MATERIALS INFORMATION and TECHNICAL RESOURCES for ARTISTS
Surface Coatings, Retouching Varnishes, and Oiling Out

VARNISHES USED AS FINAL SURFACE COATINGS

Synthetic and natural varnishes are generally applied to the surface of an artwork to add a layer of protection. Many varnishes also impart saturation, giving more depth to darker passages and improve contrast. The choice of what type of varnish coating to use can have a significant impact on both the immediate appearance of the artwork and also how an artwork will look in the years to come. Some varnishes are more susceptible to yellowing and/or darkening while others can turn cloudy or hazy over time. Finally, a handful of materials that are marketed as surface coatings should never be used as varnishes for fine art, as some of these proprietary materials and industrial coatings become irreversible and insoluble as they age. Today artists have at their disposal a wide range of varnishes to choose from, some of which have been extensively tested to evaluate specific aging properties (including ease of removability, propensity for yellowing/darkening, and glass transition temperature as it relates to tackiness). It is important to remember that even if the source of a varnish is "natural" (e.g. is harvested from the sap of a tree) this does not necessarily mean that it is a superior product that will withstand the test of time.

Major questions to consider when selecting a varnish for your artwork include the following:

- Will the varnish discolor, bloom, and/or darken over time?
- Will it be possible to safely remove the varnish from the artwork should the need arise?

Ideal Properties of a Final Surface Coating

Materials that are considered suitable for varnishing should:

- Be flexible enough to withstand the expansion and contraction that the artwork undergoes in response to atmospheric changes (this is particularly important if painting is executed on a flexible support). Varnishes that are too brittle are prone to cracking and even delamination.
- Maintain a desirable level of transparency.
- Remain colorless
- Remain easily removable even after aging.
- Create a film that is fairly fast drying so as to avoid remaining tacky and accumulating dust and grime.
- Possess desirable workable properties; varnishes should be able to be spread thinly in successive coats and/or be applied using a spray gun. Note that

thinner coatings are generally lighter in hue and less likely to crack as the underlying substrate expands and contracts while thicker coatings are more likely to discolor at a quicker, more noticeable rate and may be brittle.
- Fulfill its function is a thin film so that it does not fill in any textural effects on the surface of the painting.
- The varnish resin must be dissolved in a solvent that will not disturb or dissolve the paint during its application.
- Create a proper or desirable level of gloss, saturation, and surface finish.
- Not be susceptible to "bloom," a phenomenon that results from the gradual/immediate penetration of water vapor that creates a cloudy, hazy appearance.

Disadvantages and Advantages to Varnishing

Advantages

- Varnishing can provide a layer of protection for your artwork from the accumulation of dirt/grime, potential scratches and scuffs to the paint layer, and can even help to prevent/slow the fading of light-sensitive pigments
- UV light stabilizers (UVLS) can be easily added to varnishes and are even present in some pre-made varnishes. These can improve a varnishes resistance to light deterioration and lengthen the serviceability of the coating. If UVLSs are present in a varnish solution, the solution should be kept in an amber jar and/or kept out of the light. When UVLSs are added to a varnish mixture, it is best to use the varnish in a timely fashion (prepare small quantities and use within a month or so).
- Although there is a divided opinion on whether or not it is considered best practice to varnish acrylic paintings, artists should note that acrylic films are usually more porous than oil/alkyd films and can suffer from the accumulation of dirt and grime over time.
- Varnishes can be modified to provide a wide range of finishes, from matte to satin to glossy. Many artists feel that varnishing improves the overall saturation and original contrast of their compositions, reestablishing the separation of the lighter areas and the richness of the darker passages.
- If the appropriate varnish has been used and the surface of the artwork becomes damaged, a properly formulated varnish should be easily removed without compromising the paint layer(s). Artists are not advised to use ammonia-based solutions but instead to use simple mineral spirits to remove fairly young varnish coatings. If you encounter difficulties in removing your varnish, please contact a professionally trained conservator with a graduate degree in Art Conservation.

Disadvantages

- Varnishing requires an additional step once the artwork has been completed, sometimes after it has been acquired by a collector.
- For oil and alkyd paintings, one must typically wait 6 months to a year in order to ensure that the varnish does not "sink in" and become incorporated into the slow-curing oil film.
- The application of varnishes can sometimes be challenging. Bubbles can form, reticulation (beading up) can occur, and streaks can appear (see "Application Processes" at the end of this documents for tips on how to avoid these problems).
- If an irremovable varnish material is used then it is nearly impossible to later address scratches, bloom, stains, and other types of damage that may occur.
- All varnishes will alter the level of saturation in a painting, an aesthetic change that may or may not be desirable to the artist. It is always a good idea to test your selected varnish on mock-up paintings or sketches before applying them to finished works.
- Many proprietary acrylic-based varnishes are marketed today as suitable for use on alkyd, oil, and acrylic paintings. However, many still await further testing to evaluate whether they do in fact degrade and/or whether they can be safely removed from artworks over time. Artists are advised to carefully consider these factors when selecting a varnish.

CATEGORIES OF VARNISHES/SURFACE COATINGS

Historic/Traditional

Oil-Resin Varnishes – Oil-resin or cooked-oil varnishes are solutions of resins dissolved in heated oils (e.g. amber-oil, copal-oil). Sometimes these varnishes were prepared in the presence of driers (e.g. litharge) to help quicken the drying time of these materials. While cooked-oil varnishes create much tougher films than other types of varnishes, they a) become impossible to remove over time b) will yellow and darken, and c) can become brittle with age. Artists should never use these as surface coatings.

Water-based Varnishes and Coatings - Water-based varnishes and coatings are materials dissolved in water that were occasionally used as final and even temporary varnishes. Examples include egg white (glair), water-soluble gums (gum Arabic, cherry gum), and animal glues. None of these coatings possess good long-term aging properties and can form films that eventually become insoluble/irremovable grey, hazy crusts.

Modern Materials

Lacquers, Alkyds, Polyurethanes, and Enamels – Today there is a wide-range of lacquer-, alkyd- (e.g. Liquin), polyurethane-, and enamel-based coatings available to

artists, some of which consistent of nitrocellulose (and other cellulose derivatives) or vinyl-based/acrylic resins dissolved in solvents. While many of these products dry fairly quickly, they are not recommended for use as surface coatings as they are irremovable once dry, may produce brittle surface coatings, and with generally yellow and darken over time. These types of products have experienced a rise in popularity among contemporary artists and while they may create aesthetically pleasing surfaces for some, their use on fine art is highly problematic.
NOTE: Liquin and other alkyd oil mediums should never be used as a surface coating as it is designed to function as a paint medium rather than a varnish. Alkyd mediums, like all materials containing drying oils, will yellow over time. They are also not reversible and will become impossible to safely remove from the surface of an artwork as it ages. This is particularly disastrous if the artwork becomes damaged and in need of conservation treatment.

Natural Resin Varnishes

Natural resin varnishes are solutions of resins obtained from the sap/exudate of a tree and/or shrub that have been dissolved in a solvent. The term "spirit varnishes" is also used to describe these varnishes although the term spirit may confuse as it is generally thought of as referring to alcohol. Solution-based varnishes dry by evaporation, so proper ventilation and protection is needed both during preparation and application. Solution-based varnishes can be purchased pre-made but also can be prepared at home. The following resins described below can all be classified as solution-based varnishes.

- **Mastic –** Mastic is composed of triterpenoid resins collected from pistachio trees (Pistacia Lentiscus) found throughout Europe, India, Turkey, and South Aftrica. One of the oldest natural resins used in the history of art, mastic is soluble in turpentine solvents (as well as alcohol. Although the varnish appears clear when it is initially dissolved, mastic is known to yellow/darken and degrade over time. While the addition of UV stabilizers (e.g. Tinuvin 292) can be added to slow down these degradation processes, mastic is still not recommended as a final varnish coating. Mastic does remain reversible to some extent but it does become more polar over time and will require more polar solvents for its removal. These more "powerful" solvents may damage the paint layers depending upon their formulation. Mastic is also susceptible to bloom if the painting is exposed to excessive moisture and/or high humidity or if the solvent becomes contaminated with water. If artists choose to add mastic into their paint mediums (e.g. megilp and Maroger's Rubens medium), the paint will also have a tendency to yellow, darken, become increasingly more brittle (e.g. prone to cracking), and remain sensitive to solvents (a problem should the painting need to be re-varnished or cleaned).

- **Dammar (damar)** – Dammar consists of triterpenoid resins collected from trees belonging to the Dipterocarpaceae family. Like Mastic, dammar has

been used as a traditional picture varnish (since the early 19th century) but is known to yellow/darken and degrade with age. It can be dissolved in a range of petroleum-based solvents containing aromatics as well as gum turpentine. It can take anywhere between 10 to 50 years for noticeable signs of degradation to appear; however, the addition UV stabilizers (e.g. Tinuvin) can be added to dammar to slightly slow down these processes. Dammar coatings are also susceptible to bloom if the painting is exposed to excessive moisture and/or high humidity or if the solvent becomes contaminated with water. Dammar is not recommended as a final varnish coating as it exhibits poor aging properties; however, the varnish does remain relatively removable although it does become more polar over time and will require more polar solvents for its removal, although to a lesser extent than mastic. If artists choose to add dammar into their paint mediums, the paint will also have a tendency to yellow, darken, become increasingly more brittle (e.g. prone to cracking), and remain sensitive to solvents (a problem should the painting need to be re-varnished or cleaned).

- **Soft and Hard Copal Resins –** This class encompasses a wide range of natural resins that are typically defined by their place of origin (e.g. Manila Copal). Soft copals, usually dissolved in alcohols, are simply collected directly from a range of living trees. Soft copals can differ in quality from one grade to the next and are not recommended as final varnishes. These resins not only suffer from the same degradation process as mastic and dammar but can also become more difficult to remove over time. Hard copals are fossilized and semi-fossilized resins collected from the ground where they were deposited from ancient and even extinct trees. Hard copals need to be cooked at high temperature to incorporate them into oils or solvents. They are not reversible and should never be used as final surface coatings for fine art.

Synthetic Varnishes

It can be challenging for artists to navigate the wide range of synthetic resins that are now available on the market. Recommended materials should possess the properties that are described at the beginning of this document. Artists should note that many synthetic varnishes have yet to be tested for their long-term aging properties (e.g. propensity for yellowing, etc.). Many synthetic resins still await further testing; however, the particular brands/varnishes cited below have been analyzed by the conservation community and other experts in the field and can therefore be recommend for use as final varnishes for oil, alkyd, and acrylic dispersion paintings. As with natural resins, artists are advised against adding soluble synthetic resins to their paint medium as this may create a paint film that remains sensitive to solvents, a problem should the painting need to be re-varnished or cleaned. Finally, artists should check to see whether UV light stabilizers (UVLS) are already present in pre-made synthetic varnish solutions. If not, artists can always add these products (e.g. Tinuvin 292) themselves should they choose to

make varnishes on their own. In general, synthetic varnishes can be broken down into two categories:

- **High Molecular Weight (HMW) resins** tend to produce surface coatings that possess a satin to moderate sheen/gloss. Examples include specific grades of polyvinyl acetate (PVA) and methyl methacrylates (e.g. Paraloid B-72, B-67, MSA Varnish, and other acrylic-based varnishes). Often the latter is combined with another polymer (called a copolymer) to impart certain properties. Note that PVA varnishes tend to be dissolved in toluene, so proper health and safety measures should be exercised during preparation and application. Methyl methacrylates can be dissolved in a wider range of solvents including xylene, mineral spirits (not odorless), and in some cases, water.

- **Low Molecular Weight (LMW) resins** tend to produce surface coatings that possess a moderate to high sheen/gloss. Examples include aldehyde resins (e.g. Laropal A81) and hydrocarbon/styrene resins (e.g. Regalrez or Gamvar varnish). Both Laropal A81 and Regalrez can be dissolved in odorless mineral spirits, mineral spirit blends, and/or aromatic solvents.

Practical Information on Varnishing

- **Matting Agents -** Most matting agents found in varnishes (and certain paint mediums) are silica-based or fine wax powders. Such materials are usually added to pre-made varnish solutions to impart a matting effect to the resulting coating, essentially helping to reduce the level of gloss. In general silica and wax additions do not appear to cause significant long-term issues; however, components from wax have been observed to migrate to the outer surface of the varnish layer, creating an overall hazy or cloudy appearance (a phenomenon called “efflorescence”). In some instances, wax efflorescence can be gently reduced by using a soft brush or cloth but for delicate surfaces or thickly impastoed paint artists might consider consulting a conservator. Note that in some cases even after wax efflorescence has been reduced, it often tends to return over time as certain components in the wax will continue to remain mobile. Further research is still needed to assess whether there are any long-term preservation issues associated with some of these matting agents.
  NOTE: The type of wax added can impact the degree of efflorescence that may occur. Today conservators occasionally use Cosmoloid 80H, a hard microcrystalline wax, as a matting agent in their varnish formulations.

- **Ultraviolet Light Stabilizers (UVLS) –** There are two main types of UVLS additives used in the coating industry. Ultraviolet absorbers (UVAs) preferentially absorb UV light, thereby potentially reducing the build-up of radicals that can cause yellowing and other degradation processes to occur. Another type of UVLS are hindered amine light stabilizers (HALS) which can

quench harmful radicals and prevent degradation reactions altogether. Proprietary varnishes and coatings may contain one or the other or both, one example is the Tinuvin line of UVLS additives produced by the company BASF. Tinuvin 292 is a common additive (present at around 2%) that is present in varnishes intended for find art as it is composed of a specific UVA and HALS blend that helps to counteract discoloration. Tinuvin 292 can also be added to home-made varnishes although it is best practice to add Tinuvin to pre-made varnishes immediately before varnishing. Artists should also note that concentrated Tinuvin has a finite shelf life and is best kept out of direct sunlight. For outdoor murals, research has found that combinations of Tinuvin 123 and 477 added to certain types of coatings may help in counteracting damage induced by extreme exposure to light. Artists should take note if they choose to spray varnish formulations containing these types of stabilizers; some are known skin irritants and additional testing has yet to be done to determine whether they can also cause respiratory problems.

- **Retouch Varnishes, "Sinking In," and "Oiling Out" -** Artists tend to apply retouch varnishes when they encounter problems with "sinking in" or areas of the paint that begin to take on a matte or under-saturated appearance (this is particularly common with darker colors). Sinking-in can be a result of a) using too much solvent to thin the paint b) using a ground that is too absorbent or unevenly absorbent c) if the paint film and/or ground layers are too thin and/or c) if not enough medium is present in the paint. Sinking in can also be caused by the painter using too much thinner, which will weaken the binder's capacity to make a film, exposing the pigment to the air. As most varnishes available today are easily removable, it is not recommended to apply them between paint layers. While extremely thin layers of retouching varnish might not cause future problems, any paint applied atop retouching varnish will be more susceptible to delamination or damage caused during varnish removal (as is often done during conservation treatments). Application of successive coats of retouch varnish or interlayers of varnish and paint can also increase a paint film's brittleness, again leading to potential adhesion problems and cracking. Oiling out the surface of a painting can also be problematic as it can lead to problems with adhesion and long term solubility issues. Leaving an exposed layer of oil medium on a painting (i.e. regions of oiled out surface not covered by subsequent paint applications) will cause the surface to darken and/or yellow over time (in addition to becoming increasingly difficult to safely remove). Oiling out can be done carefully in between paint layers (or to cut the absorbency of the ground) during the painting process if artists consider the following recommendations listed below.

Alternatives to Using Retouch Varnishes and Oiling Out

- Consider possibly repainting an area that has become matte or sunken-in.

- To address problems with sinking-in, try adding a touch of medium (heat-bodied/thickened oil such as stand oil thinned in a solvent) to your paints or a problematic color or pigment (i.e. umbers are notorious for sinking in).
- Experiment with different types of grounds as well as the overall thickness to see if this mitigates issues with sinking in. Note that a wide number of acrylic dispersion grounds are now become available, each with different amounts of fillers, additives, and water content and some of very dubious quality, so artists are encouraged to perform tests with their brand of choice.
- For oiling out during the painting process or for cutting the absorbency of a ground artists are recommended to 1) apply a thin layer of oil locally as needed or globally (consider using stand oil/thickened oil thinned in a solvent if your paint/ground layers are extremely absorbent) to matte/sunken-in areas 2) remove any excessive oil using a lint-free cloth and 3) wait until the surface is dry to the touch.
- It is particularly important to avoid applying moderate to thick layers of retouching varnishes or layers of oil during the painting process as this could lead to potential delamination and/or cracking of the paint. As most varnishes remain sensitive to solvents, varnishes should not be used as the primary paint medium or applied in between paint layers. Paint applied over a varnish layer or mixed with certain amounts of varnish can remain sensitive/soluble should the artwork require future conservation treatments.
- If your composition is complete and some areas still appear matte, locally apply varnish instead of oil to even out the overall sheen, wait until dry, then apply a final protective varnish over the entire surface.
- If you choose to thin your oil with solvents during oiling out take care if you are applying over fairly young oil paint as the solvents may begin to bite into the paint layers beneath.
- If your surface is proving to be particularly stubborn once your composition has been completed, it is possible to achieve an even level of gloss by applying alternating coatings of HMW resins (Paraloid B72, MSA varnish, etc.) followed by a LMW resin (Regalrez/Gamvar).

Application Processes

- For oil and alkyd paintings, one must typically wait 6 months to a year in order to ensure that the varnish does not “sink in” and become incorporated into the slow-curing oil film. Acrylic paintings can be varnished much sooner, anywhere between 2 days to a week depending upon the relative humidity; it is essential that all of the residual water in the paint film is given enough time to evaporate before a varnish coating is applied.
- Make sure that your painting is free of surface grime and dust before varnishing. A lint-free cloth can be used to clean the surface and/or a soft-bristle brush.

- During varnish application the temperature should be between 65 and 75 F and the relative humidity between 50 and 75% (too much moisture in the atmosphere can cause the varnish to appear milky or cloudy).
- Ensure that you are selecting the right solvent for your varnish. Using a solvent that is incompatible with your varnish can result in streaks and/or cloudiness. Artists are also encouraged to practice with varnish formulations on test panels to ensure that the proper level of gloss.
- Choose a high quality, thin, flat bristle brush that is an appropriate size for the artwork. Wider brushes tend to work better for larger works and narrower brushes for small scale compositions.
- If you are applying with a brush it is best to work on a horizontal surface to maintain an even sheen. If you must work vertically it is safer to apply thin applications of varnish to avoid drips.
- If you would like to avoid using additives such as waxes or silica, try brushing the varnish evenly until it has almost set.
- If the surface of your painting appears noticeably uneven prior to varnishing or suffers from "sinking-in," try applying varnish locally to specific areas before applying an overall coat, waiting at least one day before application. Note that brushing in a vigorous manner may slightly "bite" into the underlying varnish so take care if you are applying your final coat using a brush rather than a spray gun.
- Avoid applying more than two coats of matte or satin varnishes as this can result in a cloudy surface. If your composition requires multiple coats it is best to first apply a regular gloss varnish and finish with a matte/satin varnish.
- Always work vertically when applying varnish using a spray gun. Keep the tip of the nozzle parallel to the surface of the painting and at a fixed distance when moving from side to side and/or top to bottom. It is best to think of the spray pattern as a "cone," with the greatest concentration of varnish towards the center. It is best to slightly overlap passages of varnish in order to maintain and even coat. Finally, avoid using highly concentrated varnish solutions when spraying and instead apply approximately four thin coats. More coats can be added if more sheen is required.

ADDITIONAL RESOURCES AND REFERENCES

"Varnishes, Balsams, Driers, Preservatives, and Retarders" in *The Painter's Handbook: Revised and Expanded* by Mark David Gottsegen (New York: Watson-Guptill, 2006), pp. 111-125.

"Picture Protection" in *The Painter's Handbook: Revised and Expanded* by Mark David Gottsegen (New York: Watson-Guptill, 2006), pp. 274-279; 307-309.

Some Instances in the History of Distilled Oil of Turpentine, the Disappearing Painters' Material, by Alan Phenix (Los Angeles: Alan Phenix, 2015).

Natural Pigments – Selecting Varnishes for Your Painting
http://www.naturalpigments.com/art-supply-education/selecting-varnishes-for-your-painting/

Golden Paints – Technical Information on Varnish Application
https://www.goldenpaints.com/technicalinfo_varnapp1

Golden Paints – Oiling Out http://www.justpaint.org/oiling-out-of-dead-colors-in-oil-paintings/

Gamblin Colors – Notes on Surface Quality https://www.gamblincolors.com/wp-content/uploads/2016/01/GamblinStudioNotes17_SurfaceQuality.pdf

Gamblin Colors – Video Demonstrations on Varnishing
https://www.gamblincolors.com/tips-and-techniques/video-demonstrations/

American Institute for Conservation (AIC) Paintings Specialty Group Wiki on Varnishes http://www.conservation-wiki.com/wiki/Paintings#Varnishes_and_Surface_Coatings_.281998.29

American Institute for Conservation (AIC) Paintings Specialty Group Wiki on White Surface Hazes http://www.conservation-wiki.com/wiki/White_Surface_Hazes

Smithsonian – Museum Conservation Institute
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Kress Technical Art History Website- Information on Resins
http://www.artcons.udel.edu/about/kress/historic-materials-technical-terms/resins

PhD Dissertation on Coating Research for Outdoor Murals
http://gradworks.umi.com/35/44/3544103.html