

Rediscovering Homer: Manuscript Digitization, the Homer Multitext Project, and Two Eleventh-Century Manuscripts of the *Iliad* in the Escorial

Casey Dué, Christopher Blackwell,
Mary Ebbott and Neel Smith

It was an honor when one of the editors of our project, Casey Dué, was invited to the „Handschriften- und Textforschung heute“ conference to speak about the Homer Multitext project (<http://www.homermultitext.org>), and how the digitization of ancient manuscripts fits into that on-going research project. Unfortunately, the erupting Icelandic volcano prevented Casey from ever arriving in Hamburg. Instead, she circulated the text of her planned remarks and some slides to all the participants. As she did then, we would like now to take the opportunity of these published proceedings to discuss the concept of a ‘multitextual’, digital edition of the Homeric poems and the role that manuscript digitization plays in this project. We will then go on to bring attention to two particular Homeric manuscripts in Spain, known to scholars as Escorialensis 3 and 4 (E3 and E4, or E and F in West’s 1998–2000 edition of the *Iliad*), which were digitized as part of the project in July of 2010. Although these two manuscripts are recognized as being among the very oldest Medieval manuscripts of the Homeric *Iliad*, and very important in that they contain copious scholia, they have not been studied in nearly as much detail as have their counterparts in Italian libraries. There are scholarly reasons for this relative neglect that we will discuss below, but now that high resolution images of them are available freely online, the manuscripts seem due for a reconsideration. The inaccessibility of the two manuscripts and the limitations of existing print publications have made it difficult if not impossible for scholars to know precisely what texts and scholia these manuscripts contain and to understand their relationships with other manuscripts. We will argue that each manuscript has much to contribute to our understanding of the transmission of the *Iliad* from its earliest oral performances to the Medieval period, and that their multiple sets of scholia and other annotations offer valuable information about the Homeric poems. It is our hope that these preliminary remarks will serve as an invitation to scholars around the world to undertake further study and more specialized analysis than we are able to do here.¹

The Homer Multitext project, which began over ten years ago now and is published by Harvard’s Center for Hellenic Studies and the University of Houston’s Research Computing Center, seeks to present the Homeric *Iliad* and *Odyssey* in a critical framework that accounts for the fact that these poems were composed orally over the course of hundreds, if

¹ Portions of the first part of this essay have been expanded upon and adapted from Casey Dué and Mary Ebbott, Digital Criticism: Editorial Standards for the Homer Multitext, in: Digital Humanities Quarterly 3/1 (2009): <http://www.digitalhumanities.org/dhq/vol/003/1/000029/000029.html>. See also Casey Dué and Mary Ebbott, *Iliad 10 and the Poetics of Ambush: A Multitext Edition with Essays and Commentary*, Cambridge, MA 2010: 153–166. Information about on-going developments in research connected with the images acquired by the Homer Multitext project can be found on the project blog at <http://homermultitext.blogspot.com>.

not thousands of years by countless singers who composed in performance. The project has been from the beginning a collaborative one between colleagues with various areas of expertise and from a variety of different kinds of institutions all over the United States and Europe. The particular research focus of co-editors Casey Dué and Mary Ebbott has always been the Homeric epics and the oral tradition in which they were composed, but our team includes computer scientists (notably the team of Brent Seales from the University of Kentucky) and conservators (notably David Jacobs and his colleagues at the British Library), as well as experts in photography, philologists, art historians, codicologists, papyrologists, and historians. Christopher Blackwell and Neel Smith are Classics professors whose expertise and research in information technology support all aspects of the Homer Multitext, including its theoretical underpinnings and its digital architecture.²

The question that has driven all of our research for the past decade is this: „How do you make a critical edition of an oral tradition, like that of the Homeric *Iliad* and *Odyssey*, that spanned a thousand years or more? What is the best way to represent the textual history of songs that were created in and for performance, but survive only in textual forms from later eras?“ The practice of textual criticism, as applied to most humanistic texts, has traditionally had the goal of recovering the original composition of the author. To create a critical edition, modern editors of Classical works assemble a text by collating the various written witnesses to an ancient text, understanding their relationship with each other, knowing the kinds and likelihoods of mistakes that can occur when texts are copied by hand, and, in the case of poetry, applying the rules and exceptions of the meter as well as grammar. The final published work then represents what she or he thinks are the author’s own words (or as close to this as possible). An editor may follow one manuscript almost exclusively, or pick and choose between different manuscripts to compile what seems truest to the original. The editor also places in the *apparatus criticus* at the bottom of the page what s/he judges to be significant variants recorded in the witnesses. The reader then must rely on the editor for the completeness of the *apparatus* in reporting variants. For a text that was composed and originally published in writing, this goal of recovering the original text is valuable and productive, even if it may never be fully achieved because of the state of the evidence. But is this the right approach for the Homeric epics?

The concept of a digital variorum edition, which is essentially what the Homer Multitext is, is not new. But these kinds of projects very often have a fundamentally different goal than what we have for the Homeric poems. The Cervantes Project digital library, for example, while capturing variation in the textual tradition in an Electronic Variorum Edition, does so for the stated goal of producing „a more correct edition closer to Cervantes’ original manuscript“.³ Similarly, it has been argued that a variorum edition of John Donne’s poetry has allowed the restoration of a particular line „to its original form“.⁴ For an edition

² For the technological infrastructure of the Homer Multitext, see the documentation on the project website (<http://www.homermultitext.org>) as well as Neel Smith, Digital Infrastructure and the Homer Multitext Project, in: Gabriel Bodard and Simon Mahoney (eds.), *Digital Research in the Study of Classical Antiquity*, London 2010: 121–138.

³ Carlos Monroy, Rajiv Kochumman, Richard Furuta, Eduardo Urbina, Eréndira Melgoza and Ariptra Goenka, Visualization of Variants in Textual Collations to Analyze the Evolution of Literary Works in The Cervantes Project, in: *Proceedings of the 6th European Conference on Research and Advanced Technology for Digital Libraries (2002)* 638–653 (<http://www.csdl.tamu.edu/cervantes/pubs/ecdl2002.pdf>).

⁴ Gary Stringer, An Introduction to the Donne Variorum and the John Donne Society, in: *Anglistik* 10/1 (1999): 85–95: 91 (available online at <http://donnevariorum.tamu.edu/anglist/anglist.pdf>).

of *Don Quixote de la Mancha* or the poems of Donne, this goal is appropriate to the fundamental notion of an original manuscript of an individual author and a text composed in writing.

In fact, in recent years the conventional practice of textual criticism has become increasingly abandoned by Humanists in favor of an approach that values historical sources for their own sake.⁵ Within the field of Classics, however, and in Homeric Studies in particular, the conventional model is still followed.⁶ The most recent scholarly edition of the *Iliad*, the 1998–2000 Teubner edition edited by Martin West,⁷ has as its ultimate goal the text of Homer himself, whom West terms a „*maximus poeta*“.⁸ In some ways, West’s edition is progressive in that it takes account of a far greater range of historical sources than his predecessors were able to do. He states that he and his research assistants were able to examine upwards of 1500 ancient papyrus texts. (These are listed in the first volume of that edition. Approximately half have not been published and so have not been taken into account by other editors.) These fragmentary papyrus texts range in date from approximately 300 BCE to 700 CE, and are for the most part far older than the Medieval manuscripts.⁹ West primarily relies on the Medieval transmission, however (as indeed all Homerists must, due to the fragmentary state of the papyri). He limits his consideration of the hundreds of Medieval manuscripts of the *Iliad* that survive to the twenty oldest.¹⁰

⁵ See especially Richard J. Finneran, *The Literary Text in the Digital Age*, Ann Arbor 1996 as well as John Bryant, *The Fluid Text: A Theory of Revision and Editing for Book and Screen*, Ann Arbor 2002; Susan Schreibman, *Computer Mediated Texts and Textuality: Theory and Practice*, in: *Computers and the Humanities* 36 (2002): 283–293: 287, and Kenneth Price, *Electronic Scholarly Editions*, in: Susan Schreibman and Ray Siemens (eds.), *A Companion to Digital Literary Studies*, Oxford 2008: 24 (<http://www.digitalhumanities.org/companionDLS/>) with reference to the William Blake Archive (<http://www.blakearchive.org/blake/>) and the Walt Whitman Archive (<http://www.whitmanarchive.org/>).

⁶ What we have called the ‘conventional’ model can also be called the ‘intentional’ model, where „finding an authoritative text [is] based on ‘final intentions’“ (Price 2008 [see n. 5]; see also David Greetham, *An Introduction to Textual Scholarship*, New York 1992: 347–372; G. Thomas Tanselle, *The Varieties of Scholarly Editing*, in: David Greetham (ed.), *Scholarly Editing: A Guide to Research*, New York 1995: 15f., and Peter Shillingsburg, *Scholarly Editing in the Computer Age*, Ann Arbor 1996: 74–102). Peter Robinson, *The Ends of Editing*, in: *Digital Humanities Quarterly* 3/3 (2009): <http://digitalhumanities.org/dhq/vol/3/3/000051/000051.html> speaks of this type of editing as being largely in past, but this is not yet the case in Homeric Studies.

⁷ Martin L. West, *Homeri Ilias, recensuit, testimonia congescit, I–II*, Stuttgart 1998–2000.

⁸ Casey Dué, *The Invention of Ossian*, in: *Classics@ 3* (2006): <http://chs.harvard.edu/wa/pageR?tn=ArticleWrapper&bdc=12&mn=1334>.

⁹ On the importance of Homeric papyri for our understanding of the multiformity of the transmission of the Homeric poems see Casey Dué, *Achilles’ Golden Amphora in Aeschines’ Against Timarchus and the Afterlife of Oral Tradition*, in: *Classical Philology* 96 (2001): 33–47 and the blog entry „Homeric Papyri and the Homer Multitext“ at <http://homer-multitext.blogspot.com/2010/07/homeric-papyri-and-homer-multitext.html>.

¹⁰ Van Thiel’s 1996 edition (*Homeri Ilias*, Hildesheim 1996) is an interesting point of comparison. He does not attempt to reconstruct ‘Homer’s’ text (though he does not claim that such a text did not exist, only that it is beyond our means to reconstruct it), nor does he attempt to reconstruct a text that is earlier than the Medieval period. Instead, like West, he relies heavily on the oldest Medieval manuscripts and attempts to represent a kind of Medieval vulgate. The problem with his approach is that such a vulgate almost certainly did not ever exist historically. The *Iliad* transmission is an ‘open’ one, and the text survived into the Medieval period in something like twenty-five manuscript families (see Thomas W. Allen, *Homeri Ilias*, Oxonii 1931). The one represented by the deluxe tenth-century Venetus A manuscript is generally considered the best, together with

The editors of the Homer Multitext assert that since the *Iliad* and *Odyssey* were not composed in writing,¹¹ West's conventional editorial approach to the *Iliad* is not valid. The Homeric epics derive from a long oral tradition in which they were created, performed, and re-performed, all without the technology of writing. This fundamental difference in the composition and history of this poetry means that we must adjust our assumptions in our understanding of the variations that we find in the written record. What does it mean when we see variations, which still perfectly fit the meter and language of the poetry, in the various witnesses to the texts? In the papyri and Medieval manuscripts and ancient sources that preserve the *Iliad* and *Odyssey*, we often find shorter versions and longer versions of passages, or one line in place of another. This is only to be expected in oral derived texts. Instead of 'mistakes' to be corrected, as an editor would treat them in the case of a text composed just once in writing, we should view these variations as testaments to the system of language that underlies the composition-in-performance of the oral tradition.

It should be noted that the difficulties presented by an oral tradition of composition-in-performance for the establishment of a critical text are not very dissimilar to the objections that have been raised for editions of literate authors. As Kenneth Price has argued:¹²

But for poets, novelists, and dramatists whose work may span decades, there is real question about the wisdom of relying on last choices. Are people at their sharpest, most daring, and most experimental at the end of life when energies (and sometimes clarity) fade and other signs of age begin to show? Further, the final version of a text is often even more mediated by the concerns of editors and censors than are earlier versions, and the ability of anyone to discern what a writer might have hoped for, absent these social pressures, is open to question. [...] Even if there were unanimous agreement over the superiority of one period over another for these and other writers, that superiority would probably rest on aesthetic grounds open to question. And of course we often want to ask questions of texts that have nothing to do with the issue of the 'best version'.

With the evidence we have for the multiformity of the Homeric epics, we too have many questions about the poetry and the system of language with which it was composed that have nothing to do with finding the 'best version'. Yet it is difficult to indicate the parity of these multiforms in a standard critical edition on the printed page. As we have noted, one version must be chosen for the text on the upper portion of the page, and the other recorded variations must be placed in an apparatus below, often in smaller text, a placement that necessarily gives the impression that these variations are incorrect or at least less important. An approach to editing Homer that embraces the multiformity of both the performative and textual phases of the tradition – that is to say, a multitextual approach – needs to convey the complexity of the transmission of Homeric epic in a way that is simply impossible on the printed page. A multitextual approach can be explicit about these many different channels of transmission, placing each in its historical and cultural framework and allowing the reader to understand better their relationships to one another, rather than giving the false impression that they are all of the same kind and same time.

the eleventh-century Venetus B, but these are by no means the only channels of transmission and they can not be used to reconstruct a single 'vulgate' from which later manuscripts derive.

¹¹ Cf. Albert B. Lord, *The Singer of Tales* Cambridge, MA 1960; id., *Epic Singers and Oral Tradition*, Ithaca, NY 1991 and id., *The Singer Resumes the Tale*, Ithaca, NY 1995; and Adam Parry (ed.), *The Making of Homeric Verse. The Collected Papers of Milman Parry*, Oxford 1971.

¹² Price 2008 (see n. 5): 24.

For this reason we and our collaborators on the Homer Multitext project are creating a virtual library of texts, translations, and images associated with actual historical witnesses to the transmission of the Homeric poems. The Homer Multitext seeks to present the textual transmission of the *Iliad* and *Odyssey* in a historical framework. The Multitext is designed to be able to collect historical witnesses to the text of Homer (individual Medieval manuscripts, Homeric papyri, works from antiquity that quote Homer, as well as a wide range of readings attributed to ancient scholars), and put them in a framework that allows these historical *Iliads* and *Odysseys* to be compared in various ways. By doing this, we hope to provide users with a more accurate understanding of the transmission over the course of more than 2500 years of these oral epics that were created in performance. Our goals for representing the multiformity of an oral tradition overlap in interesting ways with the potential that Ryan sees for ‘multivariant’ fictional narratives in a digital environment.¹³ We are by no means assembling a ‘Choose Your Own *Iliad*’, however, but rather seek to make it possible for scholars to more readily appreciate variation among historical witnesses. Since we interpret the majority of these variations as products of an oral composition-in-performance tradition, we do not wish to prioritize one reading over another. Creating an open-source, standards-based digital infrastructure that supports these goals has consumed the majority of our research and resources for the project over the past ten years. Christopher Blackwell and Neel Smith have been developing a collection of web based services and applications that take advantage of those services to allow users to find, search, and compare these texts in a variety of ways.

Making ancient manuscripts of the *Iliad* and *Odyssey* accessible to students and scholars is central to our editorial goals. The Multitext has now published digital images of three manuscripts of the *Iliad* housed in the Marciana Library in Venice, Italy: the tenth-century manuscript known as the Venetus A, the eleventh-century Venetus B, and the twelfth/thirteenth-century manuscript known as U4. In 2013, in collaboration with the E-Codices Virtual Manuscript Library of Switzerland and the Bibliothèque de Genève, we added the thirteenth-century manuscript in Geneva known as the Genavensis 44. Each manuscript contains its own set of scholarly commentary in the margins, commentary that takes us as far back as the 3rd century BCE. In the coming years we plan to add other manuscripts as they become available via other projects. (The E-codices project of Switzerland, for example, has made more than 900 manuscripts available under a Creative Commons license, at least a few of which are Homer manuscripts.) We have also created a library of xml editions of the Homeric papyri, and we hope to find institutions with collections of papyri who will allow us to publish high resolution photographs of the papyri in their collections.

In summer of 2010 we digitized two eleventh-century manuscripts in the Escorial library in Spain. E3 (= West E, Escorialensis Y.I.1) is a parchment codex consisting of 336 folios, containing *Iliad* I 1 – XXIV 717 with accompanying scholia. The first seven folios have been restored by later hands (fol. 1 in the fifteenth century, ff. 2–7 in the thirteenth century). Individual books are preceded by a one verse metrical summary (the same one verse summaries that you find in the Venetus B, but those summaries from the Venetus A are often added in a later hand – see, e.g., fol. 40^f, the beginning of book III). There are no hypotheses, subscriptions, or critical signs. The text and scholia in this manuscript are closely related to the text and scholia in the Venetus B, which is also from the eleventh

¹³ Marie-Laure Ryan, Multivariant Narratives, in: Susan Schreibman and Ray Siemens and John Unsworth (eds.), *A Companion to Digital Humanities*, 2004: 28 (<http://www.digitalhumanities.org/companion/>).

century. Maniaci has argued that Venetus B and E3 are ‘twins’, in that every folio matches the layout and content of the corresponding folio in the other manuscript.¹⁴ (As Bethe first noted, it is only the oldest, numbered set of scholia from B that is found in E3.¹⁵)

E4 (= West F, Escorialensis Ω.I.12) is another eleventh-century parchment codex, thought by Allen to be later than E3,¹⁶ consisting of 219 folios, containing a complete text of the *Iliad*, a commentary with lemmata, hypotheses, lives of Homer, the summary of the *Cypria* attributed to Proklos, the *Batrachomyomachia* („Battle of Frogs and Mice“), substantial excerpts from the „Homeric Questions“ (Ὅμηρικὰ ζητήματα) of Porphyry, and other scholia, both ‘exegetical’ and ‘D’ scholia.¹⁷ Individual books are preceded by hypotheses and a one-verse metrical summary. The main text of the *Iliad* begins on f. 7, where a new set of scholia likewise begins. Individual books are preceded by hypotheses and a one-verse metrical summary (the same one-verse summaries that you find in Venetus A). The layout of E4 is quite different from Venetus A, Venetus B, and E3, however. On each folio there are two columns. The left column contains the text of the poem and the right column consists of a paraphrase. According to Allen, E4 is not related to any of the other early minuscule manuscripts.¹⁸ The scholia seem to have been collected from several different sources. There is a set of numbered scholia which corresponds to the numbered scholia in B, E3, and Laurentianus Plut. 32, 3 (= Allen C and West C). There is another set of scholia in the same hand that is connected to the text with symbols, and these contain material from the so-called ‘D scholia’ (also known as the *scholia minora*). This set of scholia is also found in B, but it is in the second, later hand of B. The scholia in this group in B are likewise linked to the text through symbols. Much of the scholia of this manuscript then overlaps with those in the family of manuscripts known as bT (‘b’ being the hypothetical archetype of B, E3, and C), but E4 also shares several features with the manuscripts that independently transmit the ‘D’ scholia and with the Venetus A. In other words, E4 is the product of multiple channels of transmission, and cannot be made to fit easily into a conventional stemma.

These are the basic contents of these manuscripts. So much was known when Bethe described the manuscripts in 1893. Where can we go from here? What can we learn now from these images that was not possible a century ago? The answer, we think, is in the technologies we can employ. We had two essential goals for the digitizations we undertook in summer 2010. First and foremost for the Classicists on our team, we were interested in

¹⁴ Marilena Maniaci, Words within Words: layout strategies in some glossed manuscripts of the *Iliad*, in: *Manuscripta* 2 (2006): 241–261.

¹⁵ On the layout of B and the systems used to connect text and scholia see Mary Ebbott, Text and Technologies: the *Iliad* and the Venetus A, in: Casey Dué (ed.), *Recapturing a Homeric Legacy: Images and Insights from the Venetus A Manuscript of the Iliad*, Cambridge, MA 2009: 31–56.

¹⁶ So also Oluf G. Tyschen, Beschreibung der Handschriften vom Homer in dem Escorial und der könig. Madrider Bibliothek, in: *Bibliothek der alten Litteratur und Kunst* 6 (1789): 134–144 and Erich Bethe, Zwei *Iliad*-handschriften des Escorial, in: *Rheinisches Museum für Philologie* n.F. 48 (1893): 355–379, with an addendum on p. 484.

¹⁷ The folios were given numbers at some point in the top outside corner of each page, but some folios were evidently skipped and had to be labeled ‘bis’, with the result that the last folio is labeled 216. The ‘bis’ folios are 122 bis, 123 bis, 143 bis, and 190 bis. There is no f. 66. (That number was apparently skipped by mistake.)

¹⁸ Thomas W. Allen, *Homeri Ilias*, Oxonii 1931: 148. Preliminary study shows that the main text of E4 has some affinity with the A tradition, but the scholia are in the tradition of B and E3; see the preliminary findings in the blog post of Dué at <http://homermultitext.blogspot.com/2011/02/describing-single-folio-of-e4-188-recto.html>.

the contents of the manuscripts themselves, and their relationship to the other manuscripts of the *Iliad* with scholia. Now that we have acquired high resolution images of them, we can produce diplomatic editions of them – something that has never been done. These diplomatic editions will consist of XML-encoded electronic transcriptions of the main text of each document and all scholia groups. Every scholion will have its own unique identifier. From there, any number of computational analyses and data mining can take place. Scholars will be able to collate and compare and search against the transcriptions we have made of the other Medieval manuscripts of the *Iliad*, including the Venetus A and B. It is too soon to tell if Maniaci and earlier scholars are correct in their assessment that E3 and B are twins, copied from the same archetype.¹⁹ This may be the case, but once we have fully transcribed and identified the text and scholia of both manuscripts, we will be much more secure in our understanding of their relationship, and indeed the relationships between E3, E4, the Venetus A, Venetus B, the Townley (T), the Genavensis (Ge).

In a 2009 paper, for example, Smith and Weaver²⁰ applied cluster analysis methods to show that the groupings of scholia found in the major manuscripts published by Erbse cannot be explained by traditional stemmatic criticism. Instead, we must conclude that the unique groups of scholia found in each manuscript result from deliberate selection by individual scribes, even when they work from similar or identical source material. The same paper also looked at how frequently the names of different Hellenistic scholars are cited in ten different sets of scholia in six manuscripts. Smith and Weaver argue that some sources used by the scribe of the Venetus A and different sources used by the scribe of the Townley manuscript were rich in content attributed to Aristarchus, and that these sources were completely unknown to the scribes of the rest of Erbse's b family of manuscripts. These kinds of results, based as they are on systematic quantitative analysis of the distribution and contents of the scholia, are impossible to approach from print publication.²¹

Before now few scholars have been interested in E4, which cannot be precisely related to any other manuscript, or the *scholia minora* that we find in it. But there may well be a great deal we can learn from this manuscript, which seems to draw on multiple channels of transmission. How much overlap is there with the Venetus A? Are there differences from B and if so, what are they and of what nature? Previous editors have made learned conjectures

¹⁹ Preliminary study suggests that they are not in fact 'twins', strictly speaking, but they are indeed very closely related. See the blog post of Matthew Davis at <http://homermultitext.blogspot.com/2011/03/are-venetus-b-and-e3-twins-guest-post.html>.

²⁰ Neel Smith and Gabriel Weaver, Applying Domain Knowledge from Structured Citation Formats to Text and Data Mining: Examples Using the CITE Architecture, in: Text Mining Services: Building and Applying Text Mining Based Service Infrastructures in Research and Industry, ed. Gerhard Heyer, in: *Leipziger Beiträge zur Informatik* 14 (2009): 129–139.

²¹ Smith and Weaver note „Our results should be considered as preliminary, however, and should be retested once the digital edition is complete“. Like all scholars before 2010, they assumed that Erbse's multivolume publication at least approximately represents the contents of the manuscripts, and therefore assumed that a digital version of Erbse would provide a meaningful basis for analyzing the scholia. Work at the College of the Holy Cross in the summer of 2010 by Melissa Browne '12 and Francis Hartel '11, however, included the first complete inventory and publication of the scholia to books 3 and 4 of the *Iliad* in the Venetus A. One shocking result was the discovery that approximately 20% of the content edited by Browne and Hartel does not appear in Erbse. Smith and Weaver's initial conclusions therefore will be in even more urgent need of retesting than they could have imagined in 2009 (Smith–Weaver [see n. 20]). The methodological point remains clear however: they address questions that cannot be understood from print publication.

on the basis of a sampling made with the human eye and considerable expertise,²² but automated computational methods will surely be more accurate, and no doubt give us answers to questions we have never been able to ask until now. E4 is a unique document in many ways with an unusual layout. Preliminary work has shown that it contains information – including scholia and otherwise unattested readings – available nowhere else.²³ A better understanding of this particularly complex artifact will no doubt shed a great deal of light on how the *Iliad* was transmitted from antiquity, where and how texts of the *Iliad* circulated in the Medieval period, how scribes constructed these massive manuscripts and selected the accompanying material, and the sources of the scholarship they were drawing on.

Secondly, our team was also testing the boundaries of digital photography. For this digitization work, we collaborated with Dr. Brent Seales of the University of Kentucky's Center for Visualization and Virtual Environments, and aspects of this work were funded by the National Science Foundation. We saw the imaging that we planned to undertake in Spain as an exciting opportunity both to advance our humanist scholarship on oral poetry and the history of Homeric texts, and to integrate technologies for multi-modal imaging of cultural heritage objects in the field. With the collaboration of Dr. Seales and his team, we were able to capture multi-spectral images and 3-dimensional surface maps, and ultimately to integrate these by means of the networked infrastructure developed by the Homer Multi-text.

During photography, the manuscript rested on the Conservation Copystand built for the Center for Hellenic Studies by Manfred Meyer. The camera is a medium-format bellows-camera with a digital back. The digital sensor is monochromatic, and 38 megapixels. The resolution and lack of color are important features. In a normal, color, digital camera of, e.g., 24 megapixels, there is a color filter laid over the sensor. Of the 24 million pixels, 8 million will be filtered through red, 8 million will be filtered through green, and 8 million will be filtered through blue. So each full color 'pixel' will consume three pixels of resolution. The software in the camera will merge the three pixels into one, full-color pixel, at the cost of some softness to the image.

Our black-and-white camera had no color filter in front of the sensor. This does not mean that we cannot have color images of these manuscripts, however. The lights for the photography consisted of banks of LED lights, with each bank of LEDs emitting a specific frequency of light. There were thirteen banks, ranging from ultraviolet, through the visible spectrum (blues, greens, oranges, reds) down to several levels of infrared. The camera and lights were controlled by a computer, which automatically cycled through the spectra of light, taking a picture for each one.

The result was thirteen monochromatic images, each showing particular features of the page, as different kinds of ink and different kinds of stains or damage reflect differently. At

²² See Bethe's very preliminary assessment in 1893 (see n. 16) as well as Erbse's introduction to his edition of the Homeric scholia (*Scholia Graeca in Homeri Iliadem*, Berlin 1969–1988).

²³ Preliminary examinations of the scholia indicate that E4 has at least some information that is absent and indeed felt to be 'missing' from the Venetus A. See, e.g., the blog post by Mary Ebbott which discusses the scholia related to the oracle about the arrival of Rhesos in *Iliad* X (and his connection to the fall of Troy): <http://homermultitext.blogspot.com/2012/02/comparing-scholia-one-example.html>. On similar scholia about Rhesos in Venetus A, B. and the Townley manuscript see Dué and Ebbott 2010 (see n. 1): 90–101. For other findings in E4 see the blog posts by Casey Dué at <http://homermultitext.blogspot.com/2012/02/dog-of-orion.html> and <http://homermultitext.blogspot.com/2012/05/discovery-in-e4-scholia.html>.

the end, the thirteen images could be merged to create full-color images that take advantage of the full resolution of the sensor. Other 'false color' images can be generated as well to suit particular kinds of analysis.

In addition to this digital photography, the team captured structured light data using a custom-programmed projector tied to the camera. The projector uses a laser, rather than a bulb, which allows it to maintain perfect focus across an uneven surface. By projecting a series of images onto the surface of a page, and by processing the resulting pictures of that page, the team created a 3-dimensional model of the surface. This model, in turn, can now be used to remove distortions from the text, or to make a vividly realistic digital reconstruction of the page and its text. The raw data from this work will be archived, and available for use, at the Homer Multitext's data archive at the University of Houston. Human interfaces to the data will emerge as we conduct post-processing, indexing, and linking.

Digital imaging provides an immediate benefit by allowing nearly instant dissemination of facsimiles at extremely low cost. But the lens and sensor, when assisted by powerful and well-guided computer programs, can potentially see much more than the human eye. We are only beginning to explore the possibilities afforded by multispectral imaging, and in particular what we can see by combining different digital images according to different algorithms. For example, one folio (002-verso) of the E3 manuscript reveals to the human eye nothing particularly exceptional about the ink used to write its poetic text and commentary. When re-imaged using an algorithm that takes into account the luminance-slope of each pixel as the illuminating light moves up the spectrum from infra-red to ultraviolet, we can see that the scholia were copied over with the same ink used for some of the intra-linear scholia that date to a few hundred years after the original production of the book. While this may or may not be a significant finding, it is a new finding that we could not have made without these new techniques, and we can expect to find out other new things as well.

A significant barrier to this kind of analysis is the problem of registration. Images taken over time, under different circumstances, are easily compared by human readers on a gross level, but are extremely difficult to compare on a precise, scientific level that requires true measurement. The National Science Foundation was willing to support this work because these manuscripts represent test-beds for automated systems of registration among imaging taken at different times, under different circumstances, and between multispectral, 2-dimensional, and 3-dimensional imaging. These are challenges that face all enterprises that rely on images, from humanism to engineering to medicine.

The amount of text and scholia contained in the Escorial manuscripts is vast, and this project resulted in thousands of images, which have not yet been studied thoroughly. With the online publication of these images, freely accessible to all interested readers, we expect scholars, professional and amateurs alike, to add new discoveries about these manuscripts, their content and construction, and indeed the *Iliad* itself. As when we first photographed the manuscripts in Venice, the process of discovery began already when we were in Spain. But it is was not our intention then nor is it now to limit the investigation of these pages to a select group of our people. By making the manuscripts available in this way, we hope to encourage new and collaborative ways of exploring the *Iliad*, and new methods of scholarship. The *Iliad* has the ability to bring together scientists and historians and literary scholars, those interested in physical objects and the technology of creating them, preserving them, or capturing them digitally, those interested in the history of ideas, and those hoping to better understand the poetry and the tradition in which it was composed. Future research and publications on the Escorial manuscripts will further our own collaborative work on the

Homeric poems, the system of oral poetry in which they were created, and the transmission of this oral tradition through time, but they will also allow us to learn from scholars from a wide variety of different fields and thereby shed new light on a very ancient poem.²⁴

²⁴ Further literature not cited in the text: Immanuel Bekker, *Scholia in Homeri Iliadem*, Berolini 1825–1827. Gregorio de Andrés (ed.), *Catálogo de los códices griegos de la Real biblioteca de el Escorial*, II–III, Madrid 1965–1967. Wilhelm Dindorf, *Ungedruckte Scholien des Porphyrius zur Ilias* in: *Philologus* 18 (1862): 341–352. Id., (ed.), *Scholia Graeca in Homeri Iliadem*, Oxford 1875–1888. Mark Greengrass and Lorna Hughes (eds.), *The Virtual Representation of the Past*, London 2008. Ian Lancashire, *Cybertextuality and Philology*, in: *Schreibman–Siemens 2008* (see n. 5): 23. Emmanuel Miller, *Catalogue des manuscrits grecs de la Bibliothèque de l’Escorial*, Paris 1848. Gregory Nagy, *Homer’s Text and Language*, Champaign, IL 2004. Andrew Prescott, *The Imaging of Historical Documents*, in: *Greengrass–Hughes 2008* (see n. 24): 7–22. Alejo Revilla, *Catálogo de los códices griegos de la biblioteca de el Escorial*, I, Madrid 1936. Martin L. West, *Studies in the Text and Transmission of the Iliad*, München–Leipzig 2001.