Palette, Pigments and Pictorial Narrative in Eleventh-Century England: the use of colour in the Bayeux Tapestry and the Old English Hexateuch

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with the assistance of

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This article examines how colour was used as a tool of pictorial narrative in the Bayeux Tapestry and the illustrated Old English Hexateuch, the two longest such cycles to survive from eleventh-century England. The dyes employed for the former and the pigments of the latter are identified; the palettes that they permitted their respective artists to realise are set out; the colouring of cognate scenes are compared; and the general principles (such as they were) that affected the deployment of colour in the two works are explained.

The Bayeux Tapestry and the illustrated Old English Hexateuch (London, British Library, Cotton Claudius B.iv) have by far the longest cycles of pictorial narrative to survive from eleventh-century England – indeed from the early medieval West as a whole. They have often been compared on this account, as also because of the various individual motifs they have in common. The palettes of the two works, by contrast, and how far they correspond – not only in terms of the range of colours but also concerning how they were deployed – have barely figured in such discussions. As the dyes and pigments that supplied the colorants for each work have recently been identified scientifically, now is an opportune moment to consider these issues. Patently the dyes employed to tint wool for an embroidery will not, in general, be the same as the inks and pigments used to draw and paint on parchment. Nevertheless, knowledge of the colorants that were available to their respective creators and hence the range of colours they

could, in principle, deploy permits us better to understand how they used the resources at their disposal. And, whatever the findings, the exercise of considering the palette of the two works will shed light on the role of colour in eleventh-century pictorial narrative more generally.

We shall set out what is known about the colorants that were used in the Bayeux Tapestry and the Old English Hexateuch. We shall then consider how their creators deployed these colours, first for elements of the 'real world' that recur in both works, then in relation to particular motifs that they have been seen to share. We shall conclude by assessing such general principles as may underlie the colour choices observable in the textile and the manuscript. It is logical to begin, however, by summarising the basic facts about the two works that are most pertinent to our investigation.

The Bayeux Tapestry is not really a tapestry, of course, but rather an embroidery [Illustration 1].[1] The particular significance of the distinction in the present context is that the

[1] S. A. Brown, *The Bayeux Tapestry: history and bibliography* (Woodbridge 1998) and *The Bayeux Tapestry, Bayeux Médiathèque Municipale: MS.1, a sourcebook*, Publications of the Journal of Medieval Latin 9 (Turnhout 2013), provides an overview of the extensive literature on the object up to 2013. Subsequent monographs of note include E. C. Pastan and S. D. White with K. Gilbert, *The Bayeux Tapestry and its Contexts, a reassessment* (Woodbridge 2014); A. C. Henderson with G. Owen-Crocker (ed.), *Making Sense of the Bayeux Tapestry: readings and reworkings* (Manchester 2016); S. Lemagnen, *La Tapisserie de Bayeux: une découverte pas à pas* (Paris 2016); X. Barral i Altet, *En Souvenir du Roi Guillaume. La broderie de Bayeux* (Paris 2016); S. Lemagnen, S. A. Brown and G. Owen-Crocker (ed.), *L'Invention de la Tapisserie de Bayeux. Naissance, composition et style d'un chef-d'oeuvre médiéval* (Rouen, 2018); X. Barral i Altet and D. Bates, *La Tapisserie de Bayeux*, 2 separate editions (Paris 2019 and 2020); and D. Musgrove and M. Lewis, *The Story of the Bayeux Tapestry: unravelling the Norman Conquest* (London 2021).

way in which an embroidery was created was closer to the techniques of manuscript decoration than was the weaving of a tapestry on a loom. The Bayeux Tapestry was made by stitching a design onto a backing fabric, the countless stitches of coloured wool being akin in function to the pen- and brush-strokes that defined the outlines of, and provided the body tones for, manuscript images. The approach of embroiderers may be compared in particular to the Anglo-Saxon practice of coloured-line drawing. For rather than delineating whole areas and motifs as a single operation, the embroiders of the textile, like the creators of coloured-line drawings, had to proceed piecemeal, first adding the lines – sometimes just part-lines – of one colour within a vignette, then (changing needle on the one hand, pen and pigment on the other) moving on to do those in another colour, and so on.[2]

Although it is not known for certain when, where, why, or by whom the Bayeux Tapestry was created, the views most readily compatible with the available evidence are that it was produced at some point between 1072 and 1077, that its designer had a connection with Canterbury (being familiar with the decoration of manuscripts that were written or owned there), and that the most likely patron was Bishop Odo of Bayeux. The coherence both of the vision portrayed in the textile and of the visual language employed to convey it, strongly suggests that,

[2] Further on the coloured-line drawing technique see R. Gameson, *The Role of Art in the late Anglo-Saxon Church* (Oxford 1995), 12-13. Further on the embroidery techniques used in the Tapestry see A. Lester-Makin, 'The Front tells the Story, the Back tells the History: a technical discussion of the embroidery of the Bayeux Tapestry' in *Making Sense of the Bayeux Tapestry*, ed. Henderson with Owen-Crocker, 23-40, esp. 37; and eadem, 'Les six châteaux de la Tapisserie de Bayeux. Une discussion technique du travail de broderie de la Tapisserie de Bayeux' in *L'Invention de la Tapisserie de Bayeux*, ed. Lemagnen, Brown and Owen-Crocker, 73-91.

while many hands were necessarily involved in the manufacture of the work, a single individual was responsible for its design.

The design is delineated in coloured lines set against the neutral tone of the linen ground. Certain elements, notably boats, horses and much of the clothing, were densely filled with thread to create blocks of colour. Some zones that were outlined, by contrast, were left bare, with the result that they appear 'white': human flesh, for instance, was rendered thus. Elsewhere blocks of coloured stitching and plain linen can alternate to add extra variety to a run of elements such as the shields within a boat or the laths of a barrel, or they may interlock to evoke detailing such as the stones of a building and the decoration at the head of a sail. The lettering of the inscriptions is most commonly dark blue-black, alternatively red-brown – colours akin respectively to those of the text and rubrics of manuscripts.

The Old English Hexateuch is a rendering in Old English of the first six books of the Old Testament, comprising all of Genesis, most of Exodus, along with parts of Leviticus, Numbers, Deuteronomy and Joshua [Illustration 2]. The texts of the first half of Genesis and the second half of Numbers were derived from the work of Ælfric of Eynsham (d. c. 1010); the translators of the rest and the compiler(s) of the whole are unidentifiable.[3] Two copies of the complete work survive, one of which (Cotton Claudius B.iv) has illustrations.[4] Whether further

[3] For the text see *The Old English Heptateuch and Ælfric's Libellus de Veteri Testamento et Novo*, ed. R. Marsden, Early English Text Society, original series 330 (Oxford 2008).

[4] Facsimile: *The Old English Illustrated Hexateuch: British Museum Cotton Claudius B.IV*, ed. C. R. Dodwell and P. Clemoes, Early English Manuscripts in Facsimile 18 (Copenhagen 1974). For further bibliography to c. 2012 see H. Gneuss and M. Lapidge, *Anglo-Saxon Manuscripts. A Bibliographical Handlist of Manuscripts and Manuscript Fragments written or owned in England up to 1100* (Toronto 2014), no. 315 – to whose listings may now be added: S. McKendrick and K. Doyle,

illustrated copies once existed is debated; however, there are various indications that Cotton Claudius B.iv was not the first attempt to supply this text with illustrations.[5] Claudius B.iv itself is generally ascribed to the second quarter of the eleventh century. Its medieval provenance was Saint Augustine's Abbey, Canterbury, and that is probably where it was made.[6]

Two hundred and sixty-one of the Hexateuch's 312 pages bear illustrations. On twelve occasions imagery occupies the whole page; generally, however, the scenes are smaller, have lesser pictorial content, and alternate with blocks of text. The most common arrangement is to have two scenes to the page, followed at some distance by one, then three, and finally four scene(s) per page. The total number of illustrations changes from one quire to the next, with a preponderance featuring between fourteen and sixteen scenes (see Table 1). What this underlines is that there was no fixed formula for combining text and illustration: on the contrary, the occurrence of illustrations seems rather to have been motivated by the wish to supply as many of

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The Art of the Bible: Illuminated Manuscripts from the Medieval World (London 2016), no. 11; and C. Breay and J. Story (ed.), *Anglo-Saxon Kingdoms. Art, Word, War* (London 2018), no. 94. The other copy, Oxford, Bodleian Library, Laud misc. 509 (N. R. Ker, *Catalogue of Manuscripts Containing Anglo-Saxon* (Oxford 1957), no. 304) is actually an Old English Heptateuch, including a rendering of Judges as well.

[5] See *Old English Illustrated Hexateuch*, ed. Dodwell and Clemoes, 58.

[6] It is documented in the *s.* xv library catalogue of Saint Augustine's: *St Augustine's Abbey, Canterbury*, ed. B. C. Barker-Benfield, 3 vols., Corpus of British Medieval Library Catalogues 13 (London, 2008), I, 405-6 (entry BA 1.95). For the case that the late twelfth-century annotations were done at Saint Augustine's Abbey – which, if true, would bring the attested provenance back by three centuries – see A. N. Doane and W. P. Stoneman, *Purloined Letters: the twelfth-century reception of the Anglo-Saxon illustrated Hexateuch (British Library, Cotton Claudius B.iv)*, Medieval and Renaissance Texts and Studies 395 (Tempe, Arizona 2011), esp. 248-51.

them as the biblical narrative would allow. Their priority is further advertised by the fact that, contrary to the customary sequence in the making of a manuscript,[7] they were planned and sketched before the text to which they relate was inserted.

Quire	Drawings per page	Ratio	Illustrated pages (scenes)
1	112111231112	8/3/1	12 (17)
2	2132332231112111	7/5/4	16 (29)
3	122221322	2/6/1	9 (17)
4	2222232132222 32	1/11/3	15 (32)
5	12112221222122222	5/11/0	16 (27)
6	21122222111121222	7/9/0	16 (25)
7	33221321321212222	4/8/4	16 (32)
8	11223222212122 2	4/10/1	15 (27)
9	12112313142142 2	6/5/2/2	15 (30)
10	22232222222222	0/11/1	12 (27)
11	22131112222222	4/9/1	14 (25)
12	12212222131222	4/9/1	14 (25)
13	222212112121	5/7/0	12 (19)
14	12231111312	6/3/2	11 (19)
15	112233111123 11	8/3/3	14 (23)

[7] Contrast, e.g., Oxford, Bodleian Library, Ashmole 1431 (C. M. Kauffmann, *Romanesque Manuscripts 1066-1190* (London 1975), no. 10), an illustrated herbal made at Saint Augustine's Abbey, Canterbury, c. 1100, whose artwork also remained unfinished: here the irregular plant-shaped gaps within the completed text leave no doubt that the latter was transcribed before the artwork was (abortively) added.

16	1332223223322221	2/9/5	16 (35)
17	22232	0/4/1	5 (11)
18	21112121	5/3/0	8 (11)
19	11312212212212211	8/7/1	16 (25)
20	223222313	1/5/3	9 (20)
Totals		**(87/138/34/2)**	**261 (476)**

Table 1: Division of Drawings in the Old English Hexateuch

Many of the illustrations are unfinished to a greater or lesser degree.[8] As some of those that have been brought to completion are fully painted, while others comprise coloured figures and motifs set against a plain parchment ground, and yet others take the form of coloured-line drawings with scattered areas of body colour, it is difficult to gauge the final effect envisaged for many of those that were abandoned incomplete. The working procedure for the images that are manifestly finished seems to have been to begin (before the text was transcribed) with a faint preliminary sketch; next (after the text had been inserted) certain areas of the sketch were covered with unmodulated colour; then the contours were firmed up with coloured lines (generally red in the case of human flesh); finally, the fully coloured areas were enhanced with painterly detail.[9] All the original drawing appears to be the work of one hand which was also responsible for at least some of the colouring. Whether the same hand painted the many areas that were only partly completed is, in the absence of the distinctive touches that only came in the

[8] A not uncommon phenomenon in late Anglo-Saxon MSS: see R. Gameson, 'Book Decoration in England, c. 871-c.1100' in *The Cambridge History of the Book in Britain I, c. 400-1100*, ed. R. Gameson (Cambridge 2012), 249-93, esp. 283-85.

[9] Discussed in more detail in *Old English Illustrated Hexateuch*, ed. Dodwell and Clemoes, 62-4.

final stages of adding colour, impossible to say, though there must be a presumption that it did.[10] On these grounds – and for convenience – we shall refer to 'an illuminator' in the singular.

The pioneer in noting parallels between the imagery of the Bayeux Tapestry and motifs in the Old English Hexateuch (as indeed in other Canterbury books) was Francis Wormald, who nevertheless remained guarded about the precise nature of the relationship between these antecedents and the textile.[11] Not so the author of the most detailed study of the material undertaken to date, Cyril Hart, who believed that the designer of the Tapestry had consulted the Hexateuch directly and 'probably more extensively than any other single source'.[12] He pointed, for example, to the similarities between how Conan's escape from Dol is shown in the Tapestry and the way in which the flight of the Israelite spies from Jericho is depicted in the Hexateuch, between the presentation of Edward the Confessor receiving Earl Harold on the latter's return from Normandy in the Tapestry and the figures of certain rulers in the manuscript, between the death of Edward the Confessor in the Tapestry and those of several of Adam's descendants in

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[10] Also the opinion of Dodwell (*Old English Illustrated Hexateuch*, p. 59) and E. Temple, *Anglo-Saxon Manuscripts c. 900-1066* (London 1976), no. 86.

[11] Francis Wormald, 'Style and Design' in *The Bayeux Tapestry, a comprehensive survey*, ed. F. M. Stenton, 2nd ed. (London 1965), 25-36; repr. (with fewer and inferior illustrations) in Francis Wormald, *Collected Writings I. Studies in Medieval Art from the Sixth to the Twelfth Centuries*, ed. J. J. G. Alexander, T. J. Brown and J. Gibbs (London-Oxford 1984), 139-52.

[12] C. Hart, 'The Canterbury contribution to the Bayeux Tapestry' in *Art and Symbolism in Medieval Europe* 5, ed. G. de Boe and F. Verhaeghe (Zellik 1997), 7-15; and 'The Bayeux Tapestry and Schools of Illumination at Canterbury', *Anglo-Norman Studies* 22 (2000), 117-67, the quoted phrase at 123.

the Hexateuch, and between the ships in the Tapestry and Noah's ark in the manuscript, as also to the parities in how ship-building is shown in both works.[13]

An important aspect of the artistry of both works that was not considered in Hart's (and other such) discussions was their palettes. To this, and the materials that were used to realise the colours in question, we now turn.

Inks, Pigments and Dyes

There have been three campaigns of analysis that studied the dyes of the Bayeux Tapestry with reliable scientific techniques. The first, undertaken by l'Institut textile de France during the cleaning and reinstallation of the artefact in 1982-83, involved the removal of 220 thread samples, 160 of which were analysed by thin-layer chromatography. This permitted the identification of three of the four dye-stuffs that had been applied to the medieval fabric.[14] Then

[13] These correspondences have, of course, been noted by others, notably Wormald, 'Style and Design', pp. 30-2. See also D. Bernstein, *The Mystery of the Bayeux Tapestry* (London, 1986), 41; R. Gameson (ed.) *The Study of the Bayeux Tapestry* (Woodbridge 1997), 168-70; G. R. Owen-Crocker, 'Reading the Bayeux Tapestry through Canterbury Eyes' in *Anglo-Saxons. Studies Presented to Cyril Roy Hart*, ed. S. D. Keynes and A. P. Smyth (Dublin 2006), 243-65; and eadem, 'Reading the Mind of the Bayeux Tapestry Master', *Studies in Medieval and Renaissance History* 15 (2021), 37-66. M. Lewis ('La Tapisserie de Bayeux et l'art anglo-saxon', in *Tapisserie de Bayeux*, ed. Lemagnen, Brown and Owen Crocker, 229-45) has urged caution when linking Canterbury-produced illuminations with the Bayeux Tapestry.

[14] *Caveat lector*: while the original typed report ('Travaux réalisés sur la Tapisserie de la Reine Mathilde') of 4-3-1983 specifies à propos beige and ochre that 'Quelques échantillons contenant gaude et indigotine ou indigotine seule … et présentant une couleur ocre prouvent qu'un autre

in 2016 the first three metres of the work were recorded via hyper-spectral imaging, which (among other things) mapped the distribution of two of these dyes along the entire length in question.[15] Most recently (January 2020) the textile was studied by means of hyperspectral imaging (VNIR) by Philippe Walter and Clarisse Chavanne of Sorbonne Université.

The Bayeux Tapestry features ten original colours,[16] obtained from four organic dyes – namely madder, weld, and indigotin, plus an unidentified material yielding brown hues. The cultivation of madder (*Rubica tinctorum*), a plant thought to have originated in Persia and the East Mediterranean, spread across Europe under the Romans, and madder-dyed textiles survive in

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principe chimique non identifiable a participé à la teinture' ('Certain samples containing woad and indigotin or indigotin alone … and displaying an ochre colour prove that another chemical constituent – unidentifiable – was involved in the dyeing'; pp. 18-19), this was omitted from the published accounts of the work that appeared in 2004 and which detailed only the three dye-stuffs that could be identified (I. Bédat and B. Girault-Kurtzeman, 'The Technical Study of the Bayeux Embroidery' in *The Bayeux Tapestry Embroidering the Facts of History*, ed. P. Bouet, B. Levy and F. Neveux (Caen 2004), 83-109 esp. 91-92; and B. Oger, 'Results of the Scientific Tests (1982-1983) in *ibid.*, 117-123, esp. 120-21). Consequently, subsequent discussions that depend upon these two accounts (e.g. Brown, *Bayeux Tapestry*, xvii; Bouet and Neveux, *Tapisserie de Bayeux*, 167-68) also erroneously state that only three dyes were involved. To add to the confusion, the English translation of the articles by Bédat and Girault-Kurtzeman and Oger mistakenly uses 'woad' where 'weld' (*Reseda luteola*) is meant, and refers to 'pastel' as if it were different from, rather than a synonym for, *Isatis tinctoria* (woad).

[15] C. Boust, 'Étude par imagerie scientifique de la Tapisserie de Bayeux' in *L'Invention de la Tapisserie de Bayeux*, ed. Lemagnen, Brown, and Owen-Crocker, esp. 343.

[16] There are further tints in the restorations, produced using modern colorants.

north-west Europe from the sixth century onwards.[17] Weld (*Reseda luteola*) was native to much of Europe, including England. The indigotin was probably derived from locally-available woad (*Isatis tinctoria*) rather than from indigo proper (*Indigofera tinctoria*): the latter would have had to have been imported from Asia, whereas woad had been grown in Britain from Prehistoric times (its availability in Anglo-Saxon England is advertised by the fact that the modern name is derived from the Old English one, *wad*).[18] The identity of the mordant (used to fix and enhance colour as part of the dying process) has yet to be established; however, the weak presence of aluminium detected in 1982-3 favours alum,[19] a hypothesis compatible with, albeit not positively confirmed by, the findings of the more recent investigations. How typical or otherwise all this was of contemporary embroideries is, in the absence of other specimens, impossible to say; however,

[17] Oger, 'Results', 119-120.

[18] For the occurrence of 'wad' in Anglo-Saxon glossaries see J. Earle, *English Plant Names from the Tenth to the Fifteenth Century* (Oxford 1880), 16 and 32. For onomastic evidence of woad and woad dyeing in Anglo-Saxon England more generally see C. P. Biggam, *Blue in Old English, an interdisciplinary semantic study* (Amsterdam, 1997), esp. 96-99, 128-9, 181-4, 224, 228-33, 259, 265, 271-4, and 279-85.

[19] Oger, 'Results', 119-20.

the three identified colorants were staples of textile dying in England in the early Middle Ages,[20] as indeed beyond.[21]

In 1982-3 the reverse of the embroidery (which is normally covered by a backing fabric) was exposed. Comparison with the corresponding threads on the front revealed that the latter had, as one might expect, become duller (the reds in particular had darkened, the blues had become greener), but that overall the degradation seemed relatively modest; the more recent study of Philippe Walter and Clarisse Chavanne confirmed (unsurprisingly) that the Tapestry's

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[20] Thus fabrics dyed with indigotin, madder and possibly weld are known from Sutton Hoo; there are examples dyed with weld and madder from Lower Brook St., Winchester, examples dyed with indigotin and madder from Coppergate, York, and examples dyed with indigotin, madder and weld from London: see Elizabeth Coatsworth and Gale R. Owen-Crocker, *Medieval Textiles of the British Isles AD 400-1100: an annotated bibliography*, British Archaeological Reports, British Series 445 (Oxford 2007), 69 and 136; 91; 91, 113, 125 and 126; and 116 respectively.

[21] They are mentioned as such by Geoffrey Chaucer ('The Former Age', l. 17: *The Riverside Chaucer*, gen. ed. L. D. Benson (Boston 1987), 651). For the use of madder, weld and indigotin on a wide range of predominantly small-scale medieval textiles of French origin see J. Wouters, 'Analyse des colorants' in D. Cardon et al., *Fils renoués: trésors textiles du moyen âge en Languedoc-Roussillon* (Carcassone 1993), 158-166; for their use in the largest extant cycle of medieval tapestries (the Apocalypse of Angers) see P.-M. Auzas, C. de Maupeou, C. de Mérindol, F. Muel and A. Ruais, *L'Apocalypse d'Angers. Chef-d'oeuvre de la tapisserie médiévale* (Fribroug-Paris 1985), 45; and for their presence in a late medieval tapestry from Strasbourg see A. Rapp Buri and M. Stucky-Schürer, *Zahm und Wild: Basler und Strassburger Bildteppiche des 15. Jahrhunderts* (Mainz 1990), 37. In these cases the dyes were identified by thin-layer chromatography or high-performance liquid chromatography.

colours were more vibrant nine centuries ago.[22] The brighter hues preserved on the reverse transpired to be closely akin to those on the facsimile of the front made by Charles Stothard between 1816 and 1819, of which hand-coloured plates (designed to match the colours of the original) were sold by the Society of Antiquaries of London to its Fellows from 1821.[23] From this it was reasonably deduced that the discoloration of the front occurred subsequent to that date and was almost certainly a consequence of the incautious exposure of the work to natural light when it was on public display between 1842 and 1939. A facet of the colouring that is no longer (easily) perceptible on the front but remains evident on the reverse is the coexistence of different shades of each colour. This has been ascribed to modest variations in composition and conditions between the individual dye-baths in which the wool was treated. The presence of chromatic variations within some threads (the two halves of the same twist being disparate hues) indicates that the wool was dyed before being spun and twisted.[24]

The colours and their sources are as follows:

Red, light, tending to pink-orange (from madder)

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[22] C. Chavanne, 'Les couleurs de la Tapisserie de Bayeux' (unpublished PhD thesis, Université de Paris 1: Panthéon-Sorbonne 2022).

[23] C. Hicks, *The Bayeux Tapestry: the life story of a masterpiece* (London 2006), 121-33. A fragment of the Bayeux Tapestry removed by Charles Stothard (see M. Lewis, 'The Mystery of Charles Stothard, FSA, and the Bayeux Tapestry Fragment', *Antiquaries Journal* 87 (2007), 400-6), which was never reattached so has not generally been on display, shows the colours of the work as they were in the early nineteenth century.

[24] Bédat and Girault-Kurtzeman, 'Technical Study', 92. Further analysis of these threads and their dyes as part of the forthcoming planned 'restoration' of the Tapestry might shed further light on the practicalities of making the work and on the different hands/teams responsible.

Red, dark, tending to brown (from madder plus the organic brown)

Yellow, of a brown or mustard hue (weld plus the brown)

Green, light (indigotin plus weld)

Green, olive-toned (indigotin plus weld)

Green, dark (indigotin plus weld plus the brown)

Blue, mid-toned (indigotin)

Blue, dark (indigotin)

Blue-black (indigotin)

Beige (weld).

In addition, 'white' or neutral tones were supplied by the linen ground, as also occasionally by undyed white wool.[25]

The colorants of the Old English Hexateuch were studied in November 2021 by Team Pigment (Andrew Beeby and Richard Gameson, both of Durham University, along with Catherine Nicholson of Northumbria University), who deployed fibre-optic reflectance spectroscopy, Raman spectroscopy and multi-spectral imaging; since the manuscript does not contain metals, there was little that X-ray fluorescence spectroscopy could have added and so it was not used.[26] These non-invasive techniques can identify most mineral and manufactured

[25] The latter appears to have been used to insert 'white' in between the blue and red-brown loops of the enigmatic round object carried by a figure in Scene 41.

[26] For full details of the equipment used and the procedures followed, along with their limitations, see R. Gameson, A. Beeby, F. Fiorillo, C. Nicholson, P. Ricciardi and S. Reynolds,

pigments but only some organic ones, notably indigo/woad. The pages analysed were principally a selection of those bearing imagery that has been likened to details in the Bayeux Tapestry; however, these were supplemented by further pages whose palettes were particularly expansive and so could provide a convenient conspectus of the range of pigments as a whole.[27]

The palette of the Hexateuch was more extensive than that of the Bayeux Tapestry, featuring twenty-six distinguishable hues of eleven colours, created from fourteen different pigments and combinations thereof. The details are as follows:

Reds – ochre (naturally occurring red iron oxide); organic

Pinks – ochre + white lead (a manufactured basic lead carbonate);[28] organic red + white lead

Oranges – red lead (a manufactured mixed lead oxide);[29] ochre; red lead + ochre

Yellows – orpiment (a mineral common in volcanic regions)[30] + ochre; orpiment + organic

Greens – vergauts (mixtures of blue and yellow – two types); verdigris (manufactured from soluble copper salts)

The Pigments of British Medieval Illuminators: a scientific and cultural study (London, 2023), 1-41 and 423-27.

[27] Fols. 2r, 11r, 11v, 13v, 15v, 16v, 59r, 60r, 60v, 73r, 141r, and 141v. Twelve was the maximum number of pages that could be analysed in the time available.

[28] $PbCO_3.Pb(OH)_2$.

[29] $2PbO.PbO_2$ or Pb_3O_4.

[30] As_2S_3.

Blues – lazurite (the blue chromophores extracted from lapis lazuli, mined only in what is now Afghanistan); lazurite + white lead; lazurite + azurite (a widespread copper carbonate mineral); indigo (doubtless from woad)

Purples – organic (probably orcein, derived from a lichen such as *Roccella tinctoria*); organic + white lead

Browns – ochre; ochre + white lead

Black – gallo-tannic ink (created by the reaction of soluble gallic acids with tannins extracted from oak galls, oak bark, or hawthorn)

Greys – lapis ash (low-grade lapis lazuli residue); white lead + organic

Whites – white lead; white lead + lazurite; bare parchment.

All these inks and pigments are found in other late Anglo-Saxon manuscripts.[31] Nevertheless, the selection deployed in the Hexateuch has three idiosyncratic features. In the first place, there is the range of ochres that was used (supplying reds, pinks, oranges, yellows and browns), more than was typical for English books of the period. Second, there is the number of alternatives that were employed for certain colours (three different colorants each for yellows, greens and browns, four for pinks and blues). It is likely that both of these features were related to the vast scale of the project, one in which (to put it crudely) an unusually large expanse of parchment had to be covered with paint. In such an endeavour, ochres – widely available earths requiring little preparation and so relatively inexpensive – came into their own. Equally, there was a higher than average chance that supplies of certain pigments would run low at one time or another during the production of such a substantial work, requiring the use of alternatives. In the light of this, the third idiosyncrasy becomes more notable: namely the absence of two pigments that were

[31] See Gameson et al., *Pigments of British Medieval Illuminators*, 93-107.

commonly used in other contemporary manuscripts – organic brown and carbon black. The reasons for their non-appearance are currently impossible to divine.

	Bayeux Tapestry	**Old English Hexateuch**
Red	Madder	Red Lead; Ochre
Yellow	Weld	Orpiment; Ochre; Organic
Green	Woad + Weld	Verdigris; Vergauts of Lapis + orpiment, Lapis + azurite + orpiment
Blue	Woad	Lapis lazuli; azurite; indigo (woad)

Table 2: Principal colorants used in the Bayeux Tapestry and the Old English Hexateuch

The creators of the Bayeux Tapestry were limited to a single dye for each primary colour (as set out in the table above); these could be combined to create subsidiary colours – thus woad blue and weld yellow were mixed to form green. The illuminator of the Hexateuch had greater resources at their disposal with two or more alternatives for each primary colour, alternatives which might themselves be combined to create different hues of that primary colour. Various combinations were therefore possible for subsidiary colours, most of which were also available in the form of a distinct pigment or pigments. Thus for greens, in addition to mixtures of lazurite (lapis lazuli), azurite or indigo blues with orpiment, ochre or organic yellows, there was also the manufactured copper green verdigris, itself potentially a range of colours according to exactly how it was prepared. Other colorants, above all white lead, could be added to achieve further modulations in hue and intensity (additional properties of white lead, incidentally, were that it could impart opacity and a smoother texture to paints of which it was a component). The

mention of white advertises another point of contrast between the palette of the two works. The illuminator of the Hexateuch had colorants for both white and black, namely white lead and gallo-tannic ink; and for the former he could in addition reserve bare parchment (he intermittently added a touch of lapis lazuli to his white lead to give it a slight blue tinge in order to distinguish its hue more clearly from that of the creamier or beiger white of the parchment). The embroiderers of the Tapestry, on the other hand, had no black as such, resorting to woad (which can yield very dark tones) as a surrogate, while virtually the only method they employed to achieve the effect of white was to reserve areas of bare linen.[32]

Comparisons and Contrasts

Notwithstanding the much wider range of colorants available to the illuminator of the Old English Hexateuch than to the creators of the Bayeux Tapestry, the finished pages of the former are unlikely to strike the casual viewer as more colourful than the strips of the latter. There are three main reasons for this. In the first place, although the illuminator of the Hexateuch had, in principle, a generous selection of inks and pigments at his disposal, he rarely drew upon more than a subsection of them for any given image (his various alternative colorants were just that – alternatives). Second, he had a predilection for orange, blue, pink and white, which were regularly favoured over other colours: his core palette thus consisted of just four colours – the same number as that of the Tapestry. Third, the way the individual colours were deployed in the Hexateuch produced less chromatic variation than was the case in the Tapestry; we shall return to this point – and shall explore possible reasons for it – in due course. In sum, while the creators of the Bayeux Tapestry made full and fairly consistent use of the restricted palette

[32] For an apparent use of undyed white wool see note 25 above.

available to them, the illuminator of the Old English Hexateuch made limited and very uneven use of the much larger one at his disposal.

Direct comparison between the Old English Hexateuch and the Bayeux Tapestry must be undertaken with circumspection. Not only are they works in different media, but while one was (almost certainly) brought to completion,[33] the other was not. Moreover, the task of evaluating colour choices in the Hexateuch is bedevilled by two further factors – the discoloration that some of the lead-based paints have undergone,[34] and the possibility that the illuminator himself may have changed his mind about the best approach to adding colour (the conception behind fols. 2r to 21v and fol. 47r to the end was that significant areas were to be fully painted, while that for fols. 22r-47r was seemingly of coloured-line drawing with small areas of body colour).[35] To have as solid a basis as possible for comparison, we shall focus on the treatment of basic compositional elements that recur in both works – the ground, water, trees, vegetation, and clothing – drawing only on cases from the Hexateuch that are apparently finished, or very nearly so.

In both works the ground is regularly evoked by the lower border of the picture space (in the Hexateuch the narrow lines that delineate the outer and inner edges of such frames are generally red, while the colour with which their bars were intermittently filled could vary; in the Bayeux Tapestry the horizontal lines that divide the main field from the borders are usually red-brown). Yet from time to time undulating lines or zones might be supplied within the picture space as distinct ground planes. In the Hexateuch these are generally green, thus suggesting

[33] As the end of the Bayeux Tapestry is now missing, absolute certainty is impossible.

[34] Further on the phenomenon and its possible causes see Gameson et al., *Pigments of British Medieval Illuminators*, 14.

[35] These changes do not correspond to the divisions between quires.

grass, but they can also be orange, blue or pink.[36] In the Tapestry they are most frequently dark green, alternatively black-blue; however, when such lines rise up and thicken to form hillocks, they can become polychrome, featuring combinations of two or more of the main colours. In the abstract one might expect the straight line of the border to have been favoured for indoor scenes (i.e. contexts with levelled floors) and the wavy line for outdoor ones (evoking rougher terrain); in fact, however, both can be used for both, albeit with a preponderance of wavy lines for outdoor settings.

Water does not feature very often in the Hexateuch but contrasting approaches were taken to it where it does. The river Tigris was evoked by wavy lines coloured dark blue, infilled with a lighter blue and with white highlights, while the two blocks of water that were divided at Creation are shown one as pink, the other as green, both articulated with wavy lines in darker versions of the core colour.[37] Water is represented in the Tapestry by two or more undulating lines in parallel. In scenes 4-6 (the English Channel), 33 (the ghostly fleet) and 34 (the Channel again) these alternate between red-brown and olive green, whereas in scene 17 (the river Cousenon) all the lines are olive green.[38] In the grand panorama of the Normans crossing the English Channel, the pairs of olive green wavy lines sometimes turn red-brown or yellow where they overlap the hulls of the ships – an indication of the importance of colour contrasts to the general design of the textile, another theme to which we shall return.

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[36] E.g. respectively: fols. 12r and 15v; 4r; and 6r.

[37] Fols. 5v and 3v respectively. The depiction of the Red Sea (fol. 92r) was taken no further than a rough outline sketch, so there is no indication of how it was to be painted.

[38] The scene numbers used here are those that were marked on the backing fabric in the nineteenth century.

The illuminator of the Hexateuch tends to depict fire as flowing lines or tongues of red-orange, sometimes with white highlights of paint or of reserved parchment. Such is the case, for example, for the torches on fol. 3r, the open fire on 18v, the cooking fire on 29v, for the flames consuming Sodom and Gomorrah, as also for the smaller, more regimented flames surrounding the sword held by the angel who expels Adam and Eve from Paradise.[39] Fire is rarely shown in the Tapestry but where it does appear, the form is consistently more stylised (spikes evoking flames), while the colour changes. At the torching of Dinan the outline of the flame spikes is red-brown, their internal spaces the white/cream of the linen ground, whereas when the Normans cook their food at Hastings the flames are outlined in a mid-blue and infilled with red-brown.[40] A combination of these techniques was deployed for the fire in the scene of torching a house:[41] the flames from the two torches themselves are fully coloured, akin to those at Hastings, whereas those springing from the roof of the house have a coloured outline (alternately red-brown and mid-blue) with a plain linen body, as at Dinan.

Trees in the Hexateuch (which tend to be of 'lollipop' form) were painted in a wide range of colours; however, the palette for any individual example was generally restricted to two main tints – one for the trunk, the other for the leaves (these rendered as a single cloud-like canopy with patterning to evoke highly stylised foliage). The former may be green, green-brown, blue, orange, pink or even white; the latter are most commonly blue or white, but can also be pink or orange. The Tapestry's trees are more stylised in form and colour alike. Their trunks have angular projections (as if the lower branches have been lopped off) and sprout curvilinear upper branches, often interlocking symmetrically, that terminate in a tight curl, a single ivy-leaf with a tapering tip, or a trilobate flourish. The zones of the trunks were regularly rendered in different

[39] The last two scenes occur on fols. 32v and 8r respectively.

[40] Scenes 19 and 42.

[41] Scene 47.

colours – two or more of red, yellow, green, and blue – with contrasting hues for the curvilinear branches, and one or more different colours again for each leaf.

Plants and other vegetation in the two works – typically formed from spindly, scrolling branches and ivy- or acanthus-like leaves – are regularly multicoloured. The vegetation on fol. 5r of the Hexateuch, for example, features red-brown, pink, yellow, olive green and blue, while that in the upper border of the Bayeux Tapestry at the beginning of Scene 38 is rendered in red, blue, green, and yellow. In sum, this was an area where the illuminator of the Hexateuch made wide use of the colours at his disposal, while the creators of the Tapestry made full use of those available to them.

Although the Hexateuch recounts events from the Old Testament, it, like the Tapestry, shows characters clad in contemporary (eleventh-century) clothing.[42] The tunics that men in both works commonly wear can be any of the colours available to the illuminator and the embroiderers respectively. The same is true of the trousers sported by some men in the Tapestry; however, those in the Hexateuch are generally uncoloured, giving the superficial impression that the legs of the relevant figures are bare. When painted, shoes in the Hexateuch are black, whereas those in the Tapestry can be any one of the available colours. Cloaks (an emblem of high-status in the Tapestry)[43] are likewise of any colour, and the creators of both works took

[42] For which see, in general, G. Owen-Crocker, *Dress in Anglo-Saxon England*, 2nd ed. (Woodbridge 2004), ch. VII (often drawing upon the evidence of the Hexateuch and the Bayeux Tapestry themselves). For evaluation of the historicity of dress depicted in the Tapestry see M. Lewis, *The Archaeological Authority of the Bayeux Tapestry*, British Archaeological Reports, British Series 404 (Oxford 2005), ch. 5.

[43] See M. J. Lewis, 'Identity and Status in the Bayeux Tapestry: the iconographic and artefactual evidence', *Anglo-Norman Studies* 29 (2006), 100-20.

advantage of this diversity to differentiate people standing next to each other. More generally, the effect of continually varying the colour of the garments is to graft individuality onto otherwise repetitively rendered figures.[44]

What is disconcerting (for the modern viewer at least) is that the colours used for the garments of a recurring figure may also change from one scene to the next. Thus in scenes 29, 30 and 33 of the Tapestry, Harold's cloak is first dark-green, then red-brown, and finally blue-black. Likewise, that of Noah on fols. 13v and 14r of the Hexateuch transmutes from dark green to pinkish grey, that of Joseph before Pharoah alters from violet to blue, while the clothing of Pharoah himself changes not only in colour but also in form (though as he is the sole figure with a crown, his identity is never in doubt). More striking still are the fluctuations in the Deity's garments between fols. 2r and 5r: he starts clad in a green over-robe and an orange under-one; next he wears a blue over-robe and a blue-green under one, then blue over orange, followed by pale violet over orange, then blue over blue-green (again), whereafter he sports a violet-purple tunic with no overgarment, followed by a violet over-robe and a blue-green under-robe, ending with blue over orange. (A rare case of sartorial continuity in the Hexateuch, incidentally, is provided by the celebrated coat given to Joseph by his father which, through five appearances, is consistently blue with circular patterns, this latter detail being a direct response to how the

[44] That visual variety and decorative effect were more important than symbolism in determining colour here is indicated by the fact that the highest-status figures in the Tapestry (Edward, Harold, Guy and William) can wear robes, tunics, and cloaks in almost any of the available colours and that, when such figures are juxtaposed, the colouring of their clothing tends to be complementary: thus at the oath swearing (Scene 23), William has a yellow tunic and a blue-green cloak while Harold has the reverse.

garment is described in the Old English text, namely 'hringfah', possible meanings of which are 'spotted with circles', 'adorned with rings'.[45])

Taking all these individual elements into account (along with others not discussed above but all displaying similar characteristics), it is clear that the colours selected for individual items in the Hexateuch only intermittently corresponded to those of their real-world equivalents. In the Tapestry the relationship was even more episodic, limited to mail (predominantly blue, evoking a metallic sheen),[46] the occasional ground line, and clothing (the 'naturalistic' colouring of the last arguably no more than an inevitable consequence of the fact that the medium itself comprised fabrics coloured with textile dyes).[47] In both manuscript and Tapestry, but above all the latter, colour was primarily a device for distinguishing between abutting elements in a given scene: unhampered by the obligations of verisimilitude, it could function all the better as a compositional tool.

With the general chromatic characteristics of the two works – and the distinctions between them – in view, it is logical to enquire whether, in those scenes where an iconographic

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[45] Fols. 53r-54v. The tunic worn by St Michael in the *saec.* XI$^{3/4}$ Crowland Psalter (Oxford, Bodleian Library, Douce 296, fol. 40v) is depicted in a similar way which, given that the garment adorns a warrior saint, may be meant to suggest mail. Whether the artist of the Hexateuch understood 'hringfah' to mean 'mail' and hence whether *that* is what this is meant to be evoked by his rendering of Joseph's coat are open questions.

[46] See further G. Owen-Crocker, 'Colour and Imagination in the Bayeux Tapestry' in *Making Sense of the Bayeux Tapestry*, ed. Henderson, 41-53, esp. 46.

[47] For the rare cases where yellow and blue detailing may have been intended to evoke gold and silver thread respectively see ibid., 43-46.

connection between the Hexateuch and the Tapestry has been perceived, there are any parallels in the deployment of colour.

There is little common ground between the colours used for Conan escaping Dol in the Tapestry and its purported inspiration, the Israelite spies fleeing Jericho in the Hexateuch [Illustration 3].[48] The spy on the rope wears a brown tunic and black shoes, while Conan sports a yellow tunic, dark green leggings, brown-red shoes and a hat that is part red, part green. Similarly, while the Harold who stands apologetically before Edward in the Bayeux Tapestry has a yellow tunic, a black-blue cloak and red-brown trousers, and the King wears an olive green gown, a red-brown cloak and yellow leggings, their putative sources in the Hexateuch, Joseph and Pharoah, both wear blue, the latter having in addition a pink-grey gown [Illustration 4].[49] Likewise, whereas the servant who supports the dying then defunct Edward in the scenes of his demise wears yellow, and the king's shroud is olive green, the figure in the Hexateuch that has been suggested as the possible source (an attendant supporting the head of the biblical patriarch Jared) wears blue, while the shroud is pink-white [Illustration 5].[50] Nor is the second shroud on the same page any nearer in hue for it is blue, as is the one for Malaeel on the previous page (a vignette, incidentally, that is closer in general design to the death of Edward).[51]

In relation to the enigmatic Ælfgyva of the Tapestry (who is clad in orange headdress and under-robe and a green over-robe), the figures in the Hexateuch that offer the closest postural

[48] Fol. 141v.

[49] Fol. 60r; Genesis 41.43.

[50] Fol. 11v; Genesis 8.18-20.

[51] Fol. 11r.

parallels are the wives of the sons of Noah as they are shown leaving the ark.[52] Paradoxically, the one whose deportment is most akin to Ælfgyva's (namely the third figure) has entirely different colouring (a pink robe), while the one who is nearest in colouring (the first figure, who wears red-brown over green) is more distant in posture. [Illustration 6]. Other women who sport clothing with similar colours – such as Eve once expelled from Paradise, a member of Cain's family, one of the wives of Noah's sons on a different page, and a wife of Abraham or Nahor – are entirely distinct in terms of posture.[53] Collectively, these cases suggest that parities of palette reflect coincidence not design. And in fact all the remaining cases where an iconographic relationship between the Hexateuch and the Tapestry has been suspected are devoid of chromatic similarities. Thus Harold enthroned as king wears a green robe over a yellow under-robe, with red-brown cloak and trousers, whereas the figure of Pharoah that has been advanced as a possible iconographic source is clad in a pink-grey over-robe, a green under-robe, and a blue cloak [Illustration 7].[54] Again, the man working wood for ships in the Tapestry wears green, whereas the figure of Noah preparing timber for his ark that has been claimed as its inspiration is clad in red-brown [Illustration 8].[55]

It is abundantly clear, therefore, even making generous allowance for the different resources of the two media, that absolutely no attempt was made in the Tapestry to replicate the colours of those details in the Hexateuch that have been identified as possible visual models. Several reasons for this could, in principle, be entertained. At one extreme, it might conceivably be held to suggest that there was in fact no connection between the two works – after all, the

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[52] Fol. 15v. On artistic prototypes for Ælfgyva in the Bayeux Tapestry see M. J. Lewis, 'The Ælfgyva of the Bayeux Tapestry' (forthcoming).

[53] Respectively fols. 7v, 11r, 12v, and 20r.

[54] Fol. 59r.

[55] Fol. 13v.

sheer scale of both pictorial cycles, featuring hundreds of figures involved in myriad but sometimes very similar activities, means that some overlap of subject-matter and/or parity in the disposition of figures was almost inevitable. At the other extreme, one might theorise that the designer drew on the lost parent of Cotton Claudius B.iv, the anterior illustrated Old English Hexateuch that has reasonably been hypothesised,[56] whose colour choices at the relevant points, it might be surmised, could have been closer to what is seen in the Tapestry. However, given the lack of telling correspondences between the ways in which commonly occurring elements of the natural world were treated in the Hexateuch and the Tapestry, a 'middle' view is more plausible – namely positing that the designer of the Tapestry *was* familiar with Cotton Claudius B.iv itself, but that his borrowings extended only to certain forms not to colours. After all, even with regard to forms, the motifs in the two works that have been seen to correspond are never exact copies: rather the relevant imagery in the Tapestry follows similar approaches to depicting the subjects in question to those taken in the Hexateuch – approaches that could, therefore, have been informed by sketches, or even just memories, of the art of the latter.[57] Here it is relevant to introduce a further fact about these suspected parallels as a whole, namely that the motifs in question are scattered throughout both works: the purported source motifs do not cluster within certain portions of the manuscript, nor the presumed borrowings within particular sections of the textile. Together the dispersal of the relevant motifs and the generalised nature of the

[56] See note 5 above.

[57] If the few extant model-books dating from before c. 1250 (W. Scheller, *Exemplum. Model-Book Drawings and the Practice of Artistic Transmission in the Middle Ages (ca. 900-ca.1450)* (Amsterdam 1996), nos. 3-14) are a reasonable guide to the genre as a whole, they indicate that motifs were often copied uncoloured (nos. 3-5 and 14) or just with touches of a single colour (nos. 8, 10, 12); only two (nos. 6 and 9) have extensive colouring.

parallels suggest that the designer of the Tapestry had a broad familiarity with the imagery of the manuscript but that it merely informed his work selectively and impressionistically.

Consideration of how colour was treated in other eleventh-century works of art for which a specific iconographic source is identifiable provides a broader context in which to understand the putative relationship between the Hexateuch and the Tapestry in this respect.[58] An example that combines close attention to iconographic detail with total disregard for the palette of the original is the Harley 603 Psalter.[59] All four artists engaged in the original phase of this ambitious project, begun at Canterbury around the year 1000, copied the imagery of the Utrecht Psalter, a Reimsian manuscript of the 820s or 30s, with preternatural accuracy.[60] However, three of the Anglo-Saxon draftsmen (known as A, B and D) substituted coloured lines for the bistre strokes of the original, two of these hands (A and D) positively revelling in the aesthetic changes that this wrought. The image of the Annunciation in the Pericopes Book of Henry III, by contrast, a manuscript made at Echternach between 1039 and 1043, has a similar palette to its source (the same subject in the Codex Egberti of 977x93, one of the handful of

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[58] On the relationship between models and copies in this period more generally see, e.g., H. Swarzenski, 'The Role of Copies in the Formation of the Styles of the Eleventh Century' in *Studies in Western Art*, Acts of the Twentieth International Congress of the History of Art, ed. M. Meiss, 4 vols. (Princeton 1963), I (*Romanesque and Gothic Art*), 7-18.

[59] London, British Library, Harley 603. Monographic study: W. Noel, *The Harley Psalter* (Cambridge 1995); for further bibliography see Gneuss and Lapidge, *Anglo-Saxon Manuscripts*, no. 422. The pigments are identified and their deployment discussed in Gameson et al., *Pigments of British Medieval Illuminators*, 99-100 and 111-12.

[60] Utrecht Universiteitsbibliotheek, 32. Facsimile: *Utrecht-Psalter, vollständige Faksimile-ausgabe im Originalformat der Handschrift 32 aus dem Besitz der Bibliotheek der Rijksuniversiteit te Utrecht*, ed. K. van der Horst and J. H. A. Engelbregt, 2 vols., Codices Selecti 75 (Graz 1984).

miniatures contributed by the celebrated Gregory Master), though the colours applied to the two figures are different.[61] The earlier Gabriel had blue-green wings, a purple under-robe and a green-yellow over-tunic, while the later version has blue and purple wings, a blue under-robe, and a purple over-tunic; the earlier Mary wore a blue under-robe and a purple over-tunic, the later one is clad in a pink-purple under-robe and a dark purple over-tunic. A final case, even closer in time to the Hexateuch and the Bayeux Tapestry, is provided by the evangelist portraits in the late eleventh-century Exeter Gospels that were based on those added around the middle of the eleventh century by a Flemish artist to the Gospels of Leofric, bishop of Crediton then Exeter (d. 1072).[62] Most of the colours in the earlier portrait of Mark – pale yellow under-robe,

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[61] The former is Bremen Staats- und Universitätsbibliothek, MS b.21, fol. 9r. Facsimile: *Das Evangelistar Kaiser Heinrichs III. Perikopenbuch aus Echternach*, ed. G. Knoll, 2 vols. (Wiesbaden 1981). The miniatures are also reproduced in G. Knoll (ed.), *Das Echternacher Evangelistar Kaiser Heinrichs III* (Wiesbaden 1995). For the pigments used in other, broadly contemporary Echternach books see D. Oltrogge and R. Fuchs, *Die Maltechnik des Codex Aureus aus Echternach. Ein Meisterwerk im Wandel* (Nuremburg 2009), esp. 153-67. The latter is Trier Stadtbibliothek, MS 24, fol. 9v. Facsimiles: *Codex Egberti der Stadtbibliothek Trier*, ed. H. Schiel, 2 vols. (Basel, 1960) and *Egbert-Codex. Faksimile Codex Egberti* (Lucerne 2005). See also G. Franz (ed.), *Der Egbert Codex. Ein Höhepunkt der Buchmalerei vor 1000 Jahren* (with identifications of the pigments, by D. Oltrogge and R. Fuchs, at 190-95).

[62] Paris, Bibliothèque nationale de Paris, lat. 14782: F. Avril and P. Stirnemann, *Manuscrits enluminés d'origine insulaire* (Paris 1987), no. 26. Oxford, Bodleian Library, Auct.D.2.16 (S.C. 2719); origin Landevennec, *saec.* x^1; the added miniatures are fols. 72v and 146r: O. Pächt and J. J. G. Alexander, *Illuminated Manuscripts in the Bodleian Library, Oxford I: German, Dutch, Flemish, French and Spanish Schools* (Oxford, 1966), nos. 427 and 433. See further J. J. G. Alexander, 'A little-known Gospel Book of the later eleventh century from Exeter', *Burlington Magazine* vol. 108, no. 754

green over-robe, blue curtain, and red drape on the lectern – were replicated in the later equivalent, the main alterations being the substitution of a blue ground for the brown one of the original and the infusion of a more orange hue to the under-robe. In the portrait of John the colours of the ground (blue), symbol (blue body, pink wings) and curtain (green) were preserved, while those of the evangelist were modified (an orange rather than a deep red over-robe for example). Yet despite the continuities, the overall chromatic effect of the new images was revolutionised by the substitution of elaborate, coloured foliate frames for the much plainer ones of the original, by a brasher, more stylised manner of drawing, and by a bolder application of paint.

Collectively these and similar cases show that, while the palette of an iconographic model might influence that of a later derivative, it was only one of a range of factors that did so and was by no means the most important; the primary determinants were the aesthetic effect desired for the new creation along with contemporary 'house styles'. Now these are all instances where the pairs of works are in the same medium and the relevant iconographic subject remained the same from the earlier to the later. With the Hexateuch and the Tapestry, by contrast, there was a disjunction both of medium (manuscript to embroidery) and of iconographic subject (Old Testament events to contemporary ones). One would naturally, therefore, expect the ties, chromatic or otherwise, to be looser.

In fact there was a further, more fundamental reason why the colours of an iconographic source (whether in the Hexateuch or elsewhere) would not be reflected in the finished Tapestry – namely the way in which the colours of the textile were probably determined. We shall set out our thoughts on this subject more fully in the conclusion. Here it suffices to note that for the

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(1966), 6-16; and idem, *Medieval Illuminators and their Methods of Work* (New Haven and London 1992), 77, and 80-82 with ills. 126-27.

source colours to have been replicated, not only would the designer of the Tapestry have had to have recorded them when he viewed the Hexateuch, he would then also have had to have thought it worth specifying them in the patterns that were transmitted to the embroiderers – hardly a likely course of events.

Conclusion

Identification of the (majority of) the inks and pigments available to the illuminator of the Old English Hexateuch and of the dyes available to the creators of the Bayeux Tapestry enables us to appreciate with new clarity how the respective parties utilised the chromatic resources at their disposal. In essence, the illuminator of the manuscript employed an extensive palette selectively and episodically, while the creators of the textile consistently exploited to the full their much more limited one. If the manuscript displays more modulation of such colours as were used, the textile (in which comparable effects would have been challenging to achieve) features more alternation between colours.

A key point to make about the use of colour in the Hexateuch is that it is difficult to perceive any general principles beyond a preference for certain colours over others. Notwithstanding the range of pigments available to the illuminator, the palette is dominated by oranges, blues, pinks and whites, a partiality crystalised in the rainbow depicted on fol. 15v whose bands are (from top to bottom) orange, blue, pink, orange again, and finally blue again [Illustration 9]. These are intermittently supplemented by more modest quantities of yellow, purple, and green. Other tendencies that can be perceived – and as the word 'tendencies' indicates, there are invariably exceptions – include rendering human flesh white and hair blue, and where people are depicted in groups, making some attempt to differentiate them via the

colour of their clothing (groups of animals, by contrast, are generally all the same colour).[63] As noted earlier, ground, if indicated, is often green (though blue, orange and pink examples do appear), and trees have trunks of one colour and canopies of another. Why the deployment of colour was not more structured is debatable, but the episodic way in which the project appears to have been pursued – with different sections being brought to different degrees of completion – is surely part of the answer. More generally, it may be suspected to reflect the limitations and vacillations of a single artist working piecemeal on a task of surpassing magnitude.

Ultimately, however, a lack of clear chromatic principles was of limited consequence for the images in a book. For these were, by definition, a series of individual units, isolated one from another not only by their frames but also more fundamentally by dint of being scattered across some 310 different pages and separated by the many black-brown lines of intercalated text. Very different were the requirements for a long textile that would, ideally, be visible to the beholder in its entirety and be read as a continuous strip. Very different, too, were the circumstances in which it would have been manufactured.

The creation of an extremely long textile necessitated the involvement of many hands. Achieving continuity of colouring across such an operation must surely have presupposed one of two approaches (or a combination of both): either micro-management (detailed colour notes accompanying every part of the pattern and/or a designer who was continually in attendance whenever and wherever the work of embroidery was under way) or alternatively a set of principles that could guarantee an homogenous result even if followed independently (or at least semi-independently) by every worker involved in stitching coloured wools onto the design

[63] One exception occurs on fol. 51r, where the horses are orange then blue in alternation.

outlined on the linen in front of them.[64] The fact that the former would imply complicated logistics, while the requisite principles for the latter could have been few in number and simple in nature inclines one to favour *that* as the solution (or at least the greater part of it). For one can in fact explain all the colour choices in the Bayeux Tapestry in terms of three principles [Illustration 10].

The first – indeed the fundamental – principle would have been that adjacent elements should be different colours. This axiom became all the more liberating if, as seems likely, it came with no requirement to follow any particular sequence of hues: there are numerous symmetrical alternations of colour in the Tapestry, above all in architecture, foliage and the motifs in the borders, but non-symmetrical ones are equally, if not more, plentiful. Thus the planks of a particular boat may be red and yellow in alternation, but those of the vessel behind it run red, yellow, green-blue, yellow, green-blue, red, while those of the one in front of it are green, yellow, green, red, green, red. The main exception (presumably specified as such), an element that can remain the same colour in adjacent appearances, is mail which is frequently blue (though the colours of the helmets, leggings and shoes of adjacent mail-clad figures continue to vary 'as usual').

The second principle (merely an extension of the first) was that the line that defines the outline of any element should be a different colour or colours (some change tint during the course of their 'journey' around the item in question) from that of the body zone within them.

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[64] That the design was marked out on the linen is not in doubt, despite no trace of any original underdrawing now being visible. Such underdrawing as is occasionally visible to the naked eye (e.g. above the mane of the horse below 'pugnant' at the division between scenes 55 and 56), as also that which was detected in the most recent campaign of hyperspectral imaging, relates to nineteenth-century restorations.

Thus a horse with a red body, red near-side legs and a yellow mane, for example, might be outlined in blue-green, while its blue-green far-side legs are outlined in red (except for its red hooves, which are outlined in blue-green again). An adjacent horse with a blue-green body and near-side legs, a 'white' mane, and yellow far-side legs might be wholly outlined in red, except for its hooves – those of the near-side legs being coloured yellow, those of the far-side ones red – which are outlined in blue-green.

The third principle was that human flesh should not, in general, be outlined in yellow – doubtless because the tiny but important details of faces and hands would not be adequately visible if rendered thus against a linen ground (yellow had been shunned in coloured-line drawings in manuscripts doubtless for the same reason).[65] The rare exceptions generally occur when the faces in question are silhouetted against blocks of colour (the raised shields of the mounted knights, for instance) rather than on plain linen and so there was no risk of reduced visibility.

These three principles are sufficiently straightforward that they could easily have been conveyed to, and followed by, the embroiderers, without continual supervision (though needless to say, mistakes occasionally occurred).[66] Patently proficient at what they were doing,[67] these workers could then have proceeded on their own initiative, planning and then adding colours to the design, scene by scene. The three principles by themselves would have sufficed to ensure that

[65] See Gameson et al., *Pigments of British Medieval Illuminators*, 100.

[66] See M. J. Lewis, 'Embroidery Errors in the Bayeux Tapestry and their Relevance for Understanding its Design and Production' in *The Bayeux Tapestry: new interpretations*, ed. M. K. Foys, K. E. Overbey and D. Terkla (Woodbridge 2009), 130-40.

[67] See Lester-Makin, 'Technical Discussion' and 'Les six châteaux'.

the end result, though made in separate sections, conceivably in several proximate locations,[68] would, when assembled, be aesthetically homogenous – as indeed the Bayeux Tapestry is.

Apart from smoothing the practicalities of production, the aesthetic thus defined had additional advantages that will doubtless have been readily appreciated. Alternation of colours was a powerful tool for distinguishing between similar elements in a given scene, be they the planks of a ship, the tiles on a roof, the vessels on a table, or the individual knights in a charge. Simultaneously, it creates pattern and vibrancy. The chromatic variety in question keeps the eye engaged and, if this meant that sequential iterations of the same figure might be coloured differently, then that was a small price to pay for a beguiling overall effect. Moreover, variegation of colours imparts kinetic energy to these images – a phenomenon exploited more calculatingly in the oeuvre of modern practitioners of so-called 'Optical Art', such as Bridget Riley (b. 1931). The illusion of throbbing and movement encourages the eye to perceive action and vitality in what are ultimately static images – a subliminal support to the other devices, such as gesture, pose, and the preponderant left to right directionality of the figures and scenes, that collectively elevate thousands of stitches of coloured wool into a masterpiece of pictorial narrative.

[68] For practical considerations militating against multiple, geographically dispersed locations see Lester-Makin, 'Technical Discussion', 36-39, and 'Les six châteaux', 87-90.