WHAT CAUSES FADING?

Fading can't be prevented forever—but by protecting artwork from known dangers like light, heat, and humidity, framers can prolong the art's life.

By Rob Markoff, CPF

To many, fading is what happens when something is exposed to light. However, fading can occur even when an object is kept in the dark such as in a closet or in a desk drawer.

Fading is caused by light, heat, changes in relative humidity, atmospheric pollutants such as sulfur dioxide, and ozone. Each of these categories are not mutually exclusive. In fact, in combination, several of these factors will cause more rapid fading than by each one individually.

As the last person to handle a piece of art prior to display, it is important that framers understand what causes fading and what we can do to prolong the life of the art.

Light

Light is a form of electromagnetic energy called radiation. Radiation is measured on a spectrum from low (gamma rays, X-rays, ultraviolet) to high (infrared and radio waves). The portion of the spectrum that we can see is called the visible spectrum and runs from to upper end of UV to infrared. The scale is logarithmic, which means that even slight shifts up and down the scale are measured in powers of 10—so a "slight" shift can be significant.

It's important to understand that light is energy. In combination with air (containing not only oxygen, but also pollutants) and humidity, light initiates fading, discoloration, and embrittlement of many materials.

Damage from light is cumulative and irreversible. This means that if something is faded, one cannot put it into a darkened closet and expect that it will restore itself. Nor is it possible for a conservator to bring back the initial colors (such as in a watercolor) once they have faded. When light shines on an object, the energy from light is absorbed by the molecules within an object. This absorption causes changes within the object called a photochemical reaction. Depending on the energy from the light, the molecules will behave in a certain way. They may heat up; the energy may cause bonds within the molecules to break, causing weakness; it may cause a rearrangement of the atoms within the molecule; or it may transfer the energy to an oxygen molecule, which then interacts with other molecules to cause other damaging photochemical reactions.

The shorter the wavelength of light energy, the higher the frequency. This means shorter wavelengths of light (such as UV) have more energy than light with higher wavelengths (such as infrared), and they bombard an object with more energy in a shorter period of time. This causes the photochemical reactions to happen more quickly. Objects unprotected from UV light will suffer damage more quickly than those that are protected. While UV light is the most destructive, eliminating it will not prevent fading because all light will cause the aforementioned reactions.

Heat

Light energy from higher wavelengths cannot be seen but can be perceived as heat. Artwork that absorbs this heat is subject to a process called "thermal aging," which manifests itself through yellowing, weakening, and cracking. These chemical decaying processes are not driven by UV light—they can occur even in the dark. The environment around the art heats up, causing the art to do so as well. Artwork that is comprised of organic materials and exposed to sunlight can decay at a rate up to 20 times higher than one displayed in a cooler environment. These factors can increase if the surface of the item is dark and/or framed under glass. While sunlight is the primary source of heat, one also needs to be concerned with light output from incandescent and halogen lamps. Proximity to a heated light source can cause more rapid deterioration.

Humidity

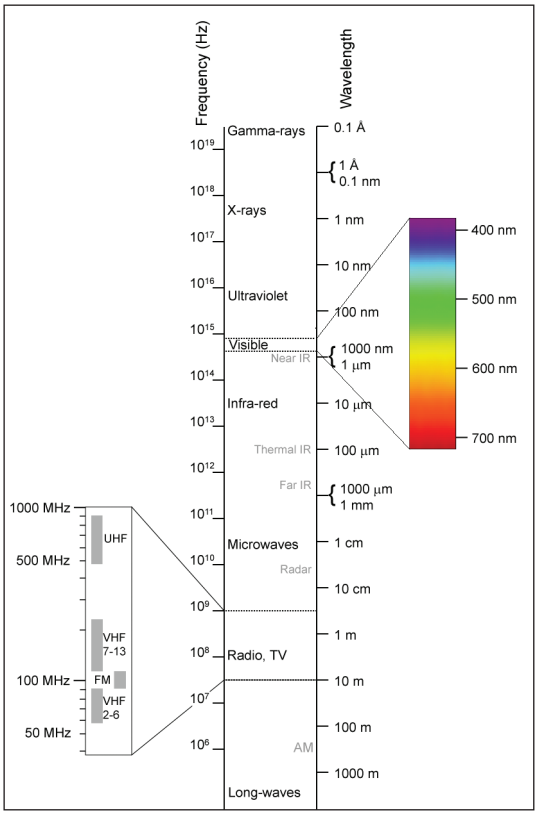
Humidity is a measurement of the amount of water vapor in the air. When there is too much moisture in the air,

biological damage from microbial growth and chemical reactions that occur naturally within objects can occur over time. Combined with heat, steam and condensation can be created within a framing package. Expansion and weakness of paper and other fibers can also be exacerbated when subjected to heating and cooling/dampness and dryness. Pigments and the binders that cause them to stick to the applied surface will suffer as well. In paintings, excessive humidity will allow moisture vapor to be trapped between the pigments and surface varnish, yielding an overall gray coloring called blooming.

A curious effect on color photography is changes to the colors even when kept in the dark. These changes most often affect the cyan dye used in color photography, causing the prints to look reddish in color. This phenomenon is called dark fading. Dark fading occurs regardless of the procedures taken to preserve a photograph and is unavoidable. It is instigated by changes in temperature and relative humidity.

Atmospheric Pollutants

Today, many of the printed items framers take in for framing are digitally printed using inkjet printers. Collections in major museums will see a significant increase of artwork printed using some form of inkjet print and libraries will see more manuscripts and books printed using digital printing techniques. Although many ink manufacturers state that the inks have a 100-year or more life expectancy, if you read the "small type" in the disclaimer, the warranty applies to prints framed "under glass." Prints framed under glass are better protected from having a large surface area exposed to atmospheric pollutants, especially ozone.



A graphic illustrating the electromagnetic spectrum.

In a recent study published in the Journal of Physics, the effects of ozone on digitally printed media were presented. The following conclusions were drawn:

- Exposing inkjet photographs to ozone can cause fading of colorants, yellowing of print papers, and cracking of ink-receiver coatings.
- Dye and pigment inkjet prints are more sensitive to ozone-induced deterioration than electro-photographic, dye sublimation, or traditionally printed materials.
- Dye inkjet prints on porous-coated papers are significantly more sensitive to ozone-induced fade than any other type of printer/ink/paper combination.
- Inkjet documents on plain papers can be more resistant to ozone than inkjet photographs.

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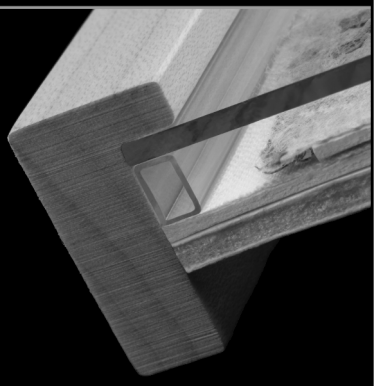

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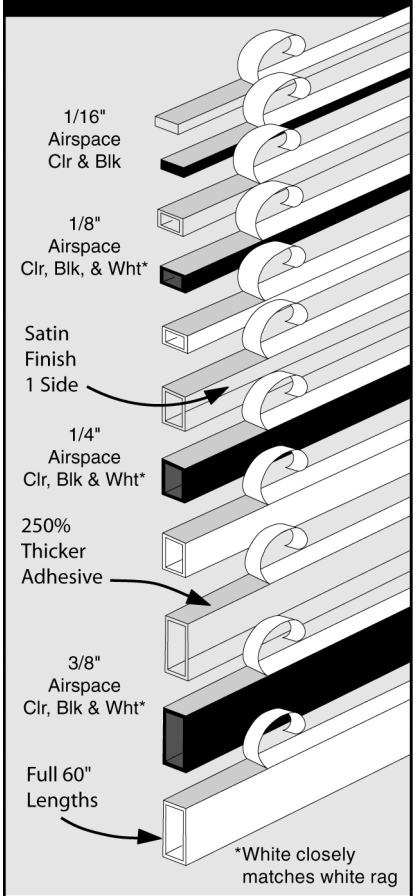

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- Exposure to ozone can cause yellowing of digital press and offset lithographic print papers.

What this study showed is that, especially when not framed, inkjet photographs that are exposed to ozone can fade even when kept in the dark. Proper care needs to be taken to protect digital output from atmospheric pollutants, especially when framing. While inkjet prints printed on canvas are very popular, there is no applied coating that can protect the surface of a framed inkjet canvas as well as a piece of UV-filtering glass or acrylic.

How to Prolong Art's Life

Sadly, everything will fade. However, the way we design our framing and the materials we choose can help prolong the life of the things we frame.

All artwork should be protected from prolonged light exposure. This means not only hanging artwork out of direct sunlight or constant exposure to fluorescent lighting, but also minimizing the total exposure to light over the life of the artwork. Some of my clients have fabric sleeves that they hang over their most valuable pieces, especially when they are not home. Make sure that energy-conscious clients who have replaced many of their lamps with Compact Fluorescent Lamps (or have artwork hanging in their offices under constant fluorescent light) understand that there is a significantly greater output in fluorescent light than any light other than sunlight.

The use of UV-filtering glazing will significantly increase the life of the artwork as it protects the art from the most damaging light energy source. However, it bears repeating that all light causes fading, and the damage caused by light exposure is cumulative and irreversible. A framer should know and understand this and have realistic expectations as to what UV-filtering glazing will and will not do. UV-filtering glazing will not prevent fading; it will protect the art from damage caused by UV radiation, some of which cannot be immediately seen but include embrittlement of paper fibers and changes in the chemical composition of fibers.

Hanging and storing artwork in a temperature-controlled environment will slow down the aging process and offer protection from localized heat sources (such as picture lights or other lighting. Exterior walls can be sources of temperature extremes, and our customers should be informed that those locations may not be appropriate for long-term longevity of their art.

Keeping artwork away from damp, humid environments is important, as is the inclusion of materials within a framing package that will minimize changes in humidity. This is especially important for canvas art. The inclusion of a rigid backing, preferably fluted polypropylene lined with a buffering material such as 4-ply rag, will protect the painting from physical damage and mitigate changes in temperature and humidity to the back of the painting. Cutting holes in a backing for a canvas actually creates localized areas of humidity extremes adjacent to the holes and is an unsound practice. Using fluted polypropylene as a final filler board will also provide greater protection from temperature extremes.

While many would argue that putting glass or other glazing in front of a canvas changes the aesthetic properties of the art, it cannot be denied that by doing so, the surface of the art is protected from many of the fading factors discussed—plus has the additional benefit of keeping the surface of the painting clean. In fact, cleaning modern paintings (such as those created with acrylic paints) poses new challenges for conservators because the nature of the surface

of the paint is prone to trapping and holding airborne pollutants. Anti-reflective glazing minimizes the effects of having glazing and can be a useful solution.

The use of framing materials that contain molecular traps called zeolytes has been demonstrated to be effective in prolonging the life of artwork, including artwork stored in boxes and folios made from these materials. Using these boards over others that do not have them will offer additional protection.

It's also important to choose an appropriate matboard. In order to make conservation matboards meet the "alkaline reserve" requirement, calcium carbonate is often added as a buffering agent. A buffering agent may not be appropriate for framing some types of objects (especially some types of photography) because the chemistry negatively reacts with the alkaline environment.

As framers, we are the last person to have contact with the art and the first to be blamed for changes in its appearance. By knowing what contributes to fading, recommending materials and processes that prolong the life of the art, and educating our customers on their responsibilities after the art leaves our shop, we improve our chances for a satisfied customer and can rest assured that we have done all we can to keep the art in the best possible condition. **PFM**

Rob Markoff

Rob has been framing for over 40 years. He specializes in volume framing with an emphasis on oversized and challenging pieces as well as art installation. He has written extensively for industry publications and is a longtime educator at The National Conference as well as other framing venues worldwide. He received the Lifetime Achievement Award from the Professional Picture Framers Association in 2015.

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