Introduction

Light is essential for us to experience art. However, exposure to both light and UV radiation causes damage that is cumulative and irreversible. Strong collections care practices promote the health of art and cultural materials for generations to come and are often about finding a balance between access, or "use," and preservation principles. The information here will help you to manage visible light and UV exposure carefully, thereby maximizing the benefits without undue risk to the artifacts.

Understanding Light and UV

Light is a form of energy that is visible to the human eye. This energy takes the form of a very small wave, and each wavelength is measured in nanometers (nm).

1 nm = 0.000000001 meter.

The human eye can perceive wavelengths between 400-700 nm; this is the **visible light** spectrum and includes energy waves emitted by both the sun and artificial light sources, like fluorescent and LED lamps.

The wavelengths of **ultraviolet** (UV) radiation are just outside this visible range, and measure between 300-400 nm. UV radiation is also emitted by the sun and artificial energy sources, and is the cause of sunburn. Sometimes UV is referred to as "light" but technically light is only the wavelengths we can see.

The energy of light or UV is dependent on its wavelength: longer wavelengths have lower energy, and shorter wavelengths have higher energy. Because UV radiation has shorter wavelengths - and higher energy - than visible light, *UV is potentially more harmful to collections than light*. Remember that humans cannot see UV, it contributes nothing to visitor experience, and we recommend eliminating it from all exhibition and storage spaces if possible.

Measuring Light

The visible light is measured in a variety of different ways, depending whether the measurement refers to the light *emitted* by a source or the light *received* by a surface. While "lumens" are a measurement often used in lightbulb descriptions to quantify output, in collections care we more commonly reference the light to which a surface is exposed. Sometimes called *illuminance*, this is measured in either **lux** or **footcandles**, where **10.7 lux = 1 footcandle.**

As an example, consider that an artifact stored on a high shelf directly underneath a fluorescent ceiling lamp will receive much more light (measured in lux) than an artifact stored on the opposite side of the room, although the lumens emitted from the lamp are the same.

To express light over a period of time, multiply lux by the time of exposure to produce a unit of **lux hours (LH)**. *Light exposure is cumulative, and low light levels for extended periods of time cause the same amount of damage as high light levels for brief periods.* While this may seem counterintuitive, the consequence is that damage from a period of high light exposure can be mitigated by keeping the exposure short.

Levels of Susceptibility to Light Damage & Types of Materials	Recommended Levels of Illuminance	Max. absolute UV exposure	Max. relative UV exposure
Category 1: Most Susceptible textiles, newsprint, works of art on paper, photographs, most organic-based natural history specimens (many have fugitive colorants), and unstable plastics (i.e. acetates, nitrates, polyurethane, and rubber), lacquer, dyed quillwork, feathers.	50 lux (5 footcandles)	0.5 mW/m^2	10 µW/lumen
Category 2: Susceptible Horn, leather, rawhide, sinew, unfinished wood	100-150 lux (10-15 footcandles)	1.0 mW/m^2	10 µW/lumen
Category 3: Moderately Susceptible Oil, acrylic, and tempera paintings, bone, ivory, finished wood, stable plastics (i.e. acrylic).	150-200 lux (15-20 footcandles)	15 mW/m^2	75 µW/lumen
Category 4: Least Susceptible metal, stone, glass, ceramic, most minerals and inorganic natural history specimens. Light sensitive materials stored inside lidded boxes fall into this category.	Dependent upon exhibition situation	Dependent upon exhibition situation	Dependent upon exhibition situation

50,000 LH of annual exposure is recommended for Category 1 materials. This is roughly equivalent to:

- 17 lux, eight hours per day, for one year
- 50 lux, eight hours per day, for 18 weeks
- 400 lux (the level of most offices), eight hours per day, for two weeks

In general, it is recommended that Category 2 and 3 materials be rotated off display regularly (at least every 3-5 years).

The Midwest Art Conservation Center is a non-profit organization for the preservation and conservation of art and artifacts, providing treatment, education, and training for museums, historical societies, libraries, other cultural institutions, artists, and the public.

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