

## Sound Practice: An Overview for Working Painters

### A Lost Dimension

Ten years ago, after having painted for fifteen years, it began to seem that something was missing from the craft I had learned from the 20th century painting professors. This sense of not just a "lost secret," but a lost dimension, resulted in a research project into the methods and materials of older painting based on the available older texts on the one hand, and the findings of contemporary technical art history on the other. This took ten years to complete. The full results of this research are available in a book called *Living Craft*. A brief overview of the book's content is available below.

### Process

A quality oil painting process is developed using sound, archival practice. This involves creating a complex, multilayer structure - the painting - which manages to hold up well over time. The nature of oil painting makes it more of a gamble technically than its historic predecessor, egg tempera, and there are many variables involved in how this structure can be made. Because the structure of an oil painting is inherently complex, it's always best to attempt keep both it and its various components as simple as possible. However, this element of simplicity cannot necessarily extend to purchasing ready-made materials if the hope or expectation is to create higher quality work: generic materials have a strong tendency to produce generic work. While the new small manufacturers make materials that are usually higher quality, this is not necessarily the case with the most important component, the oil. And these materials still don't impart the vital information about the nuts and bolts of the craft, which takes time to accrue. At the end of the day, there is no real process, just a set of purchases, a pseudo-craft based on convenience. On the other hand, time and effort invested in developing one's own relationship with the materials creates a much greater understanding of their working characteristics than any amount of work that begins and ends with branded bottles, tubs, and tubes, no matter what their supposed pedigree. Experience is still the best teacher. Those who deny this are usually trying to sell something, often gilded with "science." A given author may think it doesn't matter, or not be aware enough to tell the difference, but that doesn't mean the painter needs to settle for less. Quality art begins with quality time, and quality time begins with a quality process. A quality process begins with quality materials.

### Technical Overview

The craft, like the behavior of the light it represents, has a logic that is helpful and, if the work is to last, incontrovertible.

- Relative humidity, unsupported canvas, and unquestioned acceptance of second rate commercial materials are the largest problems oil paintings face in the long run.

- The ground is an area often ignored. If the ground is not at least slightly grippy or absorbent, long term issues with adhesion can easily result, especially on unsupported canvas.

- The use of solvent became liberal in mainstream 20th century technique, often to the point of being incautious. Long term exposure to any solvent is likely to cause health problems, and solvent is only necessary in oil painting to work with resins such as damar or copal. Otherwise, brushes can be wiped clean on a rag, then cleaned more thoroughly with oil. Brushes can also be kept on their sides in a tray in a slow drying oil such as walnut or safflower.

- All resins yellow over time due to oxidation. The global use of resin as a medium component begins in general in the 19th century. Resin has not been shown to be the "magic trick" of any major painter in

the 15th to 17th century. Resins can be used in small amounts without issue, especially on panels and with warmer colour schemes, but are best used to alter the rheology of the paint, not create saturation. Creating saturation is best left to the oil.

- Alkyd "resins" are actually modified vegetable oils manufactured on a large scale. No alkyd dries quickly without an added metallic drier. These have been consistently shown to lead to darkening over time.

- A cold-pressed oil yellows less than an alkali-refined oil. A refined cold-pressed oil, handmade or commercial, can be made non-yellowing. However, because all oils used by manufacturers are first commercially refined to remove the free fatty acids that cause rancidity through oxidation in an edible or cooking oil, these oils will never dry quickly.

- The simplest way for painters to access high quality oil economically is through the organic, nutritional grade oils. This is especially true for linseed (flax) oil, which tends to be dramatically overpriced when marketed for artists.

- Through hand refining, linseed oil can also be made to dry quickly without lead. But this may or may not be relevant to a given technique. Linseed oil can also be purified by hand to dry moderately.

- Traditional mildly alkaline additives such as chalk, marble dust, and bone ash contribute to non-yellowing behavior in the medium.

- A leaded oil must be preheated before using lead, the lead used in minimum amounts with minimum or no heat, the oil then aged in the light to be genuinely non-yellowing.

- Synthetic varnishes have improved to the point where they are being used in major national collections. Regalrez is inexpensive and marketed commercially, MS2A is expensive but has a less plastic look. However, in the past, all synthetics have been shown to encounter issues over time, and one key feature of these materials is their ease of removal. In the De Mayerne Manuscript, the opinion of Rubens is recorded that the best varnish is oil thickened on litharge. If the painter has access to oil that is non-yellowing and quick-drying, the lead can be dispensed with, a thicker oil applied thinned slightly with a non-yellowing solvent such as deodorized mineral spirits.

## The Oil

...is the most important component. If you want to explore the foundation of the older process, try refining a bottle of organic, cold-pressed linseed oil. Especially if you are an experienced painter, working with this oil leads to a logical explanation of how older painting evolved the way it did. Brands I've had experience with in America are Flora and Jarrow, there are others as well, all much less expensive in quarts online. The Allback cold-pressed organic linseed oil from Sweden is also very good, but the bulk organic linseed oil from Jedwards or Azure Standard is newer, probably more pure as it is edible, and will process more easily. The availability of oil of this quality is unprecedented in the history of oil painting, however, it must be refined to remove the impurities, and alter the structure of the fatty acids. The oil you create will dry quickly compared to commercial linseed oil or oil processed by more recent "gotcha" techniques. It will not yellow and have working qualities that are far better than any commercially processed oil, regardless of reputation, and at an affordable price.

A complete pdf file about the process of refining linseed oil is available on the website at [http://www.tadspurgeon.com/pdf/Refining\\_Linseed\\_Oil.pdf](http://www.tadspurgeon.com/pdf/Refining_Linseed_Oil.pdf). This is all text, no photos, for printing out. The process is a faster adaptation of the water-sand-salt method in the De Mayerne Manuscript (early 17th Century) which Eastlake recommended in the first volume of his *Methods and Materials* (early 19th Century). This time honored process not only removes the impurities from the oil, but alters the fatty acid structure to polymerize faster and be less yellowing.

If you make this oil, then make paint with it, you will be in a position to understand the most

fundamental "lost secret" of older painting practice: the rheological qualities inherent in hand-refined linseed oil itself. Much can be built on this foundation that cannot be built on commercial paint; this is especially true when using the putty medium, see also briefer explanation below. Commercial oil, at this point, is not necessarily "bad," but it is refined by a large scale, industrial process that inhibits its drying potential. No paint company refines their own oil. Commercial paint is not "bad," but it contains a system of additives and will not lead logically to the old craft, especially in terms of bravura or broken surface painting techniques. It is, in a fundamental sense, incomplete. This is why, since the decline of painter-made paint, so much emphasis has always been placed on the medium: it is clear by looking at 17th century painting that something is missing.

## Science and the Washing Method

Research has established that in a water-washed oil the fatty acids have been altered in three ways: by increased oxygenation, by increased dimerization (molecular linking), and by cis-trans isomerization (meaning that large molecules that were bent become straight, and therefore easier to link when polymerizing). These factors add up to an oil that is much more readily polymerized, i.e., dries more quickly, about 2.5 times faster than raw linseed oil. In other words, the efficacy of the traditional washing method, dating to the 17th century in print, is confirmed by the findings of current research. More on the science of this is explained in Effects of traditional processing methods of linseed oil on the composition of its triaglycerols (2004) by Jorrit D.J. Van den Berg, Nicoletta D. Vermist, Leslie Carlyle, Michal Holèapek, Jaap J. Boon. Aspects of this are relatively accessible, notably Dr. Carlyle's seminal contribution, and it can be downloaded free online.

## Overpriced Oil

As awareness of the craft becomes more of a concern for painters, some of the larger manufacturers are climbing on in their unique way. Yes, Winsor & Newton now markets a cold-pressed linseed oil. Of course, it is not refined, takes a long time to dry, looks pretty dark for that size bottle, and is and almost four times the price of the 73020 oil from Sweden marketed by Kremer. That is quite a lot to pay for a griffon on the label! But it gets even better. The Kremer oil is twice the price of the Allback cold-pressed organic Swedish linseed oil. And this oil in turn is about twenty percent more than the best deal of all: a bulk organic edible oil from Jedwards (east coast) or Azure Standard (west coast), both of which are newer than the Allback, more alkaline, and easier to process. This means that the Winsor & Newton oil is ten times as expensive per gallon as the better quality oil from Jedwards or Azure Standard. Does this make any sense? Only if the painter is not paying any attention, or still believes that Winsor & Newton markets a higher quality product when this has long since ceased to be the case.

## Lack of Meaningful Standards

There are still no professional standards for oil painting products and commerce is very good at telling half truths about what it markets: "integrity" is a word with many different definitions. It is very difficult to get any manufacturer to talk, for example, in concrete terms about the oil they are using: where it is from, how it has been processed. Safflower oil is marketed as non-yellowing, but without added driers, safflower takes over a week to dry. Have driers suddenly become non-yellowing, non-embrittling of the paint film over time? This is doubtful. An alkali-refined oil will invariably yellow more than the more expensive cold-pressed oils, but one manufacturer -- who uses alkali-refined oil -- claims there is no "chemical difference" between the oils. Notice how often "science" is roped in for support! That this is untrue can be shown by their different behavior in yellowing tests. How much this matters depends on the colour scheme involved in the painting, but it is a simple truth that alkali refined oil yellows more. There is a tendency both on the part of commerce and painters to look for some sort of magical solution from science. Yet, there is a logical disconnect between modern industrial science and Old Master materials that is unbridgeable by any means. The most trustworthy science comes from

technical art history, not the marketplace. In terms of the oil, the magical solution is a quality cold-pressed oil which is then refined to remove impurities, this has been proven by the condition of 15th to 17th century paintings. This oil is not available commercially and needs to be refined by the painter. This is not hard to do, and creates a qualitatively different foundation for the work

A recent, psychologically subtle refinement of the usual shell game is a sense that all oil paint must darken over time. We love this wonderful medium, but it is basically flawed, existential sigh. The problem here is again one of misdirection. A difference exists between the long term lowering of the value scale due to changes in the refractive index of the oil, and the outright yellowing of the oil that often accompanies commercial paint. These are two very different things! If the painter understands that the refractive index of the oil changes over time, the effect of this on the work can easily be minimized. If the painter understands the oil, it can be made literally non-yellowing. This is called the craft. However, if the painter wants to use commercial paint out of the tube, it is best to factor in at least some darkening and yellowing, for reasons that are explained below. Some commercial paints are better than others, but the only real way to find out is to make tests with one's own choice of medium and ground. Painters tend to resist tests but, perhaps uniquely, they tell the truth.

## Commercial Materials

A broad spectrum of commercial materials are available now to the painter, so broad it can be quite confusing. As has always been the case, it is best to do research into the actual quality of the product line, rather than accepting a company's marketing strategy as the truth. The loudest voice on the forum is typically not the smartest. Marketing is becoming increasingly involved in demonstrating how "scientific" and "committed" the company is. However, it is not 1845 anymore, there are 7 billion people on the planet, and the economic pressures on commercial art materials – from above and below – are unprecedented. With regard to oil paint, there are also significant pressures from general consumer expectations about what paint "should" be. All of this means that commercial paint, in the official artist grade, is all relatively similar, some being thicker or thinner, some containing chemical additives, some relying on the older mineral additives such as chalk. But no commercial paint uses a cold-pressed, refined oil, this would simply be too expensive. What type of oil were all paintings in the 15th to 17th century made with? Cold-pressed and hand refined. The oil is the foundation of the material, but it is the last thing the larger producers want the painter investigating. Does it matter how fine, or how evenly dispersed the pigment is? Commercial paint is typically two to three times as fine as the median particle size in the Van Eyck's iconic Adoration of the Mystic Lamb. Does this make it better? When painters start asking questions like these, the whole commercial edifice begins to be revealed as the sophisticated shell game that it is. They are importing lapis and cinnabar, someone is even making stack process lead white, but is anyone addressing the quality of the oil? No. They are selling the sizzle, hoping painters will not look at the actual steak. This is not to say that commercial materials are necessarily bad, but that they are based on a set of modern assumptions dictated by the marketplace, and have built in limitations. Once all additives are removed from the process and the oil is hand-refined, the painter is in a position to address what happened five and six hundred years ago at the easel. Building the craft into the process at this level allows for much more in the way of reliable creativity with the materials.

## Resins

Resins are often mentioned in the "secret ingredient" category. Early researchers such as Eastlake or Merimee in fact felt that resin -- hard resin varnish such as amber or copal in their case -- was the official "lost secret" of older painting practice. We know know, through the research in thirty National Gallery Technical Bulletins, that resin use was never global for any major painter from the 15th to 17th century. The most typical use was of pine resin was in "very small amounts" in order to make a red lake glaze dry. Mention is made of this because the Old Master shell game of who used what "special medium" when and where still goes on, and much time and capital can be lost getting involved with it. If you encounter resin extolled as "the secret of the Old Masters," look carefully for concrete research evidence. There won't be any, because there isn't any. It is all beguiling literary detective work designed

to sell the aura of the fabled past in a bottle. Maroger's book, for example, is utter nonsense from a research point of view. This isn't to say resins are evil, (although mastic comes pretty close), but they all yellow over time in tests and even the best ones need to be used in great moderation. All conservators and scholars say this, but a great deal of contrarian shooting from the hip still happens and this can cause confusion.

## Maroger

Mediums based on mastic varnish and black oil continue to be marketed as the "special" Maroger medium. The most special thing about this product is that it is a sure ticket to a much more fragile paint film that will darken significantly over time. Maroger was not a painter, but a technician at the Louvre who concocted a fantastic series of recipes based wholesale on the technology in Mérimée's *The Art of Painting in Oil and Fresco*, published in 1837. Maroger's book, *Secret Formulas and Techniques of the Masters* (1948), contains no actual research and is betrayed by a fantastic, yet peculiarly French, "logic of the medium" that occurs over many centuries and locations, from Leonardo to Rubens, while the paint itself is not mentioned at all. Maroger was first exposed by A.E.A. Werner in *The Vicissitudes of the Maroger Medium* published in *Studies in Conservation* (1957), in which Werner points out that Maroger uses the De Mayerne Manuscript as a source for the mastic gel medium, when no such reference exists in the manuscript. The history of the mastic gel medium is traced in perspicacious prose and great detail by Dr. Leslie Carlyle in *The Artist's Assistant*, and it is interesting that this medium, while possibly having its origins in Venice, is primarily an English phenomenon, and is in fact referred to as "Vernis Anglaise" by Mérimée.

Mastic gel mediums are routinely condemned by conservators and painting professors in the 20th century, but do occur in 19th century work occasionally which has not fallen apart. Unfortunately, this is sometimes paraded as evidence that the medium "works", when in fact it is much safer to say it will always darken, but may last over time if used with great awareness of its fundamental limitations. A quality overview of the perennial mastic issues occurs in *Turner's Painting Techniques* (1993) by Dr. Joyce Townsend. *Paint and Purpose* (1999) by the Tate also gives a good overview historically of what happens to paintings made with mastic over time. Problematically, the medium is always sold as a kind of magical panacea, which is analogous to saying that a daily dose of opium will make all your aches and pains go away. It is also important to note that Dr. Carlyle's book explores the history of English painting materials in the 19th century, and, while a great effort is made to point out quality technique when it occurs, the book is technical art history, not a manual of technique approved by conservation.

So, whether Maroger was an accidental or premeditated charlatan, recent analysis of older paintings by technical art history contains no confirmation of his specious system, rather the reverse. Under the circumstances, it would be in the long term best interests of manufacturers who purport to offer quality materials to develop an more recognizable definition of integrity, as the mastic gel is at best a very flawed medium.

## Alkyds

Alkyds are often called resins but are actually modified oils and are made industrially from many different vegetable oils. Because alkyds are made in great quantities, they are typically inexpensive, and are promoted endlessly as "just fine" by several manufacturers. They make a strong paint film but take a long time to dry unless they have added driers. As such, all commercial alkyd mediums have added driers, and all driers cause yellowing and brittleness in the paint over time. Commercial alkyd mediums are definitely prone to yellowing, this has been reported by many correspondents. Instances of delamination associated with the use of alkyd resin over an acrylic ground are also common. But, just as there are qualities of oil, there are qualities of alkyd. Kremer Pigments, for example, carries a castor oil alkyd (#79240) that is thin and light in colour. It is expensive, takes several days to dry, but does not yellow. This could be used in small amounts in a fine technique with a long open time, but so could the logical traditional material, walnut sun oil.

## New vs. Old

I often get e-mails asking how to reconcile older painting practice, such as the material in the De Mayerne Manuscript, or the findings in the National Gallery Technical Bulletins, with the general run of modern, usually academic, recommendations.

It's not, the two systems are irreconcilably different.

Modern writing on the craft has tended towards oversimplification. This is especially true in relation to older practice, which is usually deprecated on the one hand even while worshiping Rembrandt, Rubens, etc., on the other. This is possibly due to the academic origin of the modern approach— the system must work for college students. As a result, the modern approach has gone off on a tangent which worships the commercial idol of convenience and uses "science" as a justification. The conclusions of this "science," however, are simplistic in relation to an actual painter's experience of the craft. The craft is much more diverse in its combination and manipulation of materials than the laboratory can readily comprehend. Materials are not tested in context, this would be incredibly complicated and expensive. But of what value are isolated conclusions when the materials are never used in isolation? Science tests linseed oil, but where was the flax grown, at what point was it harvested, how was the seed pressed, and, most importantly, how has the oil been subsequently processed? Painters have always known these issues to be important. From the older point of view, there is really no such thing as linseed oil, this concept is both too abstract and too vague. There is only the behavior of the specific oils one knows through years of experience. This is a profound difference. Painters, as a result of their naturally deeper awareness of the materials, often end up questioning "science," which "science" finds absurd: painters have proven themselves once again to be irresponsible, end of discussion.

But this commercial-academic "science" is not real science. Genuine empiricism is aware that it's definition of truth is relative and conditional, it is simply what we know up to now. The occasional dogmatism one encounters is best viewed in this light. Observation and experiential research provide great tools, but they must be willing to acknowledge that diverse situations may well lead to diverse conclusions. As an unfortunate but inevitable result, the modern academic approach has no functional idea of the depth and potential of the older method. An insistence on a rote approach to the process and materials results in a false certainty; the physical or visceral aspects of the craft are subjugated to a static intellectual theory. Suffice it to say, this is not how the greatness of 17th Century painting came to pass.

Of course, not all conservators or academics operate like the Spanish Inquisition by any means. There are many with more responsible and flexible attitudes who are aware of the complexity of the materials situation and are working in partnership with painters. Because both parties are involved in teaching and learning, this offers a better model for the future. The "Art in the Making" series by London's National Gallery provides a great example of this, as does "Seeing Through Paintings", by Kirsch and Levenson, and anything by Joyce Townsend or Leslie Carlyle.

In relation to the old way of painting the new system can be compared to what happens when a great novel is made into a Hollywood movie: much is lost in terms of subtlety, depth, and dimension. The fascinating thing about the older way is that it is not particularly complex, it simply springs from a completely different set of root assumptions about the craft. These are much more logical than "alchemical" -- the use of that word in this context is usually well-meant but inaccurate past the earliest painters. The cumulative day-to-day experience of the craftsperson and the traditions that were handed down within the master-apprentice system created a vast body of functional knowledge. This level of hands-on experience is unavailable to the modern method. It is therefore logical, if a little embarrassing, that the modern method tries so hard to make the older method go away. The older method will never go away. It makes better paintings.

In the older method, the painter starts from scratch and develops a relationship with the materials: the process creates the product. In the modern method the painter purchases commodities and manipulates them: the products determine the process. The justification is that the products are "right," sanctified by science. However, commodity based painting tends to devolve over time because the painter must execute the static formula that works. The process becomes uninteresting to the painter and this ultimately affects the work itself.

The craft requires but also rewards a different level of attention. For this reason, craft based painting tends to evolve because the painter is with the materials in the moment. The importance of this ongoing dialogue cannot be overemphasized, it is the fundamental key to a more evolved technical practice.

## Structure

A painting is made up of layers, beginning with the canvas or panel, proceeding to the final varnish. The ultimate strength of the painting technically depends on the strength of the structure as a whole, not on the cumulative strength of the ingredients themselves. This is important to consider in using any given material: is it appropriate for its place in the structure? A material which is too strong for its position, such as glossy commercial acrylic gesso, may create resulting structural weakness: the applied oil paint ultimately flakes off. The use of a strong material like sun oil or copal varnish too soon or in too great a concentration may result in the beading of the paint in subsequent layers: the painting will need to be oiled and sanded down to accept further paint. It is important to think in terms of designing the structure of the layers of a painting so that the ultimate strength of the whole is maximized. This means using the right material in the right place.

Three great aids to structural flexibility from the history of oil painting are the use of panels, the use of chalk or other calcium carbonate as a buffer to the long term acidity of the oil, and the greater film strength over time of lead carbonate as a white pigment.

## Supports

The manufacture of canvas on stretchers has become a large industry, with many different levels of quality available. There are also many levels of quality of stretchers themselves. While work on panels predates work on stretchers by centuries, stretched canvas has come to be expected. This is unfortunate, because unsupported canvas will always be less permanent, more subject to various forms of potential damage, than that same canvas mounted archivally to a panel. It is always best to stretch the fabric oneself, and to use linen if at all possible on stretchers. If using commercial canvas, beware of fabric which has been given a shiny surface by the ground, either an oil ground made flexible by the addition of Stand Oil or an acrylic emulsion ground. Also beware of hardboard panels, these are not necessarily archival or acid-free. It is simple to make highly archival panels oneself using cabinet grade plywood covered with cotton or linen canvas. A more recent addition to this family of products is Medite, a particleboard bound with a synthetic resin. This is receiving high conservation marks at this point. An excellent quality plywood for small panels is the Baltic Birch plywood used for furniture making. Larger panels can be made with 1/4 inch plywood cradled at the back.

## Linen, Cotton, Paper

Linen is the stronger fiber and should be chosen for unsupported canvas if possible. If cotton is chosen, the reverse surface should be protected from possible damp by sizing it with PVA or by the older method of a tightly fitting panel insert, this goes back to Mantegna. Cotton on panels is fine because the fabric is permanently protected both front and back. Small paintings on prepared paper -- usually outdoor sketches -- have fared surprisingly well over the last few centuries, but should always be mounted to panels or framed behind glass in the long run.

## Size

The traditional size was some form of hide glue, rabbit skin glue is often said to be the most flexible of the affordable glues. When combined with glue gesso on panels, this system has survived in some cases for over five hundred years. On unsupported canvas it is less permanent because of the movement of the canvas and the hygroscopic nature of the size. There are alternatives available now in acrylic emulsion size and PVA size, both of which are more flexible and resist moisture better. Both of these are also stronger, so the questions become: how strong to make the size, and what to put on top of it.

## The Ground

It is important thing to keep the ground lean and at least somewhat porous or toothy so the paint will adhere well. A commercial oil ground on canvas presents potential issues with both adhesion and yellowing. This is because these grounds are made to be rolled and typically contain stand oil. Although the stand oil creates more flexibility for some time, it will darken over time and creates a ground whose surface is relatively slick, with the potential for the paint not to adhere well.

The danger of a commercial acrylic ground is the typical level of gloss making it difficult for the paint to penetrate the surface enough to safely adhere. Commercial acrylic grounds have often been the cause of delamination, because the oil paint cannot stick to their glossy, sealed surface. These can have chalk or marble dust added and thinned a bit with water to create a matte surface that will hold the paint better. Some acrylic grounds now are being made moderately absorbent, these will have no shine and a drier feel.

Because they are rigid, it is possible to put a quality ground on a panel commercially. Still, this is an area where the painter will be able to create a much more personalized and interesting painting surface with ease.

On panel, the logical solution remains hide glue and glue gesso, this gesso can be enhanced with titanium white, and made in a variety of ways that then affect the paint applied on top. It is also possible to make a more flexible oil emulsion gesso, as discussed by Kurt Wehlte in "The Materials and Techniques of Painting," for use on canvas. For more information on this, go here. All glue gesso grounds can have a thin white lead imprimatura layer applied, this is surprisingly consistent throughout the history of panel painting, although even a thin layer here needs to have a few weeks to cure hard.

## The Oil

The quality of linseed oil in America during most of the 20th century was not high, texts from that period take significant yellowing of the oil as a given. While modern commercial oils are better, the oil used for painting should be tested for yellowing, because some oils are better than others. Drying tests with oil take about six months to complete. If the oil is cold-pressed, this is often a key to higher quality. At another level comes an unrefined cold-pressed oil, usually organic as well in the case of linseed oil. However, this must be refined before use. The various low-tech processes available to the painter all take time, but are not that time-consuming or difficult, and open up a range of possibilities not possible when starting with commercial oil. This is especially true with linseed oil: because of the time factor involved, and the original high price of the oil, no approximation of the linseed oil of older painting exists commercially. While commerce offers refined linseed oil which yellows minimally, this oil has also lost all verve or snap to the refining process, it is essentially generic, remaining linseed oil in name only.

Artist refined cold-pressed organic linseed oil is a different product, with many rheological personalities based on various older recipes. How much this matters depends on how of much of a role the craft plays in a given painter's conception of the work. But if someone tells you categorically that it doesn't matter, or is not worth the effort, take a moment to stop and consider the source. It is ironic that, while highly processed oils with high price tags are sold in the art supply store, the interest in the nutritional qualities of unrefined linseed oil have made oils of incredible quality and potential available at the health food store. These can often be found more cheaply online. However, these oils must be refined to dry quickly and remain safely non-yellowing over long periods of time. Adding bread crumbs to clear a cloudy oil, then placing it in the sun for two weeks, is not enough.

The oil used in a painting medium should also not be raw. This is especially true if raw oil commercial tube paint is used. Preheated oil offers a very simple method for decreasing yellowing, and increasing the overall strength and potential longevity of the paint film. This is more true for linseed oil, although artist processed linseed oil is significantly less volatile than low quality commercial linseed oil.

A pdf file about the process of refining linseed oil is available at: [http://www.tadspurgeon.com/pdf/Refining\\_Linseed\\_Oil.pdf](http://www.tadspurgeon.com/pdf/Refining_Linseed_Oil.pdf). This is all text, no photos, for printing out.

## Tests

Most painters groan when tests are mentioned, but they are the most reliable way to put the process beyond the uncertainty of opinion and the endless diablerie of commerce. Once the habit is formed, it is actually pretty interesting to see what happens over time to a given set of materials. Tests take time, it usually takes from three to six months to find out how much an oil will yellow, and longer for a medium containing a resin. Photo of a recent batch of linseed oils, taken after three months.

## Thickened Oil

The simplest way to thicken an oil is to leave it open on the palette, or closed in half full containers. This is especially true of painter refined organic linseed oil, which becomes tackier and more glutinous in a matter of a few days in a thin layer in the open air. This oil can be used at any number of viscosities, and this method offers a simple, high quality way of working from lean to fat.

The earliest known recipes for painting oil all direct that the oil be heated for a reasonable length of time. Heating an oil to 150 degrees Celsius with constant stirring for an hour or two results in a slight increase in density with little increase in color. This oil dries faster and is more leveling than raw oil, and is still thin enough for undiluted use.

The other traditional method of producing a thicker oil is to allow it to thicken in the sun. If you are in a climate where this is easy in the summer, sun oil is an excellent and simply made material. It can be made for undiluted use in a few weeks, or allowed to thicken to the point of being a taffy. True commercial sun oil is always very pale, relatively expensive, and smells quite sharp. If you have found a surprisingly cheap "sun oil" that has a denser, cooked smell, this is modern burnt plate oil, see below. When making sun oil from any oil, this oil should be refined, either commercially or by the painter. While an unrefined organic linseed oil placed in the sun for several weeks will dry somewhat faster, it will not dry as fast as that same oil, previously refined, and still contains a full complement of water-soluble fatty acids which can yellow significantly as the paint film oxidizes over time.

Stand oil is a more modern thickened oil, usually made with low quality linseed oil which has been heated in a vacuum. Stand oil is produced by many manufacturers, and from many different grades of oil. It can be, but is not always, a reliable material. If the working qualities of stand oil fit with your style, please make sure to test several different brands for yellowing, these tests take about three to six months.

Another modern commercial thickened oil is the burnt plate oil of the graphic trade, used to alter the viscosity of printing ink. The original burnt plate oil was literally oil that had been heated until it caught fire. Modern burnt plate oil is an evolution of stand oil which involves heating the oil in a kettle which sparks off the rising volatile elements. The result is a thicker oil which has a more mobile or slippery quality, and which has less of a tendency to yellow than stand oil. Burnt plate oil is also very slow drying, and imparts a great depth of saturation to the color. For any type of realism, it needs to be used in very small amounts in a medium or putty, 5 percent is enough. If working with the product from Graphic Chemical, the most versatile grade is 5, about the consistency of stand oil but lighter. Photo is of grade 7, somewhat thicker but still on the light side.

## The Medium

Mediums became increasingly important once paint began to be engineered to be put into tubes and kept for long periods time. This paint has the advantage of convenience but does not typically suspend the pigment adequately or resist atmospheric oxygen effectively. Modern conservation research has made it clear that, while many materials were additionally used in older painting in decided moderation, the oil itself was by far the most prevalent ingredient in any medium. It's very important to keep any resin to a minimum. A small amount of hard (cooked oil) resin varnish such as amber or copal has more to offer protectively for the paint film than a soft (spirit) resin varnish, but also has more potential to yellow. The research in the National Gallery Technical Bulletins suggests that older painters may well have used a small amount of soft resin fused into the oil as a simple, readily-made solution. A quality resin for this

purpose with a long history is Larch Balsam. This is what Ralph Mayer refers to as Venetian Turpentine. The Venetian Turpentine on the market is a mixture of Larch and Colophony, which will not dry as quickly and yellow more. Canada Balsam is popular, but has recurring drying issues, and Gottsegen, backed up by the CAMEO database, feels that it yellows over time. Mediums are a place where creeping complexity needs to be scrupulously avoided. This is especially true in terms of maintaining paint film consistency from layer to layer by using the same medium throughout the course of a painting. The medium should always be leaner or used more sparingly in the beginning layers. It can be used more richly at the end, or in an alla prima painting which will dry in a single layer, but the spot use of different additions or underlayer treatments for specific effects need to be avoided; these have proven to cause significant difficulties with paint film integrity in the long run. The Tate book on the Pre-Raphaelites illustrates several examples of what happens when painters overthink the process without understanding the structure of the materials in the first place.

## Putty Mediums

Although simple, this medium has no historical reference in any older text. It's origin is the result of modern conservation research, which has found additions of chalk or other forms of calcium carbonate in the paint of painters such as Rembrandt, Chardin, or Velázquez, and ground silica in the paintings of various older Venetian painters. The various types of ground calcium carbonate and silica can be coupled with the stability of preheated oil and the quick drying nature of sun or unsun oil to produce a family of mediums with many different working characteristics. The strength of the medium lies in it's technical stability, solvent-free ease of use, and protean versatility. This last quality also means that using the medium effectively can involve a bit of a learning curve as the painter becomes acquainted with it's endless possibilities and adapts them to personal taste. Older painting practice contains many subtle elements. Next to the craft of the oil, the use of inert stone dust as an extender, brightener, stabilizer, and impasto creator is at once both the most prosaic and the most profound.

At it's most basic, this medium is simply ground stone dust used in conjunction with oil and the paint on the palette. Oil to make the paint move more, stone to tighten it once again. From the highly irregular surface impasto of some of his later self-portraits, this may well be one way, if not the only way, Rembrandt used this method.

The medium can also be premixed into a putty. This putty can be mixed into the paint before painting in any amount, giving access to a wide range of working characteristics. Putty can be used to make impasto and internal texture but can also be used in smoother surface styles. Conservators have found evidence of Rembrandt's use of translucent glazes using chalk, chalk has also been found in Vermeer's *Girl With a Pearl Earring* (c.1665).

Other forms of calcium carbonate can also be used and have slightly different rheologies as putty. Chalk is the most absorbent and, unless it is very fine, also has a certain mobility. The finer chalks, such as Champagne Chalk, have a somewhat stickier quality in oil but are also suitable for the finest detail work. The more crystalline forms of calcium carbonate - marble dust, calcite - make a putty which is more adhesive but with less potential for the glutinousness of the finer chalk putties. As Velázquez used ground calcite and Rembrandt used ground chalk, the difference isn't one of quality, but of personal preference, or perhaps simply availability, coupled with the all important element of long experience with a given material. Pure white and finely ground marble dust is readily available and works well as a point of departure. Ground silica presents a different case depending on particle size. Larger particle silica - 200 to 400 mesh - will tend to make a putty feel drier under the brush. The smaller particle silicas - such as fine cristobalite - tend to produce the lubricating effect, sliding more than the other finer particle stone dusts. While the calcium carbonates tend to accelerate drying slightly, silica tends to retard drying slightly. Any ground silica presents a long-term respiratory hazard and should always be used with a serious particle mask when in the dry state.

The putty medium is especially effective at altering the relative lack of body and tendency of commercial paint to slide due to the common modern addition of aluminum stearate as a gelling agent. By using only high quality, preheated oil in the putty, the instability of raw oil commercial paint - its

tendency to shrink and crack - can also be significantly diminished. The putty can be engineered to any level of final gloss as an addition to the paint, again overcoming the tendency of raw oil paint to dry matte and sink-in. It is ultimately possible for the painter to create a tube -- or several different tubes -- of putty which, when added to commercial paint, consistently give it a number of desirable characteristics it does not have on its own. This presents a viable alternative to the longer learning curve of making one's own paint.

### Silica Gel Mediums

This is a much more reliable gel than a mastic gel based on adding fumed silica to the oil. When using tube paint, the oil used should be preheated to avoid any yellowing potential. Many varieties of silica gel can be made by varying the amount of silica and the mix of the oil. The typical way of using this is as a glazing medium or in conjunction with the putty medium. The silica gel moves, or slides, easily, while the putty has more of a tendency to stick or grab. A fumed silica gel can also be used in a freer manner in *alla prima* painting.

Fumed silica is very light and should be handled with great care, using a quality respiratory mask. In America, Cabosil M5 is readily available as a thickener for epoxy used in boat building. In Europe, Aerosil 300 is transparent in oil. Once combined with the oil, it presents no further risk and can be tubed or kept in aluminum foil wrapped with masking tape or duct tape.

### The Paint

The quality of commercial paint is improving, the days of dark orange oil oozing from under the cap are on the wane. But it is still an excellent idea to compare brands, do research and yellowing tests of your paint, regardless of the brand's pedigree. Artist made paint will always have the potential advantage of being made with higher quality oil. No manufacturer, large or small, uses cold-pressed oil refined in a low-tech, non-invasive way and then aged in the light, as was the common older practice. In terms of linseed oil especially, this matters. On its own, commercial paint does not develop a strong enough film to resist oxygen or the subsequent sinking in of later paint layers that well. This is why the element of medium has become so important in modern painting practice. The pigment needs to be suspended and sealed from oxygen in a way that it cannot be using raw oil tube paint alone. Commercial paint is moving away from linseed oil to safflower oil. It is important to note that, while safflower oil is relatively non-yellowing, it is also a very slow drier unless driers have been added to the paint. The wiser small manufacturers are returning to the simplest paint possible, with minimal or mineral binder

However, if the paint is made with preheated oil, a very different rheology is available from the start. Preheated oil is found routinely in older paintings by the researchers at the National Gallery, as reported in their yearly Technical Bulletins. The use of preheated oil creates a stronger and more stable paint film which is less likely to yellow. The increased body of preheated oil makes it less likely that the pigment will sink in, as well as altering the rheology away from "long and stringy." The oil used to make this paint was preheated to 100C for 48 hours. It also works to preheat the oil to 150C for an hour. This paint contains nothing but oil and pigment, it is short and dense, but mobile and bouncy.

### Fat Over Lean

The structural rule of painting fat over lean is very important to observe overall within the structure of the painting, especially if raw oil is used with raw oil tube paint. It becomes less important the more the paint and medium are modified in the ways that are standard from sources such as the De Mayerne Manuscript and the findings in the National Gallery Technical Bulletins. This is because these methods -- principally preheating the oil, and introducing lead into the oil -- produce oil which is stronger, more flexible, and significantly less volatile in its drying characteristics. Another great addition for long term stability is the addition of calcium carbonate to the paint through the use of the putty medium.

Many painters take fat over lean very seriously because of the emphasis given to this principle by Ralph Mayer. It is important to realize that Mayer was born in 1895, and lived through a period of the

worst commercial linseed oil imaginable. If a painting does not become relatively fat at some point, one is always underpainting, and these layers are always sinking into one another, producing a leaden opacity, especially in the midtones. The key to avoiding this situation is to understand that commercial paint, for all its "buttery" texture, is quite lean, and begin to introduce elements of preheated or otherwise thicker oil to the layers in small, discrete increments. At the same time, the ground itself must be kept lean, or there can be adhesion issues over time. The classic recipe for delamination in modern materials is a slick acrylic ground painted over with an abundance of alkyd medium.

## Yellowing

There are several different potential causes of yellowing in a painting. While lower quality linseed oil in commercial paint is on the wane, this has been a major cause of darkening in 20th Century paintings, and it is unfortunately possible to see this readily in major museums. Another standard culprit is turpentine which has been oxidized by exposure to light and air, the residue of this can yellow badly and affect everything it was a part of. If used, turpentine should always be high quality, and protected from both light and air by being stored in small size amber glass bottles. A thin application of a given oil may dry without yellowing, while a thick application of the same oil will darken. Oil which has been preheated or aged in the light has less of a tendency to yellow than the same oil, new and raw. Humidity is another factor often overlooked. An oil which dries without darkening in low humidity may dry with significant darkening in high humidity. In some climates, a dehumidifier is a studio necessity during the summer. Setting paintings to dry in moderate sunlight is a traditional remedy for short-term darkening, north or east windows work well for this. Paintings will darken naturally if not exposed to enough sunlight, this is especially true of work made with linseed oil. However, subsequent exposure to light will brighten the work once again. The darkening associated with resins is longer term. It is wise not to use a hard resin such as amber or copal in any but the most minimal amounts, and never as a final varnish. It is wise to keep all resin use to an absolute minimum: oil paint is so sensitive and these materials so strong that between 2-5% of a hard resin varnish in the paint layer will make a significant rheological and optical difference. This is enough. More may well be inviting trouble down the line. Oil paintings made with permanent pigments do not ever get lighter or brighter over time. Painting on a white ground is therefore a good idea, as is painting the values "up" somewhat, especially when working in layers. It is much easier to continue to darken a painting, than to lighten it once again reliably.

It is becoming more common for painters to pay attention to conservators, and this is by and large a good development. But sometimes conservators become obsessed by yellowing. In oil painting, there is a profound difference between normal, visually comfortable mellowing and an overall darkening which in fact disfigures the work. It is important to keep in mind that the dire warning of the conservator about a material "yellowing over time" might be a little overstated, some conservators simply like to get the attention of painters. Conversely, it's possible to see before and after photos of paintings where old varnish was removed which show that the painting clearly benefited from the warming effect of the varnish layer— as the painter may well have intended. So, the issue is to know one's materials. A lower chroma earth color palette, such as used by Rembrandt or Velasquez, can be used safely with quality linseed oil, as was in fact the case for both painters. Raphael's higher chroma palette may well have benefited from his use of walnut oil. The more the color depends on a cool, neutral light, the more the color is focused on pure color in the midtones, the more the painter needs to be concerned with yellowing in the choice of the oil. However, as will be seen below, it is possible to paint in such a way that the relative warm-cool dimensional distance of the painting remains constant or in fact increases as the painting ages.

## Solvent

Solvent is unfortunately often considered necessary to oil painting when in fact it is only necessary to the type of painting which uses a soft resin medium such as damar. Older painters kept their brushes in oil, not solvent. Long term solvent use in an unventilated studio leads to significant health issues, Denmark has in fact labeled this "Painter's Dementia." Solvent should always be kept in small amber

glass bottles which are full, protecting the contents from both light and air. This is especially crucial with turpentine. Both the traditional putty medium and the more recent silica gel medium offer a variety of solvent-free painting options. Solvent is also unnecessary when using a small amount of hard resin varnish in the medium or a fused soft resin and oil medium. A higher quality solvent for general use may well be spike lavender, but it is important to get this without adulteration. If you find surprisingly inexpensive spike, it is cut with mineral spirits.

### Final Varnish

Whether or not to varnish a painting and how long to wait before varnishing it are complex subjects, depending on how much paint was put on, the medium used, and the amount of time the painting took in total to complete. It's important to understand that the atmosphere in houses and urban areas is now generally much cleaner than it was during the time when houses were heated with wood or coal: varnish then made the inevitable cleaning safer and easier. Not all paintings are seen the way their maker intended: Monet liked the matte quality of the surface of his paintings, almost all of which have now been varnished. At one point a high-gloss, enamel-like surface was desirable for a painting, no matter how large. Now larger paintings are often finished with a more matte overall surface. The safest varnish is one which is easily reversible, so that it can be removed if anything goes wrong: mastic varnish, in spite of its inevitable yellowing, was actually preferred for this quality. The final varnish is an area where modern products from quality manufacturers may perform better than older materials, almost all of which have been proven to yellow significantly over time. Possible exceptions are discussed below. It is always best to test the final look of a varnish first on a painting which is unimportant: someone else's idea of the perfect look may not exactly be yours.

A painting made using the all oil system can, with experience, be engineered to any desired level of shine. The more paint, and the richer the medium that can be used safely, the more the painting will be resistant to the destruction of the oil by oxygen. This is an advantage offered by painting on panels over unsupported canvas.

An early varnish used in Italy was made from sandarac, either dissolved in spike lavender or used as an oil varnish. The National Gallery has found specimens of both these in good condition, although the varnish in oil has yellowed more. The varnish used on most 17th Century paintings was mastic, a soft resin dissolved in turpentine. While this was known to yellow, it also aged to the point where it crumbled easily away, making it simple to remove. When damar came into the picture in the 19th Century, mastic was still preferred due to its lower level of shine. Writing on the experience of older varnish removal from the National Gallery makes it clear that copal, because it both yellows and dries irreversibly, should not be used here.

During the 20th century, damar was thought to offer a final solution. It has now been found that damar will darken over time, although some conservators still feel that it is the resin about which the most is known, and use it with an addition of Tinuvin, a UV absorber that extends its useful life significantly. There are many modern synthetic varnishes available now which may well offer a more reliable final finish, or have at least been engineered to be easily removed should something go wrong. These include the MSA (Mineral Spirit Acrylic) family, Regalrez (Gamvar), and the older Paraloid B-72, although the latter involves the use of relatively toxic solvents. At this point MS2A, while quite expensive, is considered to be superior in some circles, and is in use at the National Gallery in London. Regalrez is less expensive and is favored by the National Gallery in Washington. MS2A has a somewhat lower level of shine, and brushes out better. Regalrez may appear to be somewhat plastic without an addition of wax, and is so reversible that only one coat is possible using a brush. These resins are always used with an addition of a UV absorber. While these perform better than damar in theory, a look at contemporary conservation practice suggests that not all conservators feel that enough is known about these alternative resins. Genuine Silver Fir Turpentine, or *Olio d'Abbezzo*, is quite light in color and can be used as a final varnish when diluted with solvent, 1 part resin to 3 or 4 parts solvent. Sandarac can be dissolved in pure spike lavender and used in a similar way. While these materials are traditional, dry quickly and yellow minimally for natural resins, they are brittle and may well cross-link over time in a

way that makes their removal difficult. They offer an alternative to the look of damar, and need to also be used with an addition of a UV absorber.

### The Lost Secrets Puzzle

The search for answers with regard to older painting practice began officially when Reynolds set out to emulate Rembrandt. He kept notes, some of which are reproduced in Eastlake, and these notes detail a great many common errors that have been made with mediums ever since. The fundamental conceptual problem has always been the same— a search for a lost material, rather than a lost technique. This shell game still goes on at the commercial level, especially with small companies offering unusual or hard to get materials with historical backgrounds. The problem here is that there is no working manual of older painting practice written by an actual oil painter. While Pacheco's *Arte de la Pintura* has some interesting information attached to its highly cultured rhetoric, much of it is technically obscure, and some of the fundamentals are obviously unsound, as the condition of his paintings suggests. This lack of reliable written explanation makes sense since the training was hard won, often paid for, and made one's living in a fiercely competitive environment. What does exist is a great literary jumble sale of odds and ends across centuries of technique. Reading it all is difficult enough, exploring it adequately would take a large research team a lifetime. However, thirty years of research into older paintings at the molecular level, documented in the National Gallery Technical Bulletins, suggests strongly that the materials themselves tended to be simple: oil, pigment, perhaps ground stone, perhaps a small amount of egg or pine resin. This is logical because the last thing a working craftsperson could afford was technical failure. When Leonardo's great gamble, the *Battle of the Anghiari* wax-fresco, failed, he left Florence.

The way to avoid the complexity of the boutique manufacturers on the one hand, and the grand literary snipe hunt on the other, is to work with the materials at a fundamental level until you understand them well. This takes time, and patience, but is not rocket science. It is a matter of learning to pay attention at a different level. In America we turn out "Masters of Fine Art" in two years, but Chardin said it takes thirty years to make a painter. Which assessment of this situation is more accurate? The underlying problem is that our way of educating the brain relies on the left brain and linear thought. Not only is painting image or right-brain oriented, it is also multi-dimensional. All modern color models are three dimensional without the added dimensions of relative opacity -- transparent, translucent, opaque -- not to mention the effect of layering the colors over time. Without a willingness to undertake this equal and opposite form of education, it is simply not possible to access the more subtle ways color was used and paint was applied in older practice. Thus we often end up with painting which uses an increasingly superficial version of color, and an exaggerated version of style, in order to be heard above the din of all the other painting doing exactly the same thing. In his wonderful *Oil Painting Techniques and Materials*, Harold Speed says that a culture gets the art it deserves. Having abandoned all classical or ethical -- to say nothing of spiritual -- precepts about the purpose or meaning of creativity, it is no wonder that a kind of arbitrary commercial chaos has ensued.

If, on the other hand, you are interested in pursuing painting for its own sake, or, as the Taoists say, as a method of cultivation, you will find the real secrets where they have always been: hidden in plain sight. Ongoing experiential commitment to a working dialogue with the craft will easily allow access to aspects of it that are overlooked by painters in a hurry, too intellectual or aesthetic to bother, or with fame and fortune as a primary goal. The materials can only explain themselves to painters who are paying attention to them. The lost secrets are that simple, but also that complex.