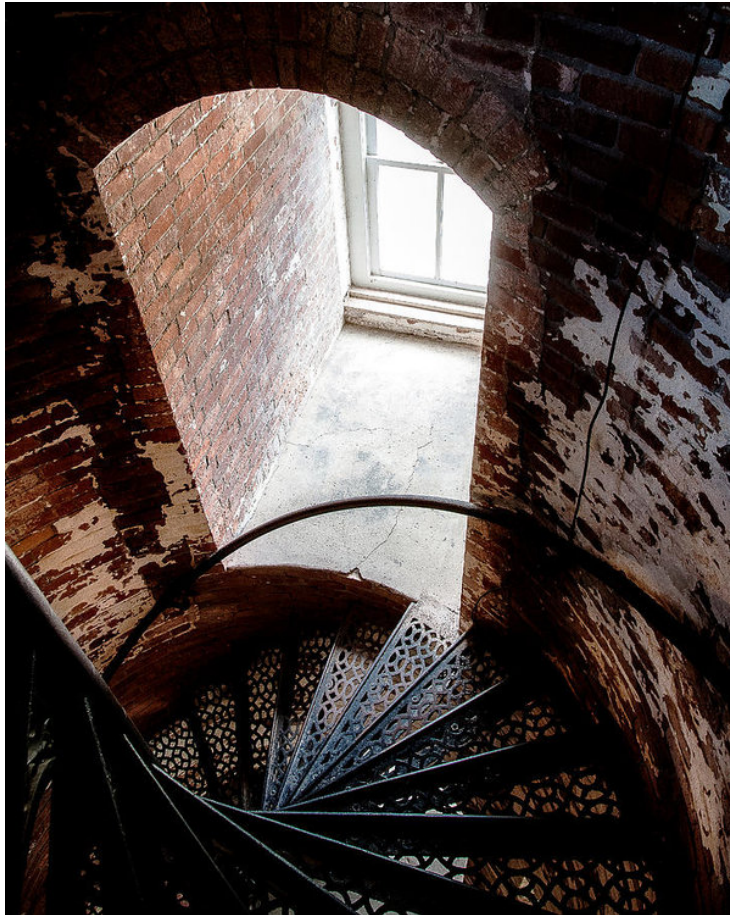


Case Study: The Sculpture Court



- Architectural features in museums with high levels of natural light
- Marble and bronze are essentially impervious to light exposure
- Diffuse natural light models sculptures beautifully

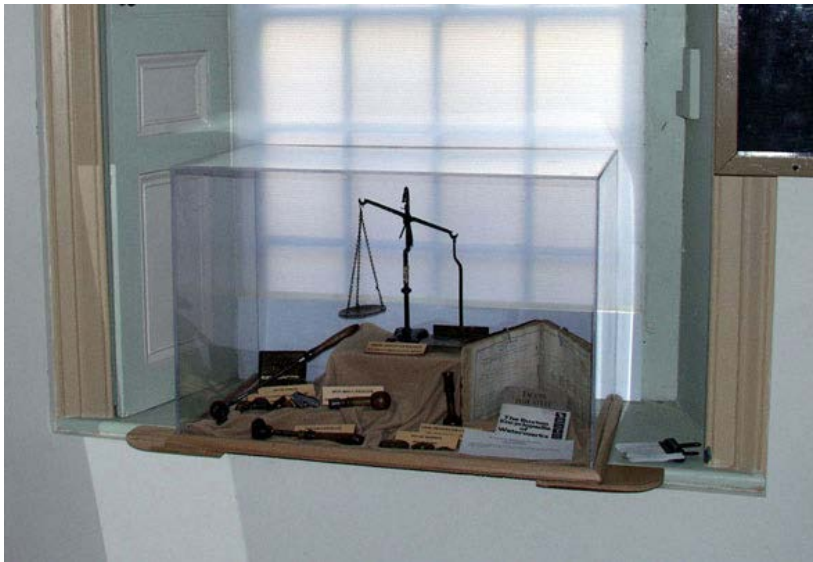
Case Study: Transition to darker spaces



- Letting the viewer's eyes adjust



Case Study: Window Well



- Light reduced by translucent fluted plastic
- Plastic also insulates the area against outdoor climate
- Zero or low sensitivity artifacts chosen
- Detailed, dark, low-contrast objects take advantage of the strong window light.

Case Study: Small Art Gallery



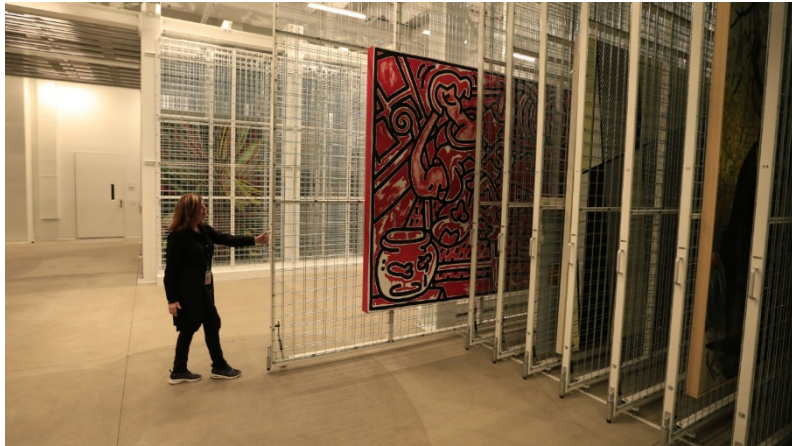
- The artist's palette is unknown, so some fugitive colors are assumed.
- Track lights with full housing attempt to reduce any source of glare.
- Pools of light highlight artworks, leave walls darker in contrast.

Case Study: Flash Photography

- How dangerous is flash photography?
- Exposure is:
time x intensity



Case Study: The Vault



- Museum storage should be near perfect darkness.
- Staff still needs to enter the vault for many reasons.
- Adequate task lighting will reduce risk of accidents.

Case Study: The Vault

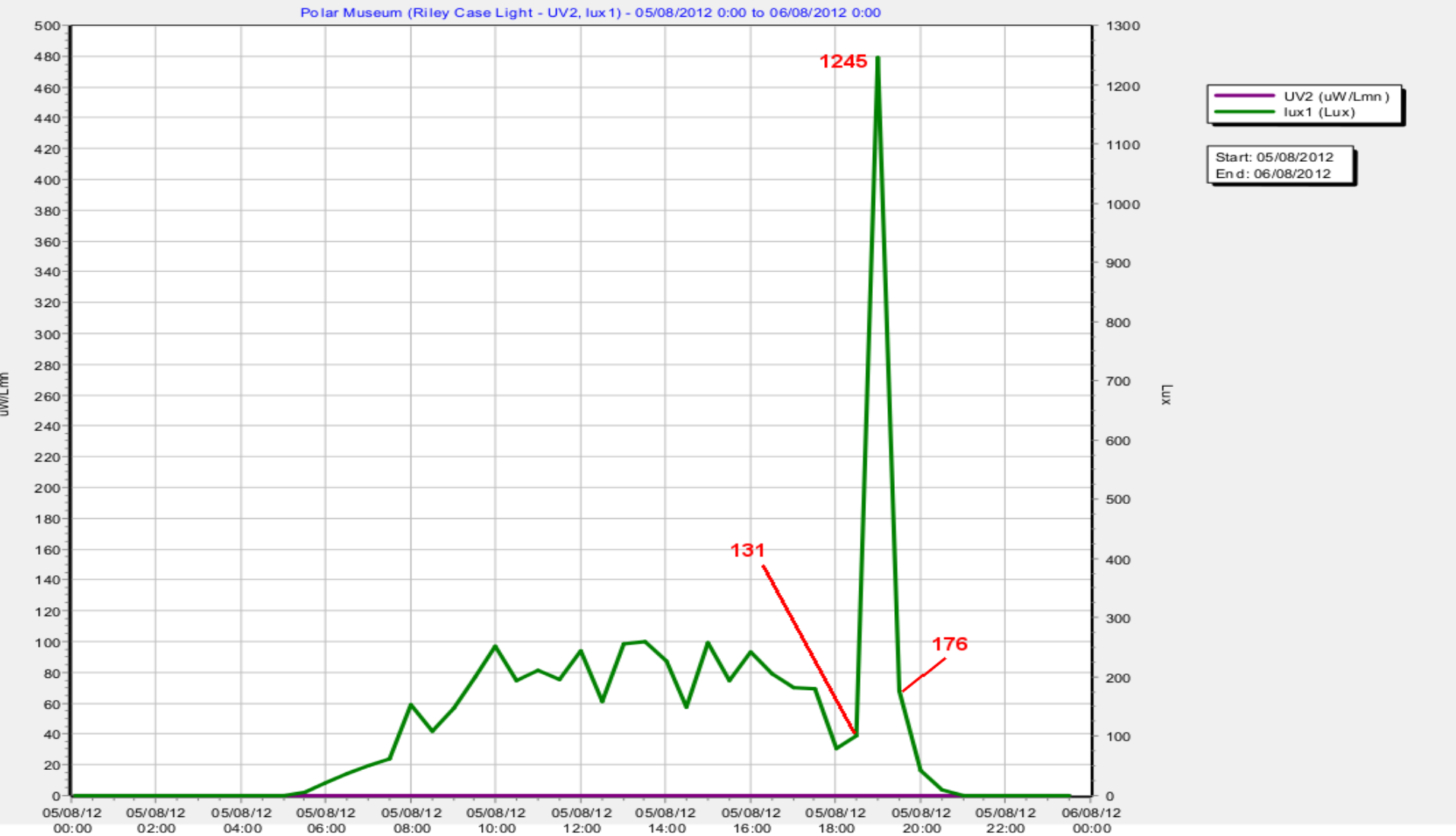


- Museum storage should be near perfect darkness.
- Staff still needs to enter the vault for many reasons.
- Adequate task lighting will reduce risk of accidents.
- Cardboard covers can be placed over framed works and easily lifted off to view.

Opaque Storage



Case Study: Light monitors



Case Study: Washington's Tent



- The first Oval Office
- Unique
- Irreplaceable
- Fabric from the 1700's
- Marquee piece of the Museum of the American Revolution

Questions?





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Heather Hendry

Email: hhendry@ccaaha.org

Phone: 215-545-0613



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