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FORMULAS

These are in parts by volume, or in the metric system, by weight or volume, followed by American kitchen measurements in parentheses. Note that certain formulas are designed for use on *panels only*. Medium formulas are generally on the thick side for *conditioning* the paint on the palette, these are easily thinned slightly with small amounts of thin oil. Variables in natural ingredients and individual methods of measurement make a technical notebook more than helpful. *Measure carefully, paint freely*. Some formulas contain historical ingredients that are toxic if not used with care. Solvents are also considered toxic in this text.

In the text, these formulas are designated thus: ▲

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HAND-REFINED VERSUS COMMERCIAL OIL

A basic difference between older and modern practice is the behavior of the *oils* involved. The cold-pressed, hand-refined oil of older practice is the key to a variety of materials and effects that are difficult to emulate in a stable manner otherwise. In the above formulas, hand-refined oil is often stipulated. In the case of SRO linseed oil, whether the oil is thin or thick, this oil performs very differently than *any* commercial alternative. This is because, first, SRO linseed dries very quickly on its own, and, second, when *auto-oxidized* (thickened in response to air) this oil becomes quite tight or resinous compared to the leveling or flowing rheology of a *heat-polymerized* oil such as contemporary stand oil. In other words, while both these oils are thick, and increase saturation, they are otherwise opposites in behavior. In most cases it is possible to substitute commercial oils for hand-refined oils and still have the formula “work,” but, this results in longer drying times, and, without an alternate tightener added to the formula, the loss of at least some, if not all, of the medium’s rheological *raison d’etre*. The difference between hand-refined oil and oil that has been commercially refined is a basic fork in the technical road. There is nothing wrong, at this point, with quality commercial oil. But, in the various 19th and 20th century texts on painting, a lack of understanding of the rheological potential of hand-refined oil – especially in the case of hand-refined linseed oil – often led to the conclusion that the global use of some type of resin must be the “lost secret” of older practice. At this point, these conclusions are not supported by the findings of over three decades of technical art history. Excellent painting systems can be constructed around contemporary commercial oils. But, in terms of understanding the way older painting operated, and the techniques potentially available then, and now, using hand-refined linseed oil, this difference is one to keep in mind.

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MAJOR SOURCES

Sources referenced by name in the text are listed below.

Alberti: Leon Battista Alberti, *On Painting*, 1435.

Carlyle: Leslie Carlyle, *The Artist's Assistant*, 2001.

Cennini: Cennino d'Andrea Cennini, *The Craftsman's Handbook*.

Translated by Daniel Thompson, 1953.

Church: Sir A.H. Church, *The Chemistry of Paints and Painting*, 1915.

Dalí: Salvador Dalí, *Fifty Secrets of Magic Craftsmanship*, 1948.

Delacroix: Eugène Delacroix, *The Journals of Eugène Delacroix*, 1822–1863.

Numbers in parentheses refer to specific entry dates.

De Mayerne: Sir Théodore Turquet de Mayerne, *The De Mayerne Manuscript*, Sloane 2052 (c.1620–1646), English translation in *Lost Secrets of Flemish Painting*, 2001, by Donald Fels. Numbers in parentheses refer to the Fels system of entries.

De Wetering: Ernst Van de Wetering, *Rembrandt The Painter at Work*, 2000.

Doerner: Max Doerner, *The Materials of the Artist and Their Use in Painting*, 1934

Eastlake: Sir Charles Eastlake, *Methods and Materials of Painting of the Great Schools and Masters*. (I, 1847; II, 1868) Numbers in parentheses refer to volume and page numbers.

Gottsegen: Mark David Gottsegen, *The Painter's Handbook*, revised and expanded edition, 2006.

Laurie: A.P. Laurie, *The Painter's Methods and Materials*, 1960.

Merrifield: Mary P. Merrifield, *Medieval and Renaissance Treatises on the Arts of Painting*, 1849.

Mérimée: J. F. L. Mérimée, *The Art of Painting in Oil and Fresco*, French 1830, English 1839.

NGTB: *National Gallery Technical Bulletin*. Various authors, followed by volume number when applicable.

Oudry: Jean-Baptiste Oudry, *Discourse on the Practice of Painting and its Main Processes: Underpainting, Overpainting, and Retouching*, 1752

PRPT: Joyce Townsend, Jaqueline Ridge, and Stephen Hackney, *Pre-Raphaelite Painting Techniques*, 2004.

RAM: Bomford, Kirby, Roy, Rüger, White, *Rembrandt*. Art in the Making series, revised edition, 2006.

Wehlte: Kurt Wehlte, *The Materials and Techniques of Painting*, 1960.

Into the Labyrinth

THE FRAME OF REFERENCE

1.1

Once upon a time, long ago, and even far away for those of us in the New World, painters had a deep understanding of their materials. This came about through a combination of training and experience, in a world both simpler and more complex than our own. In these circumstances, the complimentary routines of life and art fused naturally into a living craft. Currently, this understanding is often framed as a myth, yet the work it produced is in museums all over the world. Culturally, its existence is paradoxical: an inspiration to some, a burden to others. As painters, can we leave pride and prejudice behind, and explore older practice, artistically and technically, as a set of creative tools?

What became lost from the craft has intrigued and plagued painters for centuries, perhaps even before Reynolds set out late in his career to emulate Rembrandt's broken style with such mixed long term results. At this point, through a combination of research and technological advances in the analysis of older paintings, we know more than ever before about the ingredients of older technique in terms of pigments and mediums. But how these were modified and assembled, what the working methods of the painter's studio were during the long 15th to 17th century apogee of the craft, will probably always remain a mystery. Given that secrecy with regard to means – the art of concealing the art – was a basic professional intent, perhaps this is just as it should be.

The craft of painting has changed greatly in the last six hundred years, especially in terms of the commercial origin of materials, and the vivid colours now readily available. But, while modern life actively encourages us to be consumers, we retain opposable thumbs and the capacity to make things, offering both a different type and quality of experience. As such, there are two basic crafts: one based on purchased materials, and one based on personal materials. The purchased craft is a search for what to buy, and from which manufacturer. The handmade craft is developed incrementally, often from humble beginnings. It remains physical, and begins where it always has, in a daily relationship with the materials. Pigments and oil, chalk and glue, grinding, mixing, brushing, scraping: this story is still about learning, and discovering further levels of, a series of deceptively simple procedures. Similarly, this

book began with an apparently simple question: What would happen if the craft were explored once again as it had been originally: step by step, by hand?

Several related arguments are presented here about oil painting as a personal and vocational practice. They are addressed in relation to the quality of life: the dialogue between process and product, and are supported by examples from art history – the paintings – and technical art history – the research.

First, that painting is about life: the original teaching tool, both literally and conceptually, which contains, and therefore cannot be defined by, ideas. Second, that a handmade craft has more to offer than a machine-made one. Third, that an experiential or heuristic approach to the materials offers more than an abstract or empirical one. Fourth, that the most functional relationship between art and craft is reciprocal, not hierarchical. Fifth, that honoring the ancient contract of art in service to society has more to offer than ignoring it. This last argument goes back at least as far as Diderot's critical distinction between *le naïf* and *le théâtral*, and, by implication, to Plato's original complaint in *The Republic* that painting is copying, not a creative art. The philosophical and practical elements of painting are presented in separate covers now, but this has not always been the case. Practice and motivation are still enhanced when viewed as complementary aspects of a craft whose tenets are not materialist, empirical, nor intellectual, but grounded in the physical and metaphysical interdependence between craftsman and society.

This book contains seven sections: *concepts, aspects, colour, materials, mediums and varnishes, methods, and systems*. The basis is threefold, or triadic: older practice as defined by technical art history, the craft as a creative resource; and the equal validity of both logic and intuition in the painting process. The goal is to offer an alternative to both the encyclopedia of differential description, and the grimoire of equivocal arcana, through a practical, holistic reference that documents one painter's experience in detail. Modern texts on painting occur in frames of reference that are either scientific or aesthetic. The case is presented for the creative interaction between the art and the materials evident in the 15th-17th century heyday of the craft. Older practice is examined for what it explains about the cultural attitudes that generated it, and what this might offer painters at work today. This approach can be applied to any level of experience, by anyone whose attitude towards painting stresses the quality, rather than the tempo, of the creative process. As a frame of reference, this still provides an opportunity for the life and the work to become one.

Concepts: The concepts are based on concerted observation producing enhanced perception, thus linking the work to life in larger terms. Learning to think in colour and form develops the relationship between the visual and verbal realms of the brain. This connects logical and intuitive problem-solving skills and includes more of each over time. The concepts organize the process, aiding intuition through the logic of dialectic analysis. This technique uses an applied awareness of opposites to create new possibilities, even a new frame of reference, through creative synthesis.

Aspects: The aspects emphasize elements of the process and the greater level of tactile or haptic awareness that is intrinsic to older painting. One expects this depth from the materials, but it begins with the way the process itself is organized.

Colour: Organization is also intrinsic to the way colour is implemented, or deployed, in older painting. This section explains how colours are arranged to evoke light and space, and ways older painting used optical and other advanced techniques to map colour to form. These methods create more perceptual colour from fewer pigments in a version of simultaneous contrast with an extra dimension. They define a triadic balance between the *vivacity* of local colour, the *unity* of an integrated light-shadow axis, and the *optical depth* of the paint itself.

Materials: The materials are principally traditional, or reconstructions thereof. Modern materials are used when they have proven to be stable and non-yellowing.

Mediums and Varnishes: These section offers choices that developed based on the findings of technical art history, made with both handmade and, in some cases, quality modern materials. The positive and potentially negative aspects of six medium types are covered – *oil*, *putty*, *egg*, *resin*, *emulsion*, and *beeswax* – along with various useful combinations.

Methods: The emphasis of the *methods* is on the 17th century, but some concepts or formulas – panels, gypsum gesso, the Strasbourg Method – are earlier. The methods developed by comparing the formulas and instructions in older texts with the findings of modern conservation research. Technical art history has shown that the older texts themselves are most often compilations, the work of scribes, not painters, containing a complex assortment of useful and unlikely information. The dedicated technical publications from London's National Gallery and Tate Gallery proved to be a reliable filter for the older texts. The consistent message of

informed simplicity from these findings effectively sliced through the Gordian Knot of the literary trail, establishing the basis of the older system as simplicity, ingenuity, and expediency, practiced in the service of longevity. For the craftsman working in a cultured, but competitive context, this approach functioned as both advertising, and insurance.

Systems: The *systems* are both technical, based on a specific approach to the materials and methods, and historical, based on sets of materials and methods that were tailored to a certain style at a given period.

Purpose: This book explores the relationship between the philosophical and the practical, documenting one search for greater awareness of the oil painting process in relative detail. Its materials and techniques are not presented as historical reenactments, or definitive; it is simply a record of what worked for me, and why. The purpose has been to explore the original partnership with the craft in a contemporary way. This bond occurred naturally during the 15th-17th century flowering of the craft, there is no reason why it cannot happen again. The reader is gently urged to consider the potential of the materials when addressed on their own terms. Overarching attention to detail is both the foundation of the universe, and the functional basis of any creative process. Once observed, these details accumulate to form natural systems whose components are logical, yet unfathomable otherwise. Creating a dialogue with the materials incrementally, from the inside out, produces far reaching results for the life, the work, and their unique partnership at the easel.

Colour

AN UNRULY LEXICON

4.1

Colour as a language is at once articulate and inscrutable. A similar basis on wavelength and tonal relationships makes for interesting comparisons with music, but there are no discrete scales or specific notes in colour that simplify the situation: colour in paint is in a constant state of flux. The tremendous possibilities make colour exciting, but not necessarily peaceful. As is the case with words, it is not a matter of knowing them all, but of being able to assemble the known ones in an inspired sequence. Tension often exists between colour for its own sake, and colour as an aspect of the painting process. Early in *The Interaction of Color* (1963), Albers states firmly that paint is too complex a tool for the study of colour. Conceptual colour and its physical vehicle can be dealt with as different things, but, problematically, they act together in paint. Wehlte suggests that the study of colour, like that of drawing, occur separately, and prior to work with paint. This allows the inevitable fascination with colour as a *Ding an sich* to develop on its own terms. After a period of experimental freedom, working with a basic selection of traditional pigments is more likely to provide a sense of direction, rather than limitation.

We are educated with an emphasis on linear thought, and this is mirrored in the flat color of much 20th century painting: this is as linear as colour gets. But, conceptually and in nature, colour is purely multidimensional. Planar colour can certainly be artistic, but does not exist in nature. Which makes this approach is teleologically complex: on the one hand, a search for the abstract basis of colour as a universal language, on the other, a rejection of the way colour occurs in the universe of our common experience. Convincing natural colour involves fine tuning value and temperature when mapping colour to form. Conversely, painters often develop a personal method of altering or condensing colour, a chromatic shorthand. Because colour is so related to feeling, it is most often used intuitively. In realism this works up to a point. In making art, this point is defined by both the period and the needs of the style. More realistic rendering is typically paired with more realistic colour, but this may not be necessary: a great deal of art has been made with strong shapes

and colour, period. But to use colour intuitively and creatively, it must first be harnessed to, or filtered through, the system established by the logic of light. Colour can be creative within this logic, but is unreliable, or at best, difficult to develop further, without it.

We can turn to the scientific study of colour for guidance, but this is not based on the physical behavior of pigments. Modern colour models are three-dimensional solids that take value and chroma into account, but do not address the degree of transparency, the chromatic complexity introduced by layering, or the all-important way colours – especially colours of different types, or contrasting temperatures – *interact*. Any model is also relatively abstract compared to the living quality of colour as paint. Colour knowledge can be helpful, but pigment awareness leads to colour instinct – an aesthetic feeling of colour in paint – which is exponentially more valuable in practice.

In realistic painting, colour is used to create a specific, consistent illusion of three-dimensions on a flat surface. This means arranging colours to appear to be in different planes – to advance or recede – through mapping colour to form by type. Colour has a structure whose study makes it easier to comprehend. A colour has a given *value* from light to dark. A colour has a given *temperature* from warm to cool. A colour has a given type: *tints* contain white, *shades* contain black, *tones* contain gray, and *hues* are made from colours alone. A colour has a given *chroma* from dull to vivid. A colour has a degree of *transparency* or *opacity*, in older painting this is often used to map colour from transparent dark values to opaque lighter values. Finally, in a painting, a colour can have a certain *level* in the order of the work: it is *over* some colours, but *under* others.

The endless potential of colour can be likened to the great number of words in a dictionary. But realism needs an arrangement of colour that is literally or figuratively accurate, and this is like choosing certain words to tell a given story. This means exploring colour within the light and shadow axis, as well as the air quality, of a specific place and time. The goal is to integrate chromatic variety with value, temperature, atmospheric recession, and midtone vivacity, so the painting reads as a unified whole.

Given the primal appeal of colour, the variety of pigments available now is a mixed blessing. Even as late as the 19th century, the number of permanent pigments beyond the earth colours was less than two dozen. Manufacturers gleefully put out a confusing number of colours; information about which to choose for the palette is contradictory. Paint nomenclature remains a disorganized *mélange* of actual, historical, and alluring names for which there are loose traditions but no rules. Under these circumstances, the harried painter is apt to substitute a variety of

scintillating pigments for the art of colour mixing. This can easily lead to paintings with Chromatic Anxiety Disorder: too many pigments without enough relationship between them. In this situation, we are not using, but being used by, colour. Relentless vivacity is wearying to the eye, just as relentless *fortissimo* is wearying to the ear. In nature, vivacity is selective, balanced by the neutrality of reflections and the unity provided by the atmospheric envelope. Finely tuned colour dynamics can be an important aspect of the painting as a work of art.

To create harmony, or the sense of a specific place and time, a limited palette is an asset. This sets up a natural emphasis on colour mixing technique, and the balanced colour relationships found in nature. An emphasis on unique colour from the tube tends to put the cart before the horse. Prosaic colour on the palette does not mean prosaic colour on the painting itself, because *the perception of any colour is always determined by its context*. We think of cadmium red light as a certain colour, but it appears different in each case if it is surrounded by blue, orange, white, or gray. This introduces an important paradox. On the one hand, cadmium red light *does exist* as a specific bright red-orange hue, but on the other hand, *no colour is absolute*, either in a painting, or in life. The actual chroma of a colour may be less, or more, than its perceived chroma, according to the colours it is reacting with. And in painting colours are constantly reacting with one another, this is what they do. As such, colours are tuned to create more or less perceived chroma. This highlights the importance of mixing technique for determining the context of a given colour. Creating a convincing illusion of light and space is a matter of mixing colour within the key of a given light-shadow axis. Because colour is so sensitive to context, mixing technique is the most effective tool for creating unique colour, allowing the creation of a unique set of contexts or relationships. This can be carried to the point where value and temperature are tuned enough to emulate light, and the sense of a specific place and time. Without using contrasting temperatures to establish the identity of colour in context, a tendency to substitute chroma and energy for accuracy occurs. This approach typically involves sincerity and heroics, but is not consistent because it ignores the logic of light as the immutable foundation of colour relationships. Lively execution is often desirable, but does not alter the physics of the universe. *Alla prima* techniques featuring spontaneous or reactive mixing emphasize a strictly limited palette for precisely this reason. Mixing colour has many levels; a limited palette facilitates finding evolved ones because these exist *within* the sphere defined by the axes of red, yellow, and blue. To make convincing colour, it is important to both *see* it, and *envision* it. A method of sequencing the

transition from colour we *observe*, to colour we *mix*, provides the *organization* that enables *inspiration* to be effectively transcribed. Without this animating tension, we are either copying, or guessing.

The one hundred and forty-seven tubes on display at the store give the impression that all this choice is crucial. But this is not true. The painter only needs to be concerned conceptually with the primaries: red, yellow, and blue. Each primary comes in two types: warm and cool. In the daylight palette, in addition to white and possibly black, there are six basic positions to consider: warm and cool versions of each primary.

These positions don't all have to be filled: a painting can be made with a triad of three primaries and white. Approaching colour by type (see *The Predimensional Palette*, section 7.15.4) teaches how to mix, and map, colour resourcefully, a basic tenet of older practice. A palette based on warm and cool primaries can be adjusted in many creative ways based on the relationships between the pigments chosen. Many older paintings were made with a limited palette to concentrate on the advanced depiction of value and temperature that establishes a given visual-emotional mood. As such, when constructing a light oriented palette, it is important to first chose what is necessary, not what feels new or provocative. Observing the progress of successful colourists such as Bonnard or Matisse, it is clear that more adventurous colour comes after learning to depict light and form. Painting light convincingly is not enhanced by colour variety, nor by colour identity, but by the accuracy and harmony of colour relationship within the value structure. These must be finely tuned to feel natural and are far easier to access with fewer colours and mixing based on value and temperature – the logic of light – than with more colours and mixing based on guesswork. As with any practice, guesswork develops over time, but guesswork is unnecessary, and tends to bind colour to a reliable but repetitive formula. As a way of simplifying matters, colour mixing is often subjected to rules, such as “never mix more than three colours together.” While this type of guideline is functional up to a point, it is more useful to say that mixing more than three colours together can achieve great subtlety, but the value and temperature shifts of the colour key in question need to be well tuned in order to keep the adjacent colours in the same key. Like training wheels on a bicycle, guidelines can be helpful for learning, but eventually get in the way of the potential of the vehicle. The precision of realistic colour is such that a system for organizing value and temperature shifts is more efficient in practice. Oil painters did this for centuries, and there are specific patterns, and accepted conventions, from which to learn the art of dimensional mapping. In Western art history, the coordination of value and temperature to create the illusion of space is at

first relatively formulaic, but becomes more subtle and creative, over time. The varieties of 20th century colourist realism all use different iterations of this principle. The eye accepts tremendous license from colour as long as the basic logic of the light-shadow axis is consistent, as it is in nature.

Colours clearly have meaning, but these meanings are hard to pin down. Is that an angry, or a joyous red? A sad or hopeful blue? A cringing or affirmative yellow? Colours have sometimes had a specific symbology in a given culture, yet this has often altered over time. How is meaning changed by shape or context, when many colours are arranged together? Early Venetian painting has a specific chromatic feeling, a certain way of implementing colour within line, yet an adequate exploration of even this small selection of art history would constitute a book in its own right. But, both as viewers and as practitioners, we do not actually need this. The primary impetus of colour is its existence as a language, but in a realm beyond words; the way it simply *acts* on consciousness, and acts differently from one individual to the next. And, though we are unified in our reaction to colour, these reactions are necessarily diverse.

The complexity of the relationship between colour, feeling, and meaning makes colour selection largely intuitive. This evolves over time; a colour may feel predictable, then feel crucial, or vice-versa. Shifts here are often unconscious. Is the palette too bright or dull? Discovering the current “right” colour or colour combination is a relief: the appropriate emotional key has been discovered again.

Conversely, certain colours may feel intrinsically wrong. In her diaries, Virginia Woolf recounts Roger Fry's sudden pronouncement one day in southern France that yellow-green is not an artistic colour, and the ensuing arch debate with her sister, the painter Vanessa Bell. Because all colours are, in the largest sense, created equal, exploring areas of colour which have been unconsciously edited out, or actively dismissed, can be intriguing. Are one's inclinations highly refined, or prejudices in disguise? Awareness of areas of colour blindness can be helpful in solving a painting. A given colour may not be seen, but this doesn't mean it isn't there: the chromatic frame of reference of a time and place is often difficult to actually see when existing within it.

The intensity of our reaction to colour is modelled on the evolved way colour is used in nature. Analogously, older paintings often exhibit great sensitivity and finesse in the way colour dynamics direct the eye. Yet, just as painting is more than drawing, it is more than colour. The power of colour is always exercised within the logic of light. Harnessing colour to the system of nature allows value and temperature relationships to be fine tuned creatively.

Mediums & Varnishes

SECRECY, PROPORTION, AND EVOLUTION

6.1

Commercial paint offers convenience but relative uniformity, making the *presto chango* potential of the medium often of great interest. Beginning in the late 18th century, painters occasionally concentrated on short term results using complex materials. This means the medium is an area where a great deal has gone wrong: one of Turner's paintings famously cracked within a week of leaving the studio. The 19th century contained many proprietary formulas such as Roberson's Medium, and the tradition of trade secrets continues. For 19th and 20th century texts a separate medium component is given, but the concept does not exist in De Mayerne. In entry 195, containing one of several palette illustrations, De Mayerne indicates a large blank space where the colours are mixed with *the oil*: the simplest system possible. In a letter written early in the 19th century, Constable warns against period “nostrums” in favor of linseed oil alone. Still, later in his career, Constable made use of the sequestering triad of egg, resin, and wax. Thus, even for a painter aware of the value of simplicity, the technique evolved due to the nature of oil as a medium.

Literary detective work is often used to establish the pedigree of a material. The detective work may be sincere and painstaking, but the territory itself is quicksand. The amount of information actually written by working painters is small, and has been gone over assiduously. While scholarship has identified the occasional “impossible” recipe – *on Michaelmas eve, procure twelve scales of a yearling dragon, lute well in a new glazed pipkin*, etcetera – there are also numerous improbable recipes, especially for varnish, clearly not sourced from practice. This occurred because books made up of various craft secrets were a growth industry for centuries, often attracting “authors” who were simply collators and copyists. In this case, the identification of specific materials across centuries is sometimes obscure, and all-important details of procedure virtually non-existent. The secrecy of guilds and working painters means that the evidence presented in these cases is at most equivocal. Even with a reliable source such as De Mayerne, a question exists about how much the mettlesome – and perhaps meddling – doctor was actually told.

Within the craft, half the story is as effective as no story at all, and far more polite. Rubens, for example, does not mention egg white to De Mayerne, a material increasingly thought to be part of his technique.

The consistent conservatism of older practice established by the NGTB research is logical for the artisan with a reputation to establish and protect. The degree of accomplishment in this work, and its hallowing over time, make it easy to forget that painting was most often a means to economic security in an aristocratic milieu with exacting expectations about the objects that represented it.

Medium *proportions* offer important guidelines. Amounts of strong ingredients are prone to expansion in the studio. But this is not a situation in which the strongest sword is forged with the greatest heat. Accurate measurement and consistent medium-to-paint proportions help medium and process be reliable and replicable. By excluding solvent, denser and richer mediums can be used in small amounts. Note how, in the following examples, the proportions are altered when adding the medium to the paint at a specific ratio.

Medium One	1:2 Medium to Paint
Wax – 15%	Wax – 5%
Resin – 10%	Resin 3.3%
Chalk – 30%	Chalk – 10%
Thicker Oil Mix – 45%	Thicker Oil Mix – 15%

Medium Two	1:3 Medium to Paint
Wax – 16%	Wax – 4%
Resin – 12%	Resin – 3%
Chalk – 32%	Chalk – 8%
Thicker Oil Mix – 40%	Thicker Oil Mix – 10%

MEDIUM TYPES

6.1.1

There are six basic medium types, which can also be mixed to produce mediums with a more balanced or finely tuned behavior.

Oil: The primary instance of the medium is the oil in the paint. Paint was originally handmade with oil that was cold-pressed, and hand-refined.

The oil was also probably *aged*, *preheated* or *thickened* to an extent in many cases. Paint handmade with pigment and this type of oil is markedly different than the commercial paint of today, whose rheology is usually adjusted with aluminum hydroxide, aluminum stearate and castor wax. Research is advised, some smaller companies are returning to the greater reliability of simple formulations.

Paint made with hand-refined oil allows control of both the consistency and the level of gloss of the paint. A further medium beyond oil with possibly a little beeswax or a variety of calcium carbonate on the palette is not needed. By beginning and ending with the highest quality oil, this system is arguably similar to what is often the 17th century approach. This does not mean that resins are best eliminated, but if they are implemented with an understanding the potential of the oil, they are more likely to be used wisely.

For use in a separate medium, oil can be thickened three ways. The behaviors of these are compared in *Oil Mediums*, section 6.2.

Auto-Oxidation: These are oils thickened by exposure to air. They are the most adhesive or resinous group, especially made with SRO linseed oil.

Heat Polymerization: These oils thicken in response to high heat. They flow and level for smooth surface styles, making long, sinuous lines easily.

Oxidation-Saponification: These oils thicken in the presence of air and a metallic salt, usually lead. They have a gelatinous or syrupy quality that lends itself to elegantly condensed form.

A technical article often reports the medium as “oil.” The resourcefulness of older painters means that this can in fact be *many* different things, the majority of which are not discussed in any 20th century text. Note: combining heat polymerization and oxidation-saponification is not recommended, see *Leaded Oils*, section 6.2.4.

Putty: Another approach involves altering the paint's behavior using the putty medium derived from research into the methods of Rembrandt and Velásquez. These painters sometimes modified the paint with ground chalk or calcite, respectively; ground silica is also recorded for Venetian painting. Putty mediums can be made with a variety of ingredients, aid stability, and create textures from broken to smooth. See section 6.3.

Egg Emulsion: A third type of medium derives from the interaction of oil paint with the older egg tempera medium, incorporating a small quantity

of egg – either whole, the white, or the yolk – into the paint. Beaten egg white transformed into glair was used as a medium in medieval illuminated manuscripts. Small amounts incorporated into the medium give a thixotropic paint with resistance to blending and charismatic handling. The yolk is subtle compared to the white, giving a more matte look, finer discretion and more detailed handling, but is also an arresting agent, and keeps the colour brighter. While egg yolk ages inflexibly, and is safest on panels, the amount needed to make a difference is quite small, between two and three percent by volume. This group also includes the family of egg emulsion mediums. These mediums tend to lower surface gloss and brighten chroma. They feature the permanent, quick setting and drying, character of egg yolk, produce semi-blendable paint in a wide range of behaviors, and are compatible with the putty family. Egg emulsions are also for panels only. See section 6.9.1.

Other Emulsions: A fourth medium type is an emulsion made using a thickener such as starch, methyl cellulose, or gum arabic as the aqueous element. These additions can be used in greater amounts to make water phase tempera on panels, or, with less water and in smaller amounts, as an oil phase emulsion to modify oil paint. Oil phase emulsions have density with pressure sensitivity and add an element of *smush* – the mashed potato effect – to the paint's rheology. See section 6.9.

Resin: A fifth type of medium makes use of resins from trees. There are many types of resin with different optical and working characteristics. Resins can be dissolved in oil via *heat*, or dissolved in *solvent*, making two basic groups. Hard resins such as amber must be dissolved by heat, making oil varnishes. Soft resins such as damar or the balsams can be dissolved with solvent to make spirit varnishes, but can also be heated into the oil. There are also resins, such as sandarac or Manila copal, that are typically dissolved with heat but can be dissolved in a strong solvent such as spike lavender. These materials offer damar alternatives, see section 6.6.2. The NGTB research has shown that “small amounts” of resin, predominantly softer “pine resins,” were used consistently, but not globally, in pre-19th century painting practice. Resins add luminosity, and help protect against drying down or sinking-in: the basis of their recurrence as “the lost secret,” see section 6.1.6, below. The reliable way to incorporate resin is in a “small amount” to add brightness and alter paint handling, *not* as a global solution for increased saturation or bravura handling. In larger amounts, brittleness and darkening may not occur quickly, but do occur. Small additions of beeswax may mitigate this by protecting the paint film somewhat from humidity and oxidation. See sections 6.6 and 6.7.

Beeswax: A sixth medium type uses beeswax in the paint. Wax is sequestering and the only permanently flexible material in painting, but beyond very small amounts, is not used alone because this makes a soft paint film. It is, however, highly useful with other medium ingredients, as, for example, in the various combinations of pre-polymerized oil, damar, and beeswax. See *Beeswax*, section 6.10, and its formulas.

Mixed: The behavior of a mixed medium is typically complex in terms of the working characteristics of the paint. Balancing the behavior of disparate ingredients allows these mediums to do unlikely things, but this too is complex. If, for example, a medium is made from three ingredients – oil, chalk, and egg white – it appears that there are three axes of behavior to consider. But the character of the oil provides an important fourth axis. Refining procedure, age, and type of polymerization all influence the paint's behavior. Auto-oxidized hand-refined oil is especially influential here compared to commercial heat-polymerized oils such as stand oil or burnt plate oil.

MEDIUM CHARACTERISTICS

6.1.2

The medium's job is to enable natural painting in the chosen style. The basic issue is how to balance the paint's movement with how much it stays put. Is loose paint better, with plenty of *glide*, or should it have more hold, or *grab*? Grab can be increased until the paint no longer moves freely and the technique becomes broken. Increased grab also introduces more potential for texture. Is this interesting, or frustrating? Should layering be possible wet-in-wet, a working balance of grab and glide? Or is the elegant blending of a single layer more important? Can grab and glide be engineered for both possibilities in one system?

At first, answers to these questions are not made, but just happen. Over time, answers develop within a pattern. At one extreme the paint is facile, mobile, and ever-blendable in one layer. This is a natural function of commercial paint, or a medium of thin oil on a non-absorbent ground. At the other extreme, the paint sets firmly in discrete pieces, the technique is incremental, the surface is broken. This is a function of paint handmade with aged oil, or a medium with thicker hand-refined oil, an arresting agent, an absorbent ground, or combinations thereof. Between these poles *many* possibilities exist. Any medium has a *zone of functional viscosity*, this changes depending on the ground and the brushes. It is also a function of temperature, colder temperatures typically making mediums denser. Formulating a medium is about adjusting its physical characteristics. These include the proportion of grab and glide the medium gives the paint, and

the influence of the physical depth – thickness or thinness – of the paint. These may be involved with the elements of pressure and timing. Wet-in-wet, pressure generally decreases as the depth of paint on the painting increases, a case where firm pressure with a clean brush can result in blending, ploughing, or removal. With some medium types, the brushstrokes remain *discrete* if placed, but can be *blended*, allowing a variety of wet-in-wet options. Open time can be extended by using materials that dry slowly. Using solvent or materials that set progressively, open time becomes another form of pressure. Finally, the medium can enhance or diminish saturation. There are many options. These are best explored slowly, adjusting the behavior of the system incrementally, and writing changes down for future reference.

Grab: There are three types of grab: one related to stickiness, one to thixotropy, and one to density. Resins increase grab; soft resin spirit varnishes in a sticky way, hard resin oil varnishes in a thixotropic way. Auto-oxidized oils such as sun oil and studio oil increase grab with moderate stickiness. Chalk, calcite or marble dust, and fine silica (quartz, flint, cristobalite) increase grab through thickening. Wax increases grab in a cooler studio. Small additions of egg increase grab, although not as much as hard resin varnish. Grab contributes to the ability of the brushstroke to remain specific, hold a firm edge and makes layering and broken surfaces possible. Grab can be increased globally by using an absorbent ground. Too much grab can mean difficulty in blending, even in application.

Glide: Thin or heat-bodied oils increase glide, as does solvent briefly. A fumed silica gel increases glide and maintains a thicker paint film. For a dry ingredient, bone ash has the unique effect of making a medium more slippery or mobile. Of the thicker oils, unsun oil increases glide, and the smallest addition of burnt plate oil increases glide with thickening. These oils are leveling, to the point of melting in larger amounts. Glide with studio or sun oil is stickier, more localized, although aged oil has more glide regardless of density. Glide is influenced by many physical factors: a putty made with calcite has more glide than a putty made with chalk unless the oil involved is preheated or aged. wax increases glide in a warmer studio. Soft brushes require more glide than firmer ones. Glide can be enhanced globally by a non-absorbent ground. Glide helps blending and facility, but too much glide can lead to lack of cohesion.

Rheology and Thixotropy: The rheology of the paint is the sum total of its physical working characteristics, how it flows from the brush. Paint can be thick or thin, mobile or adhesive, long (elastic) or short (buttery!),

leveling and blendable, or quick setting and tending towards impasto. These qualities typically moderate one another when ingredients are combined, rather than canceling one another out, and unusually balanced combinations are possible. The rheology of handmade paint is more sensitive to traditional modifiers than that of commercial paint. A paint is called thixotropic if it is gelatinous but mobile, and sets again after being moved. Scientifically, the fluid exhibits increased viscosity at rest, but decreased viscosity when subjected to shear stress. This means thixotropic paint is adhesive, with elasticity in motion, and forms low relief. This condition requires a specific combination of grab, glide, and viscosity, and is typically achieved by a physical, rather than chemical, reaction between the materials involved. Paint handmade with hand-refined linseed oil is inherently somewhat thixotropic, more so with aged oil. A small addition of hard resin varnish, elastic oil, traditional burnt plate oil, thicker hand-refined studio or sun oil, or ecks makes even commercial paint thixotropic, as does the silica gel, the use of a chalk putty medium, a small addition of egg yolk, or many emulsion mediums. The oils and varnishes are more elastic, the emulsion approach tend to be shorter or more tight. These characteristics can be balanced various ways in the medium itself.

Depth: The behavior of the system can change significantly based on the amount of paint that has been put on wet-in-wet. Once the ground has been covered, more or less movement may become progressively possible with the same paint depending on how much the paint beneath it has set. Does paint go *into* paint, *over* paint, or can it do both? Experience with a specific system allows finely tuned layering situations as the painting progresses based on how pressure is used relative to depth. A useful paint viscosity for *alla prima* or completion is one that is layerable with soft brushes, but can also be moved or ploughed with bristle brushes. This develops confident handling as the work can be adjusted by adding or subtracting paint.

Timing and Set: Mediums can be formulated to rely on timing for various painterly effects. Operations proceed according to a schedule as the medium sets progressively. Timing becomes focal when using a quick setting soft resin with solvent as a medium or couch, or when involved in an extended *alla prima* system where the painting is finished in stages over several days. Timing is also related to depth: how much paint is put on, and how fast. The same system can produce different results when executed at different *speeds*. If working from loose to tight with a medium that becomes sticky, it is possible for the paint to set, or become tight, too quickly. Increasing the application speed results in a looser feeling again.

Conversely, if slower application works better, the medium can be adjusted to increase its open time. Alla prima work is more likely to involve timing than work in layers, although the final layer in an indirect painting can often benefit from a medium which forces the issue somewhat, enhancing the final sense of liveliness. Small adjustments to ingredient proportions can create procedures with a surprising synergy of opposite qualities.

Pressure: With certain mediums, the relative pressure of the brush becomes an important factor in the look of the painting. Pressure can be used at different levels to *apply* more paint, *blend* existing paint, or *plough* into previous paint. Pressure is an aspect of any additive system, but becomes focal with more thixotropic materials. Pressure is also related to brush type: softer brushes have more range of pressure than firmer ones. A soft brush ploughs smoothly, a bristle brush ploughs bluntly, with more potential for removal, or for flipping obscured colour back on top. Eastlake notes this method of weaving layers of paint together in relation to Rembrandt's later technique.

Brushes and Scale: The medium needs to be formulated for the brushes. A viscous medium may quickly destroy fine brushes. Conversely, it is difficult to apply a thin, flowing medium with coarse brushes. Yet, there are also times when a slight mismatch between paint and brushes can produce interesting results. The viscosity of the paint can be adjusted to be mobile with bristle brushes, but tight or layering with softer brushes, allowing elements of both types of handling in one layer. By facilitating a variety of manipulations, this offers flexibility with a single, consistency of paint. The scale of the work is also a factor. A dense medium may feel lugubrious on a small painting, but unify a large one. A quick setting medium may make appropriate detail on a small painting, but create a sense of constraint on a large one.

Saturation: Specific medium ingredients either enhance or diminish saturation. Unsaturated paint has a higher value structure, more reflective brilliance, and more emphasis on the fact of the pigment as in fresco, or tempera. Saturated paint has a deeper value structure and the potential for optical depth: the original appeal of oil as a medium. Generally speaking, paintings made with opaque or flat paint look better with low saturation, allowing the viewer to look *at* them. Conversely, paintings made with transparent pigments and *optical colour separation* (section 7.14) look better with high saturation, encouraging the viewer to look *into* them.

Any pre-polymerized oil, any resin varnish, and an addition of egg white all enhance saturation. It is wisest to reserve resin for use in the

smallest amount for sequestering. Any form of stone dust, or an addition of egg yolk, starch gel, or beeswax, reduce saturation, needing increased thick oil to dry with a gloss. A *conditioning medium* (section 6.8) dials in the working behavior and the surface quality desired before the work begins. This can be as simple as mixing a small amount of pre-polymerized oil into the paint to give more density, movement, and saturation. An alla prima medium can be quite saturating. But for indirect painting, it is important to reserve saturation for later layers, and follow the *fat over lean principle* (section 7.2). When working in layers, the medium must be progressively richer or fatter to maintain saturation as the layers proceed. Because this cannot go on indefinitely without producing paint that looks unctuous, or is difficult to control, this is about adding small increments of thick oil as the layers proceed. A series of saturated layers can be made on panel without issue using a conditioning medium made with thicker oil if the layers are kept rigorously thin and the preceding layer is *ground back* (section 6.11) to remove the shine prior to the next layer. Dependence on resin to make fine saturated layers is best avoided as these layers are less flexible and prone to long term darkening and delamination. A traditional glossy surface is most reliably achieved by a saturated final layer. There is then no potential that varnish may alter the value scale, and the varnish will be *on*, not *in*, the paint.