Resumo

A nossa abordagem estética, filosófica, psicológica e outras da história da arte começam no olhar – e apreciar – as cores da iluminura. No entanto, como será descrito neste artigo, as cores que hoje vemos nem sempre correspondem às aplicadas pelo artista. O ignorar destas alterações cromáticas pode induzir a sérios erros na interpretação da sua intenção original. A especulação histórico-artística deve ser, assim, precedida por uma avaliação sobre qual seria o aspecto original das cores. Uma observação mais cuidadosa pode evidenciar perda ou alterações de cor. Estas podem ser bastante dramáticas em amarelos, nomeadamente nos corantes orgânicos utilizados no passado, em manuscritos. Este artigo focar-se-á pois no caso destes amarelos desaparecidos. A investigação em História e técnicas de produção artística oferece três formas de avaliar qual o aspecto das cores originais: (i) iconografia e harmonia visual das cores, (ii) análises científicas de tintas originais, (iii) livros de receitas de artistas medievais. Conclui-se que, a consciência destas alterações cromáticas bem como da aplicação dos métodos de análise aos materiais como ferramenta interpretativa, enriquecerá o olhar do historiador da arte.

palavras-chave
ILUMINURAS ALTERAÇÃO CROMÁTICA PERDA DE COR HISTÓRIA E TÉCNICAS DE PRODUÇÃO ARTÍSTICA FONTES PARA OS MATERIAIS E TÉCNICAS DA ARTE

Abstract

All our aesthetics, philosophy, psychology, and other art history starts from looking at — and enjoying — the colours of manuscripts. However this paper demonstrates that colours observed today are not always those applied by the artist. Ignorance of this alteration results in serious errors of interpretation. Art-historical speculation must be preceded by the evaluation of original appearances. Close visual examination reveals areas of fading or discolouration. This is severe for yellows, especially for organic colorants commonly used in manuscripts. This paper therefore concentrates on the example of lost manuscript yellows. ‘Technical art history’ offers three ways to evaluate the original appearance of manuscript colours: (i) iconography and visual harmony of colour, (ii) technical analysis of surviving paint, (iii) mediaeval artists’ recipe books. It is concluded that art historians can benefit from an awareness of possible colour alterations, and from an awareness of the application of scientific analysis as an interpretive tool.

key-words
MANUSCRIPT ILLUMINATION DISCOLORATION FADING TECHNICAL ART HISTORY ART TECHNOLOGICAL SOURCE RESEARCH
COLOURS VERSUS COLORANTS IN ART HISTORY: EVALUATING LOST MANUSCRIPT YELLOWS

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Introduction

All our aesthetics, philosophy, psychology, and other art history starts from looking at – and enjoying – the colours of manuscripts. It is perhaps less obvious that all scientific (chemical and physical) analysis also starts from the observation of the colours: analysis depends on the observation that there is something distinctive present that requires analysis. However – as this paper will demonstrate – the colour observed today on an artwork such as a manuscript is not always the original colour as chosen, composed, and applied by the artist. Ignorance of this alteration results in serious errors of interpretation. Interpretations of the iconography and symbolism of colour, or deductions concerning the appreciation and comprehension of colour by mediaeval artists and their contemporary audience, or attempts to group manuscripts by stylistic use of colour, cannot be correct if the colours that interpretations are based on are not those that were originally intended. Similarly for scientists, failure to suspect the presence of some hidden material may result in failure to apply suitable methods of analysis. Clearly all theorising must be preceded by the evaluation of the original appearance and likely original material composition.

The loss of mediaeval colour

Colours can change their appearance. Colours can change their colour. Colours can change their intensity and saturation. Colours can disappear almost completely. The
The vast majority of mediaeval colour has disappeared: clothes, wall-hangings, wall-paintings, enamels, jewellery, street signs, and scenery for pageants. Even ‘fine art’ paintings have not survived well: they have invariably undergone periodic restorations, sometimes with fairly drastic reconstruction of losses. But even when the original paint is not lost extreme changes of colour occur: for example increased yellowing due to aged varnish is familiar, as is the loss of yellow glazes (due to fading or over-cleaning) resulting in unnatural blue foliage.

Compared with such losses manuscripts have survived comparatively well. Unlike clothes they do not wear out; unlike jewellery or precious metalwork they are not broken down and re-modelled as tastes change. Manuscripts are relatively safe containers for text and image: illustrations in a closed book are protected from light fading, from touch, and from atmospheric pollutants, and parchment (itself chemically stable) has alkaline surface treatments that help to counteract the acidity of modern air. Nevertheless, much colour in manuscripts has become altered or lost colour, and this alteration and loss needs to be thought about analytically.

This paper considers the example of yellows: firstly because with yellows the effects of colour loss may be either dramatic or subtle, i.e. either obvious or almost undetectable, and secondly because many interesting Portuguese examples exist.

**Colours versus colorants**

Analytical thinking about colour (whether by an art historian or a chemist) must begin with an appreciation of the difference between a **colour** and a **colorant**, that is, between a **colour** and the **colouring material** making that colour. To talk of ‘pigments’ is to talk of physical materials, and to talk of ‘colours’ is to talk of a property of those materials. Colorants and colours do not have a one-to-one correspondence. Any colour can be made by more than one pigment or combination of pigments. For example the plant yellow ‘weld’ (*Reseda luteola*) and the artificial pigment lead-tin yellow have identical colours (Fig. 1a). Perhaps more surprisingly any one pigment may exhibit more than one colour depending on its preparation method (Fig. 1b). Knowing this provides a powerful tool for the study of manuscripts. It has been shown by physical-chemical analysis that specific colours were made in different ways by different artists or ateliers, and in different regions and periods (Clarke 2001b). Identifying pigments can thus help clarify provenance and authorship. A knowledge of materials derived from chemical analysis is therefore not only interesting to a scientist or a conservator-restorer, but also to a book-historian or art historian, and can inform an art historian far more profoundly than a simple examination of colour ever can. Two examples illustrate the difference between considering **colours** and considering **colorants**.

**Examination of colours**

Much work has been done grouping manuscripts stylistically based on patterns of colour use. However, any given colour can be made in a variety of ways. Presum-
1. Unpublished results, Trinity College Dublin: Raman spectroscopy found red lead, indigo, orpiment, carbon and iron gall ink, gypsum, lichen purple (*Rocella tinctoria*) and some unidentified translucent yellow/brown.

ably within a workshop the choice of method would be consistent. It follows that it is not enough to group manuscripts based on similar appearance: the materials should be the same too. Similarity in materials strengthens an attributed grouping, and inconsistency in materials weakens it. However this independence of colour and pigment is not always appreciated. It is extremely common for people to attempt to identify pigments by eye, using simple visual examination. Typically the appearance of a sample observed on a manuscript is compared with samples and reconstructions of known composition. These reconstructions are made based on mediaeval artists’ recipe books, of which hundreds survive (Clarke 2001a).

This methodology of comparing unknowns (the materials on manuscripts) with knowns (historically accurate reconstructions) is essentially valid, and is used today in chemical analysis of manuscript pigments. The problem lies in the use of visual examination to do the comparison. It is an inadequate tool, and any attempt to identify pigments by eye is doomed to failure, partly for the reasons outlined above (that one colour may be made from alternative colorants and that one colorant may exhibit different colours), and partly because, with age, colours may degrade beyond recognition.

This may easily be demonstrated by comparing the results of visual ‘pigment identification’ and chemical analysis. Often categorical statements as to which pigments are or are not present have been made by visual examination, which subsequent chemical analysis has shown to be incorrect. For example, British Library MS Arundel 155 was examined by two independent art historians, who stated in the firmest terms that ultramarine was not present; yet chemical analysis found it. Similarly a number of authors have used visual examination to ‘identify’ the pigments on the *Book of Kells* and the *Lindisfarne Gospels*. Comparison of their results reveals very little agreement (such disagreement alone should alert us to a problem with visual analysis), and recent reliable analysis has shown all of them to be to some extent wrong (Clarke 2004 a, b). ¹ Many of these authors expressed caveats regarding the limitations of visual examination, but the limitations of analytical techniques then available (which required unacceptably large samples to be removed) meant visual examination was used *faute de mieux*. Chemical analysis has shown such visual examination to be largely worthless, and it should not be practiced today.

**Examination of colorants (pigments)**

Visual naming of colours has been shown to be unreliable, with inconsistencies solved only by chemical analysis of the colorants. One might ask: why might chemical analysis of colorants interest anyone but a chemist? Consider two examples where looking at colours was not helpful, but where pigment analysis produced useful art-historical evidence.

The first example results from a study of pigments in 100 Anglo-Saxon manuscripts (Clarke 2004b). Two particular manuscripts from c.980 AD share text and illustrative programme. One had a secure provenance of Canterbury Christ Church, and it
had been suggested on stylistic grounds that the other might also originate there. The pigment ultramarine (lapis lazuli) found on both. This was only introduced c.1000, and to find it so early was most unusual, so its presence in both manuscripts strengthened the link between them. In the second example stylistical research into the Lochorst Bible suggested it was illuminated by two teams of artists. Team A worked in an archaic traditional style, whereas team B (probably the Zweder Masters) were more naturalistic and illusionistic. Team A consistently used ultramarine, while Team B consistently used azurite. Thus pigment analysis confirmed and reinforced the proposed division of labour.

**MIXTURES AND IMITATIONS**

Any one colour may also be made from many different mixtures of pigments. From c.300 AD onwards treatises survive recording hundreds of recipes for imitating expensive colours such as ultramarine or Tyrian Purple (Clarke 2001a). These substitutes can be completely convincing to the eye. For example, it has often been asserted that Tyrian purple (derived from shellfish) was used to dye parchment pages, but analysis indicates this is extremely rare compared to purples made from other ingredients and from mixtures. Similarly mediaeval recipes explain how red brazil-wood dye could be added to blue azurite to imitate the more purple hue of the costly pigment ultramarine. Other recipes describe manufacture of a tin-based compound called ‘mosaic gold’ which contains no gold but can look remarkably like it.

**ATTITUDES TO INEXPENSIVE IMITATIONS**

There were various mediaeval attitudes to substitution and imitation. It is useful to consider these when evaluating whether (and why) certain yellow colorants were used.

One attitude was that to use valuable materials was desirable in itself. The use of gold, precious stones, and ultramarine to highlight iconographically important elements in a picture is well known. Another example is the choice of mosaic gold or real gold, or ivory black (an expensive pigment) or bone black (indistinguishable and inexpensive).

Alternatively, skill could be considered as more important than the use of expensive materials. (This, perhaps, was the choice made by the stylistically more progressive Team B in the Lochorst Bible when they used the latest illusionistic techniques but inexpensive azurite; a more flexible use of material conventions consistent with stylistic liberties.) Theophilus seems to have favoured this attitude when he warned not to disparage any thing ‘just because your native soil has spontaneously and unexpectedly produced it for you’ and asks, why would you ‘despise these as cheap local products and travel over land and sea to procure foreign ones that are no better and are perhaps of less value’ (Prologue to Book I). When analysis demonstrates the use of local products, plants or minerals, this itself becomes a useful provenancing tool. This preference for final appearance over cash-value is one reason for the popularity of imitations and substitutes. 2
These attitudes created reasons to choose one material over another (given otherwise similar colours and working properties). These attitudes would have been present in different proportions in different individuals. One might contrast for example Suger with Bernard of Clairvaux. Consequently sometimes an artist might have chosen to use a genuine expensive material, whereas an imitation may have been considered appropriate for a different object or by a different artist. That sometimes there were genuine expensive materials used, and sometimes not, is in itself interesting. The use of intrinsically expensive materials is an important indicator of the attitude of the artist and the patron to a book. And yet to the naked eye it is not always clear. Clearly if chemical analysis can discern between expensive and inexpensive materials this is helpful in indicating which attitude or attitudes applied to which objects or to which periods, regions, artists or patrons. This is directly relevant to the study of manuscript yellows because, as we shall see, imitation gold was common.

**Sophistication of the palette**

Of course there are other reasons to use pigment mixtures, not just to imitate precious materials. Not all colours can be obtained from a single pure natural material. Until very recently there was, for example, a great shortage of green pigments. For symbolic or diagrammatic work this was not problematic, since a face or a landscape could be adequately modelled with one or two crude colours, but for more sophisticated work, e.g. to be more realistically representational, the shortage of subtle colours was a problem. The problem was overcome in two ways.

The first method used to increase the range of available colours was mixing pigments. It is often stated that mediaeval artists, having made such efforts to obtain pure colouring materials, did not want to adulterate them, and that in consequence they did not mix pigments. This is simply not true. Mediaeval artists’ recipe books contain thousands of prescriptions for mixtures (Clarke 2011), and chemical analyses have shown a great variety of mixed pigments, notably those mixed to produce greens (Clarke 2001b). Another solution was layering, where a thin or transparent layer of one colour was used on top to modify another. These combinations allow for more sophisticated or more representational art, and indeed, around the ‘Eyckian turning point’, c.1420, we find more and more mixtures and transparent over-layers; this was certainly done in manuscripts, not only in panel painting or in oil painting (Clarke 2011). Another method of increasing the gamut of available of colours was to harness the colours of plants. There are many recipes based on plant extracts, either to make lake pigments, or simply to colour white pigments with the juices: ‘Take yellow flowers, and grind, and express the juice, and temper white lead with this juice, and dry. And temper it again, and dry, and repeat thus a third time’ (Glasgow MS Hunter 110, f.40r). These flower extracts are often specified to be for use ‘in carta’, i.e. on paper or parchment. However, even in a relatively well-protected environment as a closed book, organic pigments based on plant material are very prone to change colour and fade.
Lost manuscript yellows

Careful examination of manuscripts reveals areas where colour only remains as faint transparent traces. Figure 2 shows transparent infills in orange, red-pink, yellow and blue. The transparency clearly seems to indicate a faded organic colour. Similar discolouration and fading of red and yellow is visible in Figure 3. Once alerted to such fading, one can search for it.

**FIG. 2 A, B, C** Cambridge, Corpus Christi College MS69 (England, 8th century), f.20r, f.14r, MS144 (England, 9th century) f. 13r

**FIG. 3 A, B** Cambridge, Corpus Christi College MS69, f.1r (England, 8th century)
Why are lost manuscript yellows so particularly interesting and important? One reason is that so often yellow was used either to represent gold, or to imitate gold, or to be a substitute for gold, and in any picture golden objects are of undoubtedly iconographic importance. There are a great many recipes for imitation gold, and indeed some of the most ancient artists’ recipes we have are for imitation chrysography. The most common ingredient of recipes for imitation gold is saffron. The other reason for concentrating on yellow is that its colour changes and fades away so dramatically; indeed the changes to yellows are often the strongest indication — and the strongest argument — that colours in manuscripts have changed at all.

Examples of degraded yellow are found in the earliest manuscripts. On the exhibited pages of British Museum papyrus EA10470 (Egyptian, 1320–1200 BC) the yellow pigment orpiment and the orange pigment realgar (two forms of an arsenic mineral) have both become white (having converted to a third form of the mineral, arsenolite); the unexhibited pages retain their colour. Orpiment is unusual in this respect, because it is a mineral pigment, which are usually stable. Plant-based pigments, on the other hand, all tend to fade very badly, and yellow plant-based pigments fade worst of all. My attention was first drawn to this phenomenon while studying the earliest mediaeval manuscripts from the British Isles. In the Cathach of St Columba (Dublin Royal Irish Academy) on f.48r is a zoomorphic initial that only the closest inspection shows is infilled with a colour not quite the same as the parchment. Clearly in this and in many other early manuscripts the paint is extremely thin, or is a liquid dye or stain rather than a solid pigment bound in a medium. This phenomenon is not confined to English examples, nor to very early examples, and one cannot dismiss it as the result of ‘primitive’ materials and techniques. If we concentrate on yellows, then fading phenomena can be still dramatic in the highest quality twelfth century Romanesque manuscripts.

Figure 4 shows a page from the Bury Bible, a de luxe manuscript. The rubric is composed of primary colours, but compared with the other colours the yellow is dull,

FIG. 4 A, B  CAMBRIDGE, CORPUS CHRISTI COLLEGE MS2, F.7R (ENGLAND, 12TH CENTURY)
weak, and translucent. Here surely we can infer that this buff or yellow-brown colour must originally have been intended to be a strong colour as well, most probably a bright yellow imitating gold. This phenomenon appears in Romanesque manuscripts from all over Europe. I first noticed it on English examples, and was most interested to see it again in the Torre do Tombo and the Biblioteca Nacional de Portugal. Examples of this same alternation of strong colours with a drab buff were noted from Lorvão (e.g. MS L16 f.7v, f.32), and from Sta. Cruz (e.g. MS1 f.2 and MS17 f.171). In some cases we can deduce that some faded yellows were deliberately transparent. Often a transparent yellow has been used much as one might use a yellow fluorescent pen today, to highlight a rubric (Fig. 5a). That this yellow was intended as a highlighter is confirmed by this unambiguous red used similarly (Fig. 5b). The red is carefully painted around the letters, whereas the yellow is painted all over, suggesting it was always transparent.

The use of a transparent yellow is confirmed in other Portuguese manuscripts, where it is used in combination with patterns of dots (Fig. 6). This use of transparent yellow is confined neither to Portugal nor to this period, and examples might be multiplied indefinitely, from 6th to 15th century, from England, France, Italy, central Europe and Iberia. Transparency in aqueous paint media such as those used on manuscripts is important as it implies the use of an organic pigment, and organic pigments are those most prone to fading.

Evaluating losses

Visual examination and comparison clearly reveals areas of fading or discolouration, especially severe for yellow; indeed, in some cases it is not obvious that an area was coloured at all. ‘Technical art history’ offers three ways to evaluate what the original appearance of manuscript colours may have been: (i) iconography and visual harmony, (ii) technical analysis of surviving paint, (iii) mediaeval artists’ recipe books.
5. Degraded orpiment, arsenolite, is also invisible to Raman.


7. Some years ago I suggested that the use of Infra-Red lasers might overcome the fluorescence problems that have until now hindered analysis of organic pigments by Raman spectroscopy. Perkin-Elmer have now lent an Infra-Red FT-Raman instrument to the British Library, who in 2010 will examine certain Anglo-Saxon manuscripts where I identified faded yellow organics. Preliminary results using reconstructions seem promising. (David Jacobs, BL, personal communication 2009.)

**Iconography and visual harmony**

One must re-consider images where one might expect yellow for iconographical reasons. There are few motifs in mediaeval European art where the iconographic meaning of yellow is sufficiently robust and consistent to deduce a lost yellow, but possible useful motifs include heraldic devices (specified in unambiguous terminology: ‘or’ should be yellow), or representations of golden objects and haloes. Even without iconographical clues we can deduce when the colours must be wrong by loss of visual harmony, as for example in Fig. 4 where the colour of the red, blue and green letters is intense, thickly applied, strong, dark and saturated, but the brown-yellow letters are dull and insipid. Especially in these Romanesque examples it seems clear that the pale-brown colour is incongruous, and a strong yellow would surely have made better pictorial sense alongside the other strong colours. In cases where a colour is barely distinguishable from the colour of parchment (e.g. the yellow in Fig. 3 b) we may conclude that it would have been decoratively valueless, and thus is surely degraded.

**Technical analysis**

Unfortunately chemical analysis is unusually problematic for faded yellows. For organic pigments the currently favourite technique for manuscript analysis – Raman spectroscopy – is unsuitable. The best method of analysis of organic colours is High-Performance Liquid Chromatography, but it requires samples; these only need to be very small, but they do need to be not too degraded. Sometimes when a yellow colorant degrades it can be identified by its degradation products (although not in the case of saffron). Saffron has been detected using Fourier-Transform Infrared spectroscopy, even in mixtures, but only when it has survived in good condition. Despite these problems there have been successes. The *Wollaton Antiphonal* (University of Nottingham MS250), for example, is a high-quality English manuscript c.1420, painted with a very full palette. Recent HPLC analysis identified several plant-based pigments, including yellows from broom (*Genista tinctoria*), sometimes with weld added. All are found on a base of either chalk or lead white, and in one remarkable case, on the synthetic inorganic pigment lead-tin-yellow. The organic yellows were also found mixed with verdigris. Of particular interest is that it has been suggested that this book was made in the English region of East Anglia, where broom is a local product. The application of other analytical techniques to manuscripts is being developed, including Direct Injection Mass Spectrometry (requiring only tiny samples) and fluorescence spectroscopy (requiring no samples).

**Recipes**

So, in summary, analysis can be very helpful, but is difficult for yellows. Fortunately, when analysis is not able to provide the answer, we have another clue. There survive a considerable number of mediaeval treatises containing artists’ recipes, including for organic yellow pigments. The majority of these use saffron (*Crocus sativus*). Audemar (c.1300) stated saffron was produced in France (but that it was not good),
that it was imported from Spain and Italy, and the best from ‘Sicily’ [read: ‘Cilicia’ i.e. Turkey] (Clarke 2001a, #2790). The 11th century specialist treatise De clarea (‘On glair’) devotes a large proportion of its short length to saffron (Clarke 2001a, #140). Other yellows suggested by recipes include weld, safflower (*Carthamus tinctorius*), buckthorn (*Rhamnus cathartica*), blackthorn (*Prunus spinosa*), aloes, fustic (*Rhus cotinus*), and the gall of an ox or fish. These were usually mixed in glair (egg white), although hide glue was also suggested, e.g. by Le Begue in 1431 (Clarke 2001a, #2790). Alternatively organic colorants could be added to inorganic white substrates such as egg-shell, lead-white, chalk and gypsum. The prevalence and wide diffusion of recipes for organic yellows means that we should be looking for traces of them. (The prevalence of recipes for mosaic gold after c.1400 suggests analysis of what appears to be gold is also needed.) It is satisfying that recipes in the 15th century Portuguese *Livro de como se fazem as cores* (Clarke 2001a, #2950) seem to correspond well with chemical analysis of Portuguese manuscripts, suggesting that its recipes for yellows may well explain these faded areas. Knowledge of the recipes suggests lines of enquiry: in reconstructions of saffron and safflower recipes, plant fibres are visible (Fig. 7), so it would be worthwhile trying to find them (although a careful illuminator may have excluded them).

Microscopic examination of the lettering shown in Fig. 4 showed the paint medium to be thick, almost colourless brown, and to exhibit craquelure. This is what would be found if it had originally been a yellow transparent colorant in a thick glue medium. (Reconstructions showed that saffron in a glue or gum medium needs to be applied thickly.) If indeed the Bury Bible lettering was originally made with saffron (or similar) then all the colours of the lettering would have originally been equivalent in terms of strength and saturation, and thus more visually coherent. This effect has been reconstructed in Figure 8 by digitally increasing the degree of colour saturation. Surely this makes more decorative sense.
Recipes supply the surprising information that the problem of faded yellow pigments is not confined to faded yellow colours. This is because saffron was not just used in yellow pigments, but was also an additive to other pigments. Recipes document that the addition of saffron to verdigris was common in Europe (and Persia), and analysis confirms this. (The stated reason was to improve colour, although saffron also reduces corrosion of pages by verdigris.) Saffron was added to azurite to make green, and even to improve orpiment. Consequently loss of yellow organic colorants can cause colour change in even non-yellow areas. Other organics were added to other inorganics too, and so although inorganic pigments such as verdigris, minium or azurite may be identified by reliable and robust techniques, nevertheless the colours may not be original (Clarke 2011).

Mediaeval responses to colour loss

It is unclear how much durability of pigments was understood by mediaeval craftsmen. Recipes warn that certain pigments are chemically incompatible and will discolour each other if mixed, and other recipes specify that some pigments (notably organics) were suitable for manuscripts but not suitable for other supports (such as panels and walls). It is not clear how soon colour loss occurred, whether it was noticed, or whether repairs were carried out. Financial documents record mediaeval restorations of wall- and panel-paintings, but regarding manuscripts are largely silent. Accounts from Merton College Oxford c.1500 itemise painting saffron onto fore-edges – apparently now lost. Examination shows ‘improvements’ to manuscripts certainly were carried out: not really restorations but rather re-decoration projects. Pigment analysis is useful in finding anachronistic materials that document this. British Library Add. MS 40618 is an Irish eighth century manuscript, but includes some pages of late tenth century illustrations that have been pasted in (f. 22v, f.49v). One might easily spot these added pages by their later style, but ultramarine is also found on the original eighth century initials (23r and 50r); clearly these original initials must have been re-touched while the book was undergoing improvement.
(Clarke 2004b, which see for another example). Whether lost yellows were repainted remains to be determined.

Conclusions

Clearly there has been a loss and change of colour in mediaeval European manuscripts, due to the degradation and fading of colorants, and in particular there has clearly been a particularly severe loss of yellows, especially transparent yellows. This yellow loss is not confined to areas originally coloured yellow, but also in certain areas such as verdigris green. Furthermore many non-yellow pigments contained an organic component, which has probably altered in colour too.

Since what is seen now is clearly not always what was originally there, the appearance of manuscripts must be re-assessed. In the case of transparent yellow, the contrast with the parchment is often negligible, and even allowing for some darkening and yellowing of the parchment, if it had always been this colour it would have made no decorative sense. The buff or brown colour in Romanesque manuscripts has in the past been accepted as a bona fide colour. It does contrast somewhat with parchment, and is legible, but, since the other colours are usually all strong and bright, a subtle or drab yellow-brown seems out of place, and so I suggest that it would make more decorative sense if it had originally been golden-yellow.

It seems, from inspection of surviving traces of colour, and from mediaeval recipes, that there was an extensive use of vivid organic yellows, which are now lost. Clearly art historians can benefit from an awareness of possible colour alterations. It may help to explain, for example, why so little gold was used in Portuguese manuscripts in this period, compared with elsewhere in Europe.

In addition to being vehicles for the transmission of texts and images, manuscripts are also archaeological artefacts, and one must constantly bear in mind this physicality. Chemical analysis is helpful to establish provenance, to identify intrusive anachronistic elements, and to deduce original appearance. This is a golden age for the study of the physical properties of art works in general and manuscripts in particular, with increasingly sensitive analytical instruments available, and a renaissance in the philology of artists’ recipe books. But to establish what was conventional usage for different periods, regions, or ateliers, more work is needed to build up a substantial and statistically significant corpus of analyses (similar to that extant for easel paintings). This must be collaborative, as the best analyses are done by physicists and chemists working closely with conservators, librarians, and art historians. ●
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Bibliography


Biography

Mark Clarke (*1962) trained in England in conservation and conservation science, with an interdisciplinary doctorate on medieval manuscript paint. He has been a researcher in technical art history and art technological source research, at the University of Cambridge, the Institute Collectie Nederland, the Fitzwilliam Museum, and FOM-AMOLF. He specialises in the interdisciplinary study of historic artist’s paint, combining technical analysis, art history, historically accurate reconstructions, and written sources. He has made a particular study of mediaeval artists’ recipe books. He co-founded the International Council of Museums (Conservation Committee) working group on Art Technological Source Research. He is currently working on the early history of oil paint at the University of Amsterdam, and is an invited Fellow of the VLAC Institute of Advanced Study of the Royal Flemish Academy.

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