Digital Image Archive of Medieval Music

The Digital Image Archive of Medieval Music is a joint project between **Dr Margaret Bent FBA** *of the University of Oxford, and* **Professor Andrew Wathey** *of Royal Holloway, University of London. Dr Julia Craig-McFeely, the Project Manager, is developing the archive, database, web site and documentation for the project and undertaking digital photography (where photographs are not supplied by the library or archive concerned) and the enhancement and virtual restoration of images obtained. The aims are to digitize, archive and enhance images of British manuscripts of medieval polyphonic music, a rich and neglected repertory that survives mainly in fragmentary and often barely-legible sources. Work on the first phase of the project began in 1998 with funding from the British Academy. The project directors here describe the work, and present examples of recent successes.*

Very few pre-Reformation British music manuscripts survive in even semi-complete form. Most are damaged and fragmentary, and have been preserved only because they were re-used as binding material or for other purposes. The music that they contained went out of fashion quite fast (a testimony to the vitality of the tradition – few manuscripts contained music more than 30 or 40 years old) and when obsolete many manuscripts were consigned to the bookbinder's waste-box (or, in one case, at New College, Oxford, were used as backing for ceiling paintings). Medieval vandalism was compounded by the more wilful destruction at the Reformation and again in later centuries when books were rebound and the early bindings containing the music fragments were simply discarded. This practice was common up to the mid/late nineteenth century; there is a notable difference in fragment survival rates between libraries that rebound extensively in the nineteenth century and those that did not.

Taken together the surviving fragments form a crucially important witness to the range and diversity of English music, its styles and notations. Discoveries are still being made as the contents of early bindings are more completely surveyed by modern scholars. In the last thirty years, the number of manuscripts, including fragments, known from pre-Reformation Britain has expanded by over a third, with new finds frequently forcing the re-ordering of a repertory or an individual composer's output. Some 350 fragments are now known (most are single leaves or bifolia, but some are substantial units of up to twenty-four pages), witnesses to an almost equivalent number of books. Important new fragmentary sources include leaves allowing the partial reconstruction of a dismembered royal choirbook and new works by the composer John Dunstaple, discovered by Dr Bent, and a manuscript roll of fourteenth-century motets at Berkeley Castle, discovered by Professor Wathey.

Others are emerging as the work of the project progresses. Fortunately, many of the fragments contain music that can be reconstructed by reference to other music manuscripts, either fragments, or major sources that have survived substantially complete, such as the Eton Choir-book (Eton College, MS 187) and the Old Hall Manuscript (British Library, Add. MS 57950). The surviving fragments are scattered over some eighty-five libraries, archives and other repositories in the UK, from St Andrews to Exeter. We plan, as circumstances permit, to cover those English sources that have wandered to libraries overseas, twenty-one in all, in Australia, Belgium, France, Estonia, Germany, Italy and the USA. One of the purposes of the project is to remove the natural inhibition to studying this material that has long been imposed by its geographic spread.

The aims of the DIAMM project are:

• to create a new permanent electronic archive of images of manuscripts of British medieval polyphony, to facilitate wider study of their contents and to assure their permanent preservation for the nation;

• to develop techniques of digital image enhancement (or 'virtual restoration') to make legible materials that cannot at present be read;

• to develop new and more exact types of manuscript study made possible by digital image technology.

The first phase of the project involved the collection of digital images and computer enhancement of fifteenth-century fragments with a view to publication in facsimile form. In its second phase the project has expanded to embrace all of the fragmentary and some of the less accessible complete manuscripts of British pre-reformation polyphony, and will at the same time exploit further more recent technological advances. The electronic archive will eventually

facilitate wide access to a musical repertory hitherto only accessible, and then imperfectly, to a small number of specialists.

High-resolution electronic photography has been used to acquire images directly from the originals, rather than from surrogates such as existing photographs or slides (which cannot match the resolution available from direct digital capture). Image processing, a non-invasive process applied to the digital photograph, is used to recover material not at present legible. The results obtained make clear that some works lost to the naked eye can be recovered, restoring not only lost readings – and even complete pieces (see below) – but also new evidence for composer attribution and contextual evidence permitting some manuscripts to be more authoritatively dated or located. Digital imaging has also revealed the scope for new and more exact forms of study: magnification permits the detailed analysis of scribal habits and notational forms; quantitative colour measures permit the more exact study and analysis of ink-colour and of individual scripts. These techniques promise important results even for manuscripts surviving in good condition, where black-and-white photography has con-ventionally sufficed for study purposes. Developments in the use of infra-red and ultra-violet photography in conjunction with digital imaging may eventually allow material to be read through layers of dirt and/or superposed writing, but even with normal lighting spectacular results have been produced by 'lifting' over-writing and revealing the erased music underneath (see (i) below). All of these advances contribute to the archival and conservation element in the project, helping to minimize the loss to scholarship resulting from further physical deterioration.

The project uses commercially-available software, chosen with the intention that others should be able to replicate or improve on our results. We hope that not only images but also image-enhancement techniques generated by the project will thereby be disseminated rapidly within the scholarly community. For our part, we have gained considerably from contact with other projects, including the Centre for the Study of Ancient Documents in Oxford and the Dead Sea Scrolls project developed in conjunction with NASA.

High-quality images and enhancements will be disseminated through the project web-site (www.diamm.ac.uk), which also carries source-lists and updates to established finding-aids, and, where appropriate, in hard-copy facsimile publications. Systems for web-based dissemination are now in place, allowing a hierarchy of different levels of access and providing, via a password system and print-disabled files, an effective means of copyright protection. Images of standard size (96 dpi/1–2 Mb), sufficient for detailed manuscript study and significantly better than conventional colour photography, will be publicly available for nearly all manuscripts. The largest images (up to 500 Mb) used for enhancement work currently exceed the capacity of many desktop computers and web delivery systems but will be made available as technological developments and library policies allow.

The project has so far archived some 1400 images from British collections. In a few major libraries these have been captured using these libraries' own equipment but in the majority the project's own mobile high-resolution digital camera and other equipment have been used. During 2000 the project aims to collect digital images of all 350 surviving sources (some 2300 pages in total) and concurrently to continue the process of enhancement that will be needed to restore many of them to legibility. This work has already led to the recovery of works buried beneath dirt or later writing, and the discovery of new works now too faded to be easily legible with the naked eye. Three examples are given below.

New Works Discovered/Uncovered

(i) Oxford, Corpus Christi College, MS 144.

Corpus Christi College Oxford, manuscript 144 is unusual (though not unique) in containing leaves from a fourteenth-century music book that were scraped and re-used for writing another text in the fifteenth century (the *Liber metricus de nova poetria* of Geoffrey of Vinsauf). The music leaves, which may have originated at the Benedictine Abbey at St Albans, were also trimmed, removing still more of the original musical text. The resulting palimpsest manuscript was given to the Benedictine Priory at Tynemouth during the fifteenth century. First discovered in the 1970s, this manuscript has until now remained virtually illegible: music is clearly present, but a continuous composition could not be transcribed.

The pictures show two folios of the Corpus palimpsest in various stages of recovery under-taken by Dr Craig-McFeely, which are among the most spectacular examples to date of our enhancement work. Stage 1 shows the page as it appears to the naked eye (or the camera lens). In stage 2, the over-writing has been 'removed'. In

It is planned to publish part of the results of the work of the Digital Archive of Medieval Music as *English Manuscripts of Fifteenth-Century Polyphony in Facsimile* in the Academy's Early English Church Music series. The EECM is an Academy Research Project, whose fruits have been published by the Academy since 1963.

Stage 3 the contrast between the almost-visible music and the rather dark colour of the parchment is increased. In this third step some of the lighter remnants of the music are lost; finally Stage 4 superimposes a partially transparent version of Stage 3 onto a copy of Stage 2. The result darkens the music writing sufficiently to make it readable. The result – though still not easy to read in places – allows a performable transcription of the piece to be made.
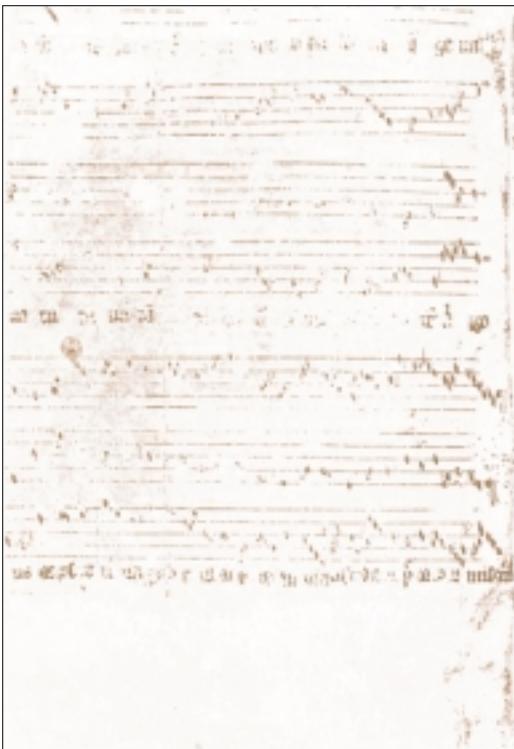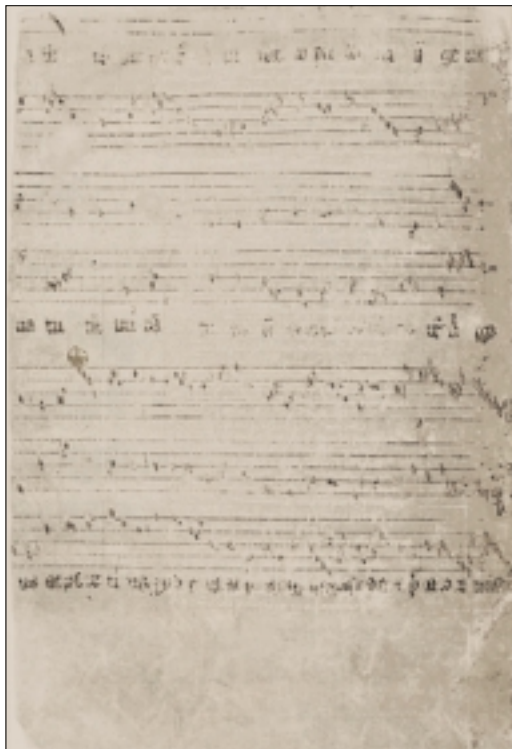
Stage 1
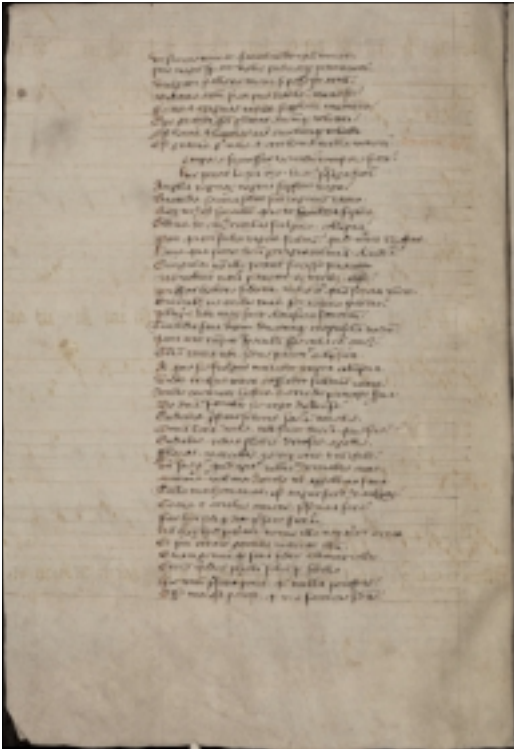
Stage 2
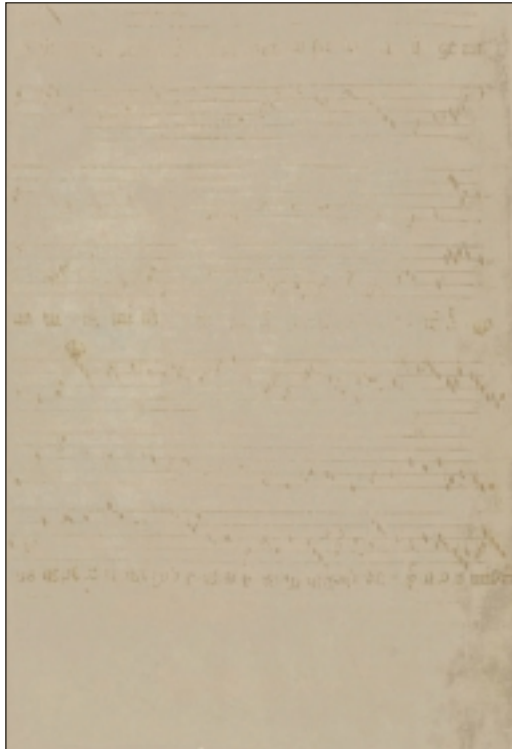
Four stages in the 'virtual restoration' of palimpsest music in Corpus Christi College, Oxford, MS 144, fol. 23v. © 2000 Corpus Christi College, Oxford. Reproduced by kind permission of the President and Fellows.
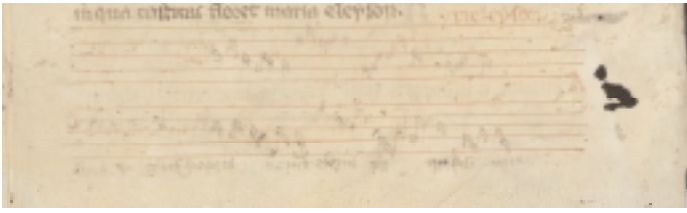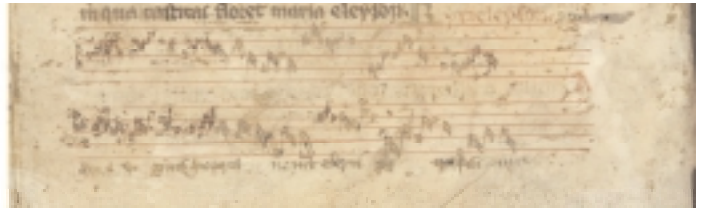
Stage 3

Stage 4

Stage 1

Stage 2

A new polyphonic setting of Beata viscera *revealed by digital photographic techniques in Worcester Cathedral, Add. MS 68, fragment X, fol. 2r.*
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(ii) The Worcester Fragments

The so-called Worcester Fragments (consisting of leaves in former Worcester manuscripts now at London, Oxford and Worcester Cathedral) are by far the largest and most important English source of thirteenth-century polyphony. Some 53 leaves and other fragments remain at Worcester Cathedral, presenting a rich and fascinating testimony to the creative vigour of the musicians there. Many of these leaves have been re-used twice: once in the late fifteenth-century when they were used to bind Worcester Cathedral manuscripts, but also in the early 1400s when staves unused by the thirteenth-century scribes were filled with shorter pieces, some of which may also have been composed at Worcester Cathedral.

The pictures above show a newly-discovered work, a fifteenth-century setting of the Marian text *Beata viscera*. Added at the foot of two facing pages, this piece is not readily visible to the naked eye (Stage 1). Photographed under ultra-violet light some text and musical notation can be more easily discerned. An enhanced version of this image (Stage 2) renders the notation almost fully legible, revealing the full extent of this new Worcester composition. A performance of this (short) new work can be heard on the project website at: www.diamm.ac.uk.

(iii) British Library, Additional MS 41340 (H), fol. 100v

The three parchment fragments now fols. 99–101 in BL Additional MS 41340 are the only source of secular polyphony to survive from late-fourteenth-century England. They preserve portions (mostly small) of no fewer than thirteen polyphonic settings of French or Anglo-Norman texts, of which at least one and probably seven can be identified as polyphonic *rondeaux* musically similar to the *rondeaux* of Guillaume de Machaut. The fragments were cut from a roll and fashioned (probably during the fifteenth century) into a cover for a manuscript of Middle English sermons used in Shropshire. They were acquired by the British Museum in 1926 but, owing to their very poor condition (they are almost illegible even under ultra-violet light), their musical contents were recognised as polyphony only in the 1980s.

The pictures below show a folio containing two of the newly-recovered fragmentary works including one rondeau (top left). Very little on this page is visible to the naked eye (Stage 1). Overall contrast is adjusted to maximise the distinction between the faded ink colour and its background (Stage 2). The ink colour is then isolated, independently darkened, and recombined with the background (Stage 3), producing an image from which the remains of these works can be transcribed with relative ease.
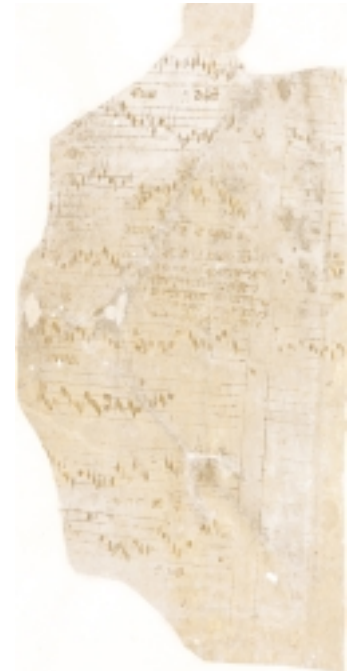
Two newly-recovered fragmentary works in British Library Additional MS 41340 (H), fol. 100v.
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Stage 1   *Stage 2*   *Stage 3*