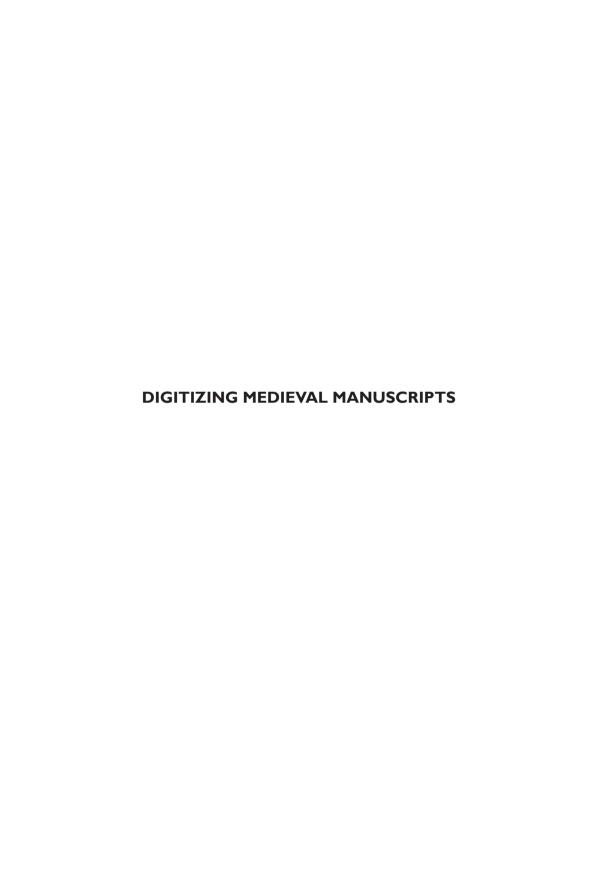# DIGITIZING MEDIEVAL MANUSCRIPTS

THE ST CHAD GOSPELS, MATERIALITY, RECOVERIES, AND REPRESENTATION IN 2D & 3D

by
BILL ENDRES

DIGITIZING MEDIEVAL MANUSCRIPTS

MEDIEVAL MEDIA CULTURES

Medieval Media Cultures offers analyses of how individuals interacted with written, visual, dramatic, and material media in medieval and early modern cultures, as well as how modern scholars interact with the remnants of medieval and early modern cultures via written, material, and now digital and electronic media.

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CONTENTS

LIST OF ILLUSTRATIONS

Figures

Tables

THE AGE OF VISUAL WONDER: DIGITIZING MATERIALITY AND UNRIDDLING LIGHT

HOW A MANUSCRIPT reflects light changes over time. Folios become worn, damaged, and effaced. Humans make erasures, and more dramatically, wash or scrape away text to produce palimpsests. But also, there is the unrelenting hand of time, the gradual deterioration of inks and pigments, the slow discolouration and stiffening of parchment. Folios grow visually mysterious, like the enigmatic descriptions of common things in medieval riddles. Whether describing a wax tablet or an icicle, Aldhelm's riddles and those preserved in the Exeter Book tease readers with their baffling descriptions. As Patrick Murphy points out, Old English riddles start with phrases such as, "*wunderlicu wiht*, wondrous creature, something rich and strange," giving voice to an inanimate object and transforming it into a mysterious being.[1] As a folio ages, it too transforms into something rich and strange, turning into a *wunderlicu wiht*. Its lost pigments and ink make it an enigma waiting to be known.

Even for pages that have escaped severe damage, mysteries abound. There is much to be explored in the materiality of a manuscript. Pages are rich repositories of history: quality of parchment, types of pigments, wear from use, and markings from travels, all make manuscripts instructive witnesses to the medieval world and beyond. In the eighth-century St. Chad Gospels (Lich MS 1), the manuscript central to this study, enigmas exist about its damaged and erased text but also about its dry-point writing, the identity of its organic pigments, the number of artists and scribes who made it,[2] and even where it was made. As with fellow manuscripts from the Insular period (ca. 600–850, British Isles), few records survive, and even basic information, such as provenance, presents limited and misleading clues. But scholars have methods to coax knowledge from such limits. Paleographers urge insight by categorizing types of scripts and comparing the anatomy of letters. Codicologists explore layout, quires, and overall structures, revealing relations within a manuscript and correspondences among manuscripts and monasteries. Textual scholars study and trace biblical versions, and for early manuscripts such as the St. Chad Gospels, they have identified features such as recensions from Jerome's Vulgate to demonstrate traditions of texts and geographic relations among manuscripts. Like other scholarly approaches, advanced techniques of digital imaging have methods for teasing out insight. These methods labour with numerically captured visual information, making the page receptive to mathematical processing, moving beyond human capacities to unriddle mysteries held in reflected light.

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[1] Murphy, *Unriddling*, 7.

[2] Endres, "Ligatures," 159–86.

To date, much of the focus of digital imaging has been on producing visual representations and increasing access. This is no trivial accomplishment. Projects such as e-Codices,[3] committed to digitizing and making available all medieval manuscripts in Switzerland, have transformed public access to and scholarly engagement with medieval manuscripts. Access and a simple tool, such as magnification, can lead to wondrous insight and revelation. However, this is only the initial wave of benefit. Further gains are possible from digital images taken with light frequencies beyond human vision, such as infrared and ultraviolet, an approach begun with photography in the first part of the twentieth century. Recently, for example, studying ultraviolet images, Myriah Williams and Paul Russell discovered two ghostly faces in the well-studied Black Book of Carmarthen (Peniarth MS 1, Llyfrgell Genedlaethol Cymru/The National Library of Wales).[4] Their discovery showcases the value of ultraviolet imaging for uncovering content otherwise lost in the shadows of an erasure. But again, this is only the beginning.

For digital imaging, innovative methods result from converting visual information into numerical values. This opens vast opportunities for analyzing manuscripts, many techniques readily available to medievalists. Once visual information becomes numeric, scholars can apply mathematical functions to manipulate and enhance it. Such methods can recover content from colour images, assess aging, and provide an enhanced view of surface details. Accessible to any medievalist, these approaches present countless benefits. For example, recovering content is possible without the need for ultraviolet or infrared imaging. Available methods can make recoveries even from photographs captured with a smartphone.[5] Therefore, when examining a manuscript at an archive, a scholar can take images and process them on site, able to assess digital recoveries by consulting the manuscript while it is still at hand.

But again, this is only the beginning. New 3D methods make studying the three-dimensional nature of a manuscript much more feasible. 3D renderings provide valuable visual information about the likes of the contours of pages, crucial for understanding trends in pigment loss. But furthermore, materiality is essential for interpretation. Scholars such as Jerome McGann and D. F. McKenzie recognize that reading is not an amorphous and passive experience, but rather a structured engagement with a palpable text.[6] With them, I celebrate the irreplaceable contributions of materiality to meaning. 2D photographs, for all their benefits, treat the page as a flat surface. They invite interpretation without input from attributes that require three-dimensional representation. Numerous scholars of manuscripts have critiqued this loss and expressed worries about training future scholars through examining 2D images, limiting contact with the rich three-dimensional nature of these bearers of medieval culture. Breakthroughs in 3D

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3 e-Codices: www.e-codices.unifr.ch.

4 University of Cambridge Research, "Ghosts from the Past Brought Back to Life," www.cam.ac.uk/research/news/ghosts-from-the-past-brought-back-to-life.

5 Advanced imaging techniques are likely to produce much better results. Depending upon the damage, however, a processed image from a smartphone might provide a scholar with the needed details or enough details to make discoveries or justify an advanced imaging project.

6 McGann, *The Textual Condition*; McKenzie, *Bibliography*.

technologies, such as virtual reality, are opening possibilities for engaging manuscripts in new, multidimensional and multisensory ways.

While technologies matter, the guiding principle for digitizing a manuscript is a knowing engagement with its materiality. Materiality dictates which digital approaches provide the best potential for study and discovery. For any particular manuscript, no one technique can capture its complex materiality. For example, the St. Chad Gospels has required a collection of methods, methods for recovering damaged content, examining surface details, and studying the contours of pages. Complicating the conditions of its material features, the St. Chad Gospels, like most manuscripts, has had an eventful life, effecting its current state and needs when digitized. Having spent some of its early years in Wales, the manuscript has been known by various names, including St. Teilo Gospels, Llandeilo Fawr Gospels, Lichfield Gospels, and Book of St. Chad. It is a Latin gospel-book, likely made around 730 CE in Lichfield, England.[7] Its earliest known whereabouts is preserved in ninth-century marginalia, recording Gelhi, a Welshman, trading his best horse for the manuscript and presenting it to the Church of St. Teilo in Wales. This suggests that the gospel-book was stolen, likely for its cover, which would have been decorated with precious jewels and metals. Its travels and damage did not favour a long life. However, it has survived, its extant pages including the gospels of Matthew, Mark, and part of Luke, ending four words shy from completing Luke 3:9.

Generally, the most telling materiality concerns a manuscript's parchment, inks, and pigments. The pages of the St. Chad Gospels are vellum, that is, calfskin. It is of high quality, suggesting that the manuscript was made by an institution of substantial wealth. Roger Powell has estimated that it would have required 100 to 120 calves to make the original manuscript.[8] Although high quality, E. A. Lowe points out, "some leaves are greasy and very thick."[9] This greasiness might explain why some of the pigments have not adhered well, such as the yellow pigment orpiment. In contrast, the iron gall ink is in good shape except for water-damaged pages. Nevertheless, ink might dwell on the surface rather than penetrate into and bind with the vellum, boding ill for recoveries. Also, letters erased with a knife might likewise be unrecoverable. However, slight and irregular traces of water-damaged ink are visible, providing a favourable sign for some level of digital recovery.

The pigments of the St. Chad Gospels are noteworthy for a further reason. The St. Chad Gospels represents the oldest surviving Insular manuscript to exhibit extensively layered pigments. However, a substantial amount of pigment has been lost. Signs of this

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7 Stein, *The Lichfield Gospels*; Brown, "The Lichfield Angel"; Brown, "The Lichfield/Llandeilo Gospels." Stein identifies Mercia and Northumbria as the most likely places for the making of the St. Chad Gospels, followed by Ireland and Wales. Brown provides cogent arguments for Lichfield, supported by recent research and the discovery of the Lichfield Angel in 2003. For an earlier, alternative perspective, see Jenkins and Owen, "The Welsh Marginalia," 41–56.

8 Powell, "The Lichfield," 261.

9 Lowe, *Codices Latini Antiquiores*, 12.

loss occur in the earliest photographs, which are from 1887, but a fair amount remains. Because pigments adhere to vellum and do not dye it, layered pigments are more susceptible, requiring stronger adhesion to remain on a page. Compounding this problem, the extent of early losses might signal that the binding material lacked the necessary strength, suggesting that remaining pigments survive at a greater risk. Therefore, leveraging digital imaging to discover and track trends in losses is crucial for conservation efforts and the longevity of this gospel-book.

The chapters in this book provide an analysis of materiality and digital imaging technologies; they describe the manner in which these imaging technologies *recover* and *preserve* materiality. The first three chapters focus on technologies for capturing various aspects of materiality. In Chapter 1, "Recovery: From Multispectral Imaging to Alternative Colour Spaces," I explore the benefits and limits of capturing reflected frequencies of light numerically. This includes the benefits of capturing frequencies outside of normal vision. I focus my discussion and examples on multispectral imaging (MSI), capable of capturing different frequencies of light, from ultraviolet, through the visual spectrum, and to infrared. To gain full benefits from these images, I assess approaches to post-processing, which are essential if images are generally going to produce more than cursory gains. However, regular colour images are not deprived of post-processing possibilities. These methods provide valuable recoveries for damaged and erased content. Therefore, I evaluate them, such as using alternative colour spaces, and develop an approach to what otherwise can be overwhelmingly complicated. Significantly, my approach includes processing photographs taken with a smartphone. I discuss and present these methods using open-source software. In this book, my goal is to make all of these digital methods accessible to and doable by any medievalist.

Chapter 2, "Reflectance Transformation Imaging: An Enhanced View of Surface Details" discusses one of my favourite advanced imaging techniques, referred to in short as RTI. RTI captures surface details, such as nearly impossible to see dry-point writing, etched with a stylus but no ink and meant to go unnoticed. I focus on highlight RTI, a method that uses a handheld flash to simulate a dome. RTI has proven highly valuable to archaeologists for recovering carvings in stone and other materials. However, RTI is equally as valuable for sorting out and discovering dry-point writing, for which scholars regularly report uncertainty in discerning its letters. Furthermore, I assess the value of RTI for other surface details, such as rising ink and pigment and viewing rulings and indentations from letters no longer visible.

Helping to preserve manuscripts might be the noblest contribution of digital images. They record how a manuscript presented itself, that is, reflected light, on a particular day, at a particular time, under particular lighting conditions, and to a particular beholder (including imaging technology conceived as a beholder of manuscripts). This recorded information remains, even as a manuscript ages. Although photography is a relatively new technology, earlier photographs (not much more than a century old) likewise record how a manuscript once presented itself. It is easy to think that new digital technologies capture more visual information; this is not always the case. A digital image cannot capture what a manuscript has lost through aging. In Chapter 3, "The Otherwise Unknowable: Digitizing and Comparing Historical Photographs," I provide a

method for comparing digitized historical photographs with one another and with more recent digital images to discover trends in aging. This work includes digitizing historical photographs, using open-source software to align them, and a means (such as my overlay viewer or graphics editing software) to stack and compare them by adjusting transparency. Such work not only reveals trends in aging, but it also generates knowledge about the effects of past conservation treatments, such as the flattening of pages for the St. Chad Gospels. Furthermore, comparing historical images provides an opportunity to assess past photographic methods, highlighting surprising anomalies that increases critical awareness for all photographic methods. Ultimately, the chapter demonstrates the value and precision of early photographic techniques, including the photostat copy, and reveals that through the digital these historical photographs may well grow in value over time, contributing to issues such as aging, information otherwise beyond knowing.

The final two chapters address issues about the human element of digitization. In Chapter 4, "Sacred Artefacts: Open Access, Power, Ethics, and Reciprocity," I examine the significance of definitions, arguing that a manuscript that still serves its community is foremost a sacred artefact rather than an artefact of cultural heritage. This invites a turn to the ethnographic principle of reciprocity. Reciprocity provides beneficial guidance for scholarship, community interaction, and issues that emerge from open access and interdisciplinary collaboration. While advocating for open access, I address problems generated by it and a Creative Commons licensing agreement. I explore evolving copyright law and ambiguities connected to the transition from analogue to digital and print to the web. I argue that reciprocity aids with these difficulties, too. It provides guidance to foster strong relations even amid uncertainties and insure benefits for a community beyond unanticipated problems.

As the innovative media of their time, manuscripts generated awe and wonder: illuminated manuscripts represent the iMax movie of their day. They celebrated and cultivated the human capacity for wonder, and techniques—including those examined in detail throughout this book—are needed to restore this sense. I have long held that the Middle Ages is much more aptly described as the Age of Visual Wonder. In the digital age, 3D renderings help to translate this sense of awe, especially when the experience is provided through 3D flyovers. In Chapter 5, "A Crisis in Knowledge-Space? A Look Toward Virtual Reality," I assess 3D technologies and their renderings as a way to engage content as embodied. 2D photography, while dramatically increasing access, eliminates multidimensional features. To engage, assess, and develop virtual reality for manuscripts, I propose the concept of knowledge-space as a guide. To ground the concept, albeit brief and limited, I examine relied upon historical means for preserving and transmitting knowledge, beginning with the Greek dialectic, moving into the medieval manuscript, progressing to the book, and ending with the comparatively infant Web 2.0. This historical perspective highlights what I am calling "knowledge-spaces," culturally and ideologically constructed means for transmitting and preserving knowledge. It provides understanding of virtual reality as a new knowledge-space, helping to navigate its challenges and potentials for studying manuscripts.

In many ways, this book can be viewed as a critique of 2D photography. At conferences and in print, I have stated that scholars need to be more critically aware about the limits

of 2D images, pointing to the example of some universities and colleges that consider photographs and even microfilm as primary sources. Doing so, not only overlooks their limits, but it also invites a forgetting that a page is a three-dimensional phenomenon, an organic substance that ages, that creaks and fusses when turned. Some features, such as the rise of layered pigments and contours of a page require three-dimensional techniques. But significantly, no one photograph captures THE scientific objective view. A manuscript is a play of light. Given technical decisions, each photograph highlights aspects of this play, thereby only aspects of a manuscript's materiality.

But critical assessment plays an even more crucial role. It is not an end in itself. It is only the beginning, the cornerstone of making in the digital humanities. Therefore, I view this book as a building upon the thinking, assessing, inventiveness, and countless hours of labour devoted to photography: from those labouring to invent and use the earliest forms to astrophysicists and their collaborators working to bring breakthroughs in digital imaging into the realm of manuscripts. I find the digital functions as a way to unify and celebrate these past efforts, perhaps no more clearly than my work uncovering trends in aging of the St. Chad Gospels, starting with photographs printed in an oversized 1887 book, through a photostat copy, through colour slides taken by Brother Frowin Oslender, through black-and-white photographs taken by the Courtauld Institute of Art, and to my multispectral imaging project in 2010. This book is about building upon the immeasurable labour, thinking, and ingenuity that began with the nineteenth-century invention of photography and the centuries of scholarship on manuscripts, the artists and scribes who laboured to make them, and the efforts to preserve them, including people such as Gelhi, for without whom the St. Chad Gospels would have been lost. Digitization is a way to celebrate the centuries of human achievement manifest in photography, scholarship, preservation, and manuscripts, build upon them to understand the past better, and in doing so, open otherwise unimagined potentials. This history itself, I believe, is a visual wonder worth recovering and preserving.