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HISTORY OF EGG TEMPERA PAINTING

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Egg tempera dates back to antiquity – although exactly how far back is unclear. Ancient Egyptian artists ‘tempered’ pigments with a variety of binders: gum Arabic, animal glue, and casein. Museums and conservators refer to these water-based paints generically as temperas, which makes it difficult to know what specific binder was used. It’s tempting to presume ancient Egyptians worked in egg tempera, but I don’t yet know of a definitive example. Many other civilizations, from the Mediterranean basin to the Far East, probably also used egg tempera; for example, chemical analysis of the 6th c. AD Giant Buddhas of Bamiyan, Afghanistan, revealed egg and milk proteins present in the paint, indicating the use of egg tempera and casein.¹



Severan Tondo. Egg tempera, 2nd century AD, 12,” Staatliche Museum, Berlin

Ancient Greek and Roman paintings survived primarily as wall murals. There are very few extant panel paintings from the classical period of Greek art, and relatively few from the Roman era. The most numerous and best-preserved examples are funerary portraits from the 1st c. BC to 4th c. AD (Roman era), painted by Greco-Roman artists living in Egypt; the dry climate contributed to the portraits’ preservation. The paintings are known as the Fayum mummy portraits, named after the valley in which many of the images were found. Most were executed in encaustic, a wax-based paint. However, several examples exhibit the linear brushwork of egg tempera and, when analyzed, some show fatty acid patterns typical of an egg binder. I can’t say for sure what is the earliest known egg tempera painting, as not all ancient paintings have been properly analyzed or are accessible to the public. The two earliest examples I found are the Severan Tondo, listed as egg tempera on the Staatliche Museum website; and a 4th c. AD mummy portrait in the Petrie Museum, London, reliably identified as egg tempera through scientific analysis.

Along with analysis, knowledge of Greek and Roman painting practices is informed by ancient texts, primarily from three figures: Greek philosopher Theophrastus de Lapidibus (4th c. BC); the Roman architect Vitruvius (1st c. BC); and Roman naturalist Pliny (1st c. AD). These authors mostly discuss pigments (Theophrastus wrote the oldest known treatise on rocks and minerals) but they also occasionally reference binders. Vitruvius mentions fresco, encaustic, and a vaguely described easel painting presumed to be egg tempera or egg oil emulsion. Pliny specifically states that Romans were familiar with egg yolk in paint.

The Medieval era saw the rise of Christianity as a dominant part of European life, creating a need for murals, altarpieces and icons. Fresco painting provided for wall decoration but portable panel paintings were needed as well. Egg tempera was suited to this and became the primary medium of Byzantine and Early Christian icon painters. Egg tempera also was used, to some extent, in illuminated manuscripts (along with gum Arabic [watercolor], egg white [glair], and animal glue). Throughout the Middle Ages egg tempera was in wide use.

By the early 1400s and the advent of the Renaissance, egg tempera had emerged as the principal form of easel painting in Italy as well as other parts of Europe. (Oil paints were also in use, primarily in Northern Europe, but not yet widespread). The materials and working methods of egg tempera at this time are described by Cennino Cennini (1370 – c. 1440) an Italian painter whose training came in a direct line from the studio of the renown late Gothic painter, Giotto (1266/7-1337). Cennini, as far as is known, was the first to write extensively about egg tempera. His treatise *Libro dell’Arte* (The Book of Art) may sound archaic at times to modern readers (he speaks of a ‘pipkin’ of water and bean size amounts of color) but it is nevertheless an informative text. It remains in print and is commonly read by contemporary tempera artists.

¹ See Lluveras-Tenorio, A., Vinciguerra, R., Galano, E., Blaensdorf, C., Emmerling, E., Perla Colombini, M., Birolo, L., & Bonaduce, I. (2017). *GC/MS and proteomics to unravel the painting history of the lost Giant Buddhas of Bamiyan*. PLoS ONE, 12(4). The website www.deepdyve.com sells access to scholarly papers from a wide range of publishers. Enter ‘egg tempera’ into the search engine and hundreds of articles come up for perusal (including the reference to the Bamiyan Buddhas). Much as I’d like to understand egg tempera’s history in all its complexity, for now I’m limited (by time and resources) to the introduction given in this chapter. I’m hopeful one day a scholar will take a deep dive into the medium’s rich and likely very long history.

It was during the early to mid-Renaissance (1400-1450) that egg tempera achieved what's considered its greatest development. Italian artists were organized into guilds that taught a systematic, deliberate method. This exacting technique, combined with great skill and careful craftsmanship, produced a masterful body of paintings, as evidenced by many extant Renaissance works. Paintings by Fra Angelico, Mantegna, Ghirlandaio, Botticelli and other 15th c. Italian masters are examples of this technical and artistic virtuosity.

Northern European painters were not as immersed in an egg tempera tradition, and their guilds not as beholden to a particular school or method. Northern Europe also had a history of an early form of oil painting behind it. Thus, in the north more experimental materials and methods began to develop. In his book on the lives of famous painters, the 16th c. historian Giorgio Vasari credits Flemish painter Jan Van Eyck with single-handedly creating oil painting. In actuality the use of drying oils in easel painting can be traced back to a long and gradual development. Oils were used in decorative painting and as protective coatings throughout the middle ages, probably earlier. These early oils were generally dark, thick, and not well suited to easel painting. By the 1400s texts began to appear describing how to refine drying oils to make them lighter in tone, faster drying, with better working properties. A commercial renaissance took place throughout Europe, and with it came the distribution of these new materials, methods, and oil paintings. By the late 1300s to early 1400s, northern European painters were working partly or entirely in oil.²



Madonna of Humility.
Fra Angelico, egg
tempera on panel, 40
x 23," c. 1419

Slow drying oil paints blend more readily than fast drying, linear tempera. This makes it easier to paint smooth transitions and three-dimensional forms. Because of its higher refractive index, oil is capable of darker shadows than can be achieved in tempera. Whereas tempera must be applied in thin layers, oil can be applied thick and impasto, which contributes opacity to lights and highlights and makes them 'pop.' For all these reasons, oil is better suited to rendering natural light effects and more materially 'real' imagery. Greater realism suited the less spiritually oriented, more scientific and humanistic culture of the Renaissance.

Northern artwork purchased by Italian collectors began to travel southward. Italian painters were deeply impressed by the new work. They either emulated the aesthetics of the north, and/or adopted the new oil medium and methods. Artists of the middle to late Renaissance painted in many different ways:

- Some artists continued to work in pure egg tempera. Fra Angelico eventually adopted northern aesthetics (less pure color, more natural light effects) but his medium remained traditional egg tempera (and fresco).
- Other artists underpainted in egg tempera, then finished with oil. An incomplete work by Michelangelo, *The Manchester Madonna*, 1497, shows a green earth underpainting done in egg tempera. It's not unreasonable to think Michelangelo would have finished the work in oil given that it was the emerging medium, facilitated the rendering of form evident in his work, and other Michelangelo paintings from this period are in oil.
- Some Renaissance paintings selectively incorporate both mediums. Egg tempera was used for parts of an image with light values and/or cool color temperature, such as whites or blues (since tempera neither darkens nor yellows with age). Areas of dark value, such as blacks, were painted in oil (because darks in oils are more saturated and deeper than in tempera). The Pollaiuolo brother's *Three Saints*, 1468, exemplifies this approach.
- Some painters mixed egg yolk and oil together to create an egg and oil emulsion paint known as tempera grassa. Several Lorenzo Lotto paintings from the early 1500s that were analyzed in 2011 are painted in tempera grassa. Botticelli's *Primavera*, 1482, is believed to be painted partly in tempera grassa.³
- Still other artists began as tempera painters but then converted fully to oil. Piero della Francesca started as an egg tempera and fresco painter; but once introduced to oil painting, he adopted it as his primary medium.

² A 2016 PhD dissertation by Dr. Kristin deGhetaldi provides an in-depth look at the transition from egg tempera to oil: *From Egg to Oil: The Early Development of Oil Painting During the Quattrocento*. University of Delaware.

³ It's still uncertain the extent to which tempera grassa was used in the 15th-16th centuries. No contemporary descriptions are known and it is a difficult medium to analyze, for reasons outlined in National Gallery Technical Bulletin, Vol. 26, 2005. However, a 2012 study affirms that the 15th c. artist Lorenzo Lotto "selected a tempera grassa technique throughout most of his creative life, although not continuously." See *An analytical investigation of the painting technique of Italian Renaissance master Lorenzo Lotto*, Journal of Cultural Heritage, Elsevier, July-September 2012. Another good discussion of this period, with references to tempera grassa, is Paula Nuttall's *From Flanders to Florence, The Impact of Netherlandish Painting, 1400-1500*. Yale University Press, 2004. For a recipe of tempera grassa, see the appendix of that name.

- Artists also switched among various mediums. Botticelli's oeuvre includes many pure egg tempera paintings, others possibly in tempera grassa, some in oil. I've seen some Botticelli paintings described as "tempera and oil" – which doesn't clarify if a work is tempera grassa, oil over tempera, or areas in tempera alongside oil.⁴

THE TRANSITION FROM EGG TEMPERA TO OIL PAINT

The transition from tempera to oil in the 1400s is often explained as a sudden technical innovation. A common perception is that egg tempera, the only paint option for centuries, was a limited medium that constrained artistic expression - until suddenly, in the 15th century, oil paints were invented (single-handedly by Jan Van Eyck, according to the 16th c. historian Vasari). As soon as artists switched to the more malleable medium of oil, paintings became increasingly realistic and more sophisticated. In short: a new paint changed art, and for the better.

This view of the transition from tempera to oil is simplistic. Oil painting was *not* a sudden innovation. The use of oils can be traced back to a long, gradual development. The book *On Divers Arts* by Theophilus (c. 1070-1125) gives instructions for working in oil, and crudely refined oils were used for protective coatings and decorative work throughout the Middle Ages. Several 13th c., northern European paintings, such as the Westminster Retable, were rendered exclusively in oil with considerable skill. Oil glazes were applied over certain pigments and gilded areas of 14th century Italian temperas. Oil paint, in fact, had been around for centuries – it just wasn't widely used.

Cennino Cennini (1370 – c. 1440) said that the purpose of art was to paint other worlds, not this world. Tempera paint is water-based and thin. It has an incorporeal, ethereal quality. It's applied in a gradual, meditative way. It's difficult to render robustly three-dimensional form because darks aren't as saturated and deep as in oil, highlights can't be painted impasto, and smooth transitions are difficult to achieve. These so-called 'limitations' of tempera made it ideally suited to medieval thinking and imagery. One can imagine that oil paint may have felt uncomfortably viscous and overtly material to a 12th century painter!*

There was a pronounced shift in western thinking in the 15th century. People became less focused on 'the heavens' and increasingly interested in the physical world. As soon as the culture had the desire for greater realism in art, oil painting quickly developed into a sophisticated, well-understood medium. A mere one to two generations separate the Wilton Diptych c.1395, painted in egg tempera, and Van Eyck's oil masterpieces, such as the Arnolfini Portrait, 1434. From this perspective art wasn't changed by an innovation in paint. Instead, the culture evolved toward a different understanding of what is 'real' (physical matter versus spiritual dimensions). This evolving consciousness was reflected in art and led to a new medium and different type of painting. It was natural for 15th c. painters to be drawn to oil. Oil is a more material medium, slightly better than tempera at representing physical matter - and Renaissance artists were within, as well as creating, a culture increasingly interested in the natural, material world.**

It's perhaps telling to look at the preferred mediums of specific artists during this transitional period. Fra Angelico, a deeply devout man, stayed with water-based tempera and fresco painting. Botticelli was drawn to both humanism and intense religiosity, with subject matter that ranged from mythology to mysticism. He began as a tempera painter but later alternated between tempera, tempera grassa, and oil. Piero della Francesca, a renowned mathematician and forward thinker, switched from tempera to oil early on and never looked back.

* While many painters love the physicality of oils, there are some 20th c. artists with a 'medieval' feeling for paint. Iconographer Aidan Hart repeatedly notes that the "more sensual effect" of oil is unsuitable to icons. Andrew Wyeth (1917-2009) felt oil was greasy, wet and slimy; he didn't like its "slick manipulation" (as described by his biographer Richard Merryman). Wyeth said,

"Oil is hot and fiery, almost like a summer night, where tempera is a cool breeze, dry, crackling like winter branches blowing in the wind. I'm a dry person, really. I'm not a juicy painter. There's no fight in oil. It doesn't have the austere in it. The difference is like the difference between Beethoven and Bach."

Another contemporary egg tempera artist, Lora Arbrador (b. 1949), frankly states,

"For me watercolor is too wisby washy, wimpy. People love the lush buttery feel of oil paints but I find them greasy and gross. Egg Tempera is the perfect medium - an emulsion. It's junnussst right!"

** At the same time, equally quickly (and, I believe, not coincidentally) mathematical linear perspective, which creates convincing three-dimensional space, was codified; anatomical studies entered into artistic training; and more naturalistic light and shadow effects became the norm. For an interesting philosophical look at the changing consciousness of the 15th c., see the essay "The Harp and the Camera" by Owen Barfield. Barfield discusses linear perspective specifically.

⁴ Current technology can generally determine that both oil and egg proteins are present in a paint film, but can't distinguish in what order they were applied, and/or if they were combined into a single paint (nor can conservators always distinguish between original paint layers and later restorations, done in different mediums, that have seeped into underlying layers).

The 1400s were an innovative era in western art history, not yet fully understood in all its complexity (particularly the change from tempera to oil; when I studied Renaissance art history in the 1980s, egg tempera wasn't even mentioned). The National Gallery in London is doing research in this area and offers an excellent selection of books and technical bulletins (available on line as free downloads) on the subject. To view the museum's extensive collection of Renaissance paintings, visit the gallery's website.

The effects of oil were acclaimed in both north and south. By the advent of the 16th c. the materials and working methods of oil painting were sufficiently developed, understood, and available to be used to good effect, and oil quickly became the primary form of easel painting throughout Europe. Tempera fell out of fashion and, in just a few generations, went from a pinnacle of achievement to near obscurity; excepting icon paintings, it was an obsolete medium. A consequence of the prevalence of oil paint was the subsequent lack of knowledge of egg tempera (many historians didn't know of its existence) and the incorrect description (begun by Vasari and continuing to this day) of many Renaissance egg tempera paintings as oils. Confusion persists. I have seen Jan Van Eyck's *Giovanni Arnolfini and His Bride* in the National Gallery in London described in different texts as egg tempera, tempera with oil, and oil.⁵ To this day, leaf through an art history book or visit a museum and often you'll find the caption under a Renaissance painting describe it simply as a 'panel,' which tells you the support matter but not the type of paint. Rarely are paintings listed as egg tempera; at best, a work *may* be labeled 'tempera,' which doesn't specify what binder was used, only that the paint was water-based.⁶ Hopefully improvements in technical analysis will lead to better documentation of mediums, especially considering the aesthetic and technical differences between egg tempera and oil. In fact, considering the significant distinctions between the two mediums, it's surprising that there isn't more discussion of the revolutionary change that occurred in the 1400s as artists transitioned from tempera to oils.⁷



The Wilton Diptych. Unknown artist, egg tempera, 1395



Giovanni Arnolfini and His Bride. Jan Van Eyck, oil, 1434

Given the variety of mediums used during this period, how does one distinguish between an egg tempera painting, a work in oil, or some combination of the two? Most Renaissance art also contains overpainting and varnishes applied long after the work was originally created. Scientific testing currently is limited in what it can discern. A combination of careful technical and visual analysis is needed to determine what medium(s) were used, and what materials are original to a work of art versus added at a later date; even then, results may be imprecise. Additionally, many paintings have not been analyzed, and/or had the results of their analysis published, or published in a language known to a reader. Amidst this confusion, one can make the following generalizations:

- Panel paintings prior to 1400 are most likely pure egg tempera.
- Panel paintings from 1400-1500 may be pure egg tempera, or a combination of tempera and oil, or pure oil. The later in the 1400s the work was painted, the more likely it's oil (although not necessarily). More linear brushwork indicates egg tempera; more smoothly blended, atmospheric work indicates tempera grassa or oil.
- By the early 1500s nearly all panel paintings were executed in oil (with the exception of icons).

Although icon painters continued to work in egg tempera, the medium mostly lay dormant for the next three hundred years. Then, in the 19th c., the English fell in love with Italian culture. Numerous Brits took up residence in Florence and began to explore the city's archives. In 1844 an Englishwoman, Mary Merrifield, rediscovered, translated, and published Cennini's manuscript, *Il Libro dell'Arte*. A second, more accurate translation appeared in 1899 by Christiana J. Herringham. At the same time, in response to the increasing mechanization of the Industrial Revolution, the Arts

⁵ The book "Giotto to Durer," published by the National Gallery, London (where the Arnolfini Portrait resides) describes it as "oil, perhaps with some egg tempera, on oak." However, the website for the National Gallery lists the painting as "oil on oak."

⁶ The labeling of works of art in museums "is, and will likely remain, vague at best. The specifications regarding media are seldom ever derived from ACTUAL analytical results. In fact, I would say that less than 75% of the time is this...the case. Labels... are often just arbitrary assignments based on visual assessments made by a curator (and less commonly by a conservator)...It is often impossible... to make definitive conclusions regarding binding media based on visual assessment alone" Quotation by Dr. Kristin deGhetaldi, from MITRA website, <https://www.artcons.udel.edu/mitra/forums>, June 29, 2017.

⁷ For more on this period, see Dr. deGhetaldi's excellent PhD dissertation, *From Egg to Oil: The Early Development of Oil Painting During the Quattrocento*, University of Delaware.

and Crafts movement in Europe and North America encouraged painters to experiment with handmade paints and traditional working methods. Inspired by these events, five British artists formed the Society of Painters in Tempera in 1901. The society met, issued papers, and published articles to educate the public and raise awareness of egg tempera. Artist members painted in tempera and, beginning in 1905, held several exhibitions of their work. Efforts were made to re-identify many of the early Italian egg tempera masterpieces incorrectly labeled as oil.⁸

By the mid-1930s most of the original founders had dissipated and by World War II the society was inactive. However, the revival of egg tempera had begun. British artist and egg tempera proponent Maxwell Armfield lived in America from 1915-1922, exhibiting his work and writing about tempera while in the United States. In 1920 Daniel Thompson, a professor at Yale School of Fine Art, began teaching a course in egg tempera, creating a new generation of painters. A strong collection of early Italian art at the Yale art gallery augmented his course and further fueled interest. In 1936 Thompson published two books: his translation of Cennini's manuscript, and *The Practice of Tempera Painting*, Thompson's contemporary interpretation of the Renaissance working method. Both books remain in publication and popular among tempera painters.⁹



From the early to mid-20th century there was also a great deal of experimentation among artists and paint manufacturers, who invented new combinations of binders and additives. If a paint was water-based and achieved a matte finish, it was generally considered a 'tempera' paint, regardless if it contained egg. The German manufacturer Richard Wurm even made a tubed paint that was neither water-soluble nor contained a typical 'tempera' (i.e., emulsion) binder (it was made with palm oil and Japan wax, among other things) yet because it yielded a matte finish, he called it "temperafarbe," or tempera color. This period created much confusion regarding what the words 'tempera paint' actually mean, and what 20th c. artwork labeled as tempera (by an artist, gallery or museum) are in fact composed of. The probability is that many modern era 'tempera' paintings are not pure egg tempera, but rather made from another water-soluble binder, or mix of binders, along with potentially one or more unknown ingredients. It's a confusing period.¹⁰

Regardless, from the 1930s onward many notable American artists experimented with some sort of tempera paint: Thomas Hart Benton, Isabel Bishop, Reginald Marsh, Ben Shahn, and John Sloan, to name a few. The leading 20th c. practitioners of actual egg tempera include George Tooker, Paul Cadmus, Jared French, and Andrew Wyeth (who learned it from his brother-in-law, Peter Hurd). In 1973 a well-known egg tempera artist, Robert Vickrey, published a book on tempera painting entitled *New Techniques in Egg Tempera*. It discusses both traditional and nontraditional ways to work with egg tempera.

Interest in egg tempera continues to grow. In 1997 artists Michael Bergt and Lora Arbrador formed a new Society of Tempera Painters. They developed a website that offered information on the history, technique, and materials of tempera painting, as well as examples of contemporary tempera artists' works. The website had an interactive forum where people could ask questions and discuss topics on tempera.¹¹ The mission statement for the new organization was the same as that of the original society: "The improvement in the art of tempera painting by the interchange of the knowledge and experience of the members."

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⁸ See Sprague, Abbie N. "The British Tempera Revival: A Return to Craftsmanship." *The British Art Journal*, vol. 3, no. 3, 2002, pp. 66–74.

⁹ Thompson's translation of Cennini's book is available and affordably priced thanks to Dover Publications. There is also a new translation by Lara Broecke, published in 2015, that corrects hundreds of errors in Thompson's text and includes extensive notes. At the time of this writing the price for Broecke's translation is high, but well worth it for enthusiastic egg tempera and Cennini scholars.

¹⁰ The word 'tempera' has a long and convoluted history in the modern era, as examined in the books *Painting in Tempera c. 1900* and *Tempera Painting Between 1800 and 1950* (see bibliography). The term is so confusing, in fact, that the second book is a collection of papers delivered at a 2018 conference in Munich, the partial intent of which was to more clearly define the word tempera! Museum and conservation communities generally define 'tempera painting' as pigments bound in a water-soluble emulsion. This broad category may include nearly any water-based paint, whether the binder is egg, glair, oil and egg, casein, animal glue or gum Arabic (even though gum Arabic is not itself an emulsion, but rather an emulsifying agent). This lexical confusion is apparent in many artists' assumptions that anything labeled 'tempera' is specifically egg tempera, when often there is no yolk in the paint. It also explains why water-soluble poster paints for children, traditionally made with a gum or glue binder, are sometimes called 'tempera paints.'

¹¹ I was a board member of the Society of Tempera Painters for many years. Sadly, STP is now essentially defunct. Membership was always small, and with minimal participation and resources, it became too much time and effort for busy board members to sustain.