Digital Humanities in Biblical Studies and Theology

Editorial

Claire Clivaz and Garrick V. Allen*

The Digital Humanities in Biblical Studies and Theology

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This special issue of *Open Theology* dedicated to digital humanities (DH) belongs to, and in many ways represents, a new step in the digital development of biblical studies and theology – the start of a general diffusion of digital research, digital tools, and digital culture in theology. This new step has come to the fore through the recent publication of books like *Networked Theology* (Campbell and Garner 2016) and *Creating Church Online* (Hutchings 2017), and also by the creation of the first research centre focused on Christian digital theology in 2014, the CODEC centre in Durham, UK, presented in the first article of this issue.[1] This introduction to this special edition briefly traces some of the significant steps that have influenced the development of the digital humanities as it relates to the critical study of the Bible and theology, and contextualises the articles in this fascicle within this larger conversation.

It is well known that the first computing theological tool – the first ever computing tool built for the humanities – was the *Index Thomisticus*, created by the Jesuit Roberto Busa.[2] Soon thereafter, the Reverend John W. Ellison produced the first computing tool for biblical studies, an index of the English translation of the *Revised Standard Version*.[3] This traditional *Anfangspunkt* in the history of DH has often promoted Roberto Busa to the position of "father of the discipline," a status supported, for example, by Domenico Fiormonte: "Busa's undertaking founded the discipline of the Humanities Computing (although years later it was renamed Digital Humanities), but above all it laid the groundwork for a profound epistemological and cultural transformation."[4] This preeminent role attributed to Busa is still underlined by the near-ecstatic enthusiasm he himself has demonstrated for DH, going so far as to compare DH to the "finger of God" in 2004.[5]

But, as Steven Jones has pointed out, the emphasis of Busa's role was also motivated by post-war political and economic agendas;[6] several other names could stake a claim to have been present at the birth of DH, as Julianne Nyhan and Andrew Flinn have illustrated.[7] Milad Doueihi suggested in 2014 that an evaluation of the history of DH should start with the analysis of Alan Turing's seminal 1950 article "Computing Machinery and Intelligence."[8] Following this proposition, Claire Clivaz has recently examined Turing's article in conversation with the writings of Ada Lovelace and Louis Frédéric Menabrea, underlining the prominent role of that the concepts of mind and/or the spirit played for all three of these authors.[9]

In light of the important epistemological turn represented by DH, theologians, along with scholars

1 See https://www.dur.ac.uk/codec/ [all websites accessed 24 September 2019] and Smith, "Old Wine, New Wineskins," 407–434.

2 http://www.corpusthomisticum.org/it/index.age.

3 Jones, *Roberto Busa*, 100–101.

4 Fiormonte, "The Digital Humanities," 30.

5 Busa, "Foreword" http://www.digitalhumanities.org/companion/.

6 Jones, *Roberto Busa*, 97.

7 Nyhan and Flinn, *Computation and the Humanities*.

8 Doueihi, "Quête et enquête," 8–9; Turing, "Computing Machinery."

9 Clivaz, *Ecritures digitales*, 61–81, 86–89.

***Corresponding author: Garrick V. Allen,** Dublin City University, Dublin, Ireland; E-mail: garrick.allen@dcu.ie

Claire Clivaz, Swiss Institute of Bioinformatics, Lausanne, Switzerland; E-mail: claire.clivaz@sib.swiss

from all other humanistic disciplines, have begun to reflect upon the future of the discipline under these circumstances. But critical self-reflection on the relationship between DH and theology has been slow to emerge: Jeffrey Siker's *Liquid Scripture*, the first monograph devoted to the Bible in digital culture, was published only in 2017, sixty years after the biblical index built by Ellison. Siker's work has been followed in quick succession by Claire Clivaz's *Ecritures digitales. Digital writing, digital Scriptures* (2019) and Peter Phillips' *The Bible, Social Media and Digital Culture* (2019). This substantial six-decade gap reflects the deep transformation of the status of the biblical text provoked by the advent of digital culture,[10] as well as the multimodal expression of the Bible and theological discourse in the digital culture.[11] To explore this transformation, the articles in this issue present the state of research within the diverse fields of theology, principally biblical studies, early Christian history, systematic theology, and practical theology.

Most of the effort expended to explore theology broadly conceived in the context of the DH have focused on biblical studies, starting with the first version of an electronic Bible in the 1960s,[12] followed by computing tools like the *Bible informatique de l'Abbaye de Maredsous* and the *Biblia Patristica* – founded in Strasbourg in 1965, now the *BiblIndex* in Lyon – or *La Bible en ses traditions* by the Biblical School of Jerusalem.[13] An edition of the New Testament, the *Editio Critica Maior* (ECM), initially conceptualised by Kurt Aland in the 1970s, has been instrumental in developing modes of digital editing.[14] Not only are recent and forthcoming ECM editions born digital, but they are supported by a bevy of digital tools developed by the Institut für Neutestamentliche Textforschung and its methodological partners, like the Coherence-Based Genealogical Method (CBGM).[15] Further gestures to the next steps of digital textual criticism and manuscript study are presented in the articles of this issue, focusing on Hebrew, Greek, and Arabic biblical manuscripts. Digital tools have also been employed in biblical studies beyond the critical edition, like on stylometric studies on the Pauline and deutero-Pauline letters beginning in the 1980s.[16] According to Juan Garcés and Jan Heilmann, since the early 1990s, biblical studies have relied on and advanced alongside DH to a greater extent than any other discipline in the humanities.[17] Generic tools like *Bibleworks*, *Accordance*, and *Logos* are now widely used (although *Bibleworks* has ceased operations),[18] as are biblical applications like *Youversion* or *Globible*, tools that have been recently analysed by Tim Hutchings.[19] But beyond biblical studies proper, theology has been slower to test and discover the ramifications of digital culture for the discipline. We are convinced that that studies situated in this special issue represent a genuine new step in this direction, examining the developing relationships inputs between DH and a range of different theological fields.

In the first article in the fascicle, Peter Philips and his co-authors directly address this relationship between DH and theology ("Defining Digital Theology: Digital Humanities, Digital Religion and the Particular Work of the CODEC Research Centre and Network"). The CODEC Research Centre in Durham has focused primarily on issues of practical theology and the ramifications of negotiating the nexus of Church, culture, and theology, undertaking studies on biblical literacy and a project on digital millennials and the Bible. But it has also produced a substantial array of research, ranging from analysing the Bible as a mediated text, to theological anthropology and the self, to the relationship between the Bible and computing. But more substantially, the article situates CODEC's work within larger discussions on the shape of DH more generally and taxonomizes the "waves" of digital theological research, culminating in "a prophetic re-appraisal of digitality in the light of theological ethics" (p. 39). The authors ultimately argue

10 Clivaz, *Ecritures digitales*, 173–181, 218–221.

11 Phillips, "The Power of Visual Culture."

12 Solomon, ed., *Accessing Antiquity*, 136.

13 *Bible pastorale de Maredsous*, http://www.knowhowsphere.net/Main.aspx?BASEID=MARP; *BiblIndex*, http://www.biblindex.info/; *La Bible en ses traditions*, https://scroll.bibletraditions.org/.

14 Aland, "Novi Testamenti Graeci."

15 See Gurry, *Critical Examination* and Mink, "Contamination."

16 Garcés and Heilmann, "Digital Humanities," 32.

17 Garcés and Heilmann, "Digital Humanities," 30: "One should note that digitization and digital research of the data relevant for biblical studies have developed since the beginning of the 1990s, earlier and in a more extensive way than in other similar Humanities disciplines, if we do a multivalent comparison."

18 Fischer and Wagner, "Editorial," 3.

19 Hutchings, "Design."

for a "big tent" brand of digital theology that is multi-faceted, engaged with DH, and self-critical of the consequences of the digital turn.

The next article by Matthew Ryan Robinson ("Embedded, not Plugged-In: Digital Humanities and Fair Participation in Systematic Theological Research") continues to explore the consequences of DH for theology. Robinson notes that systematic theologians have found aspects of digital culture worthy of theological critique and reflection, but the discipline has not yet fully engaged the possibilities of digital tools for theological research. At the heart of the article is a critique of power structures engendered in the production, use, and dissemination of powerful digital tools. Robinson calls for systematic theology to develop "a just engagement with the digital" (p. 67) and for a "reboot" that views digital tools as a means of facilitating theological communication. This approach would develop "participation opportunities" for those who lack access to theological discourse or the technologies that enable it, taking eColonialism seriously as a theological problem. The first two articles in the fascicle provide valuable (and at times conflicting) views of the state of the field.

A practical-theological approach to understanding lived religion in a digital medium is continued by Thomas Schlag ("Truth Communication in Times of Digital Abundance: A Practical Theological Perspective"), who explores the consequence of "searching" as a human practice. Arguing that searching is an innate aspect of human life, he reflects specifically upon the ways in which searches on the internet, where the user is unmanageably overrun with multimodal content and where search results are prescribed by past habits and commercial interests, reflect human desire for understanding and community. The nexus of the construction of search algorithms, individual patterns of online searching, commercial online interests, and digital religious practices requires significant more critical attention from theologians.

The remaining articles turn from theology proper to questions relating to textual criticism, manuscript studies, and the production of critical editions. The first article in this vein examines digital tools that assist in the production of the eclectic Hebrew Bible: A New Critical Edition (HBCE) within the auspices of the Critical Editions for Digital Analysis and Research (CEDAR) project at the University of Chicago by Sarah Yardney and her co-authors ("New Digital Tools for a New Critical Edition of the Hebrew Bible"). The CEDAR project represents a significant advance in critical editing because its innovative encoding procedures allow for the existence of multiple overlapping textual hierarchies to exist within a single database. Texts encoded in CEDAR are not static: each verse, line, word, and character are stored as individual XML documents. This approach to text editing has the potential to expand the utility of the classic print edition without losing the distinctive benefits of a printed book.

The next article, by Garrick V. Allen, explores some prominent digital tools for researching Greek New Testament manuscripts, focusing on the New Testament Virtual Manuscripts Room (NTVMR), the Center for the Study of New Testament Manuscripts digital library (CSNTM), and the Pinakes database ("Digital Tools for Working with New Testament Manuscripts"). Allen weighs the strengths and weaknesses of each tool for engaging particular research questions in an effort to understand how prominent digital tools have altered research habits and perceptions of the manuscripts themselves. Digital manuscripts are not immaterial, but become autonomous research objects in and of themselves, especially when marked up and encumbered with different forms of metadata.

Claire Clivaz further advances the discussion on DH and New Testament manuscripts by critically introducing her MARK16 project ("The Impact of Digital Research: Thinking about the MARK16 Project"). The article first argues that VREs are an impacting new form of research for the Humanities in general, then presents some important New Testament virtual research environments (VRE). Focusing on the manuscript witnesses to the end of the Gospel of Mark, Clivaz' project builds a new VRE devoted to scholarly analysis of the transmission and reception of this complex text. The MARK16 VRE anticipates the greater movement toward digital workspaces and includes multimodal access to material like transcriptions of manuscripts, relevant available secondary sources, commentary on scholarly decisions (e-Talks), and a space for the development of scholarly hypotheses, all arranged in chronological order. Examining Mark 16 in the VRE allows for a diversity of critical voices to be heard.

The next article by Dan Batovici demonstrates the utility of digital tools for discovering new information on old manuscripts ("Digital Palimpsests: Mark in Trinity College Cambridge MS. O.9.27"). Focusing on a

single manuscript in Cambridge, Batovici proffers a new method of uncovering the undertext of a palimpsest when multispectral imaging is not available. Using this approach, which relies on the manipulation of RGB colour space in Adobe Photoshop software, he successfully uncovers additional text of Mark 1 and 2 now copied over by Hesiod's *Opera et Dies*. Batovici concludes that the washed-off undertext of the manuscript was initially a lectionary.

Sara Schulthess turns her attention to the state of research on the Arabic Bible from a DH perspective. Schulthess argues that the cross-cultural capital represented by the digital humanities can begin to redress the lack of critical interest in the Arabic biblical tradition, helping to build formal and informal networks among researchers in this relatively small field. DH also makes the *realia* of the Arabic biblical tradition readily available in the form of digital images and allows for the development of digital tools like the *Tarsian*, *HumaRec*, and *PAVONe* projects, among other resources.

Another article by Saskia Dirkse and her co-authors examines the ways that digital tools might be used to visualise the codicological and bibliographic structure of Greek New Testament manuscripts ("Structural Visualization of Manuscripts (StruViMan): Principles, Methods, Prospects"). Building from the ParaTexBib project led by Martin Wallraff and Patrick Andrist, the StruViMan project creates a digital tool that pictures the "stratigraphy" of any manuscript based on the syntactical approach to codicology. The visualisation tool allows users to access a dense array of information, illuminating the contents and diachronic production layers of various manuscripts.

Moving away from manuscripts, a study by Vincent van Altena and his co-authors seek to construct a new method for measuring the likelihood of textual changes in transmission using digital tools ("Spatial Analysis of New Testament Textual Emendations Utilizing Confusion Distances"). In an effort to quantify the paleographic probability of grapheme interchange, particularly as it relates to conjectural emendations, the authors ascribe numerical values to the possible grapheme confusions in the Greek tradition, which then serve as the data points for an algorithm modelled on the Levensthein edit distance. Multi-dimensional scaling is then utilized to spatialise and visualise the results. This approach constitutes a new quantifiable tool for evaluating certain types of textual variation, supplementing classic forms of philological textual analysis.

The final contribution in this fascicle is an overview of the work of the Center for the Study of New Testament Manuscripts (CSNTM), who are primarily engaged in the high quality digitisation of Greek New Testament manuscripts and associated early printed material. The article describes their goals, methods, and some challenges that they have faced in gaining access to multiple heterogeneous collections and in making their images available for scholarly and public consumption.

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Digital Humanities in Biblical Studies and Theology

Peter Phillips*, Kyle Schiefelbein-Guerrero, Jonas Kurlberg

Defining Digital Theology: Digital Humanities, Digital Religion and the Particular Work of the CODEC Research Centre and Network

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Abstract: This article seeks to define Digital Theology, first by exploring the development of the CODEC Research Centre at Durham University – perhaps the only centre developed to explore Digital Theology. The aims of the centre and some of its projects are explored leading to a discussion of CODEC's place within Digital Humanities. The article concludes with a focus on different aspects and definitions of Digital Theology.

Keywords: Digital Humanities, Digital Theology, Theology, Computing for Humanities, digital culture, CODEC

1 CODEC's practical fusion of Digital Humanities and Digital Theology

The CODEC Research Centre for Digital Theology at the University of Durham formally came into existence in 2014, although the seeds had been sown in an earlier project proposal which brought together a small group of researchers at one of Durham's colleges, St John's, some five years earlier. Initially, it was our intention to explore three areas: biblical literacy, digital culture, and contemporary preaching. CODEC helped to develop a major national survey in biblical literacy in 2009, published research on preaching in the contemporary church, and began to explore the impact of digital culture on the training of Christian ministers and within the Church in general.

Within the first five years, CODEC developed a number of projects around each of these three areas. CODEC employed a number of post-doctoral researchers, several of whom had just finished their PhDs. These researchers worked with CODEC to write up the research but also to manage projects. As is to be expected, post-doctoral researchers are actually keen to develop their own research and publishing career in order to take up full-time/tenured positions elsewhere. This meant that at times CODEC's focus had become diverse, too diverse for some, but perhaps reflecting already a shift towards big tent Digital Humanities.

Early on, CODEC developed good relationships with international and national Bible Societies and began work with Biblica on "The State of Biblical Literacy in the UK" around 2013 and developed a research

***Corresponding author: Peter Phillips,** Durham University, United Kingdom of Great Britain and Northern Ireland; E-mail: p.m.phillips@durham.ac.uk
Kyle Schiefelbein-Guerrero, Berkeley Graduate Union, United States of America
Jonas Kurlberg, Durham University, United Kingdom of Great Britain and Northern Ireland

project on "Digital Millennials and the Bible" beginning in 2016. Moreover, a major UK funding body, the Jerusalem Trust, helped CODEC to develop the BigBible project around digital engagement with the Bible. The project has run successfully for over seven years. The Trust also approached CODEC in 2014 and invited a bid to develop an online portal for digital discipleship resources. CODEC was awarded significant funding to develop this portal and put in place the staffing for it. Indeed, over the next three years, CODEC worked with over 600 providers to develop a portal offering resources for discipleship which could be downloaded, mostly for free, and worked with a resource provider, 12 Baskets, to provide an electronic point of sale system. By the end of 2017, however, it became clear that the resource was not gaining the footfall needed and CODEC made the decision to close down the resource, writing up the research and moving further into research development and writing.

From 2015 onwards, CODEC moved more towards research outputs. As such, Peter Phillips, the director of CODEC, has continued to publish within the field of Johannine studies and literary theory while also now developing conference papers and articles around Digital Theology within the Digital Humanities.[1] His current work is broadly based on what he calls the pixelated Bible or the mediated text. He regards his work as embedded within Digital Humanities research: a merger of biblical reception, visual culture studies, theology and sociology, with a good dose of technological improvisation. He has written papers on digital manuscripts for various conferences and on the issue of obsolescence of digital projects and the rise of the digital facsimile. But Phillips' work also has a focus on the interpretation of culture with recent articles on the depiction of biblical narratives in film and in the exploration of transhumanism and human identity in science fiction narratives such as *Blade Runner 2049*. Karen O'Donnell's research picked up similar themes on theological anthropology and human identity, as well as her core research on digital pedagogy, and is now developing a constructive theology for a digital age.[2] In 2018, a major article exploring the state of biblical literacy within digital culture was published in *Theology* and in 2019, two books will be published – a joint volume with David Ford and Josh Mann on *Digital Millennials and the Bible* and a monograph on *The Bible, Social Media and Digital Culture*. Josh Mann published a quartet of articles around Digital Humanities and the Bible and digitality, and he is currently working on a monograph entitled *Computing the Bible: A Brief History*.[3] Dr Bex Lewis developed an important study on the interface between digital culture and children, as well as developing important conversations around bible engagement in a digital environment.[4] Marika Rose developed the Trove resource and published a number of articles around digital culture and preaching, as well as exploring identity and theological anthropology in a digital age.[5] Tim Hutchings, on top of his own prodigious research in the field of Digital Religion, worked with CODEC to develop the peer-reviewed *Journal for Religion, Media and Digital Culture*, now hosted by Brill.[6]

In 2017, CODEC welcomed its first cohort of students on its new MA in Digital Theology, joining a small number of PhD students working with us in Durham as well as cross-supervision of students in Finland exploring theology and computer science. Teaching and training had always been a large part of what CODEC had done, and throughout the research centre's existence, we offered a one week intensive module called *Medialit* exploring Christian communication in digital culture.

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1 See, for example, Phillips and Briggs, "The Bible as Augmented Reality"; Phillips, "A Responsive Chorus: The Samaritans of Sychar"; Phillips, "The Adulterous Woman: Nameless, Partnerless, Defenceless"; Phillips, Lewis, and Bruce, "Digital Communication, the Church and Mission"; Phillips, "Wesley's Parish and the Digital Age"; Phillips, "The Pixelated Text: Reading the Bible within Digital Culture"; Phillips, "The Power of Visual Culture and the Fragility of the Text."

2 See, for example, O'Donnell, "Performing the *imago Dei*: human enhancement, artificial intelligence and optative image-bearing"; O'Donnell, "Being Corporeal in Digital Spaces"; O'Donnell and Midson, eds., "Special Edition on Human Relationships and Digital Technologies"; O'Donnell, *Digital Theology: Constructing Theology for a Digital Age*.

3 See, for example, Mann, "The Hermeneutics of Digital Bibles"; Mann, "Augmented Reality, Virtual Reality, and Religion: Past, Present, and Future"; Mann, "Mobile Liturgy: Reflections on the Church of England's Suite of Digital Apps"; Mann, "How Technology Means: Texts, History, and Their Associated Technologies."

4 Lewis, *Raising Children in the Digital Age*.

5 See, for example, Rose, "Machines of loving grace: angels, cyborgs, and postsecular labour"; Rose, "It's Not the Money but the Love of Money That Is the Root of All Evil"

6 https://brill.com/view/journals/rmdc/rmdc-overview.xml.

2 Digital Humanities, interdisciplinarity and the "big tent" approach

We have already mentioned the idea of "big tent" Digital Humanities – the broadest definition of Digital Humanities popularised after the international Digital Humanities conference in 2011 which explored this issue that had arisen in plenary conversations at the previous year's international meeting.[7] Claire Warwick and others proposed a session outlining the argument for a "big tent" approach, drawing in both academic disciplines but also libraries, museums, archives, cultural heritage practice, and commercial information providers. This was a Digital Humanities writ large approach – a big tent welcoming all to work together across disciplines and institutions with the new centre at University College London operating as a kind of network or hub. However, the centre also provided specific research projects such as "Transcribe Bentham" – a tool to educate users about transcription and then to provide a crowd-sourced transcription of Jeremy Bentham's original letters.

The conversation focused on whether Digital Humanities was to be focused on the computational resourcing of humanities research ("more hack less yack")[8] or on a much bigger fusion of humanities research areas alongside developing the humanities' computing and digital methodologies for humanities research. The members of the research hub, UCLDH, did not want to put up boundaries or to provide stringent definitions but rather to embrace a view of DH that is "crowd sourced, inclusive and ever growing": "We wish to open wide the doors of this amazingly diverse discipline to any and all of those who would like to take part." Others, even those later associated with UCLDH such as Melissa Terras, were uneasy with the concept of "big tent" Digital Humanities, picking up on the rather uncomfortable circus imagery and pointing instead to the core interdisciplinarity of all academic work in the contemporary era. Academics were no longer single subject specialist but must be diverse digital scholars.[9]

CODEC, in its own way, offers an analog of this debate within Theology and Religious Studies – a cross-disciplinary, open network of scholars working in and around the interface between theology and digital culture. It is a "big tent" approach which has drawn the ire of those who seem to prefer the traditionally siloed academic disciplines and rigid structures. CODEC's "big tent" approach is not without strong critics. But this, of course, is all part of the wider definitional war within Digital Humanities.[10]

In his collection of essays on Digital Humanities, David Berry argues that "across the university, the way in which we pursue research is changing, and digital technology is playing a significant part in that change. Indeed, it is becoming more and more evident that research is increasingly being mediated through digital technology."[11] This impact is increasingly important across many disciplines and, picking up Kuhn's sense of paradigm shifts, Berry talks of a paradigm shift in academic research of all kinds.[12] Indeed, in her own soft criticism of "big tent" Digital Humanities, Terras outlines how all research has become both interdisciplinary and digital for most people engaged in contemporary scholarship. No one does research like they used to.[13]

Such views were strongly resisted as simply "insurgent Humanities" by establishment figures such as Stanley Fish.[14] Fish talks of "longform scholarship" or "linear scholarship," which takes much more time and seeks a much deeper resonance than he thinks the evanescent Digital Humanities are able to

7 Warwick et al., "UCLDH: Big Tent Digital Humanities in Practice."

8 Meloni, "Reporting from 'Academic Summer Camp': The Digital Humanities Summer Institute," cited in Warwick "UCLDH: Big Tent Digital Humanities in Practice"; see also Nowviskie, "On the origin of 'hack' and 'yack.'"

9 Terras, "Peering Inside the Big Tent."

10 Liu, "The Meaning of the Digital Humanities."

11 Berry, "Introduction: Understanding the Digital Humanities," 1.

12 A common theme in the literature, for example: Berry, "Introduction," 9; Stommel, "Digital Humanities is about Breaking Stuff."

13 Terras, "Peering Inside," 264–266.

14 Fish, "The Digital Humanities and the Transcending of Mortality"; see also the exploration and critique of Heidegger's negativity towards technology in Iain Thomson's "Understanding Technology Ontotheologically, or: the Danger and Promise of Heidegger, an American Perspective."

achieve. Such models of scholarship fit into the distinctions between "close reading" (currently often best done by humans) and "distant reading" (often only possible by machine). Fish represents what Mikhail Epstein, from a computer science/educational theorist perspective, argues is the "main problem with the Humanities today," namely, "their self-enclosure in the past and their alienation from contemporary society." He argues that humanities scholars "are interested mostly in texts and their critical interpretations, and in hypercritical interpretations of interpretations."[15] Of course, this is the caricature of contemporary humanities scholarship which Terras argues no longer applies to research in the digital era.

In the area of the Digital Humanities, Berry and others have argued that there were two main waves of transformation.[16] The first wave focused on digitization projects, technological advance, and infrastructure reorganization. The second wave focused on the production, curation, and interaction with knowledge that is "born digital" and exists digitally. Leighton and Rees suggest that this second wave needs to be subdivided into 2a: the analysis of traditional categories of the humanities through digital technology, and then 2b: the creation of new concepts in the humanities involving the digital. But this is "big tent" Digital Humanities rather than "Computing for Humanities," which tends to be much more focussed on the technological side of things. In a recent article addressing Digital Humanities and Digital Theology, Clifford Anderson offers a much more limited definition: "My standard rubric is that the Digital Humanities applies computational methods to the analysis of classical problems in the Humanities."[17] Professor Erkki Sutinen, head of Computer Science at the University of Turku in Finland, has promoted a co-design approach to Digital Theology, arguing that the most exciting results will probably arise not from a polarisation of methods but through the creative tension of bringing computing and theology together, perhaps through a co-design process between institutions which have the confidence to bring computer scientists and theologians/humanities researchers together.

CODEC has advocated "big tent" Digital Theology within "big tent" Digital Humanities – the kind of seismic shift which Terras, Berry, and others have proposed. Along these lines, Epstein speaks of "Transformative Humanities" in terms first of preservation: "the need to preserve the beauty of common, 'irregular' language as distinct from the 'precise' languages of sciences and computers"; and then of transformation: "the developing of full human potential as it is increasingly explored and implemented by sciences and technology." Overall, he talks of the need for humanities that will "reaffirm the human measure of things – not simply to reaffect the enchantment of the world, but to rehumanize the realities left out by the hard science."[18]

Epstein wants a new form of humanities based around three aspects:[19]

1. A new anthropology: looking at the study of humans as a biological species – humans evolving from nature;
2. A new humanities: the study of humans as creators and masters of the cultural, semiotic universe, which will uphold the human measure of things by maintaining the immaterial values as they are revealed and perceived by humans;[20]
3. A new humanology: the study of humans as part of the technosphere – humans evolving into artificial forms of life and intelligence, a discipline that studies the (self-)transformation of humans in an advanced technological society.

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15 Epstein, *The Transformative Humanities*, 283. Similar views are found in the multi-authored *Digital Humanities Manifesto 2.0*. See Presener, ed., *Digital Humanities Manifesto 2.0*.

16 Berry, "Introduction," 3, 8; Borgman, "The Digital Future is Now: A Call to Action for the Humanities," 1; Evans and Rees, "An Interpretation of Digital Humanities," 23–24, 29–30; Hayles, *How we think: Digital Media and Contemporary Technogenesis*, 25–27.

17 Anderson, "Digital Humanities and the Future of Theology," 1.

18 Epstein, *Transformative Humanities*, 287–288, 293–294.

19 Ibid., 138–140.

20 Compare this to Liu, "The Meaning," 410: "the Digital Humanities also have a symbolic role. In both their promise and their threat, the Digital Humanities serve as a shadow play for a future form of the humanities that wishes to include what contemporary society values about the digital without losing its soul to other domains of knowledge work that have gone digital to stake their claim to that society."

These changes, then, are not so much about "leftist" entryism as Fish suggests but rather the effect of a changing world, a changing context, the prevalence and omnipresence of digitality. It is an acknowledgement that the advanced technological culture in which we now live has had a profound effect on everything we do:

> This is what we are witnessing in the Humanities; digital technology will change the way that some of us work, research, and produce *material*. It will likely also change the conclusions we draw from our work, because of the changes in the conditions of the world brought about by the presence of technology. Technology has always done this and will do so more in the future. The Humanities are about the world, and the research in this volume reflects as much the changes in the world as it does the changes in the research practices and thinking that embrace what we consider to be the Humanities today.[21]

But it is also an acknowledgement that digital engagement offers huge potential for extending research and knowledge, for moving beyond the limitations of individual frail humans working alone in ivory towers. For example, Borgman and Hayles have explored the potential of Digital Humanities to move modes of research into newer, deeper, more enhanced forms through distant- or hyper-reading, databases, multimodal scholarship, the creation of humanities laboratories – all pointing to a change in the very way that we think through digital media and contemporary technogenesis. As Berry notes, "medial changes produce epistemic changes."[22]

3 Digital Humanities and Digital Theology

So far, those changes have not really impacted the once-called "Queen of the Sciences": Theology. Clifford Anderson notes that theologians remain at the margins of the Digital Humanities: "My suspicion is that theological scholars may appreciate what their colleagues in other disciplines are doing but see them as irrelevant to theological enquiry."[23]

Anderson argues that theologians fail to make use of the methods and tools of Computational Humanities or Digital Humanities. This might be the case among the dusty halls of ancient departments, but there is an increasingly large group of exceptions to this rule including computer-enhanced research among theologians who also engage in ethnography, sociology, text linguistics, semiotics, manuscript studies, and so on. Moreover, very few contemporary theologians are actually ignorant of digital technology, computing, or social media. Contemporary theological scholars *are* making use of digital resources to do their research; contemporary theological scholarship is as digital as other forms of scholarship in terms of writing, publishing, and dissemination of research. Biblical scholarship was at the forefront of Digital Humanities and continues to make use of the latest developments in computational research.[24] Theologians do indeed make the most of digital communication. Religious practitioners do make frequent use of presentation software and social networking in their everyday work.[25] Theologians are as much a part of/immersed in digital culture as others are.

However, there is still confusion around the concept of what is meant by Digital Theology. This confusion is somewhat surprising, especially since Digital Religion has had the benefit of a number of excellent books exploring the field.[26] Digital Religion has been developed over time and a network of scholars have been active in research and publication. Moreover, this means that aspects of Digital Religion can be re-assessed over time. For example, any researcher within the field knows the distinction developed by Christopher Helland between "online religion (where the religious activity actually occurred in the online environment)

21 Ibid.

22 Berry, "Introduction," 4.

23 Anderson, "Digital Humanities."

24 From almost 30 years ago, even "popular" magazines saw the trend; e.g. Wheeler, "Push-button Bibles: How to Compare Computer Software for Bible Research."

25 Oord, ed., *Theologians and Philosophers Using Social Media: Advice, Tips and Testimonials*.

26 Cheong et al., eds., *Digital Religion, Social Media and Culture*; Campbell, ed., *Digital Religion: Understanding Religious Practice in New Media Worlds*.

and religion online (where the medium was used as a tool to facilitate religious activity in the 'offline' world)."[27]

Heidi Campbell explores the history of Digital Religion research which led to Helland's differentiation.[28] Campbell points out that religion online was seen as the ability of religious organisations to bypass some of the limitations of offline religion, of offline location and offline authority, by providing online resources for adherents of different religions: "Online religion represented how the fluid and flexible nature of the Internet allowed new forms of religiosity and lived religious practices online."[29] The former represents offline practice advertised or facilitated online; the latter describes religious practice online. Helland and others problematised the difference between the two, although Campbell argues, surprisingly, in *Networked Religion* that the latter is not represented by the concept of Digital Religion. Of course, as with the critique of ritual scholars analyzing religious practices (e.g., worship), it can be difficult to categorize religious communities into one or the other. In fact, the ubiquity of digital means of being in existing and nascent religious communities may allow for both an extension of physical religiosity and the emergence of digital religiosity simultaneously.

Helland's initial theory related to both the mode and content of religious material online. He argued that religion online tended to make use of one-to-many communication, that is advertising offline religious practices to users of the internet, something similar to Web1.0 technology. Online religion, however, makes use of the interactivity of Web2.0 to allow greater user engagement with resources online and so promotes a move from one-to-many to many-to-many communication, collaboration, and co-construction. Interpersonal engagement marks out the development of online religion where people are able to engage in religious practice together online rather than simply being told where they might meet offline: the move from a digital noticeboard to a chat interface/bulletin board, perhaps; or the move from digital passivity to digital interactivity; from Web 1.0 to Web 2.0 to Web 3.0 and the Internet of Things.

However, Digital Religion has itself been through different waves of development. In the excellent edited collection on *Digital Methodologies in the Sociology of Religion*, Heidi Campbell and Brian Altenhofen outline four waves of digital research development in theology and religion.[30]

- **Wave 1:** The *descriptive* wave include early attempts to document the early importance of internet-based religious networking, ritual, and community development and work focused especially on case study analysis and digital ethnography. But also there is a focus on developing a vocabulary and accepted rationale for studying the internet phenomenon.
- **Wave 2:** The *categorical* is defined by the development of categories, taxonomies, and labels by which we might group the wealth of online activity; an increase in comparative analysis of different case studies; a recognition of the difference between "religion online" and "online religion" and the shift from Web 1.0 to Web 2.0 and then Web 3.0. Therefore, as discussed above, we note the shift toward religion online as offline religion now present on the internet in a kind of Web 1.0 replication of the offline world (talk of the internet as a high street with addresses; replication of paper resources through PDFs; advertisements of offline opportunities); and then religious experience and practice which is performed online, such as (Web 2.0) activities like cyberchurches (St Pixels, St Marks Cathedral in Second Life, and the plethora of other sacred sites which were popping up all over the place).
- **Wave 3:** The *theoretical* is characterized by a turn towards theoretical and interpretative enquiry, looking for methods and tools for analyzing all the data that was being developed out of the research. How do we make sense of all this data? But such shifts allowed scholars to lift their eyes above the details to see how digital culture was affecting all religions and just about every aspect of contemporary social life. In other words, theory helps us to see the global impact of digitality rather than assume it has a micro-affect only on our research. What is happening globally becomes a more dominant trend.

27 Helland, "Scholar's Top 5: Christopher Helland on Online Religion and Religion Online."

28 Campbell, *Digital Religion*, 2–5.

29 Ibid., 3.

30 Campbell and Altenhofen, "Methodological Challenges," 1–13.

– **Wave 4:** The *convergent* wave is where all three of the previous waves that "have emerged and matured over time" coalesce into richer research which brings different aspects together. This wave seeks to ask those deeper questions about society and culture which were emerging at the end of Wave 3: what is the role of institutions and online practices and what of ordinary religion whether it is online or offline? What of hybridity and the frequent merger of offline and online religion within the same experience or ritual.

The waves described by Campbell and Altenhofen are profoundly sociological, as expected both from their own work but also from the publication for which the article was written. They are waves of scholarly approaches to the phenomenon of religious practice online rather than waves of technological engagement with religion. Indeed, the introduction of different waves of technology in Wave 2 (Web 1.0 and Web 2.0) rather confuse the issue. Their waves argue for a gradual methodological shift in focus from the descriptive to the categorical to the theoretical to the convergent. Indeed, at the end of the chapter, they talk of the waves representing a short history of Digital Religion scholarship.

The four waves represent a mix of chronological waves and methodological waves, a kind of ripple affect which points to how a field develops or perhaps even how individual research develops. Campbell's work is clearly located within Waves 3 and 4. It is a mature and internationally important corpus of work, providing robust engagement with Digital Religion from a sociological perspective. Campbell's latest work on Networked Religion looks set to become a set text for future research in the area.[31]

But rather than provide straightforward history, the waves also tend to be typological. They map different approaches to doing research in this field – research which is longitudinal and developmental rather than ephemeral and embryonic. Much of our experience of Digital Religion and Digital Theology, and the literature currently being published in both fields, would argue that each of the waves are still in progress and are not confined to chronological eras. We can see this in the ongoing development of ethnographic research in Digital Religion and Digital Theology. Tim Hutching's book, *Creating Church Online*, was released in 2016; CODEC's major piece of research on digital millennial engagement with the Bible including polling data from a nationwide survey in the UK was published in March 2019; and Barna has done much the same work in the US.[32] Ethnographic research was not confined to the late twentieth century (Wave 1) but continues apace today. Indeed, there are now major new explorations of ethnography for the internet and Digital Ethnography which offer new methodologies and practices for contemporary ethnography of digital religion.[33]

Interestingly, Digital Humanities, as we have already suggested above, has also been classified through a kind of wave theory: a pre-wave and three proper waves:[34]

– Pre-Wave: Digitisation/Infrastructure, characterised by the switch from computing in the humanities to the wholesale importing of offline texts into digital formats. This required both a reshaping of institutional approaches to research and the development of new technologies, not least the development of automated reading processes, OCR, and website representation of manuscripts and other texts. How do you visualize that which was once material but is now available in enhanced digital mode?
– Wave 1: Data search, retrieval, collation and automation of analysis, processes that let the computing bear the load.
– Wave 2: Born-Digital Tools/Data Analysis/Distant-Close Reading. Having digitised a good deal of material, Digital Humanities begins to turn to corpus linguistics, analysis of stored libraries and datasets, and the sifting of the mountains of data which are being created within the information revolution.
– Wave 3: Computational Analysis, Coding, and Big Data, AI. What can a computer do that would

31 Campbell and Garner, *Networked Theology*.

32 Hutchings, *Creating Church Online*; Ford et al., *The Bible and Digital Millennials*; Barna, *The Bible in America*.

33 Hine, *Ethnography for the Internet*; Pink et al., eds., *Digital Ethnography: Principles and Practices*.

34 See, for example, Berry, *Understanding Digital Humanities*; Presner, ed., *Digital Humanities Manifesto 2.0*.

> be impossible for a human? Distant reading is one answer. But humans are good at things as well, including close reading, interpretation, and human to human communication. So, we develop better and better computers with natural language processing, facial recognition, human interpretation to create a something similar to the "God of the Gaps" argument. We find out what only humans can do and make sure computers do it better. But machine learning can already identify dependencies which cannot be explained by humans doing close reading. For example, the various intertextuality projects finding many thousands more examples of intertextual allusions than humans can make.[35]

Again, these waves are both chronological and methodological. But all waves are now operating at the same time. We are still digitizing materials, we are already working on born digital artefacts, and we are already developing the computational resources to analyse and develop both of the previous waves, we are already engaging with computer-derived data.

Within Digital Theology, still in its infancy in comparison with Digital Humanities, different centres are focusing on different kinds/waves of research. If we were to map them against some of the work being done across a selection of European centres exploring theology and the Digital Humanities or Digital Theology, different institutions focus on different aspects of the Digital Humanities project:

- Scholars at Lausanne, especially Claire Clivaz and Sara Schulthess focus on all things to do with digital manuscripts, especially focusing on the digitization of polyglot manuscripts (wave 1), the development of polyglot OCR (wave 3), and new forms of multimodal education and publishing.[36]
- Scholars at Lugano have explored communication theory and pioneered Digital Pedagogy in association with tourism and lived religion.[37]
- Scholars at Turku and Joenssu, with Erkki Sutinen and Emmanuel Awuni Kolog, focus on technological applications to generate and analyse data for research, on coding and the philosophy of technology (wave 2), on developing VR, AR, and MR representations of Bible stories (wave 3), and, going forward, looking into explorations of sacred space using virtual reality and other media, and perhaps most importantly engaging specifically with the context of the Global South.
- Scholars at the Finnish Bible Society are developing *digitalmarkus* a prototype digitally-focused translation of the New Testament into Finnish (wave 3).[38]
- A Czech group at the Centre for Philosophy, Theology, and Media Theory at Charles University in Prague focus on the "theological turn" in European media theory around Bernard Stiegler and Bruno Latour (wave 1).
- CODEC focuses both on the history of digital methods and their application to theological research, but also on the practical implications of digitization and digitality – a form of context theology in which the context is all things digital (wave 2) as well as exploring aspects of computational analysis and its impact both on theological research, human identity, and flourishing (wave 3). We have created digital artefacts and are beginning to explore network analysis, and we remain embedded in ethnographic research of digital culture. In part this is because of the emphases different members of staff have brought with them: Marika Rose on human identity, culture and technology; Josh Mann on the Bible, computing, and Digital Humanities; David Ford on the Bible and its readers; Tim Hutchings on the ethnography of Digital Religion; Karen O'Donnell on Digital Theology; Pete Phillips on the Bible in the Digital Age, contemporary technology, and theological reflections on digitality.

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35 See, for example Bamman and Crane, "The Logic and Discovery of Textual Allusion"; Coffee et al., "The Tesserae Project: Intertextual Analysis of Latin Poetry"; Franzini et al., "Using and Evaluating TRACER for an Index Fontium Computatus of the Summa contra Gentiles of Thomas Aquinas."

36 See, Clivaz, Schulthess, Chasapi, "HumaReC: Continuous Data Publishing in the Humanities"; Clivaz, Schulthess, Sankar, "Editing New Testament Arabic Manuscripts in a TEI-base: Fostering Close Reading in Digital Humanities."

37 De Ascaniis, Mutangala, and Cantoni, "ICTs in the tourism experience at religious heritage sites: a review of the literature and an investigation of pilgrims' experiences at the sanctuary of Loreto (Italy)"; Lin, Cantoni and Murph, "MOOCs in tourism and hospitality: a review."

38 https://www.digimarkus.fi/raamattu/DMrk/Mark-1 (in Finnish).

However, these four waves are not enough. CODEC and others associated with the Koli gathering of Digital Theology researchers, recognize the need for a fifth wave in Campbell and Altenhofen's scheme, namely a profoundly theological wave, a need to focus on Digital Theology in its own right.

4 Digital Theology, some definitions

But what do we mean by this fifth wave? What do we mean by Digital Theology?

In our own research, we find different aspects of both wave schemes but especially a synthesis of Campbell and Altenhofen's Wave 4 (the convergent) with Berry's Wave 2 (analysis of born digital products). Or rather the counter-balance to both: a theological reassessment of digitality and a digital reassessment of theology.

Theology is, of course, a specific discipline. Theology is not the same as the sociology of religion or information studies, or communication studies. Theology is the critical study of the nature of God, or of God's interaction with the world, or of the world's exploration of the mystery of faith. Theology is about thinking through that connection with the other. As such Digital Theology is distinct from its sister discipline Digital Religion which is much more focused on the exploration of the phenomena of religion in digital culture and their meaning. If you look at the various works on Digital Religion, you can see the focus on those phenomena, as well as the questioning about their impacts on religious expression and so on, as in Campbell and Altenhofen waves. In CODEC's MA teaching, we tend to call this digitally-mediated Christianity.

This is not to say that theologians are not active in Digital Religion, or that Digital Religion is not itself a theological enterprise. But to some extent the purpose is sociological and descriptive whereas the purpose of Digital Theology is theological. The distinction between religious studies and theology has been sharper in the United States than in Europe, where theology is more in the purview of seminaries and religiously-affiliated institution while religious studies has been dominant in the public university. This split parallels the sacred/secular distinction in America. Yet there has been a move to bring theology into the public university in recent years, as seen with the Public Theology project at the University of California Berkeley.[39] That said, the disciplines of history and theology are located in the humanities, whereas anthropology and ritual studies are located in the social sciences. The proposed differences between Digital Religion and Digital Theology lies within this same area of distinction.

We propose some possible different levels, or waves, of Digital Theology:

DT1: The use of digital technology to communicate or teach theology as a traditional academic subject

In DT1, digital is the mode through which a specific academic discipline is communicated. For all intents and purposes the academic discipline does not have to have anything to do with digitality. The academic discipline provides the content and digitality provides the mode by which the content is communicated to the learner.

Changes in theological education (seminaries and divinity schools) over the last decade have been a prime example of this, from the residential classroom paradigm (or even correspondence-like distance education) to synchronous and asynchronous online learning.[40] For example, over half of the schools accredited by the Association of Theological Schools in the United States and Canada have permission to

39 https://news.berkeley.edu/2015/05/11/campus-gets-1-million-grant-to-boost-study-of-religious-issues/.

40 Schiefelbein-Guerrero, "Educational Technology at the GTU and Beyond."

offer six or more online courses, although attempts at online spiritual formation is not without its critics.[41] Whatever the criticisms, DT1 opens up new possibilities for digital inclusion in theological study, as well as providing a useful and economical mode of delivering such study in the developing world, opening up further pioneering of Digital Theology in a context which lacks the legacy inertia of the Global North. The use of digital platforms to deliver theological education can help us take teaching to harder to reach groups, potentially enabling some of the more prophetic elements of Digital Theology (see below, DT4).

DT2: Theological research enabled by digitality or digital culture

In DT2, we pick up the idea of Terras and Alan Liu, among others, that digitality changes the whole way in which we do research. Theology is no longer something which we need to do alone in a room surrounded by books. Theological research now includes the analysis of (big) data, distant reading of multiple texts, online religious practice, and the visualization of data.

As an extension of DT1 where the digital environment is used to teach and learn theological disciplines, DT2 also utilizes this environment to provide cross-disciplinary or interdisciplinary theological collaboration. For example, Antony-Paul Cooper has demonstrated how to merge together traditional research methodologies with innovative use of social media to identify new churches. In turn, that identification mechanism can then be used to conduct further research such as offline surveys.[42] Theologians and religious practitioners are no longer restricted by geographical or scholastic distance to analyze, evaluate, and construct theological reflection.

For practical theologians, the plethora of material online has provided more accessible sources for theological analysis. Scholars of preaching and worship can readily access videos of sermons and liturgies.[43] American copyright law has also allowed more texts to enter the public domain and be digitized without penalty. *YouVersion*, as the most successful of the Bible apps, provides a wealth of opportunities to study the Bible and to inculcate evangelical Bible reading patterns among the digitally engaged. The data available for researchers in the digital age is simply unprecedented.

However, it is precisely this wealth of online information, instantaneously available and accessible, that leads Peter Horsfield to prophesy that new media will lead to the demise of the academic theologian. Ever since the early church's drive towards amassing its teaching into writings, theology has been the privilege of the elite and literate housed by or backed by powerful institutions like the church. The internet, Horsfield argues, undermines this power asymmetry for it changes how theology is reproduced and disseminated. It is no longer possible for authoritative institutions to control theological reproduction. The internet is democratizing information.

The truism that new media challenges the authority of traditional institutions, as discussed in most books on Digital Religion, needs to be tempered however. After all, while anyone can publish their theological musings from anywhere, it is still predominantly those with resources and institutional backing that will be heard. Peer reviewed monographs and articles are still privileged over blogs and podcasts. Nevertheless, digital culture suggests that the loci of theology are shifting, and this impels theologians to communicate in new ways to new audiences. As Horsfield suggests, in the cyberworld theologians have to compete alongside myriads of voices "by being noticed, easily accessed, and by being attractive…by [their] aesthetic appeal, imagination, humour and practical relevance" or they risk becoming irrelevant.[44]

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41 Delamarter, "Theological Educators and their Concerns about Technology"; Kennel, "Technology in the Life of Faith: A call for critical engagement"; Forrest and Lamport, "Modeling Spiritual Formation from a Distance: Paul's Formation Transactions with the Roman Christians"; Hockridge, "'What's the Problem?' Spiritual Formation in Distance and Online Theological Education"; Lowe and Lowe, "Spiritual Formation in Theological Distance Education: An Ecosystems Model"; O'Donnell, "Being Corporeal in Digital Spaces."

42 Cooper and Goodhew, "'Resacralising' Secular Space: New Churches in a Northern City, 1980–2012"; Cooper, "Assessing the Possible Relationship between the Sentiment of Church-related Tweets and Church Growth."

43 Of course, usually the "best" performances are highlighted on YouTube and other media platforms, which can prevent an observer from getting an accurate view of the community. Grimes, *Rite out of Place: Ritual, Media, and the Arts*, 23.

44 Horsfield, "'Moderate Diversity of Books?' The Challenge of New Media to the Practice of Christian Theology," 257. Horsfield, *From Jesus to the Internet: A History of Christianity and Media*.

DT3: Intentional, sustained and reflexive theologically-resourced engagement with digitality/digital culture

In DT3, we see digital culture as the context within which we do theology. This places theology and Digital Culture into a reflexive relationship with each other. Such Digital Theology impacts both theology as a discipline and digital culture as the milieu within which we live. As noted above, Horsfield makes clear that the traditional *loci* of theology are changing. But does digital change the traditional loci of systematic theology or the various "-ologies" in academic theological study (Christology, theological anthropology, ecclesiology, etc.)? Moreover, how does theology (our reflection on God) impact our understanding of and practice within digital culture? Such questions need to be reflexive. The relationship between theology and digital culture works bi-directionally: theology as the lens through which to analyze digital culture and digital culture as the lens through which to analyze theology; theology as guiding principles with which to participate in digital culture and digital culture offering guiding principles by which we participate in theology.

DT3 – this reflexive contextual interaction between culture and theology - is where CODEC aims to be: to intentionally explore the impact of digital culture on our theology and our theological concepts and, at the same time, intentionally explore the impact of our theology on our digitality. Potentially DT3 provides the place where Anderson's key question might begin to be addressed: "how does Digital Humanities promise to alter the way we read, write, even compute Theology?"[45]

Digital Theology is about bringing digital culture and theology together at high speed with colleagues from different disciplines (theologians, scientists, artists, coders, computer scientists, sociologists, entrepreneurs, digital humanists, designers) to see what happens, like a theological large hadron collider. Digital Theology is about interrogating classical religious doctrines and determining how they apply within or are changed by contemporary digital culture, perhaps a form of contextual theology or perhaps constructive theology of some kind since theology always has to speak in the language of its contemporary culture. What do we mean by eschatology in a world of climate change and the Singularity? Will an AI independent of human control perceive a need for forgiveness or salvation? To some extent, Digital Theology reflects Epstein's concept of a "new humanology" that studies how humans have transformed in the technological age. Digital Theology expands Epstein's initial aspect by going beyond anthropological or sociological analysis to theological analysis.

Digital Theology is about exploring what happens when digital tools or methods are applied to theology or theological tools to digital. Can we do online everything that we do offline: online sacraments, a digital haj, communion with the other, pastoral care that transcends geographical and religious boundaries? The latter has been investigated by Kyle K. Schiefelbein-Guerrero from Graduate Theological Union.[46] Digital Theology is about asking how human beings might flourish within digital culture and about countering online human deficit disorder. How do humans sympathetically adapt to the opportunities and threats digitality presents? Is there a moral or ethical dimension to that digitality? How do isolation, community, narcissism, and personalization change in and because of the digital environment?

DT4: A prophetic re-appraisal of digitality in the light of theological ethics

This leads us to the final aspect of Digital Theology: the theological-ethical critique of digitality. As an extension of DT3, DT4 appraises the impact of technology on society at large drawing upon the theological toolkit of scripture and tradition. Media is beset with headlines of the impact of digital technology on human well-being, society and politics. Even within the tech industry disquieted voices about the effects of their own creations can be heard. For instance, in a recent article, Hans Vestberg, the CEO of Verizon Communications, made the observation that "for technology to deliver on its promise of human betterment, it needs a cultural and moral compass."[47]

In such a context there are opportunities for theological ethical engagement beyond the disciplinary compounds of theology departments and seminaries. It would be presumptuous to suggest that theologians

45 Anderson, "Digital Humanities."

46 Schiefelbein-Guerrero, "Neighbor-Care in the Social Network: Rethinking Pastoral Care for the Digital Age."

47 Vestberg, "Why we need both science and humanities for a Fourth Industrial Revolution education." See also https://www.nytimes.com/2017/12/04/technology/silicon-valley-esalen-institute.html.

could provide totalising solutions to such challenges or indeed that they have a monopoly on such moral and ethical reasoning. Nevertheless, there are at the very least openings to participate in these important public conversations about the underlying ethics, religious assumptions, and telos of technology.

Some important work in this area has already been undertaken, not least among social commentary on the development of digital culture and classical scholars such as Jacques Ellul's dystopian reading of the ubiquity of technology in modern society.[48] More recently, theologians have been engaged in (digital) media ethics. For example, an edited volume due to be published 2019 brings together various theological perspectives on new media.[49] Another key area of focus for theologians concerns the human condition and anthropology which cuts to the core of ethical and political questions posed by present and future innovation.[50] As mirrored in other disciplines, AI is on the horizon of an increasing number of theologians' agendas and the number of publications in this area is likely to surge in the coming years.[51] Finally, Eric Stoddart's work on surveillance cultures falls within another area of increasing salience in a data driven digital economy and considering the security threat posed by global terrorism.[52]

Given the pace of technological innovation and the far-reaching implications of digitality on all aspects of human existence, the demand for prophetic appraisals of digital culture cannot be ignored.

5 Conclusion

This article has tried to provide some of the foundational theory to the development of Digital Theology as a field of academic pursuit. It has outlined the history of the CODEC research centre at Durham University and how this work has reflected an early experiment in incorporating "big tent" Digital Humanities into theology. Increasing engagement between theology and the Digital Humanities has resulted in the director of CODEC chairing a number of panels at leading international conferences and being invited to give a panel presentation at the leading DH international conference in 2017. It is, perhaps, no longer such a strange thing to see Digital Theology as a theme within grant applications and academic discourse. Moreover, as we have demonstrated throughout this article, academic publications are already published that outline different aspects of Digital Theology.

Digital Theology is still focusing its identity. This is perhaps to be expected in such a nascent field – a teenager striving to determine who she will be in the world and how she will differentiate herself from the masses. But at the same time, Digital Theology reflects many of the issues found in Digital Humanities as a whole and in particular around the concept of "big tent" Digital Humanities. But that is not a problematic lack of focus. Rather it is a signal of how much work is yet to be done.

As such, perhaps we need to add a fifth wave to Campbell and Altenhofen's list to define the role of DT3 in Digital Religion research.

Wave 5 Digital Theology aims:

- to use digital technology to enhance every aspect of the study of theology and religious belief and practice;
- to analyse and critique the use of digital technology within the study of theology and religious belief and practice;
- to describe and contextualise the impact of digital culture upon religious belief and practice;
- to determine digital trends in theology, specifically in terms of religious belief and practice;
- to work through multi-disciplinary research and with scholars from different disciplines;

48 Ellul, *The Technological Society*; Ellul and Troude-Chastenet, *Jacques Ellul on Politics, Technology, and Christianity: Conversations with Patrick Troude-Chastenet*.

49 Ulshofer and Wilhelm, eds., *Theologische Medienethik im digitalen Zeitalter*. See for example, Mitchell and Kurlberg, "Building Peace in View of Digital Violence and Suffering," which proposes a Christian ethical response to the images of violence that flood new media. See also Ess, *Digital Media Ethics*.

50 Midson, *Cyborg Theology*; Waters, *From Human to Posthuman*.

51 Herzfeld, *In Our Image: Artificial Intelligence and the Human Spirit* is an early exploration of this issue.

52 Stoddart, *The Common Gaze: Surveillance and the Common Good*.

- to offer a prophetic reappraisal of digitality in the light of theological ethics;
- to challenge computer scientists to design digital representations for conveying faith-oriented data.

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Digital Humanities in Biblical Studies and Theology

Matthew Ryan Robinson*

Embedded, not Plugged-In: Digital Humanities and Fair Participation in Systematic Theological Research

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Abstract: The article examines the disparity in use of digital humanities tools and resources among the theological disciplines, highlighting the question of why systematic theology has struggled to follow the digital turn. The author argues that issues of fairness in access and use of digital resources in knowledge production constitute an important set of concerns for systematic theologians in considering appropriate uses of the digital in their research. The article suggests that there are indeed reasons for methodological innovation in systematic theology in reaction to the digital revolution in humanities research – not, however, toward more plugged-in methods but toward methods embedded in life with the poor, underrepresented, and excluded. Three principles for a methodological "reboot" in systematic theology are given, which offer directions for further research as well as material for debate.

Keywords: Digital theology; Systematic theology; Colonizing knowledge; Theological method

Introduction: digital humanities, systematic theology and the cultivation of good knowledge

As is presently the case for many universities, departments, and faculties, the theological faculty at my university has recognized the need to address the challenges and opportunities presented to us by the dawn of the digital humanities age. And also like many other scholars in the humanities, I for my part have had to admit that I am unsure about how to do this. I would not speak for colleagues, but I can say for myself that for several years I have viewed the approaching digital cloud as casting the humanities into a dark shadow, perhaps, more apocalyptically, a dark age: In the place of material texts and embodied experiences, which take extensive time and repetition into account and are incorporated into research and learning, we are given online teaching and research platforms that offer self-paced modules and instant evaluation, both of which encourage students to itemize and compress the learning process by working ahead or waiting until the last minute. In the place of in-depth intersubjective conversation and group textual analysis in the context of which knowledge is a product of strenuous listening and synthesis, we are offered online virtual classrooms that isolate learners and individualize learning. I still worry about these things, but I also have to be honest that these trendy tails have been wagging the scientific dog since long before the digital revolution: An online quiz is no worse than a fill-in-the-blank paper exam when the subject matter is Shakespeare's *Hamlet*. Nor would I hesitate to acknowledge that I and my scholarship already benefit greatly from digitalization in several ways, whether in the form of online databases or the use of search

***Corresponding author: Matthew Ryan Robinson,** University of Bonn, Germany; E-mail: mrobinso@uni-bonn.de

functions in the use of critical editions of important philosophers and theologians. Finally, whether or not the trend is necessarily or uniquely bad for the humanities in general and theology in particular, the trend toward digitalization of contemporary life has achieved such a level of comprehensiveness that to ignore it would be foolish.

I understand that I am in no way unique with respect to my slow reception of the digital turn. As Tim Hutchings, one of the most prominent new theorists of Christian receptions of the digital revolution, has written, "religion is still a marginal presence in the digital humanities."[1] This is not a result of IT engineers and designers and digital humanities scholars not taking religion seriously. For theology, it may be due in part to a cautious and even suspicious attitude in theological assessments of the technological. The current relationship between theology and the digital humanities might be captured in a somewhat humorous way by paraphrasing and adapting the opening lines from Harry Frankfurt's essay "On Bullshit":

> One of the most salient features of modern research is that so much of it is going digital. Everyone knows this. Each of us contributes his share. But we systematic theologians tend to take the situation for granted. Most systematic theologians are rather confident of their ability to recognize digital humanities and to avoid being taken in by it. So the phenomenon has not aroused much deliberate concern, or attracted much sustained inquiry. In consequence, we have no clear understanding of what digital humanities is, why there is so much of it, or what functions it serves. And we lack a conscientiously developed appreciation of what it means to us. In other words, we have no theory.[2]

So how might we imagine and theorize a digital turn in systematic theology? An appropriate concept of digital humanities is needed for the specific kind of work each humanities scholar wishes to undertake. The humanities are not being remade for the digital but rather the digital for the humanities, and this is true no less for systematic theology than for the humanities in general. Across the humanities disciplines today, scholars should not feel themselves required to convert or even conform the objects of their study to new trends, but rather to consider which digital tools and formats might best assist them in the investigation of their already existing research problems and try these out in the trenches.

It remains the case that systematic theology has found little use for digital humanities in its teaching and research beyond the use of e-learning platforms and electronic library resources common to many humanities disciplines. In part one of the following, I summarize aspects of the reception of digital humanities research and teaching methods in other theological disciplines. I argue that a focus on the ready ability to use existing digital technologies to create quantifiable research has led to an initial preferential association of the digital with text-based and data-based theological work. Thus far systematic theology has seen only very limited *use* for digital humanities tools in its teaching or research methods even though it has recognized significant questions the digital revolution poses for systematic theological *reflection*.

A brief second section considers the potential concentration of powers of knowledge in the hands of those with the capabilities to use digital technologies efficiently, reliably, and sustainably. Here I call attention to the importance for systematic theology of developing a just engagement with the digital.

This serves as a transition to part three, where I outline a "rebooting" of systematic theological practice, but without giving a priority to the digital *per se*. The comprehensive digital revolution of the whole of modern society – including the university – combined with the relative lack of a compelling and unique need for digital technologies on the part of systematic theologians to be able to do whatever it is we do calls into question the mutual relevance of the digital and the doctrinal. The current pragmatic pressure on scientific disciplines to show their usefulness presents those of us engaged in systematic theological research with an opportunity to re-evaluate, at a basic level what is it exactly that systematic theology does, what purposes does it serve, for whom, and how does it perform that work. While this constellation of questions cannot be fully mapped in the space of a single article, I nevertheless use them to chart a course to understand a more empirically oriented systematic theology as the study of reflected religious speech and actions organizing individual and communal life within some total conception of reality. I want to propose that the *facilitation of communication,* and thereby of self-interpretation and self-understanding,

1 Hutchings, "Digital Humanities and the Study of Religion," 293.
2 Frankfurt, *On Bullshit,* 1.

become a primary horizon on which to set our sights for the use of digital humanities resources in systematic theology. And yet, from this proposal it follows that priority should be given within systematic theology to *developing participation opportunities* for those whose voices and opportunities for self-determination are limited by geopolitical exclusion. To the extent that the use of digital tools and methods can serve this end, they should be developed as enthusiastically as possible. But the priority remains for now offline, on real persons and communities and the articulation and communication of their self-understanding before the totality of reality.

1 Current receptions of digital humanities in theological work (state of the art)

The field of methods, resources, theories, and questions demarcated by the term "digital humanities," though relatively new as far as the history of science goes, is nevertheless vast and complicated. It may be difficult to formulate a single, satisfactory definition of what the digital humanities *are*,[3] but the general characterization of what the digital humanities *do* offered by Ashley Reed seems helpful enough for the purposes of the present essay: "The digital humanities integrate computer applications with humanities research, pedagogy, and dissemination. It is most helpful to think of the digital humanities, not as a field or a discipline, but as a set of loosely related methodologies and projects that stretch across fields and disciplines and even across sites of knowledge production."[4] That latter qualification concerning sites of knowledge production holds particular importance for the proposal outlined below. But for the moment, a quick summary of some of the intersections of digital humanities methods and theological research will be helpful, even though a rigorous theology of the digital humanities exceeds the scope of the present essay.[5]

On the one hand, there are several *uses* of the digital appearing in theological research and teaching. Over the past few years, several articles have appeared that outline some of the opportunities created by innovations in the digital humanities that are most directly relevant or promising for theological teaching and research. These resources and methods have so far focused heavily on text, including text creation, dissemination, storage and management, as well as linguistic analysis and related tools. They have correspondingly created opportunities focused in the fields of theological librarianship and biblical studies. Biblical exegesis programs like Bibleworks (no longer in business) and Accordance appeared over twenty years ago and have contributed to the creation of a whole sub-market for digitization of texts used in biblical exegesis and research on the history of Christianity. This emphasis on text is evident in Kent Gerber's short article "Getting Involved with the Digital Humanities in Theology, Biblical Studies and Religious Studies." Gerber lists and summarizes several available digital humanities methods as relevant for research in theology, but he focuses on engaging them as library resources.[6] Similarly Reed's article, cited above, on digital humanities and teaching in religion also outlines a diversity of digital tools and methods and the humanities disciplines engaging them, but nevertheless likewise focuses on digital textual archives, databases, and data or textual analysis as primary offerings of the digital humanities to the study of religion.[7]

Alongside the numerous centers for digital humanities that have been formed in recent years, the CODEC Research Centre for Digital Theology at Durham University is currently the only one devoted specifically to the interface of the digital and theological. At the CODEC center, too, a primary focus seems to be given to

3 Gerber points to the more than 800 definitions for the digital humanities collected by http://whatisdigitalhumanities.com/. Gerber, "Getting Involved," 6.

4 Reed, "Digital Humanities and the Study and Teaching of North American Religions," 307.

5 Throughout this essay, the focus remains on the intersection of digital humanities and theology generally, and systematic theology in particular. Thus, the overview summarized here does not take into consideration the broader relationship between digital humanities and the study of religion, except where directly relevant.

6 Gerber, "Getting Involved," 7.

7 Reed, "Digital Humanities and the Study and Teaching of North American Religions." See also Smiley, "Theological Librarianship in the Age of Digital Humanities."

the biblical text, but this time in the form of bible engagement. Peter Phillips, the director of the center, has recently summarized the center's research focuses in "The Pixelated Text" as resting "on contemporary biblical literacy, the mediation of the Bible in digital culture, and a world-first MA in digital theology, as well as engagement with creative industries, parachurch agencies and denominational bodies."[8] Phillips charts three waves in theological engagement with digital humanities – a past, a present, and a possible future – and all three focus on the Bible: digitization of manuscripts, Bible apps, and "AI-like applications that you would not normally link to biblical studies."[9] According to their website, all of the center's current projects reflect this research focus on biblical literacy, discipleship resources, or congregational studies on biblical literacy.[10]

Beyond the study of the Bible and the digital archiving of texts, advanced programs combining digital and fluorescent spectroscopy manuscript analysis of handwritten texts (including, for example, lecture notes, sermons, and letters) has application in the context of the creation of critical editions of the works of important thinkers, and thus in this connection finds a certain relevance in systematic theology as well.[11] Clifford Anderson, Associate University Librarian at Vanderbilt University, has outlined several projects recently completed or currently underway that illustrate a more extensive interface between theology and digital humanities.[12] These include familiar resources like HathiTrust as well as discussions of the use of text mining and visualization of word occurrences in Barth's *Church Dogmatics*. Further away still from an exegetical or history-of-Christianity focus, the use of large quantities of data holds relevance for projects in practical theology that use quantitative empirical methods to analyze church demographics, for instance.[13] Finally, the growing number of online courses (some as free and/or video courses), several now on topics in religion, deserves mention. Introductions to the Hebrew Bible, the New Testament, and the major world religions, and a variety of courses on topics in ethics among others are being offered online by leading universities including Harvard, Yale, the University of Chicago, and St. John's Nottingham via platforms like Edx and Coursera and their own sites. Internet video-hosting sites like YouTube, Vimeo and teachable.com, of course, also host enormous volumes of content in a variety of formats and degrees of quality.

The digital revolution does present systematic theology with an abundance of material for theological *reflection*. Although the looming significance of the digital for Christian-theological understandings has been noted from pastoral perspectives and through popular-cultural lenses,[14] systematic theological assessment of the digital is still an emerging sub-field. The development of technologies that mediate an increasing integration of all human communications with one another or that are intimately integrated with our bodies, then interlinked via digital networks – all allegedly to improve human health and performance – raises significant concerns over data protection, body sovereignty, and the mediated nature of identity and self-understandings. These and other challenges in turn raise questions about the ways the digital, on the one hand, and evolving forms of church, understandings of God, or models of human dignity, on the other hand, mutually inform one another. A growing body of research on the significance of digital innovations for Christian faith and practice undertaken by sociologists and scholars of religion

8 Phillips, "The Pixelated Text," 406.

9 Ibid., 409.

10 https://www.dur.ac.uk/codec/project/.

11 For one recent example of this kind of research see Hahn, "Analyse der Schreibmaterialien Schleiermachers," 885–894. Schleiermacher is, of course, well-known as one of the founders of modern theological study and research methods, though this research was prepared for the volume devoted to his lectures on pedagogy.

12 Anderson, "Digital Humanities and the Future of Theology."

13 See for example the annual report of the Evangelische Kirche in Deutschland, "Gezählt 2018. Zahlen und Fakten zum kirchlichen Leben." While not drawing on data of the size and complexity of studies common in informatics and the natural sciences, this kind of document illustrates the contribution of statistical analysis and data visualization that are used in practical-theological and ecclesiastical research.

14 Godwin, "Triathalons, Ultramarathons and Ambitious Baking: Why is Modern Leisure so Competitive?"; McGrath, *Theology and Science Fiction*; Merritt, "Is AI a Threat to Christianity?; Sweet, *Viral*.

exists.[15] And some systematic theologians have also started to reflect, for example, on the interrelation of flourishing and human enhancement as well as transhumanism.[16] There is every reason to expect this area of theological inquiry will grow in size and significance, whether in research directed toward the socio-religious significance of seemingly innocuous trends like gamification (of exercise routines, study habits, and every hobby imaginable) or in relation to more unsettling advances in the field of artificial intelligence.[17]

But no compelling and unique *use* for digital technologies in systematic theological work has yet presented itself. This may have much to do with systematic theologians' own reticence. What Anderson observes concerning theology in relation to the digital humanities generally is likely just as true of systematic theology in relation to the other theological disciplines. "My suspicion," he writes, "is that theological scholars may appreciate what their colleagues in other disciplines are doing, but see them as irrelevant to theological inquiry."[18] Why would this be the case? Is it because systematic theology concerns itself primarily with concepts and textual communications – whether in seminar, conference, or publication contexts – and, while email and word processing make these things more efficient, they hardly count as work in digital humanities? For some, this may be the reason. But I have different reasons. In the following section, I want to indicate why systematic theologians may have reason to view the digital turn – in particular its hegemonic tendencies – with a certain caution.

2 Bread or circuses: digitalization for whom?

The critical observation that the relationship between theology and the digital humanities currently is a relationship, more accurately, between biblical studies, historical theology, and theological librarianship, and digital humanities, with limited further applications in quantitative research, should not be understood as a criticism. Archives, databases, and data management, manipulation and visualization tools offer much to humanities research; it is not my intention to dispute that. Moreover, it is neither surprising nor in any way *per se* concerning that theological librarianship and biblical studies should be the first fields of major application for what the digital humanities have to offer. In consequence, for those institutions not wanting to fall behind the trend, projects and positions in biblical studies and historical disciplines may receive priority for now, for established methodologies in those fields coincide and integrate well with already existing technologies and directions of innovation (for example, manuscript and text work, stylometry, data mining, visualization of interactions with texts and so on).

Nevertheless, there are reasons to remain alert. The potential ways that a digital humanities focus can influence the production of knowledge and even the identification of what counts as desirable knowledge should be held in mind, for the intersection of societal evolution and economic viability can condition the perception of virtuosity in research at the digital humanities crossroads. As universities, foundations, and nationally funded institutes decide that, in order to stay at the cutting edge of research and teaching, significant attention and financial resources need to be devoted to centers, clusters, and general emphases on the digital humanities, then disciplines and faculties in the humanities will correspondingly value (meaning, fund or pursue funding for) research programs that reflect this emphasis. In the process, what counts as desirable knowledge can also shift to favor the *capabilities of digital tools and resources* and the *concerns of those in a position to deploy them*.[19]

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15 Bielo, "Digital Scholarship and the Critical Study of Religion"; Campbell, ed., *Digital Religion*; DeRogatis and Weiner, "Turning Students into Scholars"; Hutchings, *Creating Church Online*; Phillips, "The Pixelated Text"; Clarke et al., eds., *The Ethics of Human Enhancement: Understanding the Debate*.

16 See Victoria Lorrimar's recent theological interpretation of visions of human flourishing in discussions of human enhancement and transhumanism; Lorrimar, "Human Flourishing."

17 Duffer, "As Artificial Intelligence Advances, What are its Religious Implications?"; Godwin, "Triathalons, Ultramarathons and Ambitious Baking: Why is Modern Leisure so Competitive?"

18 Anderson, "Digital Humanities and the Future of Theology."

19 This is similar to the concern articulated by Possamai-Inesedy and Nixon in a recent article on the undemocratic consequences of the digital revolution's democratic promises; Possamai-Inesedy and Nixon, "A Place to Stand," 867–868.

This potential concern observed in university contexts is simply the arrival of a broader societal trend in Western, developed countries. The Roman poet and satirist Juvenal famously coined the phrase *panem et circenses* – bread and circus games – to refer to the popular consumption of distractions and the political implications, and often intentions, of such appeasement. Neil Postman's contemporary critique of American popular culture in the 1980s, *Amusing Ourselves to Death,* also comes to mind.[20] By way of example, I refer again to the concept of "gamification." Gamification refers generally to the incorporation of elements of game-play like points, accomplishments, and competition against others into everyday life activities. In its popular forms, gamification is symptomatic of the social and economic inequalities that the digital revolution can exacerbate. Opportunities to participate in and contribute to culture-making boosts the social capital of its producers. As culture production has gone increasingly online globally, this re-confirms the position of privilege enjoyed by those with access to significant digital resources and the ability to deploy them in meaningful and active way.

While the concept of gamification has become especially important in areas of economic activity related to consumer engagement with products and or via social networks, it is increasingly being explored in higher education in the development of pedagogical methodologies that can effectively teach people who have grown up in a digital world.[21] In *Amusing Ourselves to Death,* Postman warns against the oppression of a people resulting from their addiction to amusements and the accompanying numbing of their powers of critical reflection and analysis. But I have a different locale of oppression in mind: where does the digital turn leave those without robust access to those resources or the ability to produce and deploy them in a meaningful way? In one empirical study of 120 papers on gamification that were published between 2011–2014, a table reviewing the papers' countries of origin locates this interest overwhelmingly in Western Europe and North America. South Africa is the only African country to even appear on the list.[22] For those being dragged behind the drivers in the revolutions of the digital circus, the concern is not over the apathy brought on by amusement but for bread, for a spot at the table.

Attention should be given to ensuring that the drive toward digital humanities not become a form of what Thomas L. McPhail has theorized as "electronic colonialism" or "eColonialism."[23] The term may seem self-explanatory; namely, to the extent that communications infrastructures are created and controlled predominately by, for example, European countries, the USA, China, Japan, and South Korea, and to the extent that other countries rely on this infrastructure, the latter become beholden to or dependent on the former. But McPhail focuses his analysis not only on the hard forms of this domination but places just as much significance on soft forms. Apple may be interested in which smartphone a person uses, and Vodafone in which network provider supplies the internet connection, but Amazon and Facebook are much more interested in understanding and even shaping persons' and institutions' world outlook and senses of identity or legitimacy as those things relate to predictable, marketizable behaviors. McPhail's *Development Communication* highlights the challenge for present deliberations about the production of fair theological knowledge in an era of digital humanities: resisting eColonialism is not as simple as advocating bottom-up models or going to the "grassroots."[24] Such an approach is not possible because contemporary life is too comprehensively delocalized by mass- and specifically social-media. Rather, fair theological knowledge would require as a minimum fair participation in ongoing communication concerning what counts as worth knowing, what forms can legitimate knowledge and learning take, and what level of universality do digitally-oriented and transculturally shared knowledge and learning formats hold, or what local knowledges are represented and how. As decolonial theorist Walter Mignolo argues, a presupposition of the "universality of knowledge" persists in much research that is done from Western academic contexts.

20 Postman, "Amusing Ourselves to Death."

21 A large and growing literature exists on the interface of gamification and education. For a recent quantitative summary of methods and trends in the field, see Majuri, Koivisto, and Hamari, "Gamification of Education and Learning." For a more critical assessment of some objections see Karagiorga and Niemann, "Gamification and Game-Based Learning."

22 Caponetto, Earp, and Ott, "Gamification and Education: A Literature Review," 52.

23 McPhail published *Electronic Colonialism* already in 1981. A summary of some of that book's arguments with connections to the more contemporary moment can be found in his 2014 article for the *World Financial Review*, "eColonialism Theory."

24 McPhail, *Development Communication*, 1–20.

This attitude expressed itself classically in the form of the encyclopedia and continues to find expression in the outweighed legitimacy that is given to the quantitative. One gets the impression that *real* research results require countable data. But attention must be given to the way this orientation can defer self-critical awareness that knowledge "is not simply a question of what is known (for example, the encyclopedia). Mainly, it is a question of who is in a position to know."[25]

It is not my intention to argue against the digital turn in the humanities, generally, or against gamification, to mention just one example. Indeed, keeping our focus on Africa, eLearning initiatives and resources, including the use of gamification elements in education, are being developed in many African countries as an important effort in realizing the UN Millennium Goal of "Education for All."[26] Still, universities in wealthy Western contexts who are eager for their humanities departments to develop digitally must guard against underwriting yet another wave of colonization in the form of a sequestering of knowledge for those with extensive and above all *expensive* access to research resources relying upon digital technologies. The digital humanities turn risks privileging those contexts – scientific and institutional but no less, and most concerning to me, geographical and cultural – that are best positioned, which is to say, that have the *capabilities* in the form of infrastructure, resources and wealth, to make the digital turn both quickly, reliably, and sustainably.

Building on this critique, I want to propose that there may be a different way of viewing the relationship between systematic theology and the digital than seeing systematic theology as behind or indifferent to the digital turn. The digital turn may indeed be calling us to update our methods, but that does not necessarily mean that the digital becomes a top priority. The conditions of doing theology in a tightly interconnected, globalized world in which each tiny corner of the globe hangs suspended in webs of interdependence with every other but with vastly disparate and disproportionate degrees of participation and self-determination opportunities, call for the development of methods in systematic theology that are firstly embedded in life with the poor, underrepresented, and excluded and only secondarily plugged-in.

3 Embedded, not plugged-in: rebooting systematic theological work

Anita Cloete has recently argued concerning theological reflection in a digital culture that digital technologies are neither inherently liberating nor inherently oppressive. Instead, the digital is best regarded as "value neutral until it is applied and the consequences of the application indicate whether it was used positively or negatively," for digital technologies are neither created nor used "in a vacuum, but [are] rather a social construction and when used, [are] guided by social and institutional values."[27] Within the field of Christian systematic theology, we should thus be careful to avoid two pitfalls. On the one hand, we will need to resist the colonization of the means of production of and access to theological knowledge on the part of wealthy, well-positioned Western nations and churches. On the other hand, we should be aware of the self-isolation and extinction of vital theologies that will inevitably result in the West if we fail to recognize non-Western theologies as legitimate and up-to-standard, let alone important knowledges. In this final section, I want to propose a reboot for systematic theology that responds to the concern outlined in the previous section, a reboot that is embedded in life with the poor, underrepresented, and excluded in societies around the world and then, only in service of that, plugged-in. The challenges of engaging the digital while maintaining a preference for the poor and the excluded calls for a re-thinking of methods and best practices in theological research that will support *mutual meaningful participation in global conversations* among theological

25 Mignolo, *On Decoloniality*, 207.

26 The international "eLearning Africa" Portal and its annual conferences are one of the most prominent and active hubs for these developments. Their programs can viewed at: https://ela-newsportal.com. Gamification and education in Africa seems to be a very nascent field; Ngnaoussi Elongué Cedric Christian of Ghana published several short articles in 2018 on their interconnection to the "eLearning Africa" portal and on the eLearning Industry online community; see Christian, "Why Should We Develop More Mobile Serious Games in Africa?"

27 Cloete, "Living in a Digital Culture," 3.

researchers across global contexts. The purpose is to cultivate fair knowledge because *fair* knowledge is essential to reaching the goal of *good* knowledge.

An appropriate concept of the digital humanities for systematic theology presupposes a particular understanding of the humanities, systematic theology, and their relation to one another. For that reason, I want to begin by summarizing my vision of a humanistic education, informed as it is by Western traditions. Second, I ask what systematic theology does in relation to this vision, and I outline a paradigm for humanistic systematic theological work. In the conclusion to the article, I ask what forms of digital participation might be used productively in service of systematic theological research working with this paradigm.

Based on readings through the texts of classical Western sources like Plato's *Republic* and the Hebrew prophets to those of early humanists like della Mirandola at its more formal Renaissance beginnings, I regard the humanities as a general but exhaustive and still subtle study of the nature of human life in the world and of how to live it well. Thus, rather than a primary focus on discrete measurement and mechanization – one is almost tempted to say, the "digital" – humanistic study has focused on meaning, communication, expression, and feeling as these things are encoded in language, thought, and community – continuously and analogically, with plenty of "noise" interrupting the signal. The humanist's disciplinary toolbox includes multiple items: the study of history and rhetoric; philology and philosophy; the plastic, performing, and literary arts; theology and religion. Across the spectrum of these disciplines, both historically and contemporaneously, one common denominator has been a focus on understanding the nexus of value and capability, worth and power in human life: what is worth knowing or doing, and how can this be accomplished? And as attention is given to the relativity and contingency of human longings and our ability to realize them, that most basic of humanistic technologies comes to the fore, namely, the *techne* or "skill" of politics, or organizing flourishing and sustainable life together with others. Hence, the humanities might be summarized as the pursuit of wisdom in cultivating and maintaining good life in community. In its various modes, humanistic study seeks to understand more deeply human life in the past, to imagine creatively possible hopeful futures, and to organize social structures in the present in ways that serve individual and communal well-being.

With the rise of historicism in the post-Enlightenment period, the credibility of research in humanities disciplines began to depend increasingly on scholars' ability to document and demonstrate their claims with verifiable data and repeatable experimental (or field) research. This trend continued through the twentieth-century as a more generally empirical orientation began to win recognition in the historical and emerging social sciences. The study of religion was no exception. The so-called History of Religions School that formed initially in Göttingen in the 1890s was instrumental in developing historical-critical and comparative methods in the study of both biblical and contemporary world religions. Theologians, too, have had to come to terms with the limitations on the reach and even nature of the claims they make that come with acceptance of the reality of a more pluralistic, global field of research, one full of diversity and disagreement. Ernst Troeltsch summarized the new conditions for theological research in arguing that theology, like any other pursuit of knowledge, works only ever on the basis of incomplete information and is therefore making judgements of probability, not certainty.[28]

One of the unique contributions of theology to humanistic study remains its attention to the total conceptions of reality that are always present in communal life – sometimes explicitly, often not – and the ways individuals and community form their total conceptions of reality out of finite experiences, give formalized expression to them, and communicate them to one another.[29] Each of the theological disciplines do this in their own ways. Exegesis is the study of the texts that reflect such conceptions of early Christian communities; studies in the history of Christianity examine their evolution throughout the development of the late Roman and Byzantine periods and on through the emergence of the modern West; practical theology measures and maps them on the socio-political landscape of the present. But what about systematic theology? Like practical theologians, systematic theologians engage empirical debates when questions of

28 Troeltsch, "Historical and Dogmatic Method in Theology," 13–14.

29 This is a point I have developed with reference to Schleiermacher's theory of religion in Robinson, *Redeeming Relationship, Relationships that Redeem*, especially 1–12, 105–140.

bioethics and social ethics vis-à-vis confessional commitments arise. Like historians of Christianity, we work in each of the time periods of Christian history. Like exegetes, we even study the Bible (sometimes!). But what is the specific *métier* of systematic theological work? What does systematic theology *do* today?

I propose this question – what does systematic theology *do*? – as a new, central research question for the field. Systematic theology takes as its primary object of focus the reflected religious communications and actions organizing individual and communal life within some total conception of reality. Such a theology seeks to describe a Christian community's understanding of itself in relation to the totality of reality as it describes and prescribes this understanding to itself in its propositions and practices of the Christian symbol. With this orientation, I am combining the work of two thinkers: on the one hand, Friedrich Schleiermacher's definition of systematic theology as "the interconnected presentation of doctrine that has currency at any given time"[30] with, on the other hand, Niklas Luhmann's sociological theory of religious communication as the self-observation of religious meanings by those who "fix" the meanings as well as via second-order observation of those observations that tracks the calibration of religious discourses within their social environments.[31] My training in an unusual combination of disciplines has been influential in leading me to this position. I stand with one foot in the discipline of systematic theology and one foot in the field of religious studies, with my current research focus being directed toward inter- or trans-cultural theology. That is, I work in one discipline historically committed to the careful development of long, complex arguments in textual formats, and on the other hand in a field that, in addition to texts, values material objects, engagement with them, and extensive personal interactions with the communities and traditions in which these things have reality, significance, and purpose. In my research and scholarship, I seek to combine these influences, disciplines, and their traditional methods by viewing *doctrines* as *social artefacts* and paying attention to their presuppositions about and consequences for communal life. That is, I aim to observe the ways systematic theological language operates to form and guide community or what systematic theology "does."

There are several implications for method in contemporary systematic theological research that I wish to draw out of this formulation. First, this perspective calls for an *empirical-hermeneutical approach to systematic theology*. This is necessitated by scientific epistemological expectations of verifiability, if nothing else. But it is not a skeptical reduction; it is, rather, an expansive opportunity. By correlating doctrinal concepts with empirical observation of the social phenomena giving rise to them, systematic theologians might gain deeper insight into the processes of mutual formation between groups' total conceptions of reality and reflected or unreflected social practices, values, and skills. Theological research might then look for related phenomena in other confessions and religious or non-religious traditions and ask to what extent the religious language employed in communications about them are similar or different.[32] This would have the further advantage of opening up systematic theology hermeneutically to constructive engagements with difference in pluralistic settings.

Second, the paradigm devotes *privileged focus to theologies of the socially excluded and underrepresented* in global theological conversations. Because the goal in this systematic theological paradigm is not to advance one confession or another but rather to understand the social function and significances of theological language, symbols, and practices generally, it therefore maintains a high commitment to fair representation of theological voices. The overconcentration in production of and access to theological study and communication in the West that characterizes theological work today reflects the experience and

30 Schleiermacher, *Brief Outline*, §97.

31 Luhmann, *A Systems Theory of Religion*, 17–19.

32 This suggestion is similar to Michael Smith's recent suggestion in the *Journal of Empirical Theology* to employ "theological frames" for the "theological interpretation of social life"; Smith, "Theological Frames," 73–75. Smith helpfully points to the recent work of Deborah Bhatti on "theological action research" in combination with that of Kathy Charmaz on Grounded Theory in the development of theological frames that can yield a more textured analysis of the varieties and wider resonances of theological discourse collected in empirical theological research, whether in the form of written or live texts, performances, or even symbols, as well as analysis of the community-forming dynamics of those communications. Charmaz, *Constructing Grounded Theory,* and Bhatti, Cameron, and Duce, *Talking about God in Practice: Theological Action Research and Practical Theology.*

communication of Christian faith of only a minority of the world's Christians. For this reason, systematic theologians, and not only scholars of religion and social scientists, should be eager to give special attention and devote extra resources to the development of systematic-theological work in the emerging (or, in reality, already emerged) geographical centers of Christian thought in locations around the world including African countries like Nigeria, Ethiopia, and Kenya, as well as South American countries like Brazil and Honduras and Southeast Asian locales like the Philippines and Singapore.

Third, a more empirical-hermeneutical systematic theology in a pluralistic world engaged with the excluded and unrepresented requires *parallel work on first-order and second-order levels* of theological discourse simultaneously and as well as comparative (in particular, intercultural and transcultural) research. Vast fields of "reflected religious communication and action organizing individual and communal life within some total conception of reality" exist around the world but in "lived" forms rather than the discursive-textual forms that are, for better or worse, still important for being able to participate in a meaningful way in global theological conversations.[33] But they can be written or brought to speech in some "interconnected presentation" or another, to refer back to Schleiermacher's definition. Thus, an emerging horizon for systematic theological work has become forms of embedded ethnographic work that seek on the level of first-order observations to assist and support the articulation of self-understandings of lived experience.[34] These local theologies, in turn, can become contributions to global, second-order observations of the function and significance of theology, representing and represented by the communities in which they originate.

4 Concluding thoughts and proposals

So what can the digital do for us in systematic theology to implement the kind of systematic-theological work just outlined? What do we need to be able to do, and how can tools and techniques in the digital humanities help us do that? Systematic theology as just outlined stands in a unique position within the modern university with respect to the relationship of research to teaching. For, in this paradigm, when systematic theology creates space for the formulation of the self-understandings of others (first-order description) it produces new research at the same time (for second-order analysis). I wish to be clear that I do *not* intend to advocate the exporting of Western European theological commitments; nor am I naïve about the extent to which the framing itself does this insofar as it exports an implicit Western rationality. That would be to fall prey to the very concern over knowledge colonization named in part two of this essay.

Instead, the purpose remains focused on enabling people to speak with others in and on their own terms about their total conceptions of reality and the place of their lives and of their communities' lives in it. The goal is to cultivate *opportunities for participation* in global conversations where, again, people can engage one another on a fairer, more representative, discursive footing. Thus, the question of how the digital might be taken up in this systematic-theological paradigm in ways that empower the poor, socially

33 See the introductory chapter of McGuire, *Lived Religion,* 3–18. McGuire points to both the ever-evolving (and non-essentialist) quality of historical religions, as well as the extraordinary degree of particularity evident in the religious self-descriptions of individual persons. I am, however, more interested than McGuire was in that book in the ways this particularity works itself out in groups and discursively, where discourses are also seen as practices and artefacts maintaining a high level of particularity. I do not perceive a necessary incompatibility or mutual resistance between viewing discourses as circulating meaning, on the one hand, and embodied practice, on the other.

34 Theology in North America and Great Britain has in the new millennium been following what might be described as an empirical arm. The use of empirical methods in practical, constructive and some systematic theological studies is growing, above all embedded ethnographies based on participant observation. In the first decade of the 2000s, Jeff Astley and Leslie J. Francis began editing a series on what was called "ordinary theology." The series currently contains 42 titles. The first was Astley, *Ordinary Theology.* For a mid-point overview of the paradigm, see: Astley and Francis, *Exploring Ordinary Theology*. Ordinary theology seeks to conduct "theological reflection on the church's practice," and the studies in the series employ methods in psychology, ethnography, education, and gender studies, among others to work through related aspects of churches' self-understanding and self-formation. To mention only a few additional examples of this empirical turn see Marsh, Slade, and Azaransky, *Lived Theology;* McBride, *The Church for the World*; and in shorter form Robinson, "Fake Friends."

excluded, and underrepresented is a question about how digital tools and resources can help build capacity – create opportunities – for meaningful participation,[35] and thereby realize people's potential for living a life they have reason to value.[36] To put a fine point on the question, how can systematic theology use digital humanities technology, pedagogy, and research in development contexts and contexts of social exclusion?

I offer the following *questions* and *observations* as concluding thoughts to help guide consideration of productive use of digital resources within systematic theology.

Questions: What forms of reading, writing and self-reflected, intentional communication can digital tools be used to cultivate and how? What tools and resources in the digital humanities can make publication and distribution easier and more affordable? It is deeply problematic that, even though many journals are available in electronic formats, access to those journals is prohibitively expensive for those lacking affiliation with a major research university. And authors wishing to publish their work in open access formats have to pay exorbitant publication fees to do so. It is difficult to see how this does not effectively cordon off credible publishing and distribution as an elite territory for the wealthy. What can be done to undermine this injustice and make both access to research materials and publication fees more equitable for those without wealth?

Observations: One of the most simple but perhaps most profound opportunities created by the digital turn for scholarship in general has been the increased ease of swift, long-distance collaboration. It is important to acknowledge that being online filters human daily experience to an increasing extent and to assess this theologically and critically. Nevertheless, the experience of life and faith in the socio-political particularity of offline contexts remains primary for human beings, especially for the world's most marginalized, and at least for now. It also happens to be the case that these contexts often coincide with what might be termed "key theological development zones" – that is, contexts characterized by high socio-political volatility combined with rapid growth or change in Christianity. In a sense, such contexts constitute the frontlines of theological research. But we face the perverse situation that where the most work needs to be done, the least resources are available. Thus, although it is not a new idea, nevertheless I propose systematic theologians use digital formats to collaborate more intentionally, to redistribute "theological resources" and to build professional networks. I am not advocating for a Robin Hood-style activism; rather, this can take forms that accord well with scientific best practices. For example, more systematic theologians can be intentional about developing intercultural research collaborations. This would then allow, in fact require, building an international reciprocity network of colleagues in those locations with whom to co-write grant applications and publications, to establish extended research visits for one another and for relevant students, to plan conferences, and to share literature. Contexts which significantly lack the material resources necessary for competitive theological research and education but which possess adequate access to online social media platforms can network in this way with others possessing an abundance.

Even in my own ears, these questions and observations sound hopeful but also frustratingly vague. But there are tremors of change that indicate both priorities sympathetic to those articulated here as well as directions for future development in preparing systematic theological research rooted in and based on fair participation in theological knowledge production. First, it should be noted that there are some good online resources available that are specifically proceeding from and aimed at cultivating global inclusion and participation. Globethics.net is one such resource. They offer courses (with fees adjusted by geographical region) and host an online library (though the difficulty of providing access to many journals remains) "committed to the principle of open access, to the sharing of knowledge and information for the benefit of all."[37] I have no personal connection to the work or team at globethics.net, and this reference should not be taken as an advertisement. I do, however, find their resources useful and their priorities worth emulating in systematic theological work. How? This priority points, second, to a direction for further development. A present need and challenge in providing knowledge that benefits all is curating knowledge

35 Nussbaum, *Creating Capabilities*, 17–45, 69–100.

36 The principle of realizing people's potential to lead the kind of lives that have reason to value is the recurring refrain throughout Amartya Sen's *Development as Freedom*.

37 https://www.globethics.net/10th-anniversary.

produced by all. Another, newer project focused more specifically on integrating the digital into systematic theology is Benno Van Den Toren's new Templeton Foundation funded project "Global Christianity at Your Fingertips: Providing Online Access to Global Christian Theology, Starting with Africa."[38] The project description explains that the project will "include various online resources on global theology, as well as a network connecting faculty, librarians and students around the world."[39] To accomplish this, the project will focus on generating much more extensive bibliographies of works by African theologians than have previously been available. In turn, the generation of these bibliographies will be assisted and informed by consultations with theologians throughout French-speaking Sub-Saharan Africa on site to gather resources and be advised on best forms of presentation. Finally, third, the direction in digital humanities for theology that is illustrated by "Global Christianity at Your Fingertips," nevertheless serves to highlight the (for now at least!) irreplaceability of embedded participation.

A final proposal might therefore be to combine the work of ethnographic and other empirical fieldwork-based forms of research with the methods and training of "embedded librarianship" in systematic theological research.[40] Embedded librarianship focuses, among other things, on fully integrating the librarian into research projects and teams rather than their "serving" as "one-shot" information consultants. "The librarian functions as a team member like any other – and shares responsibility for team and organization outcomes with all the other members of the team." In "the philosophy of embedded librarianship…embedded librarians need to be fully 'read into' the nature of the work being performed…Embedded librarians need a full understanding of the nature of the task and the goals of the effort."[41] The idea of the embedded librarian might be expanded for empirical-hermeneutic systematic theological research. If systematic theology can be regarded as the documentation of a community's "reflected religious communications" to itself and about itself vis-à-vis its total conception of reality, then a basic task for generating participation in global conversations of systematic theologies that are more lived than written is documentation of those communities' "reflected religious communications." However, such documentation will need to be creative and flexible, and might work best by, at first, collecting church statements, sermons, video and other media, as well as even social media communications. Doing so in a meaningfully representative way would be tremendously assisted by informed methods of collections and documentality theory, which constructively analyzes the bi-directional borders between social performances, values and objects, and transcription or inscription.[42] Partners engaged in embedded librarianship can contribute not only in these ways, but also in conducting the final, essential transformation of such collections into digitally accessible and engageable formats. For all of this, working in team research formats and, specifically, in co-operations between "classical" systematic theology, empirical-hermeneutical systematic theological research, and embedded librarianship presents an exciting horizon for the work that lies ahead.[43]

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38 https://www.templeton.org/grant/global-christianity-at-your-fingertips-providing-online-access-to-global-christian-theology-starting-with-africa.

39 https://www.pthu.nl/en/News_and_Events/News/global-christianity-website-project-granted-175000-euro/.

40 The work of embedded librarianship has become a major discourse in library scholarship over the last ten to fifteen years. For a very recent discussion, see Mlinar, *Embedded and Empowered*.

41 Shumaker, *The Embedded Librarian*, 4–5.

42 Ferraris, *Documentality: Why it is Necessary to Leave Traces*.

43 I would like to thank the peer-reviewers for their helpful comments that led to improvement of the second section of this essay and provoked concrete and practical ideas for the conclusion.

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Digital Humanities in Biblical Studies and Theology

Thomas Schlag*

Truth Communication in Times of Digital Abundance: A Practical Theological Perspective

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Abstract: Digital providers inundate their users with an abundance of words, as well as pictorial and iconic information that has long become almost unmanageable. In terms of religious communicative usage, there are some indications that a new, perhaps even disruptive quality is being introduced into these digital practices, particularly with regard to truth communication. For both the individual actors and their places of lived religion and religious communication, the claim to truth expressed in each case is influenced by the very dynamics of digital use. Against this background, the basic question arises of whether a practical-theological reflection in the mode of a critical observation of these digital dynamics is conceivable at all. Therefore, I examine the current dynamics of digital media use in more detail by focusing on the anthropologically and theologically relevant concept of "searching" in a fundamental sense. The question arises of whether the implied, highly intensive and independent religious search developments are actually able to represent and promise in their entirety that "truth" which can be meaningfully searched for and found according to theological understanding. From these reflections on a practical public theology, some exemplary consequences for the field of religious educational practice are subsequently pointed out. I argue that, in the sense of cultivating critical perception and interpretation competence, an awareness of the significance of this abundance of analogous expressions and behaviors should be created in concrete educational processes. But an awareness should also be created of the relevance of developing an identity and a personal relationality in the digital world, shaped by the theological idea not only of "searching," but of "finding" and "being found."

Keywords: religious digital practice; public theology; practical theology; communication; truth

1 The phenomenon of digital abundance

Around 300 billion mails are sent worldwide every day.[1] And every day people watch over 1 billion hours of YouTube videos. On YouTube alone, 400 hours of video material are uploaded every minute.[2] The data volume of the internet doubles about every two years. In the year 2025, around 163 Zettabytes – 163 with twenty-one zeros – of data will be generated worldwide, ten times as much as in 2016. For clarification, this amount would correspond to all the series and films currently stored at Netflix multiplied by 500 million.

1 Cf. https://de.statista.com/statistik/daten/studie/252278/umfrage/prognose-zur-zahl-der-taeglich-versendeter-e-mails-weltweit/ [accessed 1 June 2019].

2 Cf. https://www.brandwatch.com/de/blog/statistiken-youtube/ [accessed 1 June 2019].

***Corresponding author: Thomas Schlag,** University of Zurich, Zurich, Switzerland; E-mail: thomas.schlag@theol.uzh.ch

The average internet user spends about six hours a day with internet-enabled devices and services. This corresponds to about one third of a person's waking state. If one adds up this time for all internet users worldwide, currently around 4 billion, this results in a total time of use of 1 billion years for 2018 alone.[3]

Digital providers inundate their users with an abundance of words, as well as pictorial and iconic information, a quantity that has long become unmanageable. Due to simplified technical access, information is ubiquitous in terms of both time and space; it is nearly always available. What information can actually be used amounts to only a fraction of the actual volume. And that volume is always expanding, constantly opening up new horizons, and appearing in different guises with different truth claims.[4]

At the same time, in many cases it is no longer necessary for the individual to make a deliberate decision in order to select from the existing range, as may have been the case in analogue times. Instead, what can be read or seen or heard is offered according to a logic that the users themselves have contributed to and partly influence. This logic becomes increasingly self-evident and more entrenched with every new click. Much of the information available to users is no longer consciously chosen, but results from what has been selected at some point before: "you don't choose to enter the bubble. They [personalized filters] come to you – and because they drive up profits for the Web sites that use them, they'll become harder and harder to avoid."[5] This is evidenced by the relocation of data sources. By 2025, a large proportion of the data will not be generated by private users as before, but by companies.[6] The saying "the future of the web is about personalization"[7] does not reflect a sovereign decision by users, but is primarily based on economic interests. Such personalized use results from economically motivated profiling, to which the individual contributes with every new decision to search and select. The constantly changing shape of the truth being offered is controlled by the offer itself.

At the same time, these dynamics promote intensive emotional and motivational forms of use: new things only have a chance of meeting with approval if they correspond to and confirm what one already knows or suspects in one's own filter bubble.[8] What is received digitally often corresponds exactly to what is already expected subconsciously, to what is believed to be true. And the inverse also applies: what has not yet been in the focus of interest usually fails to capture one's attention. The disturbing and the irritating are only perceived if they can serve as negative evidence for one's own view of the world. At the same time, stimuli must be increased if the same thing is to continue to draw attention.

Even if it is not yet clear whether the new digital media trigger these dynamics, there are some indications that a new, disruptive quality is being introduced into digital practices. For our case, focusing on religious practice, this is especially true with regard to truth communication. Thus the original sense of enlightenment through the medium, once euphorically assumed, has itself been lost: "today the Internet is in many places a gigantic emotion machine, in which knowledge is not in the foreground, but full entertainment according to the rules of the boulevard. Whoever stirs up emotion wins the battle for attention: cat video beats nature documentary. Rage speech beats differentiated reasoning. And fiction often suppresses truth."[9]

In this respect, the network's main rationale and idea is to keep the assertion of truth verifiable and not to evade critical debate. Kevin Kelly, co-founder of *Wired* magazine, says: "Truth is no longer dictated by authorities, but is networked by peers. For every fact there is a counterfact. All those counterfacts and facts look identical online, which is confusing to most people."[10]

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3 Cf. https://wearesocial.com/de/blog/2018/01/global-digital-report-2018 [accessed 1 June 2019].

4 Levmore and Nussbaum, *The Offensive Internet*.

5 For a discussion of their possible, but perhaps also overestimated, polarizing effects see Dubois and Blank, "The Echo Chamber is Overstated."

6 Cf. https://blog.wiwo.de/look-at-it/2017/04/04/weltweite-datenmengen-verzehnfachen-sich-bis-zum-jahr-2025-gegenueber-heute/ [accessed 1 June 2019].

7 So Tapan Bhat, Vice President of Yahoo, in http://www.lse.ac.uk/assets/richmedia/channels/publicLecturesAndEvents/slides/20110620_1830_theFilterBubble_sl.pdf [accessed 1 June 2019].

8 Pariser, *The Filter Bubble*.

9 Müller von Blumencron, "Trennt Propaganda von Wahrheit!" However, it must be asked whether the phenomenon of cat videos – which here *pars pro toto* stand for a whole entertainment genre – can at least indirectly include a search for truth, and whether it represents "only" the search for a healthy, "sweet," natural world.

10 Gray, "Lies, Propaganda, and Fake News."

"Digital prosumers" not only think and see and live in pre-programmed worlds, but they have also become firmly established in them "for themselves." One's own opinion is formed to the point where one's digitally individualized information horizon draws the boundary, which in turn has significant political relevance: "The seemingly public nature of the seeker is creepingly privatized in the private interest of the provider, who acts as a citizen, actually as a customer who can no longer be expected to accept another of one's own position – and who is no longer able to find it either."[11] This makes the search for truth in discourse at best only possible in a narrow sense.

The freedom of dealing with a wealth of information threatens to give way to the lack of freedom of preliminary decisions having long been made elsewhere. The images, words, and signs on the worldwide web are not only available to be received by the individual at all times, but are also predictable, lack surprise and spontaneity, and incite a lack of expectation which is self-determined. And this is probably not only true for secular content, but even more so for religious content within the digital realm.

2 Challenges for Practical Theology

Against this seemingly unchangeable background, the basic question arises of whether a practical-theological reflection in the mode of critical observation is conceivable at all. Can the digital abundance of images, words, and signs be interpreted in such a way that an alternative method of assessment still makes sense? Does the overall digital context therefore not require any further decoding because everything essential is already directly before the eye of the beholder, especially if the beholder invokes his constitutional right to (religious) freedom of opinion, information, and practice? If theology were to go ahead, would it now once again raise the moral index finger in an anti-technology orientation and with a fundamental unease about digital culture? Would it try to convince individual users of "something better," which would once again be a repetition of the familiar cardinal error of theological crisis semantics and a way of distancing itself from modern developments?

The following considerations are not intended to be an overly predictable way of notching up fundamental criticism. And yet the question of how these digital forms are to be assessed is anything but secondary. Because, for both the individual actors and their places of lived religion and religious communication, the claim to truth expressed in each case is influenced in a life-shaping way by the dynamics of digital use.

In fact, the practical-theological approach to the religious reality of the world is based on an ability to plausibly distinguish the essential from the unessential, truth claims from fake news. This becomes possible by means of concrete interpersonal arguments and reasoning, or at least by productive promotion of an awareness that discernible, self-critical, and mature consciousness is required. Practical theology as a specific scientific approach to understanding Christian practice is in demand, not only in view of individual lifestyles, but also in light of the collective dynamics of religious and ecclesiastical provenance. In accordance with the recent dynamics of a so-called "Public Theology"[12] and "Public Church,"[13] this specific disciplinary approach and its scientific objectives can be understood as a manifestation of "Public Practical Theology," putting forth concrete arguments and reasoning in the perspective of "serving life" (*Lebensdienlichkeit*).

Now this term "serving life" might appear rather vague. Nonetheless, it can be a helpful interpretative perspective for practical theology as an academic discipline. This is precisely the case when, questions about "the truth" are repeatedly asked in an interpretive manner. Which forms of digital religious practice make life-serving humanity possible, and which are more likely to be regarded as life-destroying? In this sense, public practical theology is understood as the theoretical reflection of the practical challenges and practices of digital theology as "intentional, sustained and reflexive theologically-resourced engagement with digitality/digital culture."[14]

11 Meireis, "'O dass ich tausend Zungen hätte,'" 55–56.
12 See Oorschot, "Making Public Theology Operational"; Brunn, *Raum. Kirche. Öffentlichkeit*.
13 See Schlag, *Öffentliche Kirche*.
14 Philipps, Schiefelbein-Guerrero, and Kurlberg, "Defining Digital Theology," 39.

Consequently, this approach is based on an understanding of truth that is not fixed from the outset by certain dogmatic propositional truths. Rather, the search for the truth of life is itself always connected with a possible abundance of different perspectives.[15] The fact that in each individual case a dispute between interpretations – especially about the possible understanding of truth – breaks out does not speak against the approach of public practical theology, but reveals the life-relevant approach of this academic theological reflection.[16]

Such theological reflection, then, should not be understood as the only possible or even ultimate interpretation, but as a *useful* interpretation. Such interpretation can be characterized by a specific competence of distinction, avoiding both euphoric and apocalyptic voices.[17] So if practical-theological reflection intends to contribute to the interpretation of life and to the associated theological practice of interpretation in the light of one's understanding of truth, it will have to deal intensively with the developments of the digital age.

But in order to perceive the digital dynamics adequately, and to be able to assess them theologically and ethically, observational and evaluation criteria are needed. It is precisely in this sense that theological reflection on digital life and communication contexts is as meaningful as it is necessary. The following considerations are intended to provide a first move in this direction. To this end, I examine the current dynamics of digital media use in more detail by focusing on the anthropologically and theologically relevant concept of "searching" in a fundamental sense, in order to subsequently point out some consequences for the field of religious educational practice.

3 Search developments in a culture of digitality

In an initial sense, "searching" can be understood as a fundamental and inherent characteristic of human beings. Humans search for answers for their own benefit and to meaningfully orient their lives. The installation "My Search Queries" by the artist Max Julian Fischer provides a vivid picture of these phenomena: A mountain of shredded strips of paper spreads out on the floor, rising and falling like a living being in a heartbeat rhythm through an artificial impulse. The text accompanying this installation reads: "My search queries document my interests. They tell a story of the things I wonder about. About the things I want and the things I think I need. My search queries document my journey on the net. I downloaded these searches from my Google Cloud account. Printed. And shredded."[18]

Humans have been searching from the outset, and to this extent human life has always demanded orientation. Life questions are always being renewed. The "interests" of the artist Fischer extend into his individual life plan or are closely connected with it. Searching manifests the incompleteness of one's own existence, which in view of the respective circumstances of life requires reassurance. In this sense "searching" also has to be understood as a dynamic movement of the individual as it develops and changes. And "development" itself is understood as an anthropological term in so far as it describes an internal process of feelings and thoughts, as well as external processes of expression, be it through language, action, or the body.

Our first search dynamics are initially directed towards quite elementary processes, such as the first crawling, hearing, groping, walking orientations in space. With an increasing ability to reflect, searching is then also directed toward the development of one's identity, the formation of trust, and the expansion of possibilities for action and design.

In the course of individual development, this is combined with the search for principles to underlie individual living, the search for meaning, for answers to the questions of living together, the search for justice, and also for answers to the questions of good, truth, and God himself. In the horizon of a culture

15 See Dalferth and Stoellger, *Wahrheit in Perspektiven*.

16 See in more detail Schlag, "Religionspädagogik als Lebenswissenschaft."

17 One thinks here of the different theological positions from a more recent time, for instance of Haberer, *Digitale Theologie*, or Jung, *Digital Mensch bleiben*, or Campbell and Garner, *Networked Theology*.

18 Fischer, *Meine Suchanfragen*.

of digitality,[19] this elementary human search can also be traced microscopically, so to speak, for digital practice: the search developments detectable here do not emerge linearly, one leading to the next, but are often mutually complementary.

On a first comparatively superficial level, this practice actually serves the initial acquisition of *information and knowledge via* a search function, but also the search for *fun, entertainment,* and *distraction.*[20] In an often consciously playful way, the medium is opened up through its haptic possibilities, whereby *search* and *addiction may* appear close together through certain technical possibilities, such as "like buttons," that offer subtle emotional rewards.[21]

In a second, further-reaching sense, a more *personal* and *participative* element can be seen insofar as digital practice focuses on active participation, creative forms of design, and participation in certain media networks and forums. Interestingly, programs in which one's own name – for example as a "user name" or as a password – is required encourage something like the first formation of identity to take place. One could thus speak here of a *search development* toward *personal participation and identity-related solidarity, and thus at the same time toward relationship and community.*[22]

From these first baby steps of participation, such *individual* forms of representation emerge at the same time as a further search dimension in which the search for one's own identity moves more to the centre stage. One thinks here of "selfie culture,"[23] which now begins as early as the pre-teens, as well as the establishment of personal accounts. Thus, certain motives for use bear clear traits of the search for recognition, for confirmation, possibly also combined with expression of a perfect exterior image.

In connection with this, and also going one step further, such forms of representation already open up the far-reaching *personal search* for health, happiness, and love, for a certain form of security and meaningful life experiences.[24] And finally, in the sense of a more *content-oriented search for orientation,* essential questions of certainty and truth can be raised, including also dimensions of religion, transcendence, eternity, and faith.

Such search developments are by no means exclusive to the use of digital media. As vital, "truth-oriented" orientation practices, these are, seen anthropologically, basic phenomena for the conduct of life which are not bound to digital formats and are certainly not exclusively connected to them. In view of the repeatedly raised question of the disruptive quality of new media, it should be noted at this point that the media upheavals from analogue to digital are "not absolute cuts and cracks, but rearrangements of complex constellations."[25] And yet it is precisely through these digital forms of communication that dynamics and possibilities emerge which have a new quality in terms of their extent and diversity, intensity and speed, accessibility, and (supposed) accuracy.

In order to take up the aforementioned basic practical-theological questions once again, it is necessary to ask how, from this perspective, the digitally induced or at least intensified search developments and the

19 Stalder, *Kultur der Digitalität*.

20 51% of adult Americans use YouTube for "figuring out how to do things they haven't done before"; 28% for "just passing time"; and 19% for "understanding things happening in the world." Survey of U.S. adults conducted 29 May to 11 June 2018, https://www.pewinternet.org/2018/11/07/many-turn-to-youtube-for-childrens-content-news-how-to-lessons/ [accessed 15 May 2019].

21 See the corresponding psychological backgrounds of these very conscious technical applications in Spiekermann, *Digitale Ethik*, 102–105; Thiede, *Digitaler Turmbau zu Babel*.

22 It is no coincidence, therefore, that for about fifteen years a research field has been established under the label "Digital Religion," which mainly originates from the Anglo-Saxon area, especially on questions surrounding the connection between religion and digitalization, and which should intensively be taken into consideration by practical theology. The studies in recent years that focused on manifestations of, and the concept of, community are particularly revealing for the reflective tasks of practical theology. See Campbell, *Religion and the Internet*, and, more systematically, Cheong, *Digital Religion, Social Media, and Culture*.

23 Gojny, Kürzinger, and Schwarz, *Selfie*.

24 In terms of professional theory, this has been demonstrated in recent years by the fact that the internet is now being used intensively as a source of advice on medical and legal issues. In this respect, for theology as a "positive science" (*positive Wissenschaft*) in Schleiermacher's sense, the question also arises as to whether these search developments have long since been extended to the field of theological professionalism. To this extent, the role of the "guardians of knowledge" must also be rethought. See Spiekermann, *Digitale Ethik*, 215–222.

25 Schröter, "Analog/Digital," 29.

associated searches for truth can be dealt with in a critical-constructive manner. The question arises as to whether the implied, highly intensive, and independent search developments are actually able to represent in their entirety that "truth" which can be meaningfully searched for and found according to theological understanding.

For, in fact, the impression is being created that through the digital possibilities and their manifold abundance of words, images, and signs, the burden of proof regarding the communication of truth has entirely shifted to the place and responsibility of the digitally active individual. However, this is associated with a number of problems at all levels of individual searches. On the one hand, technically programmed and programmatically unlimited freedom is always determined by certain algorithms according to corporate control over media content and thus to individual access and orientation processes, even externally determining them. On the other hand, with regard to the aspect of "personalization," the broader question arises as to what significance digital media use can actually claim for itself in the individual search for identity and relevance to life if "the digital network is thus permanently filling us with virtual impulses from everywhere and nowhere."[26] But what does practical theological reflection regarding the "search term" have to offer in terms of content?

4 Searching as a basic Protestant attitude of promised passivity

First of all, it should be noted that central biblical traditions could be enumerated and illuminated in a highly revealing sense in light of the developments and dynamics of searching. This cannot and must not be performed here in detail. Nevertheless, it would be extremely worthwhile to play through the different elements of the abovementioned search as a foil for the interpretation of central biblical texts or their linguistic, iconic, and symbolic programmes.

But even if one refers to certain biblical traditions, absolute truth should never be claimed because all individual interpretations do not give final answers to the "burning questions" of life, but rather open up new possibilities for further interpretation. Therefore, a theological understanding of truth, despite its claim to life orientation, cannot claim more than to be itself a certain perspective of truth. In this respect it has to prove itself again and again through a certain life-serving public practice and has to remain open to critical discussion.

But what can be said in general terms here is that, beyond the different elements of transmission, an unmistakable theological meaning can be identified in that these search developments are always surrounded by the life-relevant concept of *finding*. To formulate this even more precisely: the human attempt to find the decisive thing is based on a hope of *being found*. In this respect, the creative centre of human life is not its own activity, but the "deep passivity of our existence. Most of what we are, we don't owe to ourselves."[27] The intention to become certain of *oneself, in and because of all the freedom of the Gospel's promise,* gains its meaning only from the experience of knowing, in one's own questions and searches, prior to certainty from somewhere else.

The intensively documented search for orientation in the Bible – for example, the highly emotional development of the Psalter, or the book of Job, or the tradition of discipleship in the New Testament – leads to an insight into the human limits of one's own search. And it leads again to the experience that orientation can only be achieved by exposure to external stimuli. According to biblical and theological understanding, life-relevant search developments are not possible in the location of the individual or through one's own activities. They are only possible through insight into the fundamental passivity of all human *discovery*, *confirmation*, and *orientation*.

To state it here again quite clearly: truth does not lie in the eye of the beholder but exists in its character as a gift, which enables humans to experience revelation anew.[28] Truth only becomes a life-relevant dimension

26 Spiekermann, *Digitale Ethik*, 120.

27 Dalferth, *God First*, 49–50. See also the Pauline insight: "What makes you at all to be so arrogant? Isn't all you have a gift of God? But if it was given to you, why do you boast as if you owed it to yourself?" (1 Cor 4:7).

28 On the question of Christian truth as the centre of Protestant theology see Volf and Croasmun, *For the Life of the World*.

– through whatever media – if it can be opened up to the human being beforehand, and ultimately without his or her active involvement. The working and effective word is thus not self-generated. It is expressed because it has already previously taken shape: "Christian faith lives from the effective presence of God, not from the traditional memories of a founder figure, from the life-giving Spirit of God, not from the dead letter."[29] All communication of truth and all free and meaningful use of words and symbols, as well as interpretive practices connected with it, always follow a certain promise: that something will happen which is not available to or arranged by the human, but which can be ascertained by remembering and reflecting.

With this context in mind, the central question becomes how active and passive modes are represented in these searches. In fact, a highly ambivalent tension can be assumed: on the one hand, the highest activity and infinite data production takes place in the network with identity-forming significance. On the other hand, fundamental passivity is also a given due to the long-established production and orientation mechanisms of the network. In many cases you are not "in control of your own house" or personalized user interface. And yet this form of digital passivity differs substantially from the theological understanding of passivity. This is the case insofar as the dimension of unavailability is not to be equated with a loss of individual freedom because it represents the gift of freedom as its core content.[30]

What threatens to become fundamentally lost in digital searches is this unavailable, passive moment from which freedom can only come to itself in the first place. Access to corresponding digital content is in any case constitutively something different than the promise of what cannot be found alone. In contrast to the perceptions on the surface, which are primarily economically induced, truth communication lives from the dimension of a specific depth and its effects, which can appear totally freely because it is always present without human intervention.

Such a broader conceptualization of the "search term" can then become relevant in the horizon of current religious digital dynamics, including in practical-theological reflection. In the concluding section, this idea will be partly explained using education as a test case.

5 Practical-Theological consequences for an educated communication of truth

In the field of education and, in recent years, religious education, the challenges of digitalization have been considered more and more intensively, and possible future strategies for dealing with them have developed.[31] So it is hardly surprising that the main goal of school education is to practice media literacy as critically as possible. This is, of course, objectively appropriate, but at the same time it raises the question of what this can mean specifically for religious education, the search developments initiated by it, and its claim to truth communication, especially if religious education illuminates the modes of recognizing truth.[32]

Two points are to be mentioned here, related to the insight that "the Internet is currently undergoing its first real test: Will its protagonists be able to develop enough powerful mechanisms to help the Enlightenment to victory even in the age of ideologization? Global players in the network will have to be measured by this. It will no longer be enough to rely solely on the neutrality of technology."[33]

It is a fundamental educational goal, in view of the undeniable fascination of digital information, to first consider the abundance of images, words, and signs offered. This includes their offers of truth, in terms of their technical, political, and economic background motivations. The fact that users are especially, and presumably primarily, consumers and buyers is something that needs to be brought to the fore again and again. What is threatened when the selection and "pre-determination" of what is significant

29 Dalferth, *Wirkendes Wort*, 300.
30 In secular orientation and yet with religious connotations see Rosa, *Unverfügbarkeit*.
31 See for example Nord and Zipernovsky, *Religionspädagogik*.
32 See Meyer-Blanck, "Unterscheiden," 9.
33 Müller von Blumencron, "Trennt Propaganda von Wahrheit!"

is left to algorithms, especially with regard to individual search developments and the question of truth communication, can thus always be clearly addressed. Otherwise, supposed user freedom could turn out to be nothing more than expression of the greatest "unfreedom" in these highly life-relevant searches.

Secondly, there is the challenge of how to deal with digital possibilities in a free and constructive way in light of the passivity and gift character of the individual lifestyle. The "difference competence" to be developed and maintained here lies in distinguishing between the abundance of digital words, images, and signs and the vision of the "abundance of life" itself. The dimension of real personality in the place of one's own self and the real "other," and also the question of the truth dynamics of individual identity searches and real encounters, is not resolved by the mirroring dynamics of digital media.

In contrast to digital notions of perfectibility, the following fundamental theological-anthropological insights must be remembered: "Personal consistency is no longer to be thought of as uniformity, but rather as a composition of the different; this composition never comes to a reliable conclusion in life, but remains constantly in motion…'identity' does not mean that a human being ever becomes completely transparent to himself or herself, but rather that the person also contains the insight that the human being always remains a little withdrawn."[34] This consciousness of constitutive deprivation and transcendental unavailability, however, brings all algorithmically induced ideas of availability to their limits.

In the sense of cultivating critical perception and interpretation competence, concrete educational processes should create an awareness of the significance of this abundance of analogous expressions and life behaviors, as well as the relevance of developing identity and personal relationality. For search developments will probably only have a life-relevant experiential dimension if they themselves can be experienced, including their physical dimension, in their entirety. Language events relevant to life are – at least for the time being – dependent on real resonances. And they cannot be replaced by supposedly essential one-dimensional digital agents. However, in order for these resonances to be discovered at all, the training of perception and attention needs to be re-trained more than ever. For "if we do not rebuild and preserve a culture of attention around our knowledge, we will eventually swim like disoriented fish in a sea of information whose goodness we can no longer judge."[35]

In this context, the proposal to design the necessary search developments in the sense of the search for osmotic processes between analogue and virtual communication spaces and thus as a "search for shared realities in the plural"[36] in order to break through the technically induced logics of fragmentation is stimulating.

In this sense, a Protestant-informed practice of truthfulness "as a search for what is shared, but permanently different, and on the other hand as a search for what is common"[37] is characterized by the fact that it is able to promote itself from theologically-based criteria for digital search movements as distinctive, empathetic, and self-aware. The fact that the respective digital image, word, and sign productions each require their very own skills of approximation, deciphering and critical assessment can only be hinted at here.

In any case, for such an existential practice of interpretation, the Christian religion distinguishes itself in the realm of the justification-theological distinction of law and gospel as an "execution of consistent distinction as expression of the struggle for truth."[38] In other words, according to theological understanding, the significance of the search for truth does not lie in the fact that one will find "safely" and "for oneself alone," but that one can be sure to be found.

Such a religious self-understanding lives inside a sense of the infinite, and at the same time human, which cannot be sufficiently represented by an abundance of digital images and words. Successful truth communication must be face-to-face, containing many more experiences than are possible through even the most attractive "image-giving" experiences. Consequently, religious education in the digital age faces

34 Englert, "Komposition des Differenten," 138.
35 Spiekermann, *Digitale Ethik*, 205.
36 Oorschot, "Fragmentierte Öffentlichkeiten," 92.
37 Ibid., 93.
38 Meyer-Blanck, "Praktische Theologie," 391.

the challenge of "developing web-based communication opportunities and relying on interactive and intersubjective learning arrangements. For what applies to the content-related examination of the object of truth also applies to the forms of teaching and learning in which this takes place: They depend on an existentially relational appropriation by those who seek it."[39]

This then brings with it another important distinction based on the theology of the Reformation and productive differentiation: "It is a figure of the granted grace and corporeality of faith that the works and the insights are not necessary for justification, but are nevertheless reality in the life of the believer."[40] In view of the paradox of searching and finding this means that "Protestant teaching should confront the fact that the truth sought by the subject must by definition be something that is found by oneself, but in this finding must be set as, at the same time, not accessible to construction."[41]

For such a reality-conscious and educated communication of truth – requiring a final mention here – the spatial possibilities of church practice open up necessary counter-experiences. In view of virtual spaces for worship, prayer or mourning, for example, the extent to which existential searches can actually take place primarily via such virtual forms of use has to be questioned. Likewise, it has to be asked whether it is not precisely at such moments and times that experiences of personal and bodily relationality are required, experiences which cannot be made available, or only inadequately, via the internet. Of course, this does not mean that physical encounters cannot also include power forms and indoctrination dynamics. But it is to be hoped that real encounters will facilitate stronger forms of critical encounter.

Through holistic and bodily ritual experiences, through worship services of the living Word, which actually happens without any action of its own in its unavailability as freeing truth (John 8:32), completely new possibilities and scope for the attentive individual and collective search for truth open up in the midst of the digital abundance of images, words and signs. In this way, these spaces and the events taking place in them can be discovered in their meaning of life – which in turn is made accessible through the "sense of hearing and face…also the sense of smell, taste and touch."[42] It thus becomes clear that the personal search for truth cannot be digitally pretended. But that individuals from the almost infinite abundance of "the net" are able to grasp and understand what is essential for them, precisely by spelling out their own searches and being found "for themselves" in complete freedom, communicating collectively and thus understanding life in a meaningful way.

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39 Nord, "Die Wahrheit," 223.

40 Meyer-Blanck, "Unterscheiden," 18.

41 Ibid., 8.

42 Meyer-Blanck, *Gottesdienstlehre*, 133.

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Digital Humanities in Biblical Studies and Theology

Sarah Yardney*, Sandra R. Schloen, Miller Prosser

New Digital Tools for a New Critical Edition of the Hebrew Bible

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Abstract: This article describes the digital edition of the Hebrew Bible: A Critical Edition (HBCE), which is being produced as part of a project called Critical Editions for Digital Analysis and Research (CEDAR) at the University of Chicago. We first discuss the goals of the HBCE and its requirements for a digital edition. We then turn to the CEDAR project and the advances it offers, both theoretical and technological. Finally, we present an illustration of how a reader might use the digital HBCE to interact with the biblical text in innovative ways.

Keywords: Textual criticism, digital text, textual encoding, database

1 Introduction

Critical Editions for Digital Analysis and Research (CEDAR) is a new platform for textual research, currently under development at the University of Chicago, that will host the digital version of The Hebrew Bible: A Critical Edition (HBCE).[1] Despite the great expansion of our textual data since the earliest works of biblical text-criticism, there have been almost no conceptual advances in the tools available for studying that data.[2] Word processors have made publishing easier, and digital imaging techniques can produce clearer and more detailed photographs, but for the most part scholars are still working with flat, static text and flat, static images.[3] The tools offered by CEDAR, made possible by a new approach to encoding texts, thus represent a significant development in the history of textual criticism.

In this article, we first discuss the goals of the HBCE and its requirements for a digital edition. We then turn to the CEDAR project and the advances, both theoretical and technological, that make it ideally suited for the digital HBCE. Finally, we present an illustration of how a reader might use the digital HBCE to interact with the biblical text in innovative ways.

1 Ronald Hendel, general editor (Society of Biblical Literature, 2015–). Each book of the Hebrew Bible has its own editor and will be published individually. The first completed volume is Michael V. Fox's edition of Proverbs (SBL, 2015). A full description of the project's goals and methodology can be found in Hendel, *Steps to a New Edition of the Hebrew Bible*, 15–63. See also the HBCE website at https://www.sbl-site.org/HBCE/HBCE_About.html [accessed 10 December 2018].

2 The earliest known work of biblical textual criticism is Origen's third-century *Hexapla*, which compared the Hebrew with several Greek translations in multiple columns; see Tov, *Textual Criticism of the Hebrew Bible*, 145–46. The shortcomings of currently available tools are discussed in Yardney, Schloen, and Prosser, "A Preliminary Report from the CEDAR Project."

3 There are a few exceptions, notably the Scripta Qumranica Electronica (SQE), which is developing digital tools for reconstructing Dead Sea Scrolls; see Brown-deVost, "Scripta Qumranica Electronica (2016–2021)." In the realm of images, a technique known as Reflectance Transformation Imaging (RTI) produces dynamic images of objects, including texts, that can be viewed with different light sources that illuminate physical features of the object. Unfortunately, the SQE is currently available only to those working on the project, and RTI images are still relatively few in number and not easily accessed.

***Corresponding author: Sarah Yardney,** University of Chicago, Chicago, United States of America;
E-mail: syardney@uchicago.edu
Sandra R. Schloen, Miller Prosser, University of Chicago, Chicago, United States of America

2 The goals and requirements of the HBCE

The HBCE is the first eclectic edition of the Hebrew Bible to be produced.[4] The project aims "to approximate the corrected archetype of each biblical book."[5] By "archetype," the editors mean the latest common ancestor of all the variant manuscripts. This ancestor can be inferred, with due caution and epistemological humility, from the textual witnesses of those manuscripts. The archetype – the *latest* common ancestor – differs from the original in what we can know about it: the archetype can be inferred from the available data; the original cannot. Further, the archetype may represent a different textual state from the original, although we cannot know with certainty because we have no access to the original. The archetype, and not the original, is the target of the HBCE. The HBCE intends to approximate the *corrected* archetype because the archetype "will contain scribal errors that can sometimes be detected and corrected. For instance, distinctive scribal errors that are in *all* the manuscripts derive from the archetype. If we can discern these errors, we are obliged as textual critics to correct them."[6] Finally, the editors aim to *approximate* the corrected archetype because they recognize the potential fallibility of their judgments as well as the methodological impossibility of verifying the reconstruction of a hypothetical text.

Each volume of HBCE will be offered in both print and digital versions. The digital version will be an interactive polyglot, comprising the HBCE critical text and commentary as well as the evidence used to construct the critical edition.[7] The digital version will thus allow scholars to engage with the textual data in ways not possible in print. Instead of being limited by a critical apparatus showing the variants deemed salient by an editor, scholars will choose which manuscripts they want to compare and which kinds of variants they want to see. They will also have access to full transcriptions and images of those manuscripts so that variants can be understood in context. In addition, scholars will be able to perform their own text-critical comparisons of manuscripts, both within and across languages.

The digital HBCE will be produced as part of a new project called Critical Editions for Digital Analysis and Research, or CEDAR. Based in the Oriental Institute at the University of Chicago, CEDAR is a collaboration between computer scientists and textual scholars. The project has created new ways of encoding manuscripts that enable deeper and more comprehensive study of texts, their histories, and their relationships.[8] Although this article focuses on CEDAR's application to biblical studies, the tools we are developing are generic enough to be used for any textual corpus.[9]

CEDAR is built within a high-performance XML graph database called the Online Cultural and Historical Research Environment, or OCHRE.[10] OCHRE was originally developed to record and manage archaeological data, but it now houses over fifty projects across a wide range of disciplines in the humanities, social sciences, and hard sciences. For over a decade, OCHRE has been tested by philologists recording texts

4 While eclectic editions – editions which represent the best version of a text as determined by an editor – are the norm in New Testament studies, as well as in other disciplines in the humanities, scholarly editions of the Hebrew Bible have always reproduced a single manuscript and provided variant readings in a critical apparatus. The standard scholarly edition of the New Testament is Nestle-Aland's 28th edition of the *Novum Testamentum Graece* (Deutsche Bibelgesellschaft, 2012), an eclectic edition. The widely available *The Greek New Testament: SBL Edition* (SBL, 2010) is also eclectic. The standard edition of the Hebrew Bible, by contrast, *Biblica Hebraica Stuttgartensia* (Deutsche Bibelgesellschaft, 1977), as well as the new *Biblia Hebraica Quinta* (Deutsche Bibelgesellschaft, 2004–), which will replace it, are both diplomatic editions which reproduce the Leningrad Codex. The other major scholarly edition of the Hebrew Bible, the *Hebrew University Bible* (1956–), instead reproduces the Aleppo Codex.

5 Hendel, *New Edition*, 21.

6 Ibid., 23; italics original.

7 "Method & Theory," https://www.sbl-site.org/HBCE/HBCE_Method.html [accessed 10 December 2018].

8 A full description of CEDAR can be found at https://cedar.uchicago.edu.

9 In order to ensure CEDAR's flexibility, we are working simultaneously on three test cases in addition to the Hebrew Bible: the Sumerian *Epic of Gilgamesh* (ca. 2100 BCE), Shakespeare's *The Taming of the Shrew* (1623), and two examples of middle Bengali poetry, Ālāol's (fl. 1651–1671 CE) versified Sufi romance *Saẏphulmuluk and Badiujjāmāl*, and an anthology of 308 lyric poems compiled by Viśvanāth Cakravratī "Harivallabh" entitled *Kṣaṇadāgītacintāmaṇi* (ca. 1704 CE).

10 Descriptions of OCHRE can be found in Schloen and Schloen, *OCHRE: An Online Cultural and Historical Research Environment* and Schloen and Schloen, "Beyond Gutenberg." See also "OCHRE," https://ochre.uchicago.edu/page/ochre [accessed 20 December 2018].

with highly complex writing systems. Together, some 25,000 texts have been entered in the database, in languages as varied as Elamite, Assyrian, Egyptian, Greek, Ugaritic, Aramaic, and Demotic. CEDAR is the first text-critical project in OCHRE, but the database has several features that make it well-suited for this kind of work. In particular, OCHRE enables multiple overlapping hierarchies by using an item-based ontology in which representations of hierarchical structures are stored as separate items from the data in those hierarchies. The OCHRE data model is also highly granular, allowing scholars to atomize their data into the most minimal meaningful parts for analysis and manipulation. Finally, implementing CEDAR in OCHRE allows scholars to have a great deal of flexibility both in what data they choose to capture and in how they describe the relationships among their data. These features allow for significant conceptual and computational advances in representing and interacting with digital texts.[11]

3 Conceptual advances in CEDAR

CEDAR implements a new approach to encoding text that might be called the database model.[12] In the CEDAR project, although we are creating tools to represent and study texts, there are no "texts" per se stored in the database. That is to say, the database does not store linear strings of characters comprising whole compositions. Instead, each verse, each line, each word, each individual character, and even each individual diacritical mark is stored as its own discrete XML document. The various hierarchies in which they can be arranged are stored individually as separate XML documents. When a user asks to view a text, OCHRE accesses the appropriate hierarchies, gathers the database items associated with those hierarchies, assembles these items into words and whatever other structure is defined by the hierarchies (e.g., lines/columns/pages, verses/chapters/books), and displays an organized, formatted view of the text in the linear strings of characters that readers are accustomed to seeing. There is a distinction, in other words, between how the user reads the data and how the data is organized in the database.

This distinction is not maintained in the dominant approach to encoding texts in the humanities, which might be called the document model.[13] The document model both displays and organizes data in the same pre-digital structure of physical documents, in which characters are assigned a fixed position in one or two dimensions. As Schloen and Schloen note,

> some kinds of scholarly work can be done using this method, but it imposes unnecessary limits if it is used as the primary means of representing a text. It deprives scholars of the power to express in digital form many of the conceptual distinctions they employ routinely in the course of their work. They end up imitating the position-dependent structure of a pre-digital medium rather than exploiting the potential of the digital medium to represent their information in a more effective way. As a result, they fail to capture in an explicit, searchable form the different ways a given text has been read and annotated, making it difficult to use computational methods to compare and analyze the various interpretations. And it is precisely those texts which are open to many different readings that are of greatest interest to scholars in the humanities, who spend considerable time tracing the history of textual interpretation and the interconnections within and among texts.[14]

Digitization of texts should offer scholars new and more effective ways of doing their work, but the document model fails to take advantage of that potential because it reproduces the design of print media. The database model, on the other hand, can capture multiple interpretations and versions of a given text, which are precisely what scholars in the humanities are often most interested in studying.

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11 Another widely used approach is to encode texts in XML documents marked up according to the standards of the Text Encoding Initiative (TEI); see http://www.tei-c.org/ [accessed 20 December 2018]; Cummings, "The Text Encoding Initiative and the Study of Literature." XML is sometimes mistaken to be synonymous with TEI, but they are in fact distinct. XML is a markup language, while TEI is a set of guidelines for standardizing markup tags within that language. OCHRE uses XML but not TEI. The research questions we want to ask in the CEDAR project require a highly atomized, normalized data model which TEI is not intended to provide. TEI remains a useful way to capture many aspects of transcribed texts, however, and data can be exported from OCHRE in TEI format.

12 The database model and the document model (see below) were first described in Schloen and Schloen, "Beyond Gutenberg."

13 Ibid.

14 Ibid., 4.

The database model is especially powerful for textual criticism because the same database items can be reused in different versions of the same text. In OCHRE, each attested character and diacritical mark is encoded as a separate database item. For example, in *bərēʾšît*, the first word of Genesis in Hebrew, the *bêt* is an XML document, the *dāgēš* is an XML document, the *šəwāʾ* is an XML document, and so on (see Figure 1). Combinations of these items are then assigned to hierarchies that represent individual manuscripts. When the user asks to view the various manuscripts of Genesis, OCHRE generates them on-the-fly by gathering and arranging the same underlying database items according to each manuscript's hierarchies. The user sees separate texts, but within the database, each "text" is simply a recombination of the same building blocks.

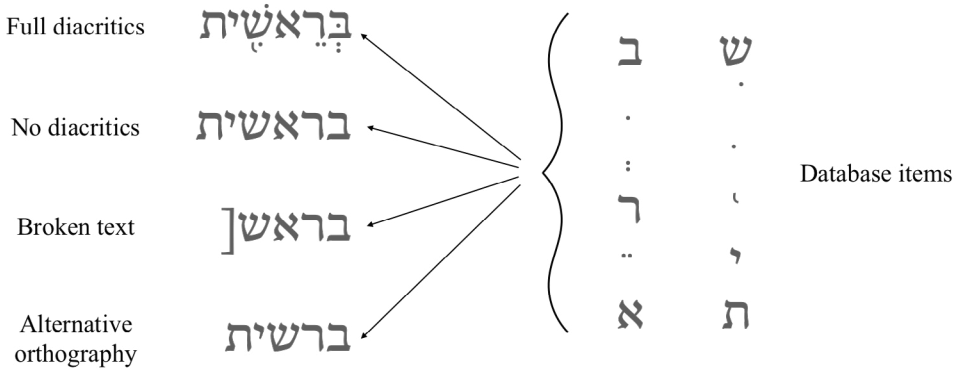

Figure 1: The reuse of database items in multiple contexts

This structure means that instead of existing in one or two dimensions, as in the document model, texts in the database model exist in three dimensions. Rather than being constrained to setting them side by side for comparison, we can stack one on top of the other.

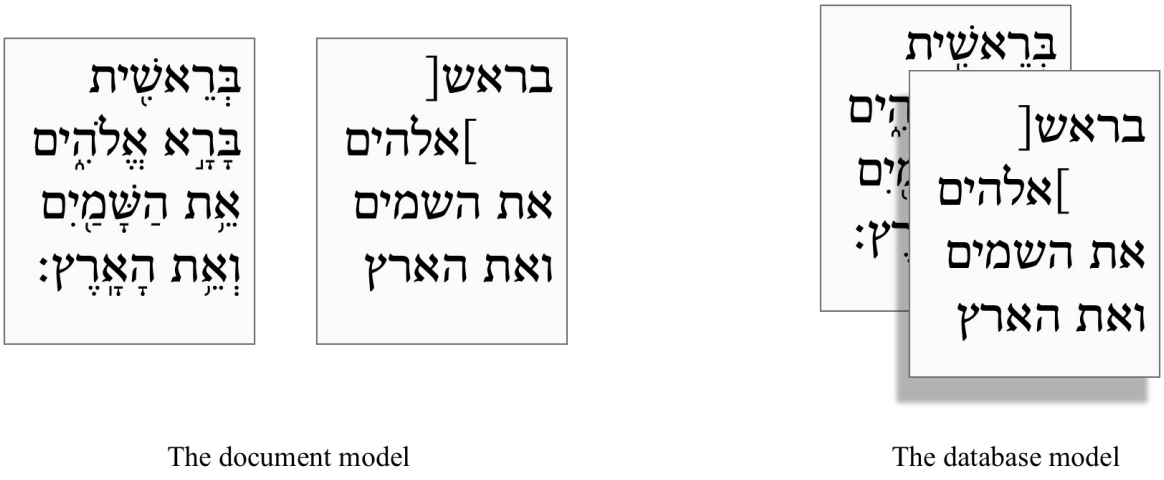

Figure 2: Two-dimensional text in the document model vs. three-dimensional text in the database model

Texts become like transparency sheets, and we can compare texts by layering one on top of the other to see where they line up. To add another text to the database, we simply assign the appropriate already-existing characters to another set of hierarchies; the new text is instantly related to other texts already in the database. By contrast, a comparison of multiple manuscripts in the document model would require the creation of many duplicate character strings with links between them. Instead of one single *bêt* reused in every instance of *bərēʾšît* in every manuscript, as we have in the database model, we would have as many *bêt*'s as we have manuscripts, with a giant web of links to relate them.

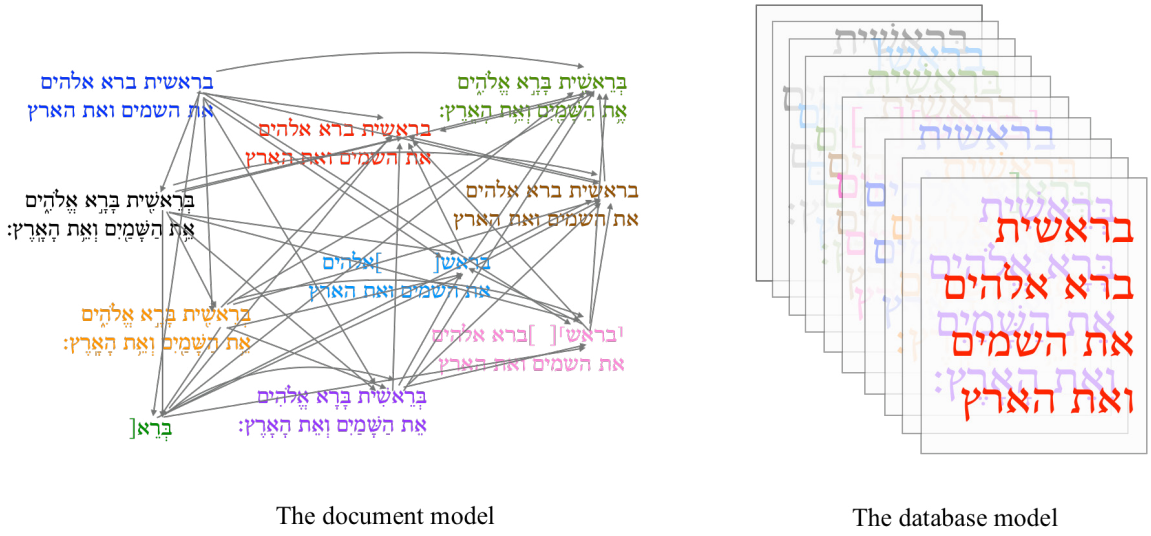

Figure 3: Comparing multiple texts in the document model and in the database model

4 Computational strategies in CEDAR

We employ a number of new computational strategies that result in the conceptual advances discussed above. First, CEDAR makes use of OCHRE's ability to encode overlapping hierarchies. Textual data are organized into two overlapping hierarchies: an epigraphic hierarchy, which is arranged by material and graphical features such as pages, columns, lines, and characters; and a discourse hierarchy, which is arranged by discursive features such as sentences, phrases, and words (or, for a biblical text, books, chapters, verses, and words).[15] Each word in the discourse hierarchy is comprised of characters from the related epigraphic hierarchy.

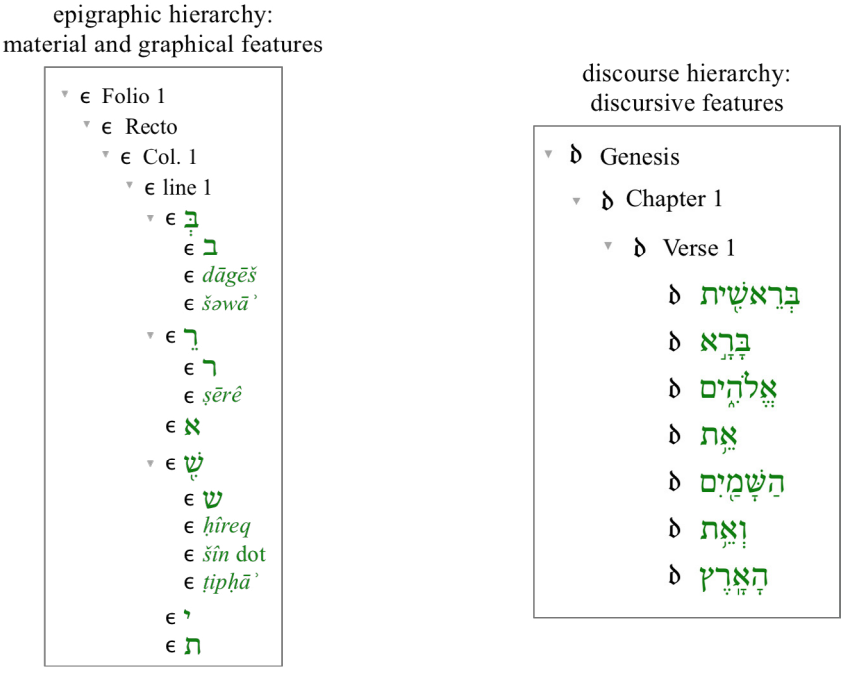

Figure 4: The epigraphic and discourse hierarchies in OCHRE

15 This structure accommodates the important observation made by Dino Buzzetti (Buzzetti, "Digital Representation and the Text Model," 76) that the expression of the text and the content of the text be encoded separately.

Second, texts in CEDAR are highly atomized, as evident in Figure 4. Each character and diacritical mark is a separate database item – more specifically, a separate XML document – with its own universally unique identification number (UUID). For example, in Figure 4, the first character in the epigraphic hierarchy is a *bêt* (the underlying character) with a *dāgēš* and a *šĕwā'* (the diacritical dots in the middle of and below the character). In CEDAR, that epigraphic unit is broken down into its three constituent elements, each of which is itself a separate database item. Each database item can be used and marked with scholarly interpretation independent of the others. While this degree of atomization may seem extreme, it is required for the work of text-critical scholars, who attend to differences at this level of detail.

Third, our strategy of atomization makes it possible to compare manuscripts in great detail and with great flexibility. In the example in Figure 5, three different options are attested for the diacritics on the *iota* in the word ειδεν in Gen 1:4. We represent these options by creating three different epigraphic units, but nested within each is the same *iota*. We are not forced to normalize spelling, but the different options are still recognized as the same *iota* because of the reuse of the underlying character. Users can then choose whether they want CEDAR to highlight differences in diacritics or not.

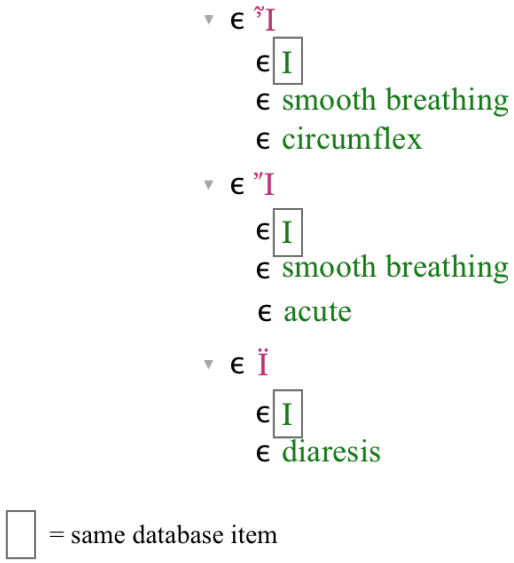

Figure 5: Reuse of database items in multiple combining characters

Atomization also allows comparison between manuscripts with diacritics and manuscripts without, while still avoiding duplication of character strings. We can use the *iota* in Figure 5 to encode a Greek manuscript that attests no diacritics at all by adding the *iota* alone to that manuscript's hierarchy, leaving the diacritics behind. The reuse of the database item creates alignment between that unaccented *iota* and any of the accented options.

Fourth, whenever possible, we create relationships between texts by reusing items in the database rather than by creating new items and linking them.[16] This strategy has a number of benefits: it avoids data redundancy and eliminates the proliferation of links that would otherwise be needed to align content, it reduces the copying errors that inevitably occur whenever another version of a text is produced by human hands, and adding the 100th version of a text and relating it to all the others is no more difficult than adding the second version.

The principle of reuse is achieved through what we call a content pool. A content pool is the set of all readings attested in physical manuscripts and critical editions of a given text. It represents not any one

16 The one circumstance in which we do not reuse database items is when we want to assign properties to a character that obtain only in one manuscript – for example, when we want to mark that a character is damaged, written above the line, ligatured, partially erased, etc. In these cases, we create a copy of the database item and mark the copy. If we were to assign a property to a reused character, that property would propagate in all manuscripts in which that character is used. Copied characters have no impact on CEDAR's ability to perform comparisons between manuscripts.

particular text but rather all of the possibilities of a textual tradition organized into hierarchies. It is thus an abstraction. For example, in Gen 1:6, two Greek manuscripts have omega as the final character in γενηθητω, while another has omicron (γενηθητο).[17] The Greek content pool in this verse thus reads γενηθητωο. Note that the content pool is not simply the alphabet for a given language, and it is not the case that every single *bêt* in the Hebrew text of Genesis is the same *bêt*: rather, every instance of the initial *bêt* in the first word of Genesis is the same. Each subsequent *bêt* is a different database item. After the content pool has been created, characters are then selected from it to build individual manuscripts, which we call local texts.[18] Local texts are essentially subsets of data selected from the content pool.

Figure 6: The Hebrew content pool for Gen 1:9 and a few local texts

The content pool is what enables CEDAR to display local texts as if they were layered on top of each other. If we were to layer the Leningrad Codex, 4Q2, and 4Q8 (see the representations of these manuscripts in Figure 6), CEDAR would display agreement in the word *wayyō'mer* because the same database items have been used to build that word in all three local texts: the *vav* is the same *vav*; the *yod* is the same *yod*; etc. Because the set of manuscripts where these characters occur has been recorded in the database, alignment algorithms are unnecessary for comparing manuscripts.

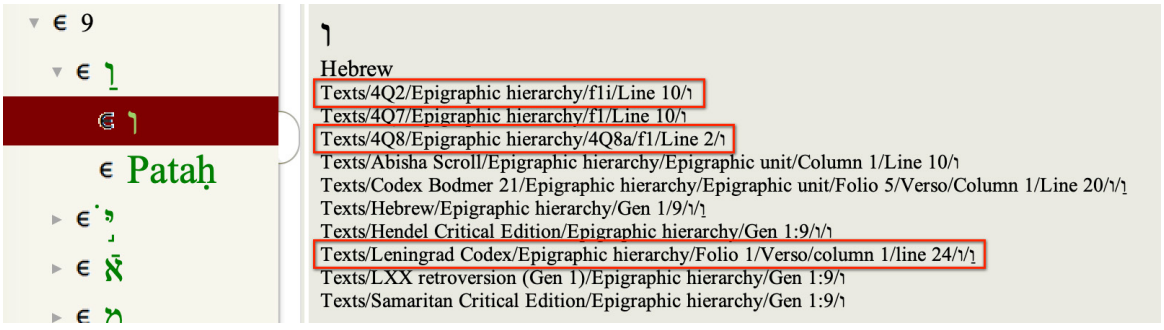

Figure 7: A character (*vav*) in the Hebrew content pool and the multiple hierarchies to which it is assigned; notice especially 4Q2, 4Q8, and the Leningrad Codex

17 Alexandrinus and Coislinianus read γενηθητω; MS 509 reads γενηθητο.

18 Incidentally, this strategy is very similar to the collation books used by the Göttingen Septuagint project. Along the left margin of a large ledger page are recorded all attested readings, followed by a list of manuscripts which preserve each reading. Because they were doing it on paper, however, the Göttingen project employed this strategy at the word level; CEDAR employs it at the character level.

This feature of the database model enables the accurate comparison of an unlimited number of manuscripts and eliminates both the duplication of character strings and the vast network of links that would be required by the document model.

Fifth, once local texts have been constructed, they can be linked to digital images of the manuscripts. We can then demarcate areas of the image to link to specific characters or words in the transcription. When a user clicks on the transcription, the linked character on the image is highlighted. Clicking on the image also highlights the linked character in the transcription. This feature, called "hot-spotting," is particularly useful for studying fragmentary or damaged manuscripts in which reconstructions may be uncertain, because it allows a scholar to communicate precisely which character traces are being interpreted. Furthermore, after a manuscript has been hot-spotted, a user can query the database for all images of a given character. This visual catalog serves as a script chart for evaluating broken characters.

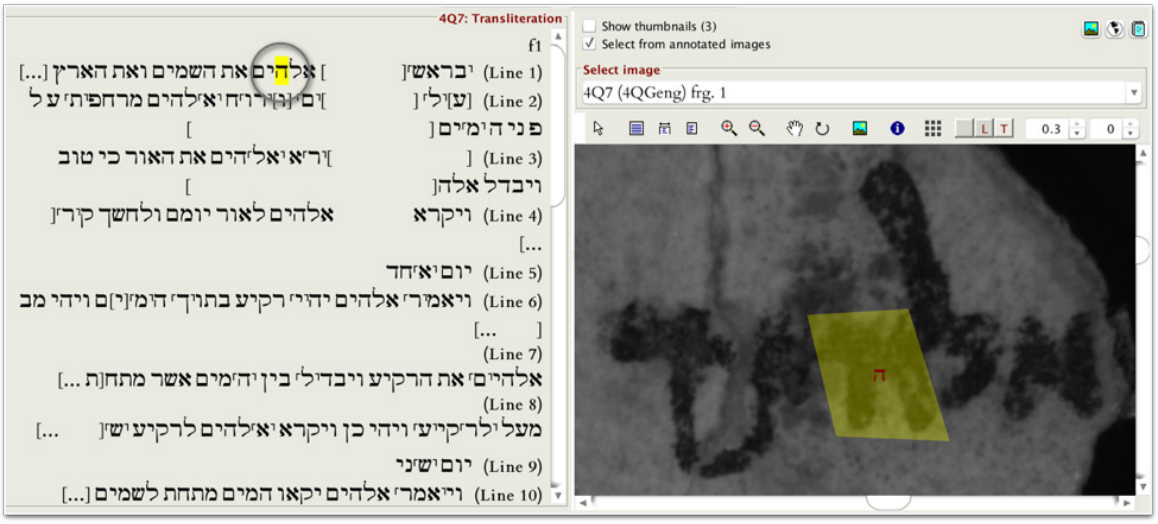

Figure 8: A transcription and image of a Dead Sea Scroll showing a "hot-spot" for the letter *he*; image used by permission of the Israel Antiquities Authority.

One final strategy used by the CEDAR project is that we compare languages by aligning them through the discourse hierarchies of their content pools.[19] Multiple items in one content pool can align with one item in another. The example in Figure 9 shows two cases of multiple Greek words aligned with one Hebrew word, as well as a case of one Greek word aligned with multiple Hebrew words.

Figure 9: Alignment between the Greek and Hebrew content pools in Gen 1:2

Because each local text is built out of the items in its content pool, aligning the content pools allows us to compare any two or more manuscripts in as many languages without duplicating data. We can compare

19 Recall that in CEDAR texts are organized in two overlapping hierarchies: an epigraphic hierarchy and a discourse hierarchy. Content pools, while strictly speaking not texts themselves, nevertheless are still organized into these same hierarchies. The content pool for each language thus has both an epigraphic and a discourse hierarchy.

any Greek local text with any Hebrew local text – or any several Greek texts with any several Hebrew texts – using only the alignment shown in Figure 9. Any new Greek or Hebrew local texts that we add will also automatically be aligned.

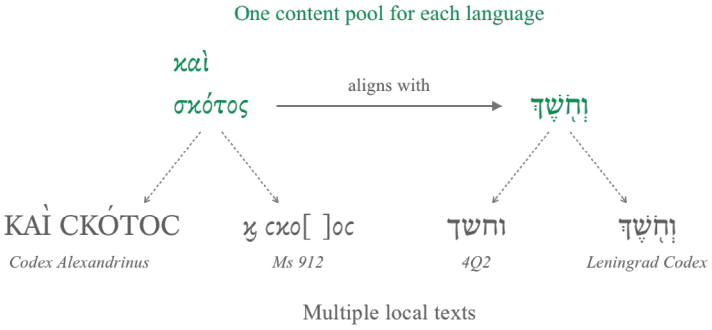

Figure 10: Aligning content pools allows for comparison between any local texts without duplication of data

In cases where the translation is sufficiently loose that it is impossible to establish a one-to-one relationship (or even a one-to-many relationship) between words in the content pools, we have the option to create higher-level structures in the discourse hierarchy. We can create phrases that align with phrases, as in Figure 11, or if need be we can go higher and align entire verses with entire verses, entire paragraphs with entire paragraphs, and so on.

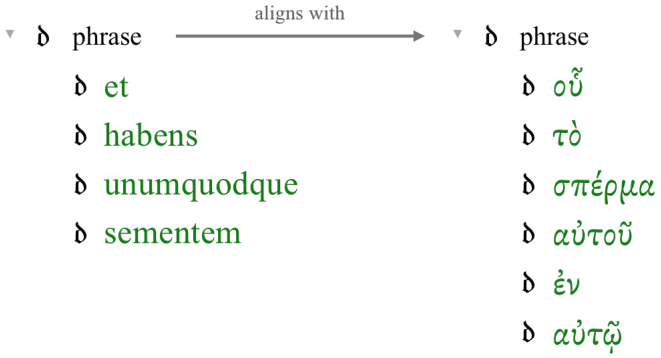

Figure 11: Alignment between phrases when word-to-word alignment is not possible (Gen 1:12)

The Greek, Aramaic, and Syriac content pools are all aligned with the Hebrew because they are translations of the Hebrew.[20] When a user asks to compare a Greek local text with a Syriac local text, that relationship is traced through the Hebrew content pool.

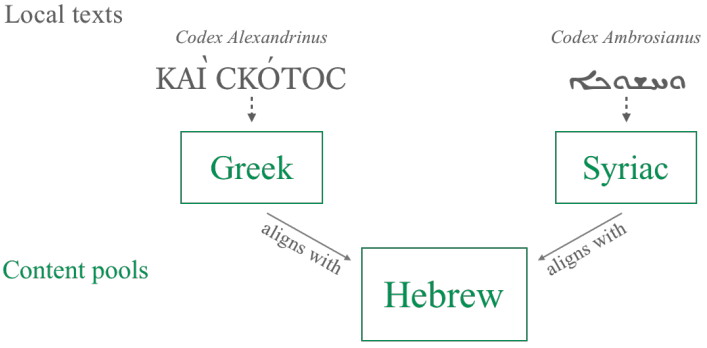

Figure 12: Comparing Greek and Syriac local texts through their alignment with the Hebrew content pool

20 At this time, we are focusing our efforts on entering data that pertains to the textual history of the Hebrew. In the future we hope to include data relevant to the textual history of the Greek, such as the Old Latin and Syrohexapla.

Latin, despite also being a translation of the Hebrew, is aligned primarily with the Greek (see Figure 11) because as Indo-European languages Latin and Greek share syntactic and morphological structures which would be obscured if we compared them through the Hebrew. (For example, in the opening words of Genesis, the relationships *in*/ἐν and *principio*/ἀρχή would be lost if we aligned both languages with the Hebrew בראשית. Instead the relationship would be recorded as *in principio*/ἐν ἀρχή. While that level of detail would be sufficient for some kinds of research, textual scholars need their data to be as granular as possible.) Thanks to the flexibility of CEDAR, in cases where the Hebrew and Greek diverge and the Latin follows the Hebrew, we can align the relevant Latin discourse units with the Hebrew.

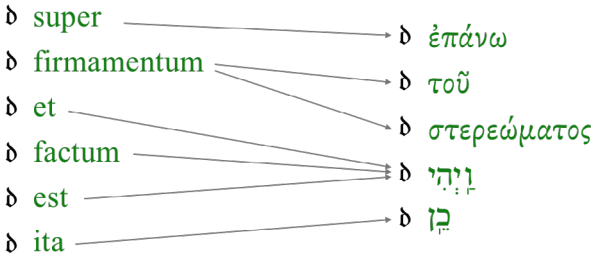

Figure 13: Aligning the Latin with both Greek and Hebrew (Gen 1:7)

5 Using the digital HBCE

The benefit of CEDAR's organized system of reusable content is that rather than reading a list of decontextualized variants in the critical apparatus, users of the HBCE digital edition will have access to all of the primary data used by the scholar in constructing the edition, in addition to the tools to analyze it. Ronald Hendel's edition of Gen 1:9 for the HBCE will serve as a demonstration of CEDAR's potential.[21]

Let us say that we are reading HBCE Genesis 1, and we come to verse 9: וַיֹּאמֶר אֱלֹהִים יִקָּווּ הַמַּיִם מִתַּחַת הַשָּׁמַיִם אֶל־מָקוֹם אֶחָד וְתֵרָאֶה הַיַּבָּשָׁה וַיְהִי־כֵן וַיִּקְווּ הַמַּיִם מִתַּחַת הַשָּׁמַיִם אֶל־מִקְוֵיהֶם וַתֵּרָא הַיַּבָּשָׁה.[22] The accompanying text-critical notes indicate that there are multiple divergences in this verse from the Masoretic Text, and we decide to investigate. We first ask CEDAR to display HBCE as the base text with the Leningrad Codex overlaid in order to see more specifically how HBCE differs from the Masoretic Text. CEDAR uses color-coding to inform the user efficiently about the relationships between the texts.[23] Green indicates that the texts agree. Black indicates characters in the base text (in this case, Hendel's HBCE edition) that are not attested in the overlaid text (in this case, the Leningrad Codex). Red indicates disagreement between texts. When we click on the red *he*, a pop-up window (see Figure 14, bottom left) provides relevant information about that character. The top half of the window shows information related to the texts on display in this particular view. We see that instead of HBCE's *he*, the Leningrad Codex reads *mem*, resulting in a different word: מקום instead of מקוה. The bottom half of the pop-up window shows information about texts in the project that are not included in this view. We can see that the *he* reading is shared by the Dead Sea Scroll 4Q8 and the retroversion of the Septuagint (see left red box). When we click on a black character, say the circled *tav*, a similar window (see Figure 14, bottom right) informs us that while the Leningrad Codex lacks the black text, the *tav* at least is attested in 4Q10 and the retroversion of the Septuagint (see right red box).

21 Ronald Hendel's critical edition of Genesis is forthcoming in the HBCE series.

22 "And God said, 'Let the waters below the heavens be gathered to one gathering so that the dry land may appear,' and it was so. The waters below the heavens were gathered to their gatherings, and the dry land appeared."

23 Our use of color-coding is not necessarily a long-term solution given the obstacle it presents for color-blind users.

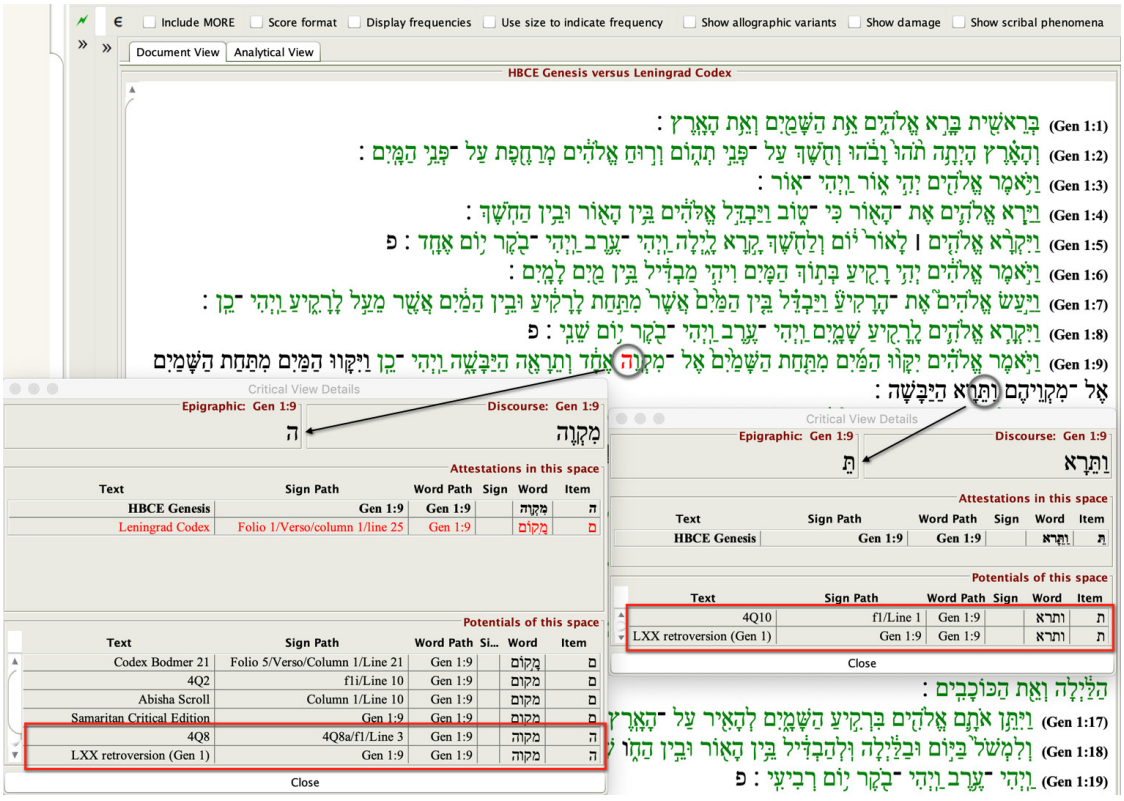

Figure 14: HBCE Genesis with Leningrad Codex overlaid; pop-up windows provide details

Based on the information from the overlaid view, we now want to look at 4Q8 and 4Q10 along with the Septuagint manuscripts that attest this verse. When comparing across languages, CEDAR displays transcriptions side-by-side rather than overlaid. When we click on a word in any of the transcriptions, CEDAR highlights the equivalent word in all the rest. When we click on מִקְוֵה in the HBCE edition, we can see the agreement in 4Q8 and the three Greek manuscripts. Nothing is highlighted in the Leningrad Codex because it has a different reading; nothing is highlighted in 4Q10 because it is fragmentary and does not attest this verse.

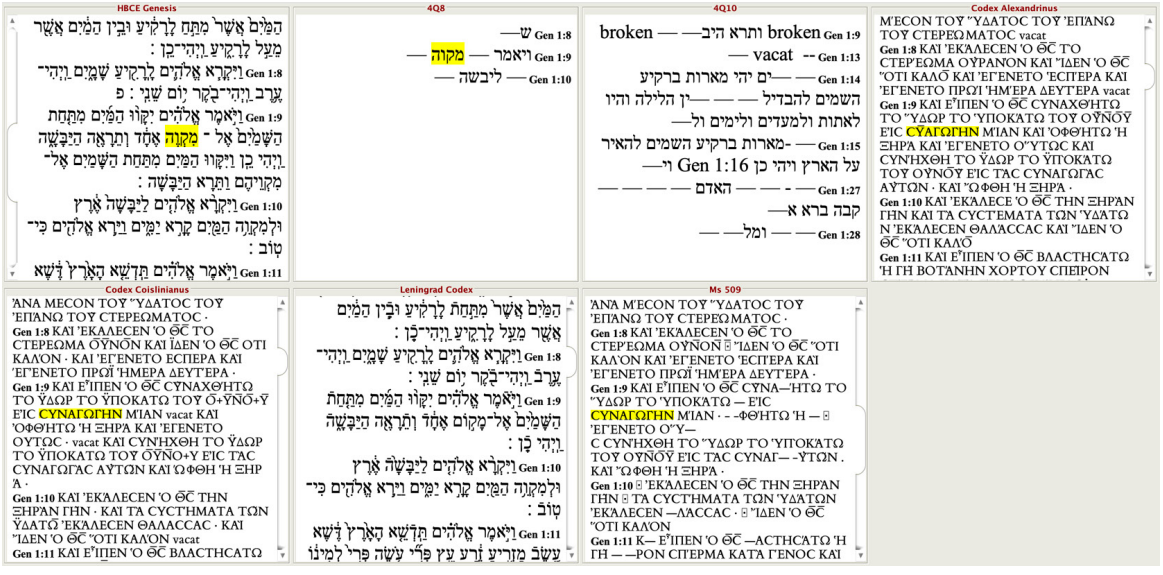

Figure 15: Comparison across languages with equivalent terms highlighted

Transcriptions are useful, but we want to see the primary evidence, so we ask CEDAR to display the image of 4Q8. The *he* is unequivocal.

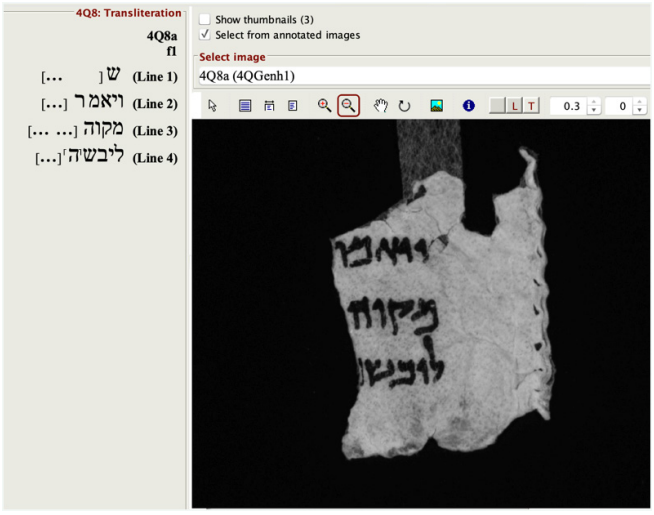

Figure 16: High-resolution digital image of a Dead Sea Scroll fragment (4Q8[a]) linked to its transcription; image used by permission of the Israel Antiquities Authority

Satisfied with that reading, we move to the Greek manuscripts. A full page of Codex Alexandrinus is time-consuming to navigate, so in the transcription we click on CΥΑΓΩΓΗΝ, the word we want to see, and CEDAR highlights it on the image.

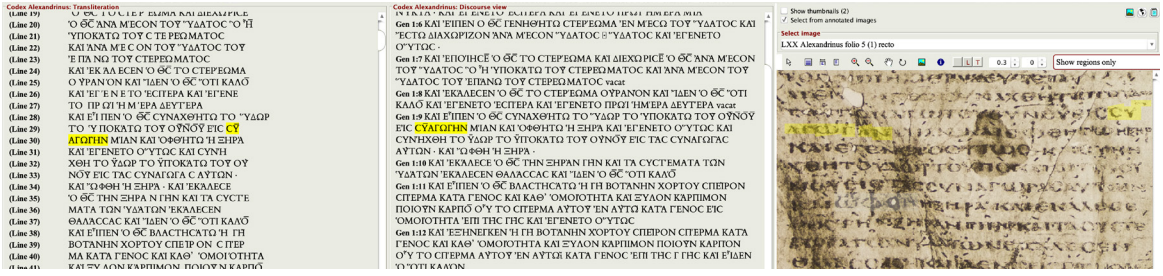

Figure 17: Digital image of Greek codex (Alexandrinus) with hot-spot. The left pane shows the transcription arranged by line, the center pane shows the transcription arranged by verse, and the right pane shows the image of the manuscript. Clicking in any of the three panes highlights corresponding content in the other two; image of *Facsimile of Codex Alexandrinus* (London: British Museum, 1881), vol. 1, fol. 1r used by permission of Special Collections Research Center, University of Chicago Library.

We repeat this process for the other two Greek manuscripts and confirm that the reading is sound.

Having worked through the evidence for the first non-Masoretic reading in the HBCE edition of Gen 1:9, we turn to the second. When we click on וַתֵּרֶא, we see agreement in 4Q10 and again in the Greek manuscripts. 4Q10 preserves just part of a much longer plus which is attested in its full form in the Greek witnesses.[24]

24 On principle, the CEDAR team makes as few editorial decisions as possible so as not to hinder future scholarly analysis. At times, however, we are forced to make decisions, as here when we needed to decide how to relate this very small fragment of 4Q10 to the rest of Genesis: does it attest the end of the Septuagint plus, as we have chosen to encode it, or is it instead an apocopated form of ותראה earlier in the verse? While our decision was based on philological research (the *wəyiqṭol* of ראה is not attested in an apocopated form in MT), another scholar could reach a different conclusion. Because of its ability to encode multiple overlapping hierarchies, CEDAR allows for a future scholar to align the text of 4Q10 differently. This new analysis will not overwrite our initial analysis; instead, both will exist in the database, attributed to the appropriate researcher and available for subsequent use.

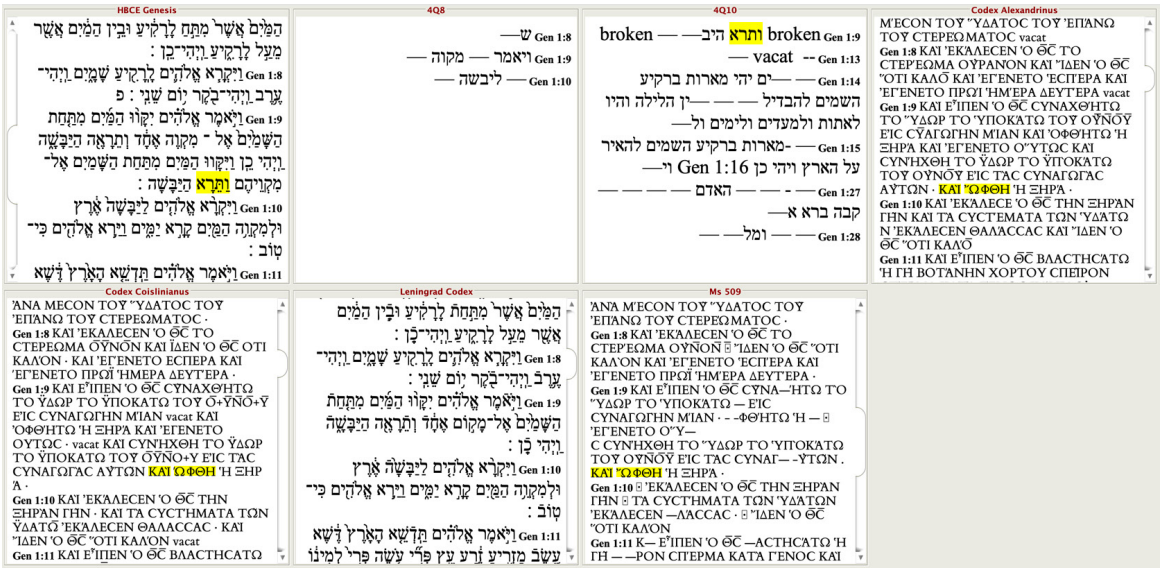

Figure 18: A second comparison across languages

Once again we check the transcriptions against the primary evidence in the images of the manuscripts.

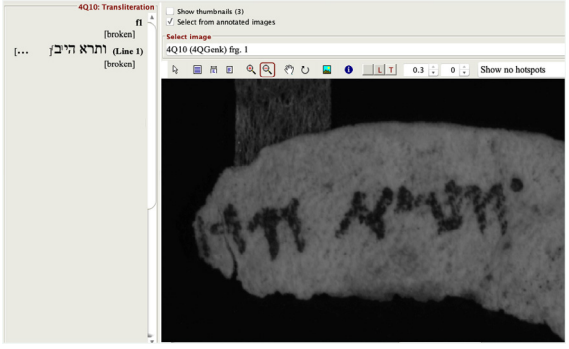

Figure 19: Image of 4Q10 with transcription ; image used by permission of the Israel Antiquities Authority

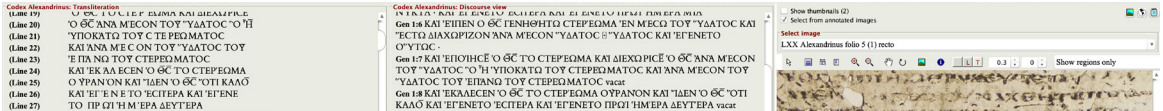

Figure 20: Codex Alexandrinus with a second hot-spot; image of *Facsimile of Codex Alexandrinus* (London: British Museum, 1881), vol. 1, fol. 1r used by permission of Special Collections Research Center, University of Chicago Library.

While Figure 20 shows a hot-spot only for the word ωφθη, HBCE editors can choose which structures they want to highlight. An editor could, for example, choose to make the entire plus a single hot-spot so that clicking anywhere in the text of the plus would highlight the whole. Because every element of a text is a database item in CEDAR – from biblical verses to lines of text to phrases to words to individual characters and diacritical marks – editors have the freedom to hot-spot any feature of a text at any level of detail.

This example demonstrates the value of the HBCE digital edition. Although there are still advantages to the print edition – reading comfort and the ability to access the resource without an internet connection,

to name two – the digital edition can make available a wealth of primary evidence to a degree that print technology cannot match. Furthermore, the evidence is encoded so that it is granular and easily manipulable, creating opportunities for new observations that in turn will lead to new research.

A few distinctive features of the print HBCE which were not demonstrated in this example deserve mention. First, when an editor determines that the textual data represent multiple editions, the editions are printed in parallel columns (this feature is not applicable to the example of Gen 1:9). In the digital HBCE, both editions will be entered into the database as local texts which the user can choose to view in parallel columns or, for a detailed comparison, in an overlaid view (see Figure 14). Second, the print HBCE includes a critical apparatus and commentary that describe the relationships among the variants and, when appropriate, suggest scribal motivations. In the digital HBCE, these notes will be linked to the critical text and will be viewed in a parallel pane. Although this feature has not yet been utilized in CEDAR, it has been used by other OCHRE projects, such as The Ras Shamra Tablet Inventory;[25] including it in CEDAR will be relatively straightforward.

Having provided an overview of the digital edition of the HBCE and the CEDAR project, we would like to offer a few methodological thoughts. First, the goal of this project is to support and assist scholarly analysis, not supplant it. We are not teaching computers to do textual criticism. Rather, we want to provide unprecedented amounts of data to researchers in a form that allows them to do their work more efficiently and in greater detail. Those researchers will still need to understand the significance of the data and know how to use it.

Second, we make no claims about the authority or primacy of any given manuscript or textual form. We do not even imply it by the way we organize our data. In CEDAR, all texts are given equal value. This point is important methodologically because we leave it up to scholars to determine, on a case-by-case basis, which reading is original.[26] Furthermore, the CEDAR data model allows scholars to formulate their research questions with a great degree of flexibility. The user interface does not insist, for example, that the Leningrad Codex serve as the base text against which all other manuscripts are compared. It is entirely at the user's discretion to decide which of the many manuscripts should serve as the base text and which manuscripts should be added as comparisons.

6 Conclusion

The digital HBCE will expand the utility of the print edition without losing any of its distinctive features. Scholars will retain full access to the critical text, notes, and commentary of the HBCE while gaining all of the primary evidence that the editors used to construct their editions. The digital edition will thus offer a fuller realization of Hendel's goals for the apparatus of the print edition: "that it be clear, complete, and refutable."[27] Even the very best apparatus presents only a sliver of the available evidence, both by design, to focus on what the editor has deemed relevant, and by necessity, because an apparatus must be brief if it is to fit on a printed page along with the text it refers to. The presentation of evidence in the digital HBCE, by contrast, is limited only by the time required for the data entry. Furthermore, CEDAR enables kinds of functionality, such as layering texts and hot-spotting images of manuscripts, that are technologically impossible in print. The digital HBCE will both complement and expand the print edition.[28]

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25 See https://projects.rcc.uchicago.edu/ochre/RSTI/index.html [accessed 1 April 2019].

26 "In principle, all ancient readings have an equal status, without relation to the text or translation in which they are found. Although there is certainly some statistical validity for the preference of certain textual witnesses over others, this judgment should not influence the evaluation of individual readings. Statistical information is irrelevant when data are evaluated" (Tov, *Textual Criticism*, 272).

27 Hendel, *New Edition*, 37.

28 A version of this paper was presented at the annual meeting of the Society of Biblical Literature on 17 November 2018. A recorded slideshow of that presentation, "A Preliminary Report from the CEDAR Project," can be found at https://cedar.uchicago.edu/test-cases/. Our thanks to Ronald Hendel and Jamie Carr for their comments on the paper. We also wish to acknowledge David Schloen, who conceived of the CEDAR project, and Jeffrey Stackert, who has greatly enriched CEDAR with his engagement, support, and enthusiasm. Finally, our thanks to Simeon Chavel, Joseph Cross, and Doren Snoek for their contributions to CEDAR.

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Digital Humanities in Biblical Studies and Theology

Garrick V. Allen*

Digital Tools for Working with New Testament Manuscripts

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Abstract: This article critically examines the functionalities and significance of three prominent digital tools that have become central to the study of Greek New Testament manuscripts. The design, functionalities, and significance of the New Testament Virtual Manuscript Room (NTVMR), the Center for the Study of New Testament Manuscripts (CSNTM) digital library, and the Pinakes database have a hand in shaping the research questions of the field. As such, it is important to understand what these tools do, how they function, and how they might develop further to address the needs of the field. The analysis of these tools leads to fundamental questions about using digital representations as proxies for primary sources, challenges for managing the materiality of artefactual and digital objects, the collaborative nature of digital scholarship, and the implicit interpretations of the Greek New Testament tradition inherent in digital workspaces.

Keywords: Center for the Study of New Testament Manuscripts, Digital Images, Digital Workspaces, Manuscripts, New Testament, Pinakes

The first person to ever collate every known Greek manuscript of a specific New Testament work was Herman Charles Hoskier, a wealthy eccentric with a fine moustache. He published the fruits of his over three decades of labour in 1929 as the two-volume behemoth *Concerning the Text of the Apocalypse*.[1] The greatest practical barrier to Hoskier's work, as he complained multiple times in letters to colleagues, was that travel to view manuscripts was expensive, time-consuming, and sometimes dangerous. To view Revelation's manuscripts Hoskier travelled to European and American libraries in the turbulent period around the Great War (in which he was twice wounded in the French ambulance service), commissioned photographs of manuscripts at his own expense, and at times purchased them outright.[2] Even for an indefatigable scholar of great means, the task of collating every known manuscript of a New Testament work was nigh on impossible. Only Hoskier's religious determination to rescue the *textus receptus*, his dwindling personal cash reserves, and use of a technology that was becoming more affordable in his time (photography) allowed him to complete this task within his lifetime.[3]

Hoskier's enthusiastic utilization of emerging technologies like affordable photography sheds light on the critical adoption of new forms of media in current scholarship. Researchers have always experimented

1 Hoskier, *Concerning the Text of the Apocalypse* (1929).

2 The dangers of early twentieth century European politics notwithstanding, these reasons also explain why only two individuals have ever persevered to accomplish this feat since Hoskier: Wasserman, *The Epistle of Jude* (2006) for Jude and Solomon, "The Textual History of Philemon" (2014) for Philemon.

3 Once a well-off inheritor, securities trader in Gilded Age Manhattan, and graduate of the blueblood Eton College, Hoskier died nearly penniless and alone on Jersey in the Channel Islands. On his biography, the significance of his scholarship, and his personal idiosyncrasies see Allen, "'There is No Glory and No Money in the Work,'" 1–19; Allen, "The Patient Collator and the Philology of the Beyond," 3–38, and other articles in Allen, ed., *The Future of New Testament Textual Scholarship* that explore his significance for modern textual scholarship.

***Corresponding author: Garrick V. Allen,** Dublin City University, Ireland; E-mail: garrick.allen@dcu.ie

with whatever implements were available to build a case for their arguments, and it is not surprising that modern biblical scholars continue to develop digital technologies and online research tools that help to answer critical questions. In a time when scholarship is migrating away from print culture toward digital media (or at least combining print and digital modalities in ever more complex ways), many publicly-funded projects and much critical effort are being invested in the production of digital tools that help to answer our current research questions and to disseminate our conclusions. Hoskier's reliance on inexpensive photographic reproduction is no different than modern textual scholarship's reliance on digital images and metadata.

Although in many ways still in their infancy, digital tools and online repositories have significantly increased the efficiency of manuscript consultation through the medium of digital images and bibliographic databases. For example, and although much less ambitious than Hoskier's enterprise, I am in the process of completing a monograph centred around four studies that required reading parts of *every* Greek manuscript of the book of Revelation, culling relevant data from different aspects of these artefacts.[4] I was able to explore the these manuscripts in only about two years because the images of the manuscripts and other information about them was already aggregated in a number of websites designed for such research. And in this process, the quality of digital images – whether high or low – raised new and unforeseen questions about a particular manuscript. I did of course visit libraries and museums to personally view manuscripts during this time,[5] but the majority of my work occurred at my desk in a country with only two Greek copies of the book of Revelation (P^{47} and GA 61). The multiplicity of major institutional digitization projects,[6] editorial platforms that offer access to manuscript images, and bibliographic databases has drastically increased the efficiency of access to manuscripts and information on past scholarly encounters with these artefacts. This article analyzes three digital tools that have been central to my recent research: the New Testament Virtual Manuscript Room (NTVMR), the image library of the Center for the Study of New Testament Manuscripts (CSNTM), and the Pinakes database. There are of course multiple other websites that are valuable for the study of New Testament manuscripts, like the Leuven Database of Ancient Books, Papryi.info, sites that focus on specific manuscripts, and institutional websites like DigiVatLib and BnF Gallica.[7] But many of these tools focus exclusively on the papyri or other early manuscripts of the New Testament's tradition, or are oriented primarily toward public consumptions rather than scholarly research. I want to explore tools that enable the study of the later, more neglected manuscripts of the New Testament and sites that aggregate information that transcends institutional holdings. The examples that I have chosen are websites that have been designed to inform research on the New Testament manuscripts and cognate manuscripts cultures.

This article evaluates the functionalities and significance of the NTVMR, CSNTM archive, and Pinakes, exploring their many benefits and potential shortcoming when it comes to engaging Greek New Testament manuscripts. What kinds of critical questions are they designed to answer and how might researchers interested in New Testament studies engage them? What overlaps exist between New Testament studies and other non-typographic cultures? How do researchers benefit from the use of these tools and what might be lost when we explore manuscripts in an almost exclusively digital medium? How does the proliferation of increasingly sophisticated digital tools alter research methods and the forming of critical questions? Providing preliminary answers to these questions is important in an academic culture that is continuing to negotiate the relationship between analogue and digital modalities, not only in our research outputs and tools, but also in our access to primary sources and artefacts.

The most important tool for studying the materiality, paratextuality, and texts of New Testament manuscripts is the New Testament Virtual Manuscript Room (NTVMR).[8] Managed by the Institut für

4 There are also now seventy-one more Greek manuscripts than Hoskier knew. See Allen, *Manuscripts of the Book of Revelation*.

5 Autopsy examination remains essential to manuscript studies regardless of the availability of digital images.

6 See examples articulated in Houghton and Smith, "Digital Editing and the Greek New Testament," 113.

7 Leuven Database of Ancient Books <https://www.trismegistos.org/ldab/about.php>; Papyri.info <http://papyri.info/>; Codex Sinaiticus <http://www.codexsinaiticus.org/en/>; HumaRec <https://humarec.org/> on GA 460 (Venice, Marciana Gr. Z 11 [379]); Digital Vatican Library <https://digi.vatlib.it/>; BnF Gallica <https://www.bnf.fr> [all accessed 30 January 2019].

8 <http://ntvmr.uni-muenster.de/> [accessed 16 January 2019].

Neutestamentliche Textforschung (INTF) in Münster and developed in partnership with the Institute for Textual Scholarship and Electronic Editing (ITSEE) in Birmingham, the site is "devoted to the study of Greek New Testament manuscripts," as it states on its homepage.[9] The site functions as an integrated collaborative platform for the work of the Editio Critica Maior (ECM) of the New Testament and other edition projects. As the metadata for the manuscripts archived here continues to accrue with further engagement from the editors and other scholars, the NTVMR is becoming an "open edition" where textual editorial decisions from the various ECM projects can be contextualized by images of the manuscripts, transcriptions, various indices, textual commentary, and other integrated modular databases.[10] The images embedded in the NTVMR are intended to facilitate the production of critical editions, but they are also becoming autonomous digital objects embedded with different forms of metadata – transcriptions, paratextual tags, descriptions, and indices.

Not only is the NTVMR the platform where the digital workflows of the ECM editorial projects are managed, comprising image aggregation, transcription, collation, normalization of readings, and now also publication, but it is a place where scholars beyond the immediate ECM editorial teams can create tools that interpret, supplement, or further contextualize the textual research published there.[11] The NTVMR replaces the need to travel to the INTF Münster: every primary source and the main tools that the INTF possess are becoming available in a digital workspace, combined with hyperlinked access to multiple related resources.[12] In addition to efficiency of access, the NTVMR also offers a platform for collaboration and space for scholars to engage with the manuscript images in sophisticated ways.

While the workspace is organised around the electronic transcription of manuscript texts,[13] the site has organically morphed to accommodate a number of additional tools for textual research. The openness and collaborative atmosphere of the NTVMR is all the more relevant since the ECM fascicle of Acts was published as a digital edition under the "NT Transcripts" module in 2017, a monumental achievement in the development of editions of the New Testament.[14] Unedited real time collations for other New Testament works whose ECM fascicles are in production like the book of Revelation are also available on a contingent basis, along with the main text of the NA28 edition linked to a digital version of the LSJ lexicon. Although still developing, the NTVMR is a powerful omnibus of research tools, manuscript images, and discussion platforms, including multiple blogs and discussion boards.

The most important aspect of the NTVMR when it comes to studying manuscripts is of course its quantity of manuscript images available for research purposes, many of which are digitized versions of the INTF's microfilm library. As of January 2019 97.3% of all papyri with material from the Greek New Testament, 95.5% of all majuscules, 92.8% of all minuscules, and 27.6% of all lectionaries have been imaged and are available on the website. This is a monumental achievement, a form of modest mass digitization for a specific ancient

9 On its development see Clivaz, "Internet Networks and Academic Research," 165–167; Houghton, "The Electronic Scriptorium: Markup for New Testament Manuscripts," 31–60; Houghton and Smith, "Digital Editing," 110–127; and Griffits, "Software for the Collaborative Editing of the Greek New Testament," <http://etheses.bham.ac.uk/8244/> [accessed 24 January 2019].

10 For example, the Amsterdam Database of New Testament Conjectural Emendation <http://ntvmr.uni-muenster.de/nt-conjectures> [accessed 16 January 2019]. On this ideal of creating an open edition, see Schmid, "Transmitting the New Testament Online," 189–205 (esp. 204).

11 On the editorial processes of the ECM, see Allen, "Text and Tradition," 3–16 (esp. 4–7). More specific work reports on the ECM of the Apocalypse can be found in Schmid, "Die neue Edition der Johannesapokalypse," 3–15; Sigismund, "Die neue Edition der Johannesapokalypse," 3–17.

12 See Strutwolf, "New Testament Virtual Manuscripts Room," 275: "Ziel ist es, alle interessierten Nutzer über das Internet mit Quellenmaterial, das sonst nur durch einen Besuch des INTF zugänglich wäre, zu versorgen" (here 275).

13 Strutwolf, "New Testament Virtual Manuscript Room," 276.

14 Print edition: Strutwolf et al., eds. *Novum Testamentum Graecum Editio Critica Maior* (2017). The digital edition is available under the "NT Transcripts" tab <http://ntvmr.uni-muenster.de/nt-transcripts> [accessed 30 January 2019].

literary corpus, lectionaries notwithstanding.[15] Helpfully, a significant quantity of these images – especially the papyri and majuscule script manuscripts – have also been indexed, greatly assisting researchers in accessing witnesses to particular texts.[16] The NTVMR is also integrated with a digital version of the *Kurzgefasste Liste*, a digital version of J. K. Elliott's *A Bibliography of Greek New Testament Manuscripts*, and the Pinakes database (see below).[17] The incorporation of classic print tools for the study of manuscripts into the digital space of the NTVMR means that the site is becoming an integrated platform for textual and material research on the New Testament and a model for the study of other non-typographic ancient literary corpora. It is multifaceted, flexible, and open to new research ventures and tools for engaging the tradition.

However, the NTVMR still retains limitations in terms of researching these manuscripts, especially their bibliographic and material contexts. First, leaving aside the fact that the site lacks entirely comprehensive images for every manuscript, not all images that it does have are directly open to the public due to issues associated with copyright and holding institution restrictions. Scholars can, however, register and gain greater access to the images for research purposes with minimal limitation. Second, and more to the point, not every folio of every codex that preserves a part of the New Testament is available. In many cases only the New Testament portion of a codex is present, omitting access to any other parts of the artefact, like lection tables, prologues, onomastic traditions, or other non-biblical literature, a point of particular import for the book of Revelation.[18] Not only does this situation lead to possible misunderstandings about the bibliographic context of the New Testament's transmission, but it creates issues in evaluating the production layers of codex, its history of use, and other codicological aspects of its current form.

A good example of both the NTVMR's inherent value and current limitations is GA 2062 (Vatican, Bibl. Vat., Vat. gr. 1426), especially if, for example, one was interested to explore it as an example of the codices that preserve the book of Revelation alongside the works of Pseudo-Dionysius the Areopagite.[19] After selecting the "Liste" tab on the main site and inputting the NTVMR identification number for this manuscript (32062), a large quantity of information appears on the next page: date of production (thirteenth century), New Testament works it preserves (only Revelation), the extent of this work (29 leaves), its place within a larger object (fols. 131–159 in this codex), its attachment to a commentary (in this case, Oecumenius), the number of columns per folio (1), and number of lines per folio (46) (Figure 1). Users may also avail themselves to additional information provided by the Pinakes database, including its writing support (paper), identifying diktyon number (68057), and script (minuscule) (Figure 2). Direct access to the manuscript's entry in Pinakes through a link is also available, even though the Pinakes page currently gives an incorrect GA number.[20]

Even more information is accessible via the bibliography tool at the bottom of the page, which in this case offers two sources (without exact page numbers) and a link to Elliott's online bibliography, which

15 The approach of the NTVMR can be contrasted to the special focus afforded specific manuscripts on other sites, like Codex Sinaiticus <http://www.codexsinaiticus.org/en/> and GA 460 (Venice, Marciana Gr. Z 11 [379]) <https://humarec.org/>. On the digitization of manuscript images of the New Testament with special reference to the Codex Sinaiticus project see Parker, *Textual Scholarship*, 128–142. The digitization of images in the NTVMR stands somewhere between mass digitization and critical digitization: the images are not always of high quality and the comprehensiveness of the bibliographic information attached is often incomplete, but users and editors are now back-filling information pertinent to the images, including transcriptions, paratextual image tags, indexes, and other metadata. On the relationships between mass and critical digitization see Dahlström, "Critical Editing and Critical Digitisation," 79–97.

16 95.2% of papyri, 79.3% of majuscules, 17.6% of minuscules, and 1.3% of lectionaries have been indexed as of 18 January 2019.

17 For the latest print versions of these tools, see Aland et al., eds., *Kurzgefasste Liste* and Elliott, *A Bibliography of Greek New Testament Manuscripts*. The Elliott bibliography is available online at <https://bibil.unil.ch/bibil/public/default.action?request_locale=fr> [accessed 30 January 2019].

18 See the preliminary list of "hybrid" manuscripts in Elliott, *New Testament Textual Criticism*, 154–155. Elliott lists GA 046 2015 2016 2017 2018 2020 2022 2023 2024 2025 2027 2030 2038 2042 2048 2049 2050 2051 2052 2054 2055 2056 2059 2060 2070 2074 2077 2078 2083 2196 2329 2428 2434 2436 2493 2663. This list remains incomplete.

19 See GA 1948 2016 2024 2055 2059 2062 2595.

20 GA 2162 instead of 2062: <https://pinakes.irht.cnrs.fr/notices/cote/68057/> [accessed 21 January 2019]. Diktyon numbers were assigned in an effort to link information on Greek manuscripts across digital workspaces. See Binggeli and Cassin, "Le project *Diktyon*," 201–206.

provides two further results when the link is selected, both from H. C. Hoskier (Figure 3).[21] The bibliography is deficient, especially in light of the more substantial bibliography on the Pinakes site, which includes fuller data on the other parts of the codex and its codicology. But even together, these bibliographies currently omit significant material relevant to this manuscript. Notably, neither references the fullest examination of Revelation in the context of this codex, a 1995 article by Marc de Groote.[22] Despite the "work-in-progress" nature of the bibliography of GA 2062, the NTVMR provides a wealth of data before even coming to the images of the manuscript.[23] The information is not comprehensive, but provides substantive guidance for further research.

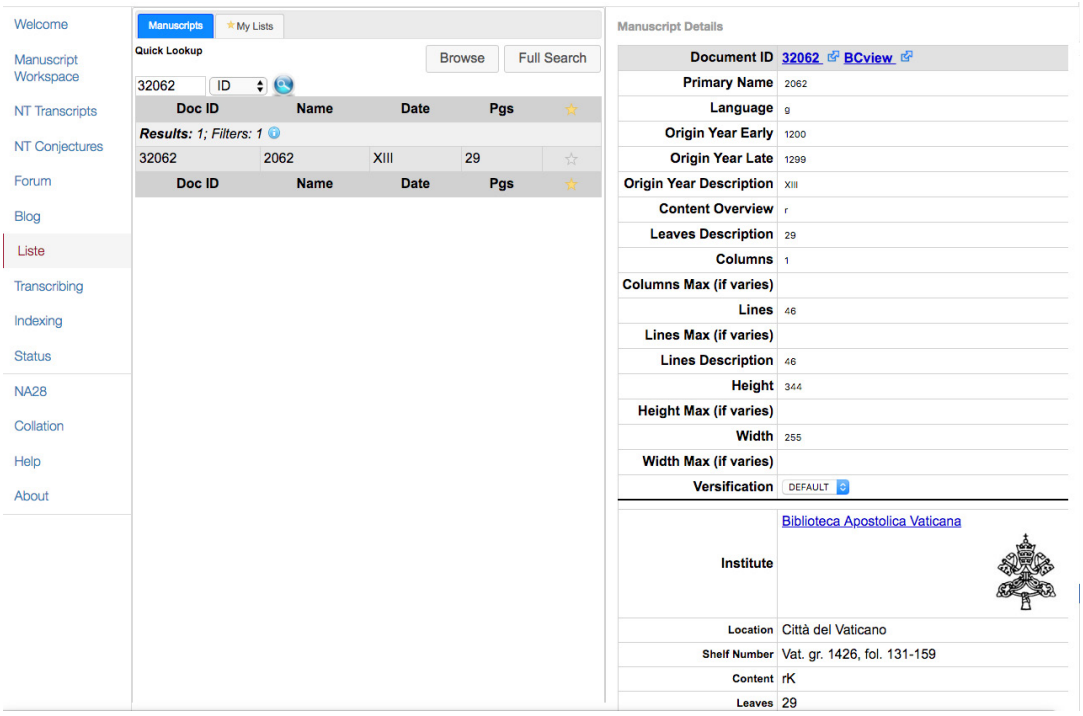
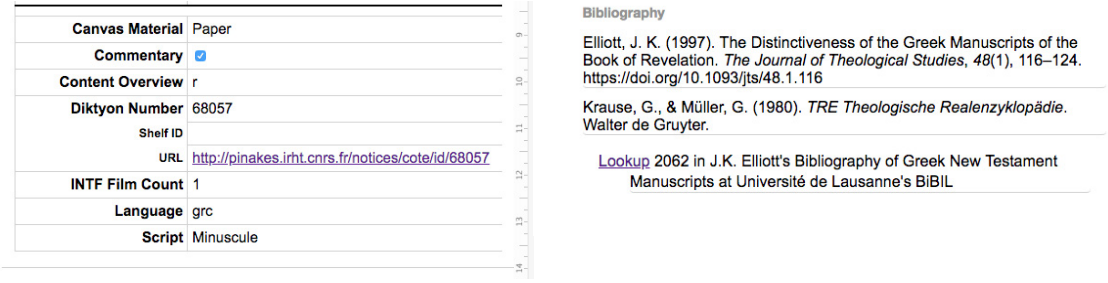


Figure 1. "Liste" Entry for GA 2062



Figures 2 and 3. Pinakes and Bibliography Data Available through the "Liste" Tab for GA 2062

Selecting the "Manuscript Workspace" tab then pulls up a new page consisting of indexed thumbnail images, a larger manuscript viewer, and a transcription editor. Once a thumbnail image is selected, the full image opens in the manuscript workspace. The brightness and contrast of the image can be edited at the tool bar above the image to create a more legible surface depending on the quality of its digitization. In the

21 <https://bibil.unil.ch/bibil/public/indexAdvancedSearch.action?replay=true> [accessed 21 January 2019].

22 de Groote, "Die Handschriftliche Überlieferung," 8–15.

23 I have been informed in personal correspondence with Gregory Paulson that a focused project is underway at the INTF to improve the bibliographic entries for the minuscules.

case of GA 2062, the text is legible and the manuscript is indexed, preserving only Rev 1:1–2:1 and 15:1–22:21. As far as examining the text of Revelation in this manuscript or the commentary of Oecumenius (it is often difficult to immediately distinguish the two), the NTVMR is extremely valuable. The text of the manuscript can be copied, or, more likely, modified from a base text in the transcription workspace to produce an electronic transcription, a text that can then be further marked up as necessary (see Figure 4).[24]

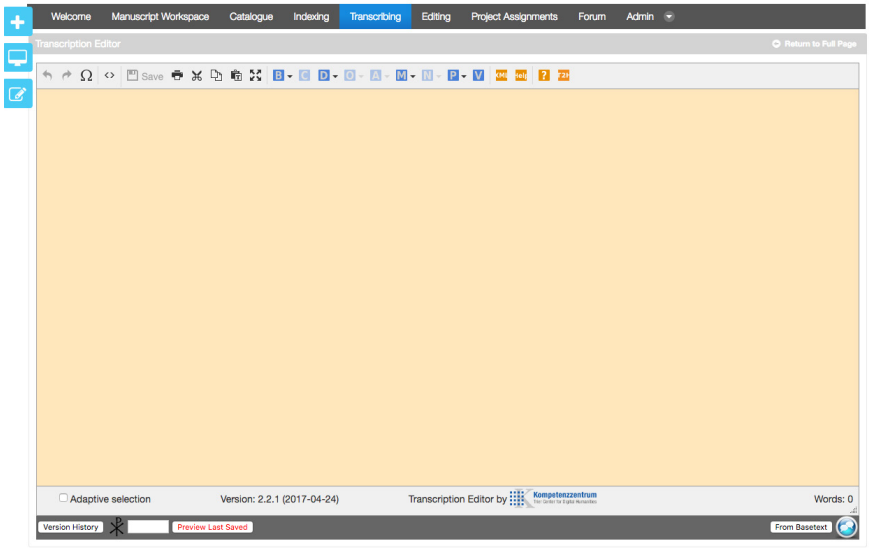


Figure 4. Transcription Workspace

But when it comes to understanding the place of this copy of Revelation in the context of the Pseudo-Dionysian corpus, the lack of further access to the bibliographic composition of the larger codex hinders this examination. Images of the rest of the artefact are lacking and the site does not include an enumerative bibliography beyond the biblical material. Even though this is the only digital copy of any part of this manuscripts that I have located,[25] it does not help answer questions about the relationship between Revelation and the Pseudo-Dionysian works that comprise the majority of the codex. Was this codex intentionally produced to juxtapose Revelation to non-biblical works? Why produce such a codex? Is the current combination of the codex the product of later bookbinders or librarians? Are the scribal, aesthetic, and codicological profiles of the codex consistent across all the various works? To answer these questions with any level of surety still requires autopsy examination of the manuscript in its institutional setting, or at least the viewing of every folio of the codex.

But even if digital images of the entire codex were available, it is not certain that they would be sufficient to examine the relationship between Revelation and the rest of the codex. Although digital technologies are valuable for assisting in some forms of codicological research, like the study of watermarks or the follicle patterns of parchment,[26] images of 2062 – especially in their current low quality – would be insufficient for mapping the quire structure of the manuscript, the history of its binding, or the ink profiles of the different works of the codex. We can only guess at why larger sections of Revelation are now absent or why Revelation is now bound alongside the works of Pseudo-Dionysius.

It is at this level of manuscript analysis that the inherent limitation of digital images as a proxy for a material object comes to the fore. Regardless of the quality of the images, they acquire a form of autonomy as digital objects in relation to the material artefacts they represent, especially when they are marked up or

24 For more on the functionality of the NTVRM as a transcription tool for editions see Smith, "Old Wine, New Wine Skins," 407–434.

25 It is not accessible on the Digital Vatican Library viewer <https://digi.vatlib.it/> or the CSNTM website <http://www.csntm.org/> [accessed 21 January 2019].

26 See Boyle and Hiary, "Seeing the Invisible," 129–148.

integrated with other interpretive metadata like transcriptions or tags. Although never to be mistaken for the manuscripts themselves, the images do enable researchers to better prepare for in-person examination, to inform the posing of critical questions, and to formulate initial hypotheses. In the case of GA 2062, the NTVMR offers a wealth of information, access to additional digital tools, direction toward printed secondary research, a selection of images, and tools to annotate or transcribe the manuscript. It does not offer access to all the images of the codex or answer every critical question we might bring to 2062 and other manuscripts like it, but it does offer researchers a workspace to begin to formulate relevant questions and, if necessary and possible, to plan excursions to view the manuscript in person, or to decide if such a journey is indeed worth the requisite resources.

As someone who began to seriously study manuscripts only after the NTVMR was published, I cannot imagine working with manuscripts without it. But at the same time I have a sense of ambivalence toward the digital objects as mono-dimensional representations of material artefacts that exists in time and space. This complex relationship with digital images is unavoidable and is perhaps a healthy by-product of changes to our media cultures.[27] The presence of the physical object is far more desirable for research purposes than the digital images,[28] but the images retain their critical value in contexts, like editing or certain forms of quantitative studies, where efficient access to numerous exemplars is essential. The accruing of metadata attached to these images is in some ways a manifestation of the anxiety that the image is not the artefact it represents; the metadata provides a way to transcend the gap between object and digital representation.

As researchers continue to engage manuscript images and produce modular tools integrated into this collaborative website, the NTVMR will only become a more powerful critical tool, despite its current limitations for some forms of enquiry, modes of analysis for which it was admittedly not initially designed.[29] As the NTVMR develops, it will be important for researchers to keep in mind the difference between the artefact itself and its digital representation. And not only in terms of the types of evidence that both forms can provide, but also in terms of their reality as material objects. Digital images enable some forms of efficient analysis, but the objects represented by the images have a presence and materiality that differs from the materiality and elusive presence of the digital realm, which maintains its own distinctive forms of embodiment. Even if the NTVMR will never become a comprehensive and all-encompassing platform for all engagement with New Testament manuscripts, its efficiency and aggregation of tools stimulates new research questions and allows researchers to make connections across the corpora that have not yet been observed. What is valuable about the NTVMR is that its scholarly users can make it do what they want it to, if only enough funding and labour are can be mustered.

In addition, images of New Testament manuscripts are available on a number of institutional websites, none of which boast the collaborative framework and modular format inherent to the NTVMR, but which maintain other benefits for different forms of research. An interesting example of this type of tool that transcends institutional holdings is the website of the Center for the Study of New Testament Manuscripts (CSNTM), a privately funded venture founded and managed by Daniel Wallace.[30] The goals of the CSNTM are manifold: to make high quality digital photographs of every Greek New Testament, to create "exhaustive collations" of those manuscripts (a Hoskierian enterprise), to analyze scribal habits, to develop electronic tools to examine the manuscripts, and to "cooperate with other institutes in the great and noble task of determining the wording of the *autographa* of the New Testament."[31] Thus far, the CSNTM has focused on aggregating digital images, visiting a number of institutions to partner in photographing their artefacts.

The main feature of the site is its library of images, which are often of higher quality than the images in the NTVMR, even though the library is limited in the quantity of manuscripts available in comparison to the

27 Not all digital representations of material artefacts are mono-dimensional. See, for example, Hunt, Lundberg, and Zuckerman, "Concrete Abstractions," 149–171.

28 Except in cases where the text of the manuscript is more legible in the high-quality image than in the manuscript itself.

29 As I noted above, the initial purpose of the NTVMR was to facilitate the production of editions and associated tasks, especially transcription and collation. The example of GA 2062 transcends the intended functionality of the NTVMR, but the site is flexible enough to take on tools that address other research questions without losing its primary functionality as a transcription tool.

30 <http://www.csntm.org/> [accessed 21 January 2019].

31 <http://www.csntm.org/About/WhoWeAre/Mission> [accessed 21 January 2019].

NTVMR.[32] Most of the manuscript images are also partially indexed, tagged with a selection of paratextual features, and described in an "information document" that constitutes a catalogue entry for the manuscript. But the control of the indexing, tags, and transcriptions (when they appear) are held with the fellows of the Center and remain anonymous. The site does not allow for scholars or the public to mark up, transcribe, or otherwise work with the images, although there is a link for suggesting changes to the tags and indices. (The process of implementing or rejecting these suggestions is unknown.) The images cannot be downloaded for further study, but must be examined image by image on the site. The CSNTM library is a repository, not a workspace. It is of course helpful and important to be able to view high quality digital images, but it is more important for scholars and other serious readers to be able to interact with, mark up, and interpret the manuscripts and their texts. The tightly controlled structure of the CSNTM site and its editorial oversight drastically decreases its usefulness as a critical tool.

Another contrast to the NTVMR is that the CSNTM has undertaken an expressly critical approach to digitization, in which images are created, curated, and managed by a select core group of scholars. This approach has its benefits: a high-quality product, mostly accurate metadata, and long-term security for the management of the site. Critical digitization for a corpus as vast as the Greek New Testament is a luxury available only to those whose long-term funding sources are secure, or at least not reliant on the whims of national funding bodies.

The differences in approach to digitization between the CSNTM and NTVMR requires collaboration between these institutions for the benefit of the advancement of research on New Testament manuscripts, which is the express goal of both groups. But there is no evidence of integration between these websites. This apparent lack of cooperation in image sharing on the part of CSNTM is surprising in light of CSNTM's explicit goal of "cooperating with other institutes."[33] Since the NTVMR is the manifestly more sophisticated workspace, it makes sense that images in the CSNTM should also be accessible in the NTVMR, a move that would only facilitate the CSNTM's own goals of producing research on these manuscripts related to scribal habits and the reconstruction of the "original" text of the "autographs." While it is impossible to make transcriptions on the CSNTM website, the NTVMR is expressly designed for this purpose. If the CSNTM wants to produce "exhaustive collations," the most efficient way to accomplish this task would be to share their images in scholarly digital workspaces like the NTVMR. This seeming lack of cooperation, whatever its reasons, demonstrates that public funding bodies are right to require open access to materials produced under their aegis. This requirement facilitates research and fruitful collaboration.

Issues of propriety over manuscript images notwithstanding, the CSNTM is a valuable tool for the study of the manuscripts that they have thus far digitized. A good example of this value is GA 2604 (Dublin, CBL W 139), a deluxe illuminated twelfth-century Gospel codex. Until recently the images in the NTVMR of the manuscript were incomplete and those that existed for it were digitized black and white microfilm (Figure 5). The manuscript is also unindexed on the NTVMR, since its text is of little import for the current ECM projects on the Gospels. In contrast, the images in the CSNTM library are entirely complete, indexed to a basic level, and in colour, even if the gilded ink appears somewhat reflective in the images (Figure 6).

32 Another issue with the CSNTM is that the site is not transparent about which manuscripts they have imaged to this point or how many they hope to digitise in the future. This lack of transparency makes it difficult to determine how the CSNTM's library differs quantitatively from the NTVMR. As of 30 January 2019, the search page notes that 1,562 results are available, but only by searching for a particular manuscript does one learn if it is available on the site.

33 The "Recent Projects" tab also includes the statement that "the Center continues to make more images *free for all and free for all time*" (emphasis original) <http://www.csntm.org/About/RecentProjects> [accessed 24 January 2019]. This statement is accurate as long as one has access to the CSNTM site, but the fact that the Center does not allow for the downloading of their images for research purposes, or apparently allow their higher-quality images to replace black and white microfilm on the NTVMR, suggests the "free for all" does not necessarily include academic researchers. See also Wallace, "Challenges in New Testament Textual Criticism," 91 who notes that the CSNTM and INTF had apparently agreed to collaborate on the production of images in Europe: "But now is the time for collaboration with other institutes" (97).

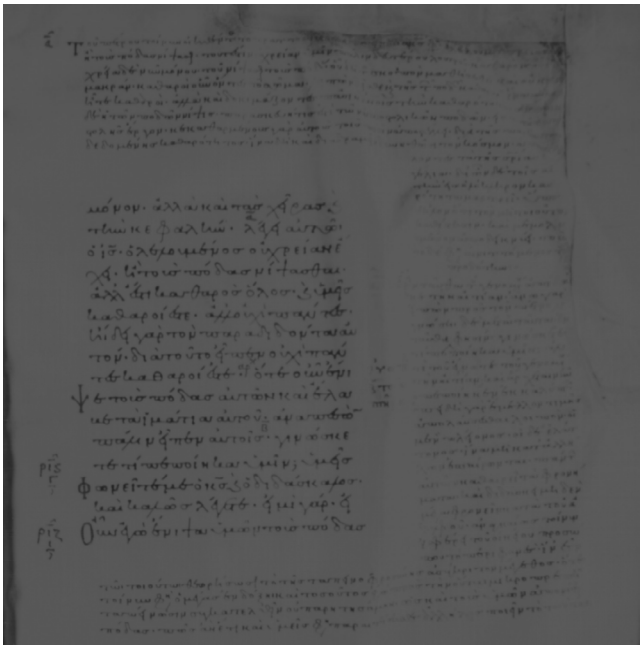


Figure 5. GA 2604 (CBL W 139) 347r in the NTVMR © The Trustees of the Chester Beatty Library, Dublin

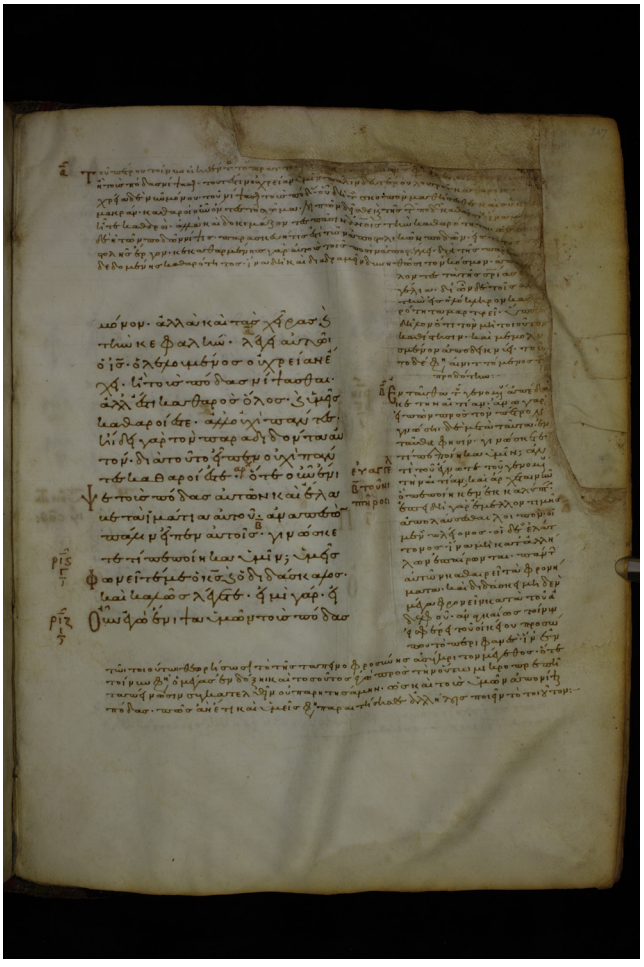


Figure 6. GA 2604 (CBL W 139) 347r in CSNTM Library The Center for the Study of New Testament Manuscripts (www.csntm.org) digitized CBL W 139 at The Chester Beatty. © The Trustees of the Chester Beatty Library, Dublin

The more complete and higher-quality images in the CSNTM library allow for a fuller analysis of the manuscript, including its frame catenae, cruciform Letter to Carpianus, Eusebian apparatus and canon tables, synaxaria, various traditional prologues, evangelist icons, decorative headpieces at the start of each Gospel, kephalaia lists, and Hebrew lexica for each Gospel. Until recently, only visiting the Chester Beatty in person would have afforded access to the fullness of this artefact,[34] which explains why it has never been analyzed in any scholarly context as far as I have been able to divine. In addition to understanding the paratextuality of an expensively produced late-Byzantine Gospel codex, a concrete consequence of the complete and improved images has been the identification of a personal note in the lower margin of 310v (Figure 7), which details the name, occupation, and family background of a one-time reader of the manuscript.

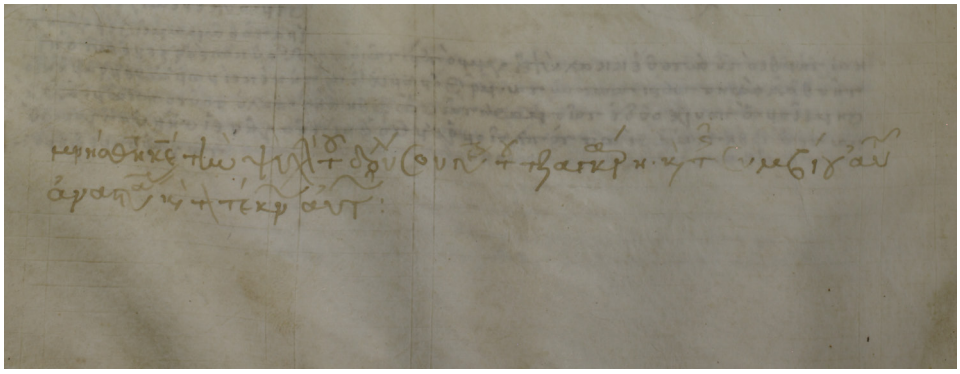


Figure 7. GA 2604 (CBL W 139) 310v (detail) The Center for the Study of New Testament Manuscripts (www.csntm.org) digitized CBL W 139 at The Chester Beatty. © The Trustees of the Chester Beatty Library, Dublin

μνησθητ(ι) κ(υρι)ε την ψυχην του δουλ(ο)υ σου πετρ(ου) τζαγκαρη . και τ(η)ς συμβιου αυτ(ου) αναστασιας και των τεκνων αυτων

Remember, Lord, the soul of your servant Peter the shoemaker, and his partner Anastasia and their children.

Without this note, any memory of Peter the shoemaker and his family may have been lost to history. It is not that that Peter and his family were people of great consequence who changed the course of history in measurable ways, but this type of information is crucial for glimpsing the lives and social realities of people who may have actually read and interpreted the Greek New Testament in different contexts. The images have also illuminated the repair patterns in numerous folios, showing that parts of the water damaged parchment were replaced by an illuminated musical score, evidence that helps us to reconstruct the life and use of the manuscript. The critical digitization of CSNTM makes for slower work in comprehensively imaging every New Testament manuscript, but it provides a richer set of curated data for researchers to explore the consequence of manuscripts even beyond the search for the text of the "autographs."

The "Information Document" to GA 2604 is also a helpful tool, correcting and supplementing some of the manuscript's information in the *Kurzgefasste Liste* and offering an outline of its content, even if the cataloguer did not take the time to identify the bi-columnar Greek work that opens and closes the codex as

34 The Chester Beatty recently launched a new website with digital collections and the entirety of W 139 is available for download as a single PDF or folio by folio <https://viewer.cbl.ie/viewer/object/W_139/10/> [access 22 January 2019]. The CSNTM site does not allow images to be downloaded, protecting the propriety of their digital images as property of the Center. Additionally, the CBL owned images for this manuscript have now been uploaded to the NTVMR, bypassing the CSNTM altogether.

a recycled witness to John Chrysostom's *Homilies on Matthew* 52–54 (CPG 4424).[35] If only these images were available in the NTVMR, researchers beyond the core CSNTM team would be able to mark up, transcribe, and tag the images and texts of GA 2604 and others like them. Despite the hope for greater cooperation between institutes, the CSNTM is a valuable repository of images when they have them, even if the Center's proprietary stance over its images, control over their metadata, and lack of cooperation with other institutes curtails in unfortunate ways the site's usefulness as a critical tool.

The final digital tool that I examine here is Pinakes, an online catalogue with an interest in manuscripts of all Greek literature produced through the end of the sixteenth century with the exception of manuscripts inscribed on papyri.[36] Originating as the microfiche Greek Index Project of the Pontifical Institute of Medieval Studies in Toronto, the site is now managed by the Institut de Recherche et d'Histoire des Textes in Paris in partnership with multiple other academic stakeholders.[37] The site was first published in 2008 and now contains at least partial data on over 40,000 manuscripts housed in over 1,300 libraries worldwide. Unlike the NTVMR and CSNTM, Pinakes does not preserve any images of the manuscripts, but functions instead as an aggregator of catalogues, codicological data, and manuscript content information. The non-papyrological witnesses to the New Testament are also included within this mass of material.

Returning to the questions surrounding manuscripts that preserve Revelation alongside the works of Pseudo-Dionysius, for example, Pinakes proves helpful even if images of the whole manuscript are not readily available online. This is the case for GA 2042 (Naples, Bibl. Naz., MS. II. A. 10), a fourteenth century copy of Revelation with the Andrew of Caesarea commentary. This manuscript is not in the CSNTM library and, although the entirety of Revelation is accessible in the NTVMR in the form of indexed, digitized, black and white microfilm, most of the non-biblical material in the manuscript is not available. After a simple search via library call number, we reach the Pinakes entry for GA 2042 (diktyon 45988). The entry has three parts. The first, "Identifiants," cross-references to other online databases or catalogues that identify the manuscript in a way other than the diktyon number. In this case, the manuscript is identified also as "Aland minuscules" 2042, with a link that brings users to the "Manuscripts Workspace" page of the NTVMR where partial images of the codex can be consulted. Pinakes and the NTVMR are integrated where their material overlaps. Additionally, the manuscript is also identified as "Napoli, BN, II A 10" in the online catalogue Nuova Biblioteca Manoscritta (NBM), and a link transports users to the entry on that site.

The second part of the entry is a bibliography (Figure 8). In the case of this manuscript, the bibliography of secondary resources that engage this manuscript is minimal and incomplete. The NBM entry accessible via hyperlink in the "Identifiants" section provides a much richer source of information, especially as it regards approaches to this manuscript in the context of biblical studies.[38] The Elliott bibliography available via the "Liste" function in the NTVMR adds one other reference not in NBM: this manuscript's entry in Hoskier's *Concerning the Text*. Together, these three bibliographic tools provide an adequate overview of previous work that has engaged this manuscript. This is an important lesson when it comes to digital tools

35 A smaller issue with the "Information Document" is that its author is identified only by initials, in this case dbw, which is likely Daniel B. Wallace (although this is a guess). The photographers of the manuscript are identified as rpc and jwp, which does not tell the public or scholarly community anything about the identity of the people responsible for the work. The names of people responsible for this material must be made public, otherwise these documents, like the images on the site, will remain oriented toward the use of those inside the core team of the CSNTM who have further inside information. Is time really so limited that proper attribution cannot be bestowed on those doing the work? This admittedly minor point speaks volumes about the CSNTM's stance toward outside researchers.

36 <https://pinakes.irht.cnrs.fr/recherche-manuscrit.html> [accessed 22 January 2019].

37 <https://www.irht.cnrs.fr/> [accessed 22 January 2019]. Collaborative partners include the *Bibliotheca hagiographica graeca manuscripta* project (BHG), run by the Société des Bollandistes in Brussels, and the ParaTexBib project managed by Martin Wallraff in Munich <http://www.paratexbib.eu/> [accessed 31 January 2019]. See Binggeli and Cassin, "Le project *Diktyon*," 204. Pinakes, like the NTVMR, is a highly collaborative venture that is continuing to develop to meet the changing needs of scholars who work with Greek manuscripts. On the history of Pinakes, see Binggeli and Cassin, "Recenser la tradition manuscrite des textes grec," 91–106.

38 The Pinakes bibliographies tend to focus on codicological issues and are culled from resources and journals that focus on this approach. The entries are updated with secondary resources up to 2010 <https://pinakes.irht.cnrs.fr/presentation.html> [accessed 31 January 2019].

for the study of New Testament manuscripts: multiple sites must be referenced on a particular issue to gain sufficient bibliographic information since each focuses on aspects of the manuscript from different critical perspectives. And even then these tools cannot stake a claim to comprehensiveness.

Bibliographie :

Répertoire	Titre	Commentaires	Pages
	M. De Groote, *Christophori Mitylenaii Versuum variorum collectio Cryptentis*, CCSG 74, Turnhout, Brepols, 2012		
	M. Formentin, « Uno Scriptorium a Palazzo Farnese ? », *Scripta*, 1, 2008, p. 77-102		
	A. Palla, « Un testimone trascurato della Seconda lettera ad Ammeo di Dionigi di Alicarnasso », *Νέα Ῥώμη. Rivista di Studi Bizantinistici*, 13, 2016, p. 33-44 ; figg. 1-2		37 (n. 23)

Figure 8. Bibliography on Pinakes for GA 2042 (dikyton 45988)

The final section in the Pinakes entry is "Contenu" (Contents, Figure 9). The first line of this section offers space for codicological comment, including the number of folios, date, writing support, information on named copyists, and other comments. This entry is blank for 2042. Next comes the enumerative list of works in the manuscript. This list counts eighteen works in this codex, dividing out the material from Pseudo-Dionysius and the commentary on his work by Maximus the Confessor into separate entities, even though the commentary appears in the margins of the Dionysius text (as we are told in the "Commentaire" column: *in marginibus iuxta textum*). A surfeit of other information on the makeup of the codex and its works is also available, including the location of each work in terms of folio, the name of the author, the Latin title of the work, its CPG or BHG number, the century of each part's production (allowing for codices that have multiple production layers), and editorial comments on each work by the (anonymous) cataloguer. Finally, the last column gives the sources from which this information was aggregated. (Much, but not all, of the data in Pinakes is not based on first-hand experience with the manuscript, but amassed from published catalogues and other secondary sources.) In this case, the information on the entry comes from Elpidio Mioni's catalogue of Greek codices in the national library of Naples.[39]

From this information we learn that the majority of the codex (fols. 1–116) are devoted to Pseudo-Dionysius, complete with commentary of Maximus the Confessor located in the margins, and that Revelation with the Andrew commentary immediately follows this lengthy section (fols. 117–143v). Both the Pseudo-Dionysius/Maximus material and the Revelation/Andrew combination were produced in the same century in the judgement of Mioni, suggesting that they were intentionally designed to be juxtaposed in the initial production layer of the codex. The continuous foliation in the left column of the entry also indicates this judgement. And we are told that the Andrew commentary too appears *in marginibus iuxta textum*, suggesting that the layout of the text and commentary is consistent from Pseudo-Dionysius to Revelation. The change of foliation following Revelation for the material from Thucydides and Dionysius of Halicarnassus (I–VIII) reflects the judgement that these works were copied later than the other parts of the codex.

In lieu of access to the manuscript itself in the Biblioteca Nazionale Vittorio Emanuele III in Naples or to Mioni's rare print catalogue, the Pinakes entry is the most efficient tool for exploring the larger bibliographic context of Revelation in this artefact, even if most of its information is conveyed in French, Italian, or Latin. Pinakes also has the added value of connecting the entry to other manuscripts in the database. Selecting one of the works in the "Oeuvre" column, for example, brings researchers to a list of other manuscripts in the database that preserve that same work. After clicking on "Commentarius in Apocalypsin" a new page opens with a list of eighty other manuscripts that preserve the Andrew commentary. Even though this list is not comprehensive – by my count 109 Greek manuscripts preserve at least parts of the Andrew commentary – it provides a basic data set to begin to explore the Greek manuscript tradition of this work. Selecting the "Apocalypsis Iohannis" hyperlink reinforces the incompleteness of the Pinakes database when it comes to biblical manuscripts, the papyri and post-sixteenth-century manuscripts notwithstanding: it lists only 91

39 Mioni, *Catalogus codicum graecorum*.

manuscripts that contain Revelation, even though Revelation's most recent catalogue lists over 300.[40] This does not mean that the other manuscripts of Revelation are not accessible in the database, but that this search tool is not always comprehensive. New Testament works were initially catalogued as anonymous in the analogue card version of the database and digital entries created directly from these files have not yet been updated.[41]

Issues of comprehensiveness notwithstanding, Pinakes, as an interconnected aggregator and organizer of print catalogues, secondary research, and codicological information represents an extremely valuable tool for anyone working with late antique and medieval biblical manuscripts. Not only does the tool offer insight into the bibliographic composition of some of these codices, but it contextualizes the transmission of the New Testament within the broader textual cultures of which it was a part. It also supplements sites like the NTVMR and CSNTM that focus primarily on images. Pinakes reminds us that the historical, cultural, and contextual span between the great fourth and fifth century codices of Sinaiticus, Vaticanus, and Alexandrinus and the early print editions of the New Testament is not an empty space. And its information is a first stop to begin to map this liminal space in the context of New Testament studies.

Contenu :

Numéro	Titre	Folios	Siècle	Date	Support Principal	Remarque	Copistes, Possesseurs & Autres	Révision
0								

Témoins (18)

Folios	Auteur	Oeuvre	Identifiant	Recension ou partie	BHG	Date Lit.	Siècle	Date	Commentaire	Contenu	Rev.	Biblio.
001-3v	Maximus confessor	Prologus in opera Pseudo-Dionysii	CPG 7708.1 BHG 0558m				13		Cum lacuna			R(III)1778
004	Christophorus Mytilenaeus	Epigramma In Dionysium Areopagitam					13					R(III)1778
004--48v	Maximus confessor	In Dionysii De Diuinis Nominibus	CPG 7708.4				13		In marginibus iuxta textum; in fine epigramma (PG 3, 117 A2-4)			R(III)1778
004--48v	Dionysius Areopagita (pseudo)	De diuinis nominibus	CPG 6602				13		Praemittitur (f. 4) tabula capitum			R(III)1778
048v--71	Maximus confessor	In Dionysii De Caelestia Hierarchia	CPG 7708.2				13		In marginibus iuxta textum			R(III)1778
048v--71	Dionysius Areopagita (pseudo)	De Coelesti Hierarchia	CPG 6600				13		In fine epigrammata duo (PG 3, 116c)			R(III)1778
071--100v	Maximus confessor	In Dionysii Ecclesiastica Hierarchia	CPG 7708.3				13		In marginibus iuxta textum			R(III)1778
071--100v	Dionysius Areopagita (pseudo)	De Ecclesiastica Hierarchia	CPG 6601				13		In fine epigrammata tria (PG 3, 116-117)			R(III)1778
101--103v	Maximus confessor	In Dionysii De Mystica Theologia	CPG 7708.5				13		In marginibus iuxta textum			R(III)1778
101--103v	Dionysius Areopagita (pseudo)	De Mystica Theologia	CPG 6603				13		Premittuntur tabula capitum et epigramma; sequitur aliud epigramma (PG 3, 997-1048)			R(III)1778
103v--115v	Maximus confessor	In Dionysii epistulas	CPG 7708.6				13		In marginibus iuxta textum			R(III)1778
103v--115v	Dionysius Areopagita (pseudo)	Epistulae 1-10	CPG 6604-6613				13					R(III)1778
115v--116v*	Hagiographica	Dionysius Areopagita (S.), Commentariolus	BHG 0558e-0558g		0558e		13		De quibusdam dictionibus a Dionysio usurpatis, quarum prima pars refert ad BHG			R(III)1778
117--143v	Andreas Caesariensis	Commentarius in Apocalypsin	CPG 7478				13		In marginibus iuxta textum			R(III)1778
117--143v	Testamentum nouum	Apocalypsis Iohannis	BHG 0920z				13					R(III)1778
I-IV	Marcellinus biographus	Vita Thucydidis					14 in.		Fragmentum			R(III)1778
IVv-Vv	Thucydides historicus	Historiae					14 in.		Vita anonyma (cf. ed. Hude, Lipsiae 1913, p. 10-12)			R(III)1778
Vv-VIII	Dionysius Halicarnassensis	De Thucydidis idiomatibus (ad Amm. ep 2)					14 in.					R(III)1778

Figure 9. Contents of GA 2042 (dikyton 45988) in Pinakes

New Testament scholars are in an enviable position. In addition to the vast quantity of primary and secondary sources available in print, scholars have images of nearly every Greek New Testament manuscript at their fingertips in one form or another. In the NTVMR, the largest of the digital repositories, these images are available in a sophisticated workspace where the metadata produced by other scholars (e.g. transcriptions, underlying XML data, image tags, access to the burgeoning digital ECM) – de facto interpretations of the images in the context of the tradition – is an integrated aspect of the viewing experience. And this workspace is highly interconnected with sites that offer other forms of context on New Testament manuscripts, like Pinakes. And the INTF are continually working to improve the NTVMR as a scholarly tool. Likewise, the CSNTM offers access to manuscript images in a highly curated manner, producing only the highest quality colour digital images and carefully controlling their editing and dissemination.[42] The potential of their critical digitization project for the study of the manuscripts is significant, even if the analytical value of the

40 See Lembke et al., eds., *Text und Textwert*, 2–22. Of course, new material is being added to Pinakes (and the digital *Kurzgefasste Liste*) on a regular basis.

41 Updates on similar data in Pinakes have been undertaken on hagiographic texts and on Gospel codices, but there are no immediate plans to update data on biblical material in Pinakes writ large, although this task could theoretically be completed at a later date. See Binggeli and Cassin, "Recenser la tradition manuscrite des textes grec," 92–93.

42 Some images on the CSNTM site are high-quality digitisations of black and white microfilm.

site as a workspace is limited as currently constructed. Finally, Pinakes is an important tool for the non-papyrological witnesses to the New Testament because it situates these manuscripts within the broader context of late antique and medieval book cultures. In instances where the NTVMR does not contain images of every leaf of every codex with a New Testament work, Pinakes often provides an enumerative bibliography of the codex as a whole.

But where do these tools leave the field when it comes to working with primary sources? First, the tools both reflect and enable interpretation. Representing the combined labour of hundreds of scholars working over many years, they enable researchers to begin to grapple with the quantity and quality of the Greek witnesses to the New Testament. Their organization already reflects interpretation of the data, since they are designed in response to patterns within the tradition, systematically addressing the needs of scholars, especially those working to produce editions. But these sites also enable more sophisticated forms of engagement with the tradition: greater access to marginalia and commentary, idiosyncratic aspects of each manuscripts, the ability to immediately compare manuscripts side-by-side that are housed in different countries. This is especially relevant for examining manuscripts as reservoirs of reception, as records of producers and readers with particular ideas about the New Testament and its meaning. The efficiency of these models is obvious, and their economic benefits allow more people to participate in the interpretations of these objects and their texts. These tools, especially as they continue to aggregate relevant information, will continue to have an outsized influence on the shape of current research.

But this turn to digital tools for manuscript study also has unforeseen complications. For example, should we continue to conceptualize digital images as mere representations of the "real thing," or should we begin to treat them as autonomous research objects, especially as images in the sites like the NTVMR continue to accrue different forms of interpretive metadata? What effect do manipulations to digital images have on their relationship to the artefacts they represent? How do the differences in materiality between the artefact and its images – for both are material objects in their own ways – impinge on the way readers approach each instantiation? Working primarily with digital images encourages the forming of particular research questions because they are amenable to certain approaches: textual transcription for the editing of editions, stemmatic analysis like the Coherence-Based Genealogical Method (CBGM),[43] and the efficient comparison of multiple manuscripts. These are valuable and important approaches for New Testament studies, but they do not exercise a monopoly on the critical foci for the discipline. For example, as currently configured, the repositories of images do not offer adequate information to analyze the larger bibliographic context of many of the manuscripts (even though Pinakes makes up for this lack in some cases), and the images are not (and may never be) suitable for codicological analysis or the examination of other material aspects of a codex. These features offer information both on the production and the later lives of these books as real people used them in time and space, and they reveal the concrete reading events that offer insight into how people interpreted a particular text or how they conceived of the New Testament as a bibliographic reality.

These tensions notwithstanding, working with digital images, while remaining aware and critical of these digital tools in our research, is important because they are becoming an ingrained part of digital editions, notably the online forms of the ECM. In order to use digital editions to their fullest potential, one must know how to read the manuscripts and to understand the processes by which the editions were constructed. Although print editions will remain important tools for navigating the manuscripts, they have enabled most scholars to largely avoid the most primary sources of the discipline. But the proliferation of manuscript images now allows for the partial bypassing of these print culture conventions, connecting editions to the manuscripts that they seek to represent. Digital tools enable textual scholarship to ask new critical questions and to reimagine the functions and purposes of important tools like printed editions. But we should always remember that different research questions call for different tools. For the textual scholar of the New Testament, many of these tools come from a rich heritage of printed material and otherwise analogue implements.

43 For recent a recent overview and critical analysis of the CBGM, a tool also predicated on the data in the NTVMR's transcripts of Acts and the Catholic Epistles, see Gurry, *A Critical Examination of the Coherence-Based Genealogical Method* (2017) and Wasserman and Gurry, *A New Approach to Textual Criticism* (2017).

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Digital Humanities in Biblical Studies and Theology

Claire Clivaz*

The Impact of Digital Research: Thinking about the MARK16 Project

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Abstract: This article presents the challenges of developing Humanities research in a digital environment in relation to a New Testament test-case: the MARK16 project. The first section argues that virtual research environments (VREs) have become an excellent milieu in which to develop a digitized research project based on collaborative work. The second section presents an overview of VREs and digital projects on the New Testament. The third section demonstrates the ways in which the MARK16 project participates in the development of VREs and fosters new modes of engaging material in digitized NT research.

Keywords: Digital Humanities, New Testament, Humanities, Gospel of Mark, VRE, digital culture, research, history, DARIAH, digital practices

Preamble

The research question of this paper is simultaneously simple and boundless: does it matter if we practice Humanities research in a digital culture rather than in traditional print cultures? And what does the answer to this question mean for New Testament research in particular? Such abyssal questions are fundamental and should at least be considered when a scholar is planning a research project in biblical studies, theology, or religious studies. Indeed, the number of digital research projects are increasing at the international, European, and national levels.[1]

Such questions closely accompanied the preparatory phase of the SNSF PRIMA grant MARK16, a five-year project supported by the Swiss National Foundation.[2] These interrogations are deeply embedded within the opening phase of the project and will remain so throughout, as MARK16 aims to build a new Digital Humanities research model. This will be based on a test case that is well known in New Testament textual criticism (NTTC): the ending of the Gospel according to Mark.

Consequently, this article explores the epistemological digital turn in the Humanities and relates it to the MARK16 project, hoping to inspire further research and engagement in NTTC and New Testament studies. The first section outlines some challenges for digital research, pointing to the fact that virtual research environments (VREs) seem to be the main emergent digital milieu in which this work occurs. The second section presents an overview of VREs in New Testament and Early Christian research, and the third discusses the challenges presented by MARK16 in building a new Humanities research model around a NTTC test case.

1 To my knowledge, neither international nor European complete databases of projects in the Digital Humanities exist. One can for example gain perspective on their expansion by looking at this catalogue of digital editions published in 2016: Franzini, Terras, Mahony, "A Catalogue of Digital Editions."

2 http://p3.snf.ch/project-179755; https://digitalhumanitiesplus.sib.swiss/#/project/mark16.

***Corresponding author: Claire Clivaz,** Swiss Institute of Bioinformatics, Lausanne, Switzerland;
E-mail: claire.clivaz@sib.swiss

1 Towards virtual research environments as a digitized research milieu

If the roots of the Digital Humanities can be dated to the end of the Second World War, with the notable works of Vannevar Bush and Roberto Busa,[3] the name "Digital Humanities" (DH) itself only surpassed the label *Humanities and Computing* at the beginning of the 21st century, a switch I discussed in detail in a previous book.[4] Accompanied by a lively debate,[5] the effect of this change on the Humanities is summarized by Steven E. Jones:

> New practices and areas of interest for computing in the humanities correspond to changes associated with the eversion of cyberspace in the culture at large. In one sense, the new digital humanities is humanities computing, everted. [...] The term also reflected a larger change: from implying a separation between the stuff of the humanities – manuscripts, books, documents, maps, works of art of all kinds, other cultural artefacts – and computing, to more of a mixed reality, characterized by two-way interactions between the two realms, physical artefacts and digital media.[6]

Depending on the authors, this overwhelming aversion in culture can sometimes be perceived as a dramatic turn, as suggested by Bernard Stiegler who describes digital expansion as a phenomenon of "disruption over all the earth."[7] It is difficult for us today to discern and predict exactly what our cultural future will be. Meanwhile, humanists can only continue to work patiently, observing and analyzing transformations with a critical mind. Jones' observation of the emergence of a "mixed reality" in the Humanities is particularly appropriate for describing what is at stake in the transformation of practices and research. I give two examples of this mixed reality below – one regarding the digital practices in the Humanities and the second the transformation of a textual printed corpus into a digital collection. I conclude this section by arguing that, in a similar way, research in the Humanities is presently a mixed reality with a tendency to develop its forefront research through virtual research environments (VRE).

In 2004, John Houghton, Colin Steele and Margaret Henty published one of the first analyses of digital scholarly practices. If their volume underlines the emergence of a new kind of knowledge, their editorial overview points principally to the access and dissemination needs of scholars: "research databases, related software and other analytical objects are new core tools, as the very nature of discourse shifts from hypothesis testing towards collecting processing and analyzing primary data."[8] This is a recurrent and universal point of DH: the first DH developments are almost always provoked by the needs of archiving and accessing to primary and secondary sources. As a major feature of a potential new kind of digital knowledge, Houghton et al. point to emergent collaborative research.[9] Eleven years later, in 2015, ERIC DARIAH led a European inquiry into digital practices that can be compared to Houghton et al.'s earlier study on many levels.[10] 2,177 respondents across Europe responded to the inquiry and six national profiles have been analyzed in detail in the countries that gathered the required quantity of responses.[11] The need to develop digital infrastructures is largely shared in this inquiry:

> Asked to rate the importance of different needs in a scale from 1 to 10, three quarters of digital humanists rated improved findability and access to existing digital research resources or data as the most important, with a score exceeding 9.5 out of

3 Bush, "As we May Think"; Jones, *Roberto Busa, S.J.*

4 See Clivaz, *Ecritures digitales*, 46-51 and 83-84.

5 See, for example, Svensson, "Humanities Computing."

6 Jones, "The Emergence of the Digital."

7 See notably Stiegler, *Dans la disruption*, 22: "l'accélération du phénomène de l'innovation [...est] un facteur planétaire de désintégration sociale. Ce pouvoir automatique de désintégration réticulaire s'étend sur toute la Terre à travers ce qu'on appelle depuis quelques années la *disruption*."

8 Houghton, Colin, and Henty, "Research practices," 247.

9 Ibid.

10 The inquiry has been led by the DARIAH working group DIMPO: https://www.dariah.eu/activities/working-groups/wg-digital-methods-and-practices-observatory-dimpo/.

11 Chatzidiakou and Dallas, *DARIAH-EU Scholarly Practices Survey.*

> 10. A slightly lower score of 9 was granted to digitization of research resources or data currently not in digital form by three out of four respondents. Two other needs, improved findability and access to digital tools or software, and networking with other researchers, research groups and institutions, share third place with a score exceeding 7 by more than three out of four respondents.[12]

Among the results of this interesting inquiry, the future face of digital research can be perceived. However, collaborative DH remains a non-majoritarian approach. Only one third of respondent scholars engage regularly in collaborative research.[13] This collaborative aspect is certainly a crucial one in the emergence of new research practices in DH. It is also the case in digital editing, the second example of a mixed reality in digital scholarly practices. As developed in a previous publication, the traditional set of "textual corpus" is evolving into the digital collection.[14] According to Sarah Mombert, the digital collection attests to an effect of "decanonization"[15] by putting texts considered as marginal in print culture at the forefront, and can be defined in the following way:

> In the digital edition domain, where the use of the term "collection" is still not fixed, I would propose this minimal definition: a potentially evolutionary set of interlinked digital objects, with the intention of producing some meaning.[16]

This rather flexible definition has nevertheless some decisive features that underline the exodus from the traditional form of the textual corpus. According to Elena Pierazzo, a digital edition "firstly is a website, a digital and physical artefact which is infinitely extensible"; secondly, it is characterized by "its collaborative nature."[17] As Mombert suggests, time and financial resources frame the new limits of such collections.[18] However, their most eminent feature is surely their multimodal aspects, their capacity to gather together texts, images, and sounds to build new digital knowledge objects.[19] In this general evolution of the digital edition, its "collaborative nature" can be connected with the remarks about the transformation of digital scholarly practices mentioned above. The evolution of the notion of "limits" is another important point: the book cover is not here anymore to secure the delimitation of a collection of items. The sense of the limit is apparently essentially given by "time and financial resources," since a website is "infinitely extensible."

By considering these two examples – scholarly digital practices and digital edition – we begin to see that a new form of research in the digital scholarly landscape is progressively emerging. It could take the name and the form of the "virtual research environment," in which the collaborative dimension is particularly important, as Annamaria Carusi and Torsten Reimer have pointed out.[20] In a clear and synthetic 2013 article, Leonardo Candela, Donatella Castelli, and Pasquale Pagano have explained that they "envisage a future where regardless of geographical location, scientists will be able to use their Web browsers to seamlessly access data, software, and processing resources that are managed by diverse systems in separate administration domains via Virtual Research Environments."[21] In other words, VREs could be the new way to define research *loci* and serve as the new "covers" of the scientific objects, replacing the paper covers of printed books as signs of knowledge territories. These three authors give the following definition of a VRE:

> Virtual Research Environment (VRE) is used with a comprehensive scope, i.e., it represents a concept overarching all the environments cited above and identifies a system with the following distinguishing features: (i) it is a web-based working environment; (ii) it is tailored to serve the needs of a community of practice (Lave & Wenger, 1991); (iii) it is expected to provide a community of practice with the whole array of commodities needed to accomplish the community's goal(s); (iv)

12 Ibid., 7.
13 Ibid., 6.
14 See Clivaz, *Ecritures digitales*, 196–217 and 224–230.
15 Mombert, "From Books to Collections," l. 5128.
16 Ibid., l. 5186.
17 Pierazzo, *Digital Scholarly Editing*, 193.
18 Mombert, "From books to collections", l. 5248.
19 Clivaz, *Ecritures digitales*, 210-217.
20 Carusi and Reimer, "Virtual Research Environment Collaborative Landscape Study."
21 Candela, Castelli, and Pagano, "Virtual Research Environments," 75.

> it is open and flexible with respect to the overall service offering and lifetime; and (v) it promotes fine-grained controlled sharing of both intermediate and final research results by guaranteeing ownership, provenance and attribution.[22]

As we see, two of the five features that describe a VRE are focused on the community of practice and so foster collaborative research. For the authors, such a "web-based working environment," is expected to become "the 'default' approach for scientific investigations as well as for any societal collaboration-based activity" within ten years.[23] This perspective might sound ambitious, but now, five years later, this intuition seems more and more correct every day. The MARK16 project, discussed in Section 3, concludes in five years and thus accompanies the end of the "VRE establishment decade" announced by Candela, Castelli and Pagano.[24] This successful VRE story, presented in 2013, has been notably illustrated by JISC, the UK service for education and research. Over a period of eight years, ending in 2012, JISC developed a research program on VREs.[25] In 2010, Carusi and Reimer published a full study about this "collaborative landscape" within the JISC framework.[26] Last but not least, Craig Bellamy argued in a 2012 article that a VRE is not only a possible future research model, but also a way to reshape academic teaching in its entirety:

> Many of us learned interdisciplinarity the same way we learned about computing: the hard way. But a new generation of projects in the digital humanities may lessen the need for programming whilst to exposing to critique the underlying technical decision-making process. Whilst it is important to 'make stuff' in the digital humanities, different schools have different capacities to do this and VREs may be one way to impart digital humanities values and processes without the need to build projects from scratch.[27]

Like the concept of "digital collection," the definition of a VRE remains malleable, a description of a new place to lead scientific research. Digital culture forces scholars to constantly rethink and reconsider their work and tasks. Despite its open-ended definition and description, and considering its wide diffusion as a research model in recent years, I propose in Section 2 a non-exhaustive but representative overview of some VREs in New Testament studies. Section 3 will then explain how a MARK16 VRE will bring something new into this developing digital research landscape.

2 Digital New Testament online resources and VREs: An overview

Much like the Digital Humanities in general,[28] digital research in New Testament studies has first been developed around texts and editorial challenges.[29] For about two decades, the digitization of manuscripts and the exploration of new editorial possibilities have fostered new trends in NT research and sparked lively reflections and conversations among NTTC scholars.[30] Whereas the reference edition of the Greek New Testament *Nestle-Aland* 28 is available online in open access[31] – but without the critical apparatus – a digital common working place has opened for NTTC scholars under the leadership of the INTF and ITSEE:

22 Ibid.
23 Ibid., 77.
24 Ibid.
25 https://www.jisc.ac.uk/rd/projects/virtual-research-environments.
26 Carusi and Reimer, "Virtual Research Environment Collaborative Landscape Study."
27 Bellamy, "The Sound of Many Hands Clapping," §16.
28 See for example Busa, "Foreword": "Humanities computing is precisely the automation of every possible analysis of human expression (therefore, it is exquisitely a 'humanistic' activity), in the widest sense of the word, from music to the theatre, from design and painting to phonetics, but whose nucleus remains the discourse of written texts."
29 Other fields in biblical studies, Early Jewish, and Christian studies have of course also developed VREs. The present article is focused on NT VREs.
30 See e.g. Epp, "It's all about variants"; Parker, *An Introduction to the New Testament*; Wallace, "Challenges in New Testament Textual Criticism"; Schmid, "Transmitting the New Testament Online"; Clivaz, "The New Testament at the Time of the Egyptian Papyri."
31 http://www.nestle-aland.com/en/read-na28-online/.

the New Testament Virtual Manuscript Room (NTVRM).[32] Without doubt, the NTVMR is one of the most important VREs for the study of the NT and is largely interactive: scholars, when enrolled, can collaborate on the manuscript transcription tool. The NT Transcripts tool presents the state "in real time" of the *Editio Critica Major* (ECM),[33] in the form of an "unedited realtime collation." The user enters the room of the ECM's making, and one can of course wonder at which point something available online is really "unedited." But the expression points to the flexible state of the online collation, always subject to revision. Allowing researchers access to past versions would be a useful modification. This digital collaborative editing has been presented and analyzed in detail in Troy A. Griffits' PhD.[34] If a 29th paper edition of the Nestle-Aland Greek New Testament is in preparation, as well as the paper editions of each ECM NT fascicle, the online ECM is positioned as an evolving, consultable tool. The examination of scholars' uses of the online ECM in comparison to print editions will indicate which form they will more commonly consult in their work.

Other NT VREs with digitized manuscripts are in development, such as the website of the *Center for the Study of New Testament Manuscripts*, PAVONe – the platform of Arabic versions of the New Testament – and in the project *Paratext of the Bible* that "catalogues all available material in an e-Clavis [and…] develops a set of categories according to which each paratext of the New Testament is edited according to internal criteria."[35] A special mention could also be made of the project of the Jerusalem School, *The Bible in its Traditions*,[36] which seeks to establish the biblical text by reconstituting a polyphony, offering translations that make as much as possible to "taste an original flavor" and presenting annotations "drawing new and old from its treasure."[37] The ambition is to propose references in the history of the tradition including visual arts, film, etc. The project can be described as an "augmented paper Bible." The structure follows the textual logic, with references, comments, and all information listed synoptically.[38] It is important and useful for all scholars and Bible readers, but apart from the OA aspect, it follows the model of the book overall. As such, it is not formatted according to a VRE perspective but could evolve in this sense. For a subfield like biblical studies or New Testament studies to really innovate digitally, it is necessary to collaborate with wider DH projects, such as the H2020 project ReIReS, *Research Infrastructure on Religious Studies*.[39]

The field loses nothing if it is also inspired by wider projects, even if there is clearly a tendency for a digital edition to evolve in the sense of a digital collection, as we have seen in Section 1. However, the canonical delimitation of the Bible remains a way to draw a limit in a digital collection.[40] The impact of this canonical delimitation, even in a digital world, can be noticed, for example in NT or biblical VREs with more pedagogically focused resources, like *Early Christianity: the Letters of Paul* or *The Bible Odyssey*.[41] As I argued in Section 1, VREs naturally tend to combine teaching and research material, and by looking at *Early Christianity* or *Bible Odyssey*, this fact is largely confirmed, depending on how one values scholarly videos.[42] Simple reference lists or resources are also available on multiple sites, such as on the reference website of the SBL, or on personal scholarly websites like Mark Goodacre's NT portal.[43] Besides these independent projects, institutional structures are emerging: the first European digital theological center is in Durham – the CODEC Center – and it is leading several projects to bring digital biblical literacy to a wider audience.[44]

These examples give an idea about the diversity of online projects in New Testament studies. They

32 http://egora.uni-muenster.de/intf/index_en.shtml; https://www.birmingham.ac.uk/research/activity/itsee/index.aspx; http://ntvmr.uni-muenster.de/.

33 http://ntvmr.uni-muenster.de/nt-transcripts.

34 Griffts, "Software for the Collaborative Editing of the Greek New Testament."

35 http://www.csntm.org/; http://pavone.uob-dh.org/; http://paratexbib.eu/.

36 https://bibletraditions.org/.

37 https://bibletraditions.org/vd/en/2.Definition.en.pdf.

38 See the demonstration chapter: https://bibletraditions.org/bible/Jas5.13-18.

39 https://reires.eu/.

40 Clivaz, *Ecritures digitales*, 167–195 and 218–223.

41 https://www.edx.org/course/early-christianity-letters-paul-harvardx-hds1544-1x; https://www.bibleodyssey.org/.

42 This point will be developed in Section 3.

43 https://www.sbl-site.org/educational/default.aspx; http://www.ntgateway.com/.

44 https://www.dur.ac.uk/codec/project/; https://www.dur.ac.uk/codec/project/.

cannot all be considered VREs, but they all contribute to extending the digital space devoted to research on, and the teaching of, the New Testament. This overview reveals also that there has never been a VRE designed to lead research on a chapter or section of the NT text, whereas the VRE MARK16 allows researchers to gain information and discuss hypotheses on this particular chapter. Trying to design such a VRE first requires adressing an important question: are we doing serious scholarly work in VREs, or are they useful essentially for teaching? The question is not an exaggeration considering, for example, that the Society of Biblical Literature has classified the material available on its *Bible Odyssey* website as "educational resources," although the rubric presents many research tools.[45] It is obviously beyond the ability of the present article to predict whether VREs will regularly welcome NT exegesis beyond the linear nature of books. However, Section 3 argues that it is worth attempting to develop such a trajectory to mobilize all digital potential in order to renew perspectives on Mark 16.

3 The MARK16 Project as innovative New Testament Virtual Research Environment

It is a well-known enigma that a diversity of endings are found in manuscripts containing Mark 16.[46] The two oldest witnesses we have are Codex Sinaiticus and Codex Vaticanus (4th century CE), both of which conclude the second gospel in this way: "So they [the women] went out and fled from the tomb, for terror and amazement had seized them; and they said nothing to anyone, for they were afraid" (Mark 16:8).[47] Apart from these two codices and the 12th century minuscule 304,[48] all the other manuscripts present endings that continue on after Mark 16:8, most often preserving the longer ending of Mark 16:9-20.[49] For centuries, readers apparently preferred to continue the story after Mark 16:8, or otherwise to stop prior to this verse, as seen in the traditional Easter liturgy that ends the reading at Mark 16:7 on Easter night. The enigma is reinforced by the fact that there is no evidence from the early papyri of the Markan ending(s): no manuscript evidence of Mark 16:8 preceding the fourth century has survived. To renew the quest about this classical *locus* of NT research methodologically, the MARK16 project will build a VRE.[50] In this Section, I firstly present the features of MARK16 that fit with the analysis presented in Sections 1 and 2, then I discuss changes in scholarly practices illustrated by MARK16: the access, definition, and presentation of the sources and secondary literature, and the representation of the diversity of opinions in the past and today.

3.1 MARK16 and the research challenges of the VREs

MARK16 will be lead by a team of three researchers, the PI, Claire Clivaz, a post-doc, Mina Monier, and a bioinformatician, Martial Sankar. An international scientific committee accompanies the project composed of Leif Isaksen (University of Exeter, UK), Jennifer Knust (Duke University, USA); Valérie Nicolet (IPT, France), Laurent Romary (INRIA, France), Joseph Verheyden (Catholic University Leuven, Belgium), and Peter Williams (Tyndale House, UK). At the end of this five year project, the VRE should become a place of reference for research about MARK16, providing material related to this chapter (sources and secondary

45 https://www.sbl-site.org/sitemap.aspx.

46 For the most recent article on the question, see Hultgren, "'A Vision for the End of the Days'"; see also my conference paper given on 7 November 2018 at the conference "Textual plurality in the Bible" in Paris: Claire Clivaz, "Mk 16,8 and the manuscripts evidence: listening to the scribal voices" (article in preparation).

47 I am using the *New Revised Standard Version*.

48 Elliott, "The Last Twelve verses," 82.

49 For a summary of the existing Mark endings, see Focant, "Un silence qui fait parler," 342–344. Focant details six categories of existing variants (pp. 342–343), whereas they are commonly summarized as four (see for example Robinson, "The Long Ending of Mark as Canonical Verity," 41–42).

50 MARK16 VRE is scheduled to be open at the end of 2019: https://mark16.sib.swiss; the blog of the project is already open: https://digitalhumanitiesplus.sib.swiss/#/project/mark16.

literature), the visualization of the data, the project outputs (publications and activities) and an important innovation: the interpretation tool that is presented below. Of course, as usual in a Humanities project, the PI and the post-doc will also have the opportunity to develop and present their own hypothesis about the NTTC enigma in Mark 16. Before discussing two main features of the MARK16 VRE, I will evaluate it in light of the points presented in Section 1 and 2.

MARK16 will fit with the five features of a VRE given by Candela, Castelli, and Pagano, and quoted in Section 1. It will be "(i) a web-based working environment," promoting "(v) fine-grained controlled sharing of both intermediate and final research results by guaranteeing ownership, provenance and attribution."[51] The web-based MARK16 will give access, as far as possible, to all relevant material for the study of this biblical chapter, with hyperlinks to the material available online, or with pdf or images of the material available in Open Access licenses. As MARK16 is supported by the Swiss National Foundation institution (SNSF), the material produced during the project itself has to be OA, normally in the golden way. In the SNSF project HumaReC, our team has already established its VRE publication model: HumaReC received an ISSN from the National Swiss Library[52] and all the material produced by the team and published on the VRE is in license CC-BY 4.0, including the code available on GitHub.[53] MARK16 will apply the same publication model to its data. The fourth criteria – to be "(iv) open and flexible with respect to the overall service offering and lifetime"[54] – is also on the MARK16 agenda. In fact, since October 2017, all the projects submitted to the SNSF must present a data management plan, including the mention of a public depository for their data at the end of the project.[55] We have chosen to discuss with the Huma-Num services to deposit our data, with HAL and Nakala.[56]

Finally, Candela, Castelli, and Pagano's VRE criteria 2 and 3 point to community practices: a VRE is "(ii) tailored to serve the needs of a community of practice", and "(iii) is expected to provide a community of practice with the whole array of commodities needed to accomplish the community's goal(s)."[57] These two criteria summarize a VRE's generic features underlined in Section 1: it is a collaborative workspace. MARK16 is completely tailored for a community of practice, NTTC scholars and students, willing to develop DH practices. Although the PI and the post-doc will develop and present their own hypotheses about MARK16, the VRE is intended to allow scholarly debates between the diverse hypotheses in research, allowing users to build their own paths within research material. To create such a result, several collaborations have been established. First, members of the team will spend time in the institutions of the members of the scientific committee, in order to test the VRE with colleagues and students, and get regular feedback on the project from the users' point of view. Certain tools will be open to all interested scholars on request, such as a common Zotero bibliography online.[58] Second, several collaborations will be developed to build, for example, a small manuscript room with the interesting folios of Mark 16, collaborating with the *Virtual Manuscript Room Collaborative Environment* designed by Troy Griffits.[59] Regarding data visualization, we will collaborate and be in touch with Leif Isaksen's team and the *Pelagios* project.[60]

In summary, one can say that MARK16 fits exactly with the five VRE criteria proposed by Candella, Castelli, and Pagano. It also builds on the VRE decade of development. To establish a VRE, one has to become conscious of the renewal of research practices it implies, and this analysis has been done so in the preparatory steps of the project. MARK16 fits also with the important scholarly expectation in the DIMPO 2015 inquiry about digital practices: to construct a digital research infrastructure.[61] Moreover, it represents

51 Candela, Castelli, and Pagano, "Virtual Research Environments," 77.
52 https://humarec.org.
53 https://github.com/humarec/humarec-tei.
54 Candela, Castelli, and Pagano, "Virtual Research Environments," 77.
55 http://www.snf.ch/SiteCollectionDocuments/DMP_content_mySNF-form_en.pdf.
56 https://www.huma-num.fr/; https://hal.archives-ouvertes.fr/; https://www.nakala.fr/.
57 Candela, Castelli, and Pagano, "Virtual Research Environments," 77.
58 https://www.zotero.org.
59 http://vmrcre.org/.
60 http://commons.pelagios.org/.
61 Chatzidiakou, and Dallas, *DARIAH-EU Scholarly Practices Survey*, 7.

an original way to give an answer to the open-ended potential of a digital collection, essentially limited by "time and financial resources," as Mombert underlined.[62] Indeed, focusing on a biblical chapter as research object illustrates the fact that the canonical delimitation of the Bible remains a way to draw a limit in a digital collection, as I underlined in Section 2.[63] Of course, such a delimitation is produced by NT scholarly community practices, and the VRE will allow it to be opened up to a diversity of related texts and sources. Several studies devoted to Mark 16 simply bypass all the apocryphal Christian literature,[64] a limitation that is clearly overcome in the MARK16 project. Finally, by referencing the multimodal material available online relevant to Mark 16, our VRE will fully belong to the development of digital collections towards a multimodal digital culture,[65] as the next points develop.

3.2 The MARK16 VRE as illustration of changes in scholarly practices

A VRE attempts to pass from a paper-based context to a digitized research environment. Scholars doing research on textual variants within printed culture are used to ending up with many boxes full of photocopied articles and abstracts of books, as material used to write a final book on a topic. Thanks to the migration from paper-based research to VREs, one is able to have access in the same place to many sources, secondary literature, and materials, as well as the results of the research itself. This switch has deep consequences for research and publications by reshaping the relationship of the researcher to the sources and secondary literature. Inscribed within the "intrinsic VRE nature," in order to build "a 'collection' of existing systems and resources,"[66] MARK16 presents, in chronological order, the sources and secondary literature available in open access. Other sources can also be signaled in an online bibliography.

All items will be clearly referenced and situated in a timeline. Paradoxically, the chronological aspect is often neglected when it comes to VREs. See for example Rob Nelson in *Mining the* Dispatch,[67] a VRE that uses topic modeling to explore the Confederacy's paper based records during the Civil War. As far as I have observed, this website does not indicate when the material was produced. The VRE *Virtual St Paul's Cathedral Project*[68] is another example that, although anchored in the field of English literature,[69] is largely interdisciplinary with elements coming from acoustics, architecture, theology, and history. However, this interdisciplinary website generally does not provide references for its items:[70] a VRE must provide clear chronological references for each source, document, or secondary literature presented. The mockup in Figure 1 gives an idea of the organization of the timeline.

The referenced manuscripts will be consultable, as far as is possible, in a manuscript room focused on the folios of Mark 16. The section "texts" will sidestep the usual categorization of ancient Christian texts, in particular the separation between canonical and non-canonical texts, a separation too often present in most research on Mark 16. Moreover, the MARK16 timeline will transform the usual partition between ancient sources[71] and modern secondary literature. Indeed, chronological factors provide the basis of their essential distinction, and nothing prevents one from integrating them in the same temporal section simply entitled "texts." This large classification is a Copernican revolution of sorts within the MARK16 VRE, and

62 Mombert, "From Books to Collections," l. 5248.

63 Clivaz, *Ecritures digitales*, 167–195 and 218–223.

64 For example, nothing is told about the eventual relationship of Mark 16 with apocryphal Christian literature in Black, *Perspectives on the Ending of Mark*, Hester, *Does Mark 16:9-20 Belong in the New Testament?* or Lunn, *The Original Ending of Mark*.

65 Clivaz, *Ecritures digitales*, 210–217 and 228–230.

66 Candela, Castelli, and Pagano, "Virtual Research Environments," 77.

67 http://dsl.richmond.edu/dispatch/pages/home.

68 https://vpcp.chass.ncsu.edu/.

69 Wall, "Recovering Lost Acoustic Spaces."

70 See for an example https://vpcp.chass.ncsu.edu/donne-preaching/.

71 Until the 4th or even the 7th century in Early Christian studies, see Clivaz, Mimouni, and Pouderon, *Les judaïsmes dans tous leurs états*.

the impact of this methodological decision will be monitored. This section will be open-ended by definition and of course open to collaboration with all the interested scholars.

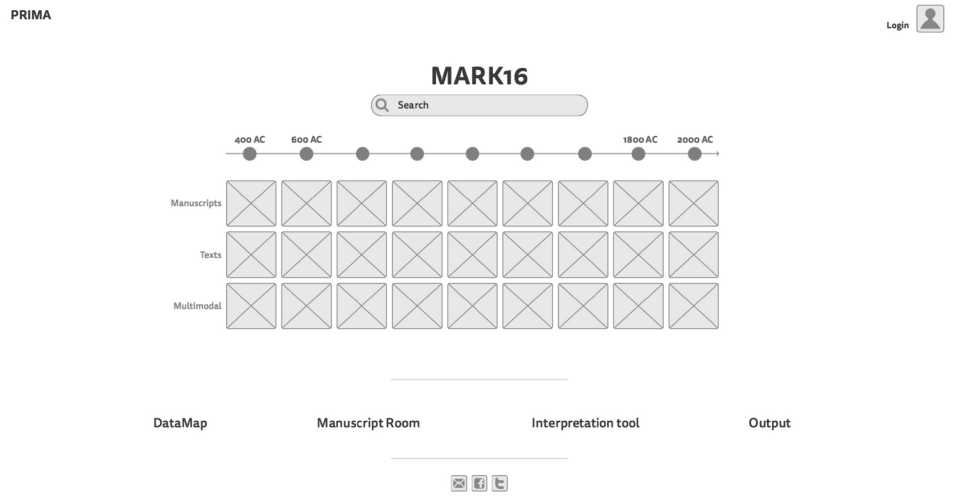

Figure 1. Model of Chronological Layout of Material in MARK16

The third section of the timeline is the multimodal material available on Mark 16. The online videos on the topic are notably increasing, including examples by Helen Bond on *Bible Odyssey*, or by Bart Ehrman and Dan Wallace.[72] Such material has to be considered, analyzed, and compared to the written production of these scholars: what does the oral rhetoric change about their argumentation? What does it reveal or make unclear? The interplay between images, texts, and sounds is one of the major features of digital culture, and invites the production of multimodal editing tools, such as eTalks. We have published two eTalks[73] presenting the first step of the project:

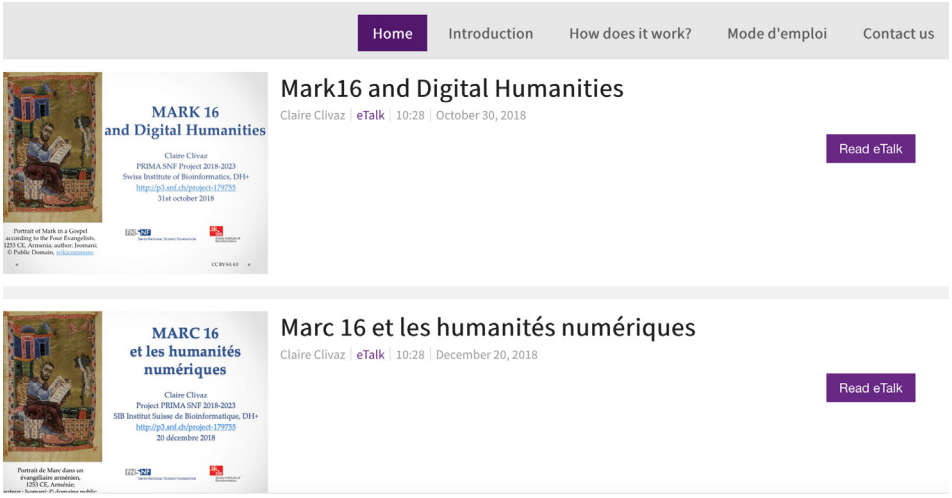

Figure 2. eTalks https://etalk.sib.swiss/dh/

Another important change in digital scholarly practices that the project wishes to inculcate is the fostering of diversity in opinion. The challenge here is to translate into a VRE the preoccupation of the French historian

72 http://www.bibleodyssey.org/tools/video-gallery/w/what-is-the-ending-to-marks-gospel; https://www.youtube.com/watch?v=c1zmaVU UzMU; https://www.youtube.com/watch?v=wEnKMLpclUc.

73 https://etalk.sib.swiss/dh/. For a presentation of this new multimodal editing tool, see Clivaz, Pache, Rivoal, and Sankar, "Multimodal literacies." This video explains how an eTalk works: https://etalk.sib.swiss/dh/mode-demploi/.

François Hartog: is it possible to write history from the point of view of both the losers and the winners?[74] In principle, within a VRE, DH research provides several skills worth discussing from diverse points of view. However, previous historical VREs are often focused on making resources available and mapping them, rather than on debates.[75] MARK16 will build a new tool to allow for scholarly debate around MARK16 to be visible on the VRE, that is the interpretation tool. It is an editor that allows scholars to answer a particular scientific question or hypothesis by browsing and selecting items that could support their hypothesis. Then the collected items will be classified by argument to build an argumentative section and to allow for oral comments. The collection of items and their classification can be easily performed using a user-friendly editor interface.

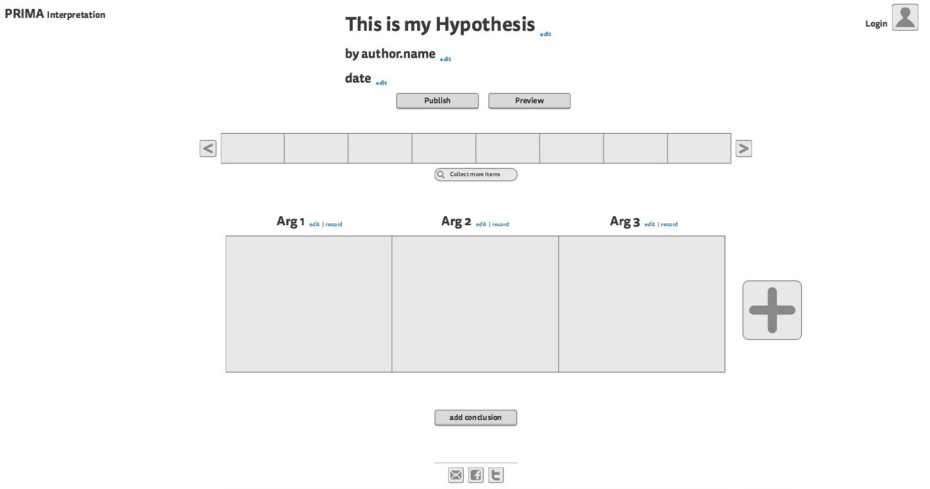

Figure 3. Sample Hypothesis Template

By relying on visual elements and orality, the visualization of the hypothesis will be feasible using a viewer interface. This historical "digital storytelling" should be "able to design content that makes a lasting impact on [the] audience."[76] Considered from this angle, the project nears the traditional task of the historian as described by the second century CE author Lucian of Samosates, a historian's audience was supposed to applaud to express its agreement.[77] A voting function will allow MARK16 users to vote for their preferred MARK 16 "historical digital storytelling."

In this diversity, there will of course be a space for my own hypothesis on MARK16, which I will explore in the project. My working research hypothesis can be articulated in the following way: the key element to understanding what might have been erased from earlier Markan versions should be the analysis of the disciples' emotional reactions in front of Jesus' apparitions. These can be expressed by diverse feelings. For example: fear (Mark 16:8; Luke 24:37; *Gos. Pet.* 57), grief (Mark 16:10; *Gos. Pet.* 59), "unbelief of joy" (Luke 24:41), or the laughing of the resurrected Jesus himself (*Ap. Jas.* 3.35–38).[78] Sarah's laughing and fear in LXX Gen 18:15 belongs to Mark 16's cultural background, as well as trouble and sadness in LXX Gen 45:3.[79] Such a historico-cultural background will be explored in MARK16 to make visible the diversity of points of view regarding the Jesus appearance stories in early Christian communities.

In digital culture, scholarship should certainly be more concerned with promoting diversity of opinions rather than proclaiming one definitive point of view. With the possibility of representing various opinions

74 Hartog, "Le témoin et l'historien," 14: "Alors que l'histoire des vainqueurs ne voit qu'un seul côté, le sien, celle des vaincus doit, pour comprendre ce qui s'est passé, prendre en compte les deux côtés. Une histoire des témoins ou des victimes peut-elle faire droit à cette exigence qu'emporte avec elle le très vieux mot d'*historia*?"

75 Robertson, "The Differences between digital history."

76 https://storytelling.design/storytelling.

77 Lucian of Samosates, *How to Write History*, § 49.

78 For preliminary inquiries, see Clivaz, "Incroyants de joie"; Clivaz, "What is the Current State."

79 Iverson, "A Further Word," 87.

of the past in a VRE, scholars should invest their efforts in representing the views of both the historical winners and losers. They should become more interested in research that is open to diverse scholarly voices and, for example, attempt to understand the *raison d'être* of several Greek NT editions,[80] rather than arguing for one of them against the others. After all, the Bible was transmitted in diverse great codices at the earlier centuries, in diverse communities, of which the codices Sinaiticus, Vaticanus, Alexandrinus, and Ephraemi Rescriptus are only echoes. After all, early Christians renounced the Diatessaron edition of the gospels, keeping four of them in their New Testament canon. Let the digital culture allow for diverse early and present Christian voices to be heard as a profitable gift of its impact in research.[81]

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81 Many thanks are due to Elizabeth Monier and Garrick Allen for proofreading the English of this article.

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Digital Humanities in Biblical Studies and Theology

Dan Batovici*

Digital Palimpsests: Mark in Trinity College Cambridge MS. O.9.27

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Abstract: The O.9.27 manuscript of Trinity College Cambridge is a minuscule manuscript of Hesiod's *Opera et Dies*. In a 2001 PhD thesis on Greek palimpsests in Cambridge by Natalie Tchernetska, this manuscript is described to contain two distinct lower scripts, one of which identified as a New Testament text. The author read four lines and a partial fifth of the one-leaf palimpsest that contain Mark 1:44, which is remarkable considering that the washing made the lower script virtually the same colour as the page. This note re-examines the Markan lower script in O.9.27 and offers an account of the use of image processing software for the purpose to uncover more text in a difficult palimpsest, a method useful when MSI is not available.

Keywords: Palimpsest; Gospel of Mark; lectionary

1 Introduction: a difficult palimpsest

Trinity College Cambridge MS. O.9.27 is a Greek minuscule codex with Hesiod's *Opera et Dies* 1–760.[1] It was donated to Trinity College by Roger Gale in 1738.[2] In the bottom margin of folio 1r there is a note ascribing the codex as having belonged to the famous collection of Cardinal Domenico Grimani (1461–1523).[3] In a PhD thesis focused on the Greek palimpsests hosted in various libraries in Cambridge, Natalie Tchernetska included the presentation of two distinct lower scripts in Trinity College Cambridge MS. O.9.27.[4] One of them is identified as a New Testament text, four lines of which she was successful in reading being from Mark 1:44.[5]

This aim of this short note is to present a method for digitally dealing with palimpsests when multi-spectral imaging (MSI) is not available which, as will be seen, will lead not only to reading additional text, but also to the identification of the initial manuscript as a lectionary. The following revisits therefore the palimpsest leaf which contains text from the gospel of Mark and offers a discussion of the use of digital image processing software for reading what otherwise is an almost completely washed off lower script. To that end, I first describe the issues that impede the reading of the lower script, followed by a presentation of the digital enhancement process used, and concluding with the results yielded when applied respectively to natural light digital images and UV digital images.

1 For a discussion of the transmission of *Opera et Dies* see West, "The Medieval Manuscripts of the Works and Days," 161–185.
2 The manuscript is now fully digitised (with descriptions) and can be found online at http://trin-sites-pub.trin.cam.ac.uk/james/viewpage.php?index=973. The Pinakes entry is available at https://pinakes.irht.cnrs.fr/notices/cote/12026/.
3 For a catalogue description of the manuscript see James, *The Western Manuscripts in the Library of Trinity College, Cambridge*, 470–472, here 471.
4 Tchernetska, *Greek Palimpsests in Cambridge*, 90.
5 I would like to thank Peter M. Head for drawing my attention to this palimpsest in the first place, Madalina Toca for a second eye on the transcription, Greg Paulson for the assistance in assigning the GA number to the Markan text, and the two reviewers of the Journal for their detailed comments.

***Corresponding author: Dan Batovici,** KU Leuven, Leuven, Belgium; E-mail: dan.batovici@kuleuven.be

Natalie Tchernetska's apt presentation of the palimpsest is a fitting starting point:

> The lower script I is rotated 180 degrees relative to the upper script and is faint, despite the fact that it is not fully covered by the upper script: only traces of a text in minuscules and of initials in red are visible (Plate 9a). The ruling text is of type Leroy 20E2; the text is written in two columns. The outlines of these letters are blurred and do not let us examine clearly its type of script and hypothesise its date. Nonetheless, with the help of digital enhancement (Plate 9b), I read the bottom line of the left column and several top lines of the right column on the verso of the flyleaf, which contain a fragment of the New Testament, Mark 1:44. The last words on the bottom line of the left column are]ὅρα μη/, and the first four top lines of the right column read / δενὶ μηδὲν εἴπῃ ἀλλὰ ὕ / παγε σεαυτὸν δεῖξον τῷ / ἱερεῖ καὶ προσένεγκε / περὶ καθαρισμοῦ σου[. […] It cannot be determined, however, when the flyleaf was added to the main body of O.9.27.[6]

This parchment flyleaf stands now as the third flyleaf of the manuscript (the other two are left blank and made of paper) and is followed by the first leaf with Hesiod's *Opera et Dies* (f. 1r). It is slightly smaller than the rest of the manuscript: it measures 16.5 × 25.5 cm, whereas the rest of codex measures around 18.5 × 27 cm. This too shows that it is a displaced leaf that has been added subsequently to the Hesiod manuscript.[7]

A significant impediment in reading the Markan text today is the result over time of the ruling of the page. On the one hand, it was not followed closely when copying the text which includes Mark 1:44: the ruling is set in a slight angle compared to the baseline of the lower text (which is placed, as said, on two columns, upside down in the newer binding). On the other hand, the ruling has been applied with perhaps too strong a pressure and, as a result, the general aspect of the page today is far from being that of a flat surface: the ruling now forms a grid of parallel arched waves in the parchment, of a rather high relief. Further complicating the matter, the lines of the grid cut through the middle of every other line of the lower script.

Yet the reading of the Markan text is substantially hampered by the fact that the washing off has made the lower script of virtually the same colour as the parchment, as can be seen in the image below, the bottom of the recto of the flyleaf. Edges of the script becomes slightly more visible under an UV lamp but unfortunately not enough for reading additional text.

Figure 1. Detail of O.9.27, flyleaf 3, verso. Used with permission from the Master and Fellows of Trinity College Cambridge.

6 Tchernetska, *Greek Palimpsests in Cambridge*, 98.

7 To put this in current codicological terminology—following Andrist, Canart, and Maniaci, *La syntaxe du codex*—the added overwritten leaf forms now a new 'circulation unit' (p. 61) with the Hesiod manuscript. Of interest here is the 'production unit' (pp. 59–60) with the Markan text, which was broken from its initial codex, effaced, as well as overwritten, and bound in the new codex, O.9.27 (tentatively, transformations D2 + A3 according to Andrist, Canart, and Maniaci, *La syntaxe du codex*, 81).

2 Method and results when using normal light digital images

Natalie Tchernetska's methodological solution for rendering readable the lower scripts of the palimpsests in the thesis is "digital enhancement," which indicates the computerized manipulation of the digital image of a manuscript page. This approach is used throughout the thesis, the latter including a descriptive chapter on the matter.[8] Tchernetska lists a number of ways to proceed in using a specialized software—Adobe Photoshop—and rightfully draws attention to the fact that digital enhancement would work even better when one starts from an UV digital photography, instead of a digital image in natural light.

However, none of the Tchernetska's described methods were effective on the O.9.27 palimpsest, since the colour of the lower script is too close to that of the parchment. As seen in the quotation above, digital enhancement was used in the case of this particular manuscript, but the exact method applied in its case is not described.[9] In any event, she transcribed the following text from the bottom of the left column (last two words of the last line), respectively from the top of the right column (four lines) on the verso of the flyleaf, from Mark 1:44, which are the areas in which the lower script is the most visible:[10]

δενὶ μηδὲν εἴπῃ ἀλλὰ ὕ
παγε σεαυτὸν δεῖξον τῷ
ἱερεῖ καὶ προσένεγκε
περὶ καθαρισμοῦ σου
... ...
]ὅρα μη

I had the chance to work with the manuscript on several sessions in the Wren Library of the Trinity College in 2010, with subsequent study visits in 2011 and 2014. Unfortunately, at that time it was not possible to produce in Cambridge UV digital images of the palimpsest leaf, or MSI. However, I did receive digital images with which I could work, through the kindness of the Wren Library custodians. In the following I will describe briefly my own solution for manipulating the digital image of the flyleaf—with the help of the Adobe Photoshop software—in order to read further text of the lower script.

The starting point is the fact that there are several possible formats for encoding a digital picture. The one which includes the highest number of possible colours and which is also the most common is the RGB colour space.[11] The RGB mode decomposes virtually any visible colour in three channels: Red, Green and Blue, whose initials form the name of this particular mode of image encoding. The three channels are overlapping, and from their combination over each pixel results in the colour we perceive on the screen. And conversely, when scanning an image, the visible colour is decomposed by the scanner's software in these three basic channels.

Since in the initial digital image the lower script has almost the same colour as the parchment itself, I proceeded to verify whether any of the three channels displays a more pronounced contrast between the script and page. I found that while the Red channel has almost no contrast at all, the Green and particularly the Blue channels offer at least some contrast between the script and the colour of the page, as can be seen in the image below.

8 Tchernetska, *Greek Palimpsests in Cambridge*, 133–144.

9 Ibid., 143.

10 Ibid., 98.

11 For a discussion of colour spaces in digital context see Plataniotis and Venetsanopoulos, *Color Image Processing and Applications*, 1–50. They classify the RGB space among the "physiologically inspired color models, which are based on the three *primaries*, the three types of *cones* in the human *retina*," of which "the Red-Green-Blue (RGB) color space used in computer hardware is the best known example" (p. 3).

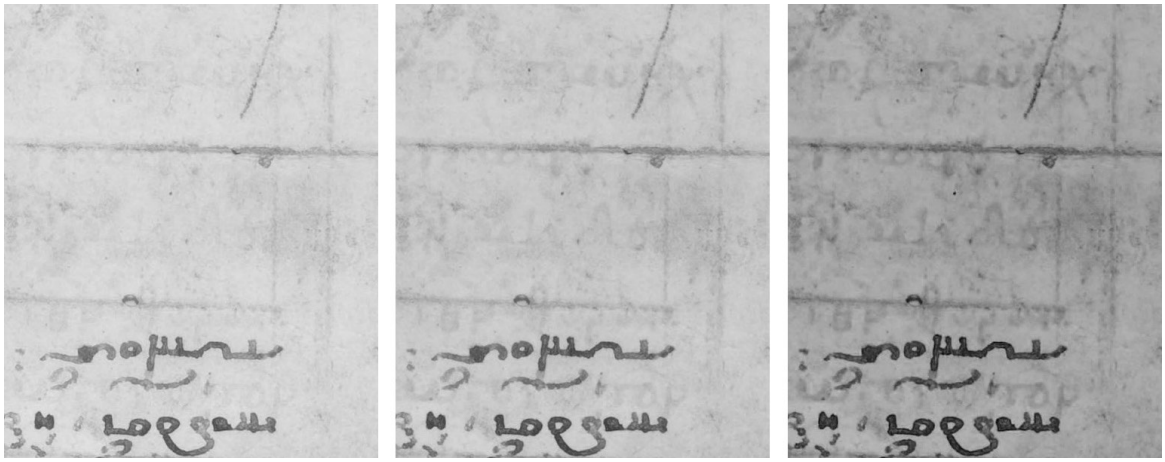
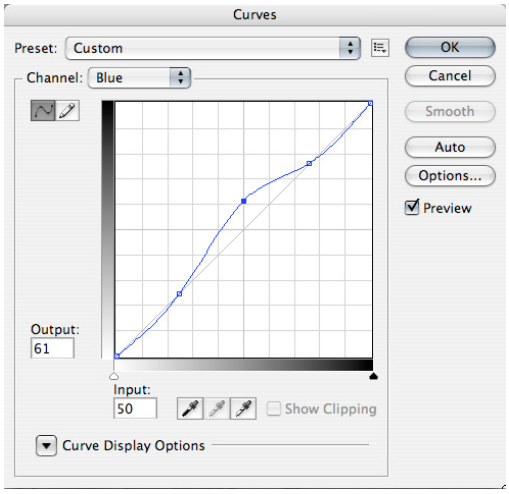


Figure 2. Trinity College Cambridge MS. O.9.27: detail of the Red, Green and Blue channels respectively, containing Mark 2:2. Used with permission from the Master and Fellows of Trinity College Cambridge.



Consequently, I digitally manipulated in various ways the two relevant channels, taking into account the peculiarities of this manuscript. For instance, since the lower script appears in these channels among the midtones and in a tone which is very close to that of the page, sharpening the overall contrast of the image would have just render the extant traces invisible. Using the Curves adjustment tool instead, however, one can add control points to the curve as in the image to the right in order to keep both highlights and shadows virtually unchanged (and therefore avoiding an overall sharpened contrast) which allow the user to only modify the middle tonal areas. This can result in an increased contrast between the lower script and its background, which is the desired effect, even though it does not result in an easily readable image. Additionally, in order to tone down the visual impact of the upper script, I have changed its colour into a neutral colour. For that, I produced a selection of all darker ink areas and created a layer with a grey filling within that selection, places above the layer containing the image of the manuscript.

Using these features and constantly comparing magnified areas in normal light and various manipulations creates an impression of the lower text in a number of places on the flyleaf. As a result, I was able to read most of the text that Tchernetska read, though departing from her transcription on one occasion. In addition, it was possible to ascertain the fact that the verso has 28 lines on each column and that the recto has a corresponding two-column text. More importantly, this allowed me to partially read further six lines—Mark 2:2–3—as well as several other disparate words and groups of letters in the two columns. Below there is the relevant fragment from the second column of the verso, lines 12–18, as shown on the digitally manipulated Blue channel.

12] συνηχ
13]λοι ωστε
14 χ]ωρειν μηδε
15 τα] π[ρος] τεν θυραν
16 και [ελ]αλει αυτοι[ς] τον
17 λογ]ον και ερχονται
18]παρα[

Figure 3. Detail of O.9.27, flyleaf, containing Mark 2:2. Used with permission from the Master and Fellows of Trinity College Cambridge.

Reading more text from Mark in the column opened new possibilities with regard to the question of grasping the initial state or purpose of the leaf, before it was washed off, overwritten and rebound as the third flyleaf in Trinity College Cambridge MS. O.9.27. The fact that this column starts with Mark 1:44 on its first four lines, reading then Mark 2:2–3 in lines 12–18, seemed to suggest a continuous text of Mark or at least a text which contains a larger, continuous, quotation from Mark. It also became apparent that between the 6th and the 12th line of the second column—which separate the two sections which were now transcribed, containing respectively Mark 1:44 and Mark 2:2–3—there is not enough space to accommodate both 1:45 and Mark 2:1.[12]

Although no such omission is signalled in NA28[13] (or in the editions of Tischendorf[14] and von Soden[15]), the apparatus in Swanson's edition shows that a number of continuous-text Markan manuscripts have lectionary markings at Mark 1:44 and 2:1.[16] This suggests therefore that the flyleaf, in as much as it omits Mark 1:45, is a lectionary and not a continuous-text manuscript of Mark.[17]

While this has produced new results, they were still limited in the absence of UV digital images, which would have provided a starting point with a sharper contrast between the ink of the lower script and the colour of the parchment than the digital images produced in normal light. Presumably, the further enhancement of this initial contrast could have resulted in a more legible image.

3 Using UV digital images

Fortunately, in October 2018 I was provided with UV digital images of the flyleaf of O.9.27 through the kindness of Mr. Sandy Paul, sub-librarian at Trinity College Library Cambridge, causing new impetus for this study. As expected, the initial image indeed contained a contrast similar to that obtained by processing the normal digital image as described above. To begin with, it contained more information and contrast on each of the three colour channels, as can be seen below. Incidentally, the Blue channel proved again to be the most useful. Again, by constantly comparing magnified areas in normal light, UV, and the various

12 While in lines 1–6 there are about 110 letters, there are about 250 letters in NA28 in Mark 1:45–2:1, to be distributed in six lines (7–12). While there is little that can be read in the palimpsest to verify this, it seems very unlikely to have had all this text squeezed in this space.

13 Aland et al. (eds.), *Novum Testamentum Graece*, 28th rev. edition.

14 Tischendorf, *Novum Testamentum Graece i* (8th ed.), 228.

15 Von Soden, *Die Schriften des neuen Testaments* II, 124.

16 Swanson, *New Testament Greek Manuscripts: Mark*, at 22 and 23.

17 For an introduction to lectionaries in the Greek tradition see Osburn, "The Greek Lectionaries of the New Testament," 93–113. On p. 95 Osborn notes: "As distinct from continuous-text MSS, lectionary MSS are those in which the text of the NT is divided into separate pericopes, or lections, rearranged according to the fixed order in which they are read as lessons for the church on particular days during the year. Such MSS, currently numbering over 2,400, make up approximately 40 percent of all extant Greek MSS of the NT." On the use of lectionaries see Petras, "The Gospel Lectionary of the Byzantine Church," 113–140.

manipulations of each, one gets a better-informed impression of the lower text, even though only in a number of places on the flyleaf. Most of it remains too well washed off or covered by the upper text.

Figure 4. Trinity College Cambridge MS. O.9.27: fragment of the Red, Green and Blue channels respectively, in UV light. Used with permission from the Master and Fellows of Trinity College Cambridge.

Digital UV images proved helpful. As a first result of the method described above, it was possible to read in lines 5 and 6 further text from the remainder of 1:44, including its last word—αυτοι[ς—at the end of line, ascertaining that the whole verse was there. More importantly, in line 7 εκ κα(τα) μαρκ(ον) became readable. This is a common abbreviation for a liturgical incipit which introduces a liturgical reading from Mark, whose presence between Mark 1:44 and the beginning of Mark 2 confirms that the leaf comes from a lectionary.[18]

In Trinity College Cambridge MS. O.9.27 verse 1:44 is certainly included up to αυτοις, and it can also be verified that verse 45 is left out entirely. The introduction to 2:1 is still not legible, but there are traces of decoration in red ink in the margin (noted by Tchernetska) as well as further traces of a spiralled decoration in the same ink as the lower text. However, there is no general sense of what symbol they may have formed before being washed. Riddle, who has studied the lectionary text of Mark, does not include the ending of Mark 1 in his discussion,[19] yet Colwell notes that "Mark's Gospel supplies the lections for the Saturdays and the Sundays of Lent."[20] Both their collation[21] and Gregory's study[22] concur in placing the reading of Mark 1:35–44 in the second Saturday of Lent,[23] and Mark 2:1–12 in the second Sunday of Lent, preceded by Mark 2:28–3:5 (on the first Saturday of Lent) and John 1:44–52 (first Sunday), and followed by Mark 2:14–17 (third Saturday), and Matt 25:1–13 (third Sunday). Consequently, it was possible to read most of the first nine lines of the two columns on the other side, with passages from Mark 2:5–6 and 2:11–12 respectively.

18 Biblioteca Vallicelliana MS D 63 offers a more accessible parallel: it is a 12th century lectionary—*l.* 137—of a similar dimension (18.5 × 23.7, compared to 16.5 × 25.5 of O.9.27), also written in two columns. On the bottom half of folio 12r there is virtually the same situation: the reading from Mark 1:44 ends in α προσταξεν Μωσης εις μαρτυριον αυτοις and does not include verse 45 at all. This is followed by the abbreviated indication, written in red ink, that another reading from Mark follows, and then an incipit introduces Mark 2:1 and goes up to 2:5 on the second column. Digital images of the manuscript are available online at http://www.internetculturale.it/jmms/iccuviewer/iccu.jsp?id=oai%3Awww.internetculturale.sbn.it%2FTeca%3A20%3ANT0000%3ARM0281_Vall_D_63&mode=all&teca=MagTeca+-+ICCU. The Pinakes entry is https://pinakes.irht.cnrs.fr/notices/cote/56319/.

19 Riddle, "The Character of the Lectionary Text of Mark in the Week-Days of Matthew and Luke," 21–42.

20 Colwell, "The Contents of the Gospel Lectionary," 3.

21 Colwell and Riddle, *Prolegomena*, 117.

22 Gregory, *Textkritik des Neuen Testamentes* 1, 361.

23 As do the annotations collated by Swanson from continuous Markan manuscripts; Swanson, *New Testament Greek Manuscripts: Mark*, 23.

However, the method used in this short note was not successful for reading the flyleaf entirely. In this sense, this a provisional and partial transcription of the manuscript. Most of the text remains unreadable because it is very well washed out and for most areas also covered by the upper script. What I was able to read was enough to ascertain that this is a lectionary, and also that the recto of the flyleaf contains the continuation of the lectionary reading started on the second column of the verso. What follows is the updated transcription of the flyleaf (using Vallicelliana MS D 63 as the base text), with no attempt at a full edition or textual commentary, which will have to await the perusal of multi-spectral imaging (MSI). Until then, the advances possible through this method are establishing this is a lectionary and reading additional text on both sides. It is hoped that this note will succeeds in drawing attention to this curious, misplaced, lectionary leaf.[24] Until then, the lectionary text of Mark on the flyleaf has received the Gregory-Aland designation L2484 from the Institut für Neutestamentliche Textforschung in Münster.

Table 1. Trinity College Cambridge MS. O.9.27, flyleaf 3 verso

		1	δενι μηδεν ειπης αλλα υ	Mk 1:44
		2	παγε σεαυτον δειξον τω	
		3	ιερεῖ και προσενεγκε	
	...	4	περι του καθαρισμο[υ σου	
	τας ε]	5	α προσε]ταξε[Μωυσ	
Mk 1:38	χομεν[ας κωμοπολεις]	6	ης εις μ]αρτ[υ]ριον αυτοι[ς	
	ινα κ[αι ε]κει [κηρυξω εις]	7	]δ[ ] εκ κα μαρκ	
	του[τ]ω γαρ [εξεληλυθ]α	8	]ει	Mk 2:1
Mk 1:39	κα[ι]	9	σηλθε]ν ο [ις εις] κα	
	...	10	περνα[υ]μ και η	
	] εις	11		
	οληην την γαλιλαι]αν κ(αι)	12	κ]αι ε[υ]θεως συνηχ	Mk 2:2
	τα δαιμ[ονια εκβ]α	13	θησαν πολ]λοι ωστε	
	λλ[ων	14	μηκετι χ]ωρειν μηδε	
	...	15	τα] π[ρος] την θυραν	
		16	και [ελ]αλει αυτοι[ς] τον	
		17	λογ]ον και ερχονται	Mk 2:3
		18	π]ρο[ς] α[υτο]ν παραλυτι	
		19	κ[ον] φερον[τες	
		20		
		21		
		22		
		23		
		24		
		25		
		26		
		27		
Mk 1:44		28		
	και λεγει] αυτω ορα [μη			

Table 2. Trinity College Cambridge MS. O.9.27, flyleaf 3 recto

Mk 2:5	λεγει τω παραλυτικ[ω] τεκνον	1	παραλυτικω σοι λεγω	Mk 2:11
	αφε[ων]ται σοι	2	εγειρε αρον τον κραβαττον σου και]	
Mk 2:6	αι αμαρτιαι [σο]υ ησαν	3	υπαγε εις [τον	
	[δ]ε [τινες τ]ω[ν γραμ]ματε	4	οικο]ν σου [κ]αι [ηγ]ερ[θη ευθως και	Mk 2:12
	ω[ν εκει καθημενοι] και	5	αρ[ας τον κραβα[ττο]ν [ε]ξηλθεν	
	[διαλογιζομ]ενοι [εν] τα[ις] κ[α]	6	[εναν]τιον παντων	
	ρδιαις αυτων [τι] ουτως λαλει β]	7	ωστε [ε]ξ[ιστασθαι παν	
	λασφημι[ας	8	τας και δ[οξαζειν	
	...	9	...	
		10		

24 Producing critical editions of lectionary texts is still a desideratum: Paulson, "A Proposal for a Critical Edition of the Greek New Testament Lectionary," 121–150.

4 Concluding remarks

The advances presented above in reading the text of Trinity College Cambridge MS. O.9.27 do not, unfortunately, overcome one of the initial problems posed by the flyleaf palimpsest: the blurriness of the erased lower script continues to hinder any sensible approximation of the dating, even after the digital manipulation of UV images. It still stands that it was written before the late 13th century, a *terminus ante quem* given by Tchernetska's dating of the upper script.[25] Other than that, it is rather difficult to describe the script, since so little of it can be read, and in a precarious way, even if one can get an impression of it during examination. The script seems to have a squared manner in the writing of the letters, to write και with the κ written separately from αι, and the two angled strokes of the former jotted down separately from the vertical strokes. There is virtually only one ligature (ει).

As to the initial function and state of the Markan text before being washed and overwritten, Natalie Tchernetska suggested a number of possibilities: "It is plausible that the original manuscript contained either a liturgical text of the kind in which scriptural readings are frequent (for example, a prayer book or a lectionary); or some other Christian text where NT fragments might be cited, such as a commentary or a homily; finally, it could have been a modest NT manuscript copied for private use."[26] Following the use of digital UV images, we can now better determine its purpose, and show that the palimpsest which has been washed and repurposed as a flyleaf in Trinity College Cambridge MS. O.9.27 was initially, or has been copied from, a lectionary.

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25 Tchernetska, *Greek Palimpsests in Cambridge*, 92.

26 Ibid., 98.

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Digital Humanities in Biblical Studies and Theology

Sara Schulthess*

The Bible in Arabic: Digital Resources and Future Challenges

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Abstract: The aim of this article is to discuss the current state of Arabic Bible studies from a Digital Humanist perspective. It presents an overview of the current existing digital resources, such as digital manuscript collections, and underlines the importance of developing digital projects for the study of Arabic versions of the Bible with a focus on the New Testament. It will also shed light on future challenges and the urgent needs of the scientific field in order to harness the full potential of digital scholarship.

Keywords: Arabic versions; New Testament manuscripts; Digital Humanities; Collaborative; Digital edition; Open access

1 Introduction

The impact of digitization on Humanities research is enormous and is effecting changes in every discipline. In this issue, Garrick Allen and Claire Clivaz underline the impact of Digital Humanities in the field of New Testament studies, the Greek New Testament, and its manuscripts in particular. Many digital efforts have been centred on textual criticism and the critical editing of the Greek New Testament: "For about two decades, the digitization of manuscripts and the exploration of new editorial possibilities have fostered new trends in NT research and sparked lively reflections and conversations among [New Testament textual criticism] scholars."[1] Given these developments, can the same be observed regarding the study of the New Testament in Arabic or the study of the Arabic Bible in general?

The Arabic tradition is not a well-known topic in Biblical studies. Despite the variety of translations, the high number of manuscripts,[2] and the interesting transmission history of the Bible in Arabic, very little research has been conducted in this field. While there was a certain amount of scholarly interest in 17–18th centuries,[3] Western research rapidly turned away from Arabic versions of the Bible. New Testament scholarly disinterest in this respect is particularly striking. However, a rising interest in the Arabic versions began a decade ago with a remarkably high number of new projects and publications appearing. A notable hallmark with respect to New Testament studies was the 2012 publication of Hikmat Kashouh's thesis in the

1 Clivaz, "The Impact of Digital Research", 4. See also Allen, "Digital Tools."

2 For the New Testament, there are more than 200 manuscripts of the gospels and more than 190 manuscripts of the Pauline Epistles.

3 Vollandt, "Some Historiographical Remarks."

***Corresponding author: Sara Schulthess,** Swiss Institute of Bioinformatics, Lausanne, Switzerland;
E-mail: sara.schulthess@sib.swiss

series *Arbeiten zur neutestamentlichen Textforschung*.[4] Previous publications have supported this renewal that certainly has roots in digitally linked evolutions in New Testament studies.[5]

Former research in the field suffered from the way in which Arabic versions were approached as being not "useful" for the reconstruction of the original Greek texts.[6] The concept of "original text" and its reconstruction methods have now been questioned for decades; the possibilities offered by digital technologies play an important role in this respect. In the digital age, manuscripts have increasingly become the focal point and critical editions are no longer the main reference.[7] This reorientation applies not only to Greek witnesses, but it also contributes to the development of the study of New Testament versions, Arabic included.

The question then arises: will this impulse lead to concrete digital projects and research? It should soon become apparent that we are in a nascent stage. In addition, the current situation can be felt as ambivalent. It is probably clear to all scholars involved in the study of the Arabic Bible that Digital Humanities can help from many perspectives but the emergence of new methods and tools that require important training might also seem unfair. It is an extra effort added to those already required to work in the Arabic Bible field: It is worth mentioning here the informational work that is necessary to obtain recognition within Biblical Studies and more generally funding; or the difficulty to acquire the various required competences.[8] This summary of Samir Khalil Samir remains in many respects valid:

> The situation is particularly difficult, since there is practically no chair of Christian Arabic studies. There is similarly almost no specialized institute in this field, nor a journal, nor a regular bibliography, etc. Everyone is obliged to work on their own, doing the best they can.[9]

The tensions that appear at the confluence of marginal fields and Digital Humanities have been discussed by Caroline T. Schroeder, who argues that Digital Humanities should be considered as a new cultural capital:

> Understanding Digital Humanities advances as cultural capital exposes the tension many scholars engaged in – or even just interested in – digital or computational work experience. Many of us feel compelled to "catch up" with our peers in English Departments while also feeling powerless to do so.[10]

To be aware of Digital Humanities as cultural capital and thus the inequalities it may produce does not mean that we should not try. Firstly, it is by being part of the Digital Humanities landscape that even marginal fields can help to define what Digital Humanities should be. Schroeder shows that Coptic documents question some of the TEI-XML standards; she also advocates for the acknowledgment of editing and encoding work as a core Digital Humanities practice, an aspect that is particularly true for the study of the Arabic Bible, which is still exploring its enormous textual diversity. This willingness to see the study of the Arabic Bible as a "Digital Humanities critical participant" has motivated the present article as well as the author's own projects (see section 4.1).

Secondly, seeing Digital Humanities as a form of cultural capital helps to develop strategies. As Schroeder explains, "We need to cultivate privileged allies (cross-disciplinary collaborations, inter-institutional collaborations), and to recognize our own power within the academy."[11] Here one could also add the

4 Kashouh, *The Arabic Versions of the Gospels*.

5 Schulthess, *Les manuscrits arabes des lettres de Paul*, 15–68. Schulthess, "Les manuscrits du Nouveau Testament, le monde arabe et le digital."

6 See Schulthess, *Les manuscrits arabes des lettres de Paul*, 37–41; Gibson et al., "The Bible in Arabic."

7 Clivaz and Hamidovic, "Critical Editions in the Digital Age."

8 E.g. philological competences. Studying one Arabic version often requires the mastering of two or three other languages. Zaki explains, regarding the Pauline letters in Arabic, that "These versions are either new translations made from Greek, Syriac, Coptic, or Latin *Vorlagen*, or reworkings of an existing Arabic version through either collation against another *Vorlage* or against another Arabic version. The final result of such collations is a text profoundly different from the original(s), with its own history of transmission into several recensions" (Zaki, "The Textual History of the Arabic Pauline Epistles," 392).

9 Samir, "L'avenir des études arabes chrétiennes," 25. My translation.

10 Schroeder, "The Digital Humanities as Cultural Capital," 37.

11 Ibid., 45.

importance of openness that goes along with collaboration. Clivaz argues that "research communities in Humanities who will maintain a focussed approach at the methodological level but openness at the point of publication have great potential to produce new knowledge and discoveries."[12]

Openness should not only apply at the point of publication; it is also important to support open research that includes open source and open data alongside open access. Collaboration and openness are at the core of a constructive digital research and particular attention will be paid to these aspects in what follows.

2 Networks and collaborations

Something that may seem obvious to us in the digitized world of today is the importance of scholarly networks facilitated by the internet. Scholarly networking is an important aspect of research and its value has increased dramatically via email exchanges and the internet. Already in 1996, this evolution was compared to "the invention of the printing press in its impact upon research and education" in the prospective book *Computer Networking and Scholarly Communication in the Twenty-First-Century*.[13] Networking is also intrinsically related to the beginnings of the Digital Humanities, which started as more of a community than a discipline (it is arguably still the former rather than the latter). Susan Hockey highlighted in her "History of the Humanities computing" the importance of the *Humanist*:

> Networking, at least for electronic mail, was previously confined to groups of computer scientists and research institutes. By the mid-1980s, facilities for sending and receiving electronic mail across international boundaries were provided by most academic computing services...At the ICCH conference in Columbia, South Carolina, in spring 1987 a group of people mostly working in support roles in humanities computing got together and agreed that they needed to find a way of keeping in touch on a regular basis...*Humanist* has become something of a model for electronic discussion lists...*Humanist* has become central to the maintenance and development of a community and it has made a significant contribution to the definition of humanities computing.[14]

In case of the New Testament in Arabic, it is important to mention the existence of the NASCAS network. NASCAS (North American Society for Christian Arabic Studies) is defined as: "an e-mail discussion group, committed to promoting the study of Arabic-speaking Christian communities, their literature, and their history. Contributions in English or French are welcome. All discussions are academic, non-confessional, and non-political."

Started in 2009 by Alexander Treiger,[15] this Google group is still very active. As in other scholarly lists, it is used for information exchanges regarding future events, current research, references, locations of manuscripts, etc. In the case of NASCAS, the involvement and the accessibility of many recognized scholars, such as Samir Khalil Samir, is particularly notable. In addition to knowledge sharing, this direct academic contact between scholars is valuable especially for young researchers or new people in the field.

One may imagine that such networks are instrumental in the creation and development of collaborative research, which is unusual in Humanities disciplines and an important Digital Humanities topic. In 2007, Christine L. Borgman harshly stated that "the humanities are at the opposite extreme from the sciences, where 'collective cognition' is valued. They have the lowest rates of coauthorship and collaboration of the disciplines, with the higher rates of collaboration occurring in digital projects. E-Research is expected to promote collaboration in the humanities, due to the size of projects and the range of expertise required."[16]

Can increased collaboration be observed in the Arabic Bible field since Borgman's 2007 statement? In response to this question, the collaborative aspects of existing digital projects are highlighted in Section 4 below. While it did not necessarily start from a digital perspective, it is worth mentioning here the *Biblia*

12 Clivaz, "Internet Networks and Academic Research," 159.
13 Harrison and Stephen, *Computer Networking and Scholarly*, xi.
14 Hockey, "The History of Humanities Computing."
15 https://groups.google.com/forum/#!topic/nascas/jTtblj4y4IM; NASCAS also has a website: http://www.christianarabic.org/, which is no longer updated. All links were last accessed 31 March 2019.
16 Borgman, *Scholarship in the Digital Age*, 219–20, cited by Fitzpatrick, *Planned Obsolescence*, 24.

Arabica project (2012–2018). This research project started at the Freie Universität Berlin and Tel Aviv University. In 2015 the German base of the project moved to Ludwig-Maximilians-Universität Munich. The objectives were "to close scholarly lacunae and provide an infrastructure for a dynamic and fast-developing field."[17] It is clear that the partners of *Biblia Arabica* did excellent work in bringing scholars together and establishing a productive dynamic between them, notably by organising several international meetings on the Arabic Bible and panels at SBL and EABS dedicated to this topic. At the beginning of 2019 the *Biblia Arabica* project became a consortium for scholars interested in the Arabic Bible: "It will continue as an international platform for research in the field, providing an infrastructure and an umbrella for independent research projects."[18]

The bibliographical tool the *Biblia Arabica* team has developed as a collaborative project will be presented in detail in Section 4.2. The blog that welcomes academic contributions is another notable feature.[19] Finally, with respect to co-authorship, it is also worth pointing out that a recent publication of the *Biblia Arabica* collaborators has five (co)authors.[20] Multiple authorship is a common practice in many of the natural and social sciences, which may extend to the Humanities due to the redefinition of authorship in a digitized environment.[21]

3 Access to sources and research

3.1 Manuscripts

One important step is access to primary sources, manuscripts, through scanned microfilms or preferably born-digital images. This is particularly important for the study of the Arabic Bible because of its nascent stage. In fact, only a few versions are edited and most researchers have to work directly with manuscripts. Access to manuscripts is also crucial for the development of digital research: "Content-based digital resources produced for humanities scholars generally start with a period of digitization of primary source material."[22] The digitization of interesting manuscripts for the study of the Arabic Bible often depends on libraries' policies. In her article, Schroeder underlines that digitization processes tend to reproduce research inclinations: "Although the internet and digitization have been heralded as means of widening and democratizing access to information, digitization efforts – like research in the academy in general – replicate the pre-digital centrality of the Western canon in a new digital canon."[23]

While it is not the aim of this article to list all the digital collections containing Arabic manuscripts of the Bible, I mention the main collections and point toward the online availability of some well-known and interesting New Testament manuscripts. A large number of manuscripts can be found in European libraries, which include the Bibliothèque Nationale de France in Paris, the Vatican Libraries in Rome, the British Library in London, and many others.

17 Vollandt, "*Biblia Arabica* Becomes a Consortium."
18 Ibid.
19 https://biblia-arabica.com/category/blog/.
20 Gibson et al., "The Bible in Arabic."
21 As predicted by Fitzpatrick: "To some extent, all of the texts published in networked environments will become multi-author, by virtue of their interpenetration with the writings of others; our task will be, first, to acknowledge the ways that our work has always been collaborative, relying upon texts that precede and follow, and second, to understand the collective not as the elimination of the individual, but rather as composed of individuals." Fitzpatrick, *Planned Obsolescence*, 24.
22 Terras, "Digitization and Digital Resources in the Humanities," 56.
23 Schroeder, "The Digital Humanities as Cultural Capital," 27.

In *Gallica*, the Bibliothèque national's digital library, it is possible to consult at least 55 Arabic manuscripts that are related to the Bible.[24] It is, for example, possible to consult colour photographs of Paris BnF arabe 6725, that contain fragments of the New Testament from the 9th century.[25]

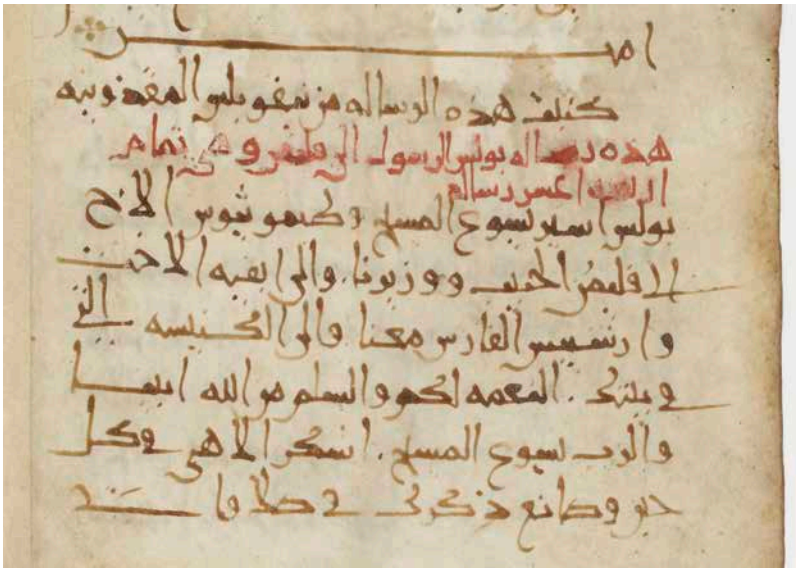

Figure 1. Paris BnF arabe 6725 folio 9v Beginning of Philemon © Bibliothèque nationale de France

For Paris BnF grec supplément 911, an 11th century Greek-Arabic codex of the Gospel of Luke, Gallica offers only images of the microfilms.[26]

Another important digital library is *DigiVatLib*, a Vatican Library project that aims to digitize the entire Library's collection of manuscripts. The project is of great importance for the Arabic Bible as many important manuscripts are stored at the Vatican Library. Available online are images of manuscripts such as Vat. Ar. 13, a fragmentary codex containing parts of the Gospels and the Pauline letters, its oldest folios dating back at least to the 9th century;[27] Vat. Copt. 9, a bilingual Coptic-Arabic Gospel manuscript (ca. 1204 CE);[28] Vat. Ar. 12900, which contains a Latin-Arabic bi-folio of Galatians that may date back to the 9th century.[29]

In terms of clerical collections, St. Catherine's Monastery at Mount Sinai is the most important. The Library of Congress has now made its microfilm collections, captured by Kenneth W. Clark during his 1949 expedition, available online.[30] Among these manuscripts, one can find for example Sin. Ar. 72 (Gospels, copied in 897) and Sin. Ar. 151 (Praxapostolos, 9th–10th century). The University of California Los Angeles (UCLA) is collaborating with the Early Manuscripts Electronic Library (EMEL) on a promising digitization project. It was announced that a UCLA library grant "will fund key aspects of the Sinai Library Digitization Project to create digital copies of some 1,100 rare and unique Syriac and Arabic manuscripts dating from the fourth to the 17th centuries...the UCLA Library will host the images online on behalf of the monastery."[31]

24 Results with "Bible" as subject and "Arabe" as language.It is necessary to stress that searches on Arabic manuscripts of the Bible cannot be restricted to "Arabic." Many polyglot manuscripts exist in Greek, Syriac, Coptic, or Latin collections. In addition, manuscripts written in garshuni (Arabic language using the Syriac alphabet) are generally listed in Syriac catalogues.

25 https://gallica.bnf.fr/ark:/12148/btv1b8406179n.

26 https://gallica.bnf.fr/ark:/12148/btv1b110040650.

27 https://digi.vatlib.it/view/MSS_Vat.ar.13.

28 https://digi.vatlib.it/view/MSS_Vat.copt.9.

29 https://digi.vatlib.it/view/MSS_Vat.lat.12900.

30 https://www.loc.gov/collections/manuscripts-in-st-catherines-monastery-mount-sinai.

31 http://newsroom.ucla.edu/stories/ucla-library-to-offer-digital-images-of-rare-ancient-manuscripts-in-egypt. See also https://nypost.com/2019/04/17/ancient-christian-manuscripts-digitized-at-mount-sinai-monastery. *Biblia Arabica* might collaborate on the cataloguing: https://biblia-arabica.com/news/biblia-arabica-team-meets-with-partners-in-athens-to-discuss-cataloguing-of-mt-sinai-manuscripts/.

In another collaboration with EMEL, there is also the *Sinai Palimpsests Project*, funded by Arcadia, which aims to make Sinai palimpsests readable using spectral imaging and to offer an online digital library of the palimpsests featuring high-quality digital images.[32] Images of seventy-four palimpsests with extensive metadata are accessible online, among them important manuscripts for the Arabic Bible such as Sin. Ar. NF 8 and Sin. Ar. NF 28. The project has selected experts for the scholarly side according to their language(s) of expertise and editions are in preparation. It is stated that the participating scholars have the first right of refusal to prepare editions of palimpsests that they have worked on.

The work done by the *Hill Museum & Manuscript Library* (HMML) also has great potential: the organisation identifies manuscript collections around the world that need photographic preservation. One of its missions is "digitally preserving rare and endangered manuscripts."[33] HMML has an important Eastern Christian collection including Arabic manuscripts. A search for Arabic Bibles in the Virtual reading room returns more than 250 records.[34] Consultation of the images requires a free registration.

The Committee for the Promulgation of Ancient Religious Texts at the Brigham Young University should also be mentioned here. This organisation provides digitized microfilms of Christian Oriental manuscripts including collections of the Coptic Catholic Patriarchate, the Coptic Museum and the Coptic Orthodox Patriarchate in Cairo, St. Mark's Monastery in Jerusalem, and the St. Thomas Catholic Church in Mosul.[35] Additionally and important for the Cairo Genizah and other Jewish collections are the Cambridge Digital Library[36] and the Friedberg Project.[37]

3.2 Books and journals

Access to publications is another important challenge when it comes to studying the Arabic Bible. During the XI International Congress of Christian Arabic Studies in Rome, Samir advocated for a "bibliothèque digitale du patrimoine chrétien," encouraging the creation of a platform for existing literature. Such an initiative would make Christian Arabic works accessible to scholars limited to under-resourced libraries, particularly in the Middle East.[38] This proposed initiative touches upon the issue of open access. Two series have recently started, published by Brill, are of importance for the Arabic Bible: *Biblia Arabica* and *Arabic Christianity Texts and Studies*.[39] However, these series are unfortunately not in open access.[40]

The tension that appears between openness and validation or authority has been discussed by many.[41] In many respects, scholars depend on publishers. Ziyad Marar notes that "early career authors need to build their reputations and thereby their claims to authority; publishers have a crucial role to play in this process."[42] In the case of the Arabic Bible, it is not that the authors are necessarily "early career authors" – even if the number of young scholars involved in positive – but that the field itself is "in its infancy."[43] This situation, therefore, creates a need for Academic validation, leaving little room for negotiations with publishers. Thus, it may be worth finding intermediate solutions, as argued in Section 5.

32 http://sinaipalimpsests.org/about-project.
33 http://hmml.org/about/.
34 https://www.vhmml.org/readingRoom/.
35 https://cpart.mi.byu.edu/home/manuscripts/.
36 https://cudl.lib.cam.ac.uk/collections/genizah/1.
37 https://fjms.genizah.org/; Gibson et al., "The Bible in Arabic."
38 Samir, "Situation actuelle de la recherche dans le domaine arabe chrétien: Projets communs souhaitables," presentation at the International Conference of Christian Arabic Studies, Rome, 2016.
39 https://brill.com/view/serial/BIAR; https://brill.com/view/serial/ACTS.
40 My own PhD thesis was published in open access thanks to a Swiss National Science Foundation publication grant; Schulthess, *Les manuscrits arabes des lettres de Paul*.
41 See e.g. Eve, *Open Access and the Humanities*.
42 Marar, "Creating Scholarly Knowledge in the Digital Age," 83.
43 Griffith, *The Bible in Arabic*, 1.

4 Digital projects

4.1 *Tarsian* and *HumaReC*

Tarsian and *HumaRec* are two projects that included scholarly editions of parts of New Testament Arabic manuscripts embedded in a manuscript viewer. *Tarsian* was developed within the framework of my doctoral research.[44] Following the new Swiss National Science Foundation policy in favour of open access, it was decided to add a digital edition of the First Letter to the Corinthians in Vat. Ar. 13 to the project. Encoded in TEI-XML, the Arabic text is supported by a French translation and enhanced features developed on the basis of open source software created by EVT.[45] This version was published between February and July 2016. The encoded files are available under a CC BY-ND 3.0 license.[46]

HumaReC is in many respects a continuation of this first project[47] and it focuses on the changes in the publication of digital research. The project's open access platform includes a manuscript viewer, a research blog, and a "web book."[48] The object of study is Marciana Gr. Z. 11 (379), a codex that contains the Acts, the Catholic Letters, and the Pauline Letters in Greek, Latin, and Arabic. *HumaReC* focuses on the proto-Pauline Letters. *HumaReC* is not *per se* a collaborative project; however, the principle of continuous publishing that was developed during the project allows for incorporation further material at any time, whether from the editorial board or from users of the platform. As for the *Tarsian* project, the manuscript viewer was created with the help of the EVT software. The text in Greek, Latin, and Arabic is encoded in TEI-XML and is available under the CC BY 4.0 license.[49]

4.2 The online *Bibliography of the Arabic Bible*

The *Biblia Arabica* project in Munich launched an online tool in November 2018. The *Bibliography of the Arabic Bible: A Classified and Annotated History of Scholarship*[50] is intended to be a comprehensive, classified, and searchable reference tool for secondary literature:

> Each bibliographic item has an entry displaying a full reference, summary of the content, manuscripts mentioned, a digital identifier (Uniform Resource Identifier or URI), and links to open-access online versions of the item where available. Items have been classified by the biblical books, translators, communities that used the translations, and subjects to which they refer...While this bibliography is not a space for hosting digital facsimiles, it will provide a hub linking users to the growing multitude of resources already available online.[51]

The *Biblia Arabica* bibliography is remarkable in many aspects. From the beginning this project was collaborative and it still encourages users to become contributors. The fact that it is based on Zotero makes it easy to share one's bibliographic collection. It is also exemplary with regard to its openness:

> The *Biblia Arabica* bibliography module is a customizable software framework for displaying bibliographic records on the web in an open-access, searchable interface. Records are created and maintained in Zotero, a widespread and easy-to-use

44 https://tarsian.vital-it.ch/about/. The research project "The Arabic Manuscripts of the Letters of Paul of Tarsus. Come back to a neglected field" (2013-2016) was led by Claire Clivaz (SNF Project 143810).
45 Clivaz, Schulthess, and Sankar, "Editing New Testament Arabic Manuscripts." For EVT, see http://evt.labcd.unipi.it/.
46 https://github.com/msank/tarsian-tei.
47 The research project "HumaReC – Humanities Research and Continuous Publishing: a digital New Testament test-case" (2016-2018) was led by Claire Clivaz (SNF Project 169869). Clivaz, Schulthess, and Chasapi, "HumaReC."
48 The research platform received an ISSN from the Swiss National Library (ISSN 2504-5075) and is catalogued by *Helveticat*: http://permalink.snl.ch/bib/sz001893712. The "web book" aims to become an independent object: it is a long, structured text similar to a conventional book but it is related to the other data on the platform and is written in a continuous way as well. https://humarec.org/webbook/book/.
49 https://github.com/humarec/humarec-tei.
50 https://biblia-arabica.com/bibl/index.html.
51 Gibson et al., "The Bible in Arabic."

> open-source bibliography manager, and exported to TEI-XML. The data is compliant with linked-open data standards and may be easily exchanged with or linked to other projects that use either Zotero or TEI formats...The *Biblia Arabica* bibliography module is open-source software (CC-BY-3.0 license) and is freely accessible on Github.[52]

The fact that each entry is tagged (notably with the shelf-mark[s] of the manuscripts it mentions) is especially powerful in the *Biblia Arabica* Bibliography.

4.3 *PAVONe*

PAVONe – Platform of the Arabic Versions of the New Testament is a Digital Humanities Center project at the University of Balamand.[53] It is an online database that aims to include explicit and implicit verses of the Gospels: "Over time, this corpus will include the transcribed texts, citations and allusions of the Arabic translations of the Gospels. In addition to this digital corpus, the project provides a set of tools to enable and facilitate the study of the text."

The database contains a manuscripts section, a lectionary section, and a citation section. Finally, the search section allows for the searching of a specific verse or word in the database regardless of the source type. The *PAVONe* project is exciting and it has great potential: the important place of the lectionaries and the liturgical structure (as used by the Greek Orthodox church) is very promising.[54]

For now, *PAVONe* focuses on the Arabic text of the Gospels. This limitation will surely evolve according to new collaborations that the project might foster in the future. Furthermore, the database could only benefit from a more collaborative vision: it may be useful to advise the users as to how transcriptions that they may have completed in their own research could be integrated into the database. Furthermore, it would also be useful to have access to the data files, since the use of the database can be laborious.

5 Perspectives

The need for better orientation within a large amount of manuscripts is still one of the priorities in research. The *Biblia Arabica* team has announced that they are working on a "clavis" for Arabic Bible manuscripts.

> As a prerequisite to any penetrating study of a particular biblical book in Arabic, modern scholars need to begin with the cumbersome and time-consuming task of sifting through the manuscript material, which demands a fair amount of detective work and archival skill. It is for that reason that the Munich team of the *Biblia Arabica* project is currently developing a union catalogue of Arabic Bible manuscripts. Such a clavis of all surviving textual testimonies should allow scholars easy navigation through the corpus and encourage them to take into consideration the full range of evidence.[55]

Currently it is unknown whether the *clavis* is going to be digital. One can only hope that after having followed high standards in term of openness and collaboration for digital bibliographies, the team will continue to contribute positively to the encounter between Arabic Bible study and the Digital Humanities.

It would also be helpful if existing projects on manuscripts were linked together, projects concerning the Arabic Bible like the future *clavis* and the *PAVONe* database, but also broader projects regarding the New Testament. The *New Testament Virtual Manuscript Room* lists several multilingual manuscripts containing Arabic;[56] their bibliographies should include a link to the *Biblia Arabica* bibliography.

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52 https://github.com/biblia-arabica/arabic-bible-bibliography/blob/master/documentation/BiAr_Manual.pdf.

53 http://pavone.uob-dh.org.

54 Many manuscripts contain indications of the day of the week when a passage should be read. Kashouh states, "Since every church (e.g. Melkite, Coptic) has a different ecclesiological calendar, examining these liturgical signs and rubrics can significantly inform us about the ecclesiological milieu of the manuscript or group of manuscripts...There are significant liturgical variants from one manuscript to another even within the same family. Some scribes kept the same Arabic text of their exemplar but adapted a different liturgical calendar." Kashouh, *The Arabic Versions of the Gospels*, 8.

55 Gibson et al., "The Bible in Arabic."

56 http://ntvmr.uni-muenster.de/liste.

Another important task today is the extension of the Arabic Bible's digital corpus. A digital corpus does not necessarily mean a concrete website or tool but rather the existence of a critical mass of machine-readable sources. A digital corpus is a prerequisite for unlocking the full potential of editing work done by many scholars and for the use of computational tools. As a basic example, one need only imagine the great assistance that could be provided by a concordance based on the existing edited manuscripts. The creation of a digital corpus is a common effort. I contributed modestly to the corpus with the online editions of *Tarsian* and *Humarec*. The *PAVONe* project is about to become an important actor, hopefully also moving toward open data. Furthermore, it is desirable that edited manuscripts in books and journals become digitally accessible. In fact, we find in many of the recent publications parts of manuscripts that are transcribed. Even if it is unrealistic to hope for completely open research at this point in time, it would be productive to find a middle course that makes these transcriptions available. Scholars should be encouraged to make transcriptions available even if the rest of the publication is not in open access. Ideally, the transcriptions should be in a machine-readable format – even unstructured, plain text documents would be helpful. This would be an efficient and simple way of connecting all actors in the building of a collaborative and open digital corpus and an effective step towards a digital scholarship for the Arabic Bible.

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Digital Humanities in Biblical Studies and Theology

Saskia Dirkse, Patrick Andrist*, Martin Wallraff

Structural Visualization of Manuscripts (StruViMan): Principles, Methods, Prospects

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Abstract: This paper introduces a tool which offers scholars a new way to visualize the structure of manuscripts. The Structural Visualization of Manuscripts (or StruViMan) is a web-based application, developed as part of the Paratexts of the Greek Bible Project, a European Research Council project based in Munich. Drawing on the principles of structural codicology, StruViMan is able to translate the different stages of a manuscript's development into a visual model based on the codex's physical, historical layers and aims to facilitate the comparison of manuscripts. It can be used by any web-connected manuscript database from any cultural area and does not require the presence of electronic images. This presentation begins with a short survey of the principles underpinning the tool's conception and development, followed by a demonstration of how manuscript data from both biblical and non-biblical Greek codices are transformed into interactive, customizable visualizations with varying display modes. We will also touch upon StruViMan's technical aspects as an open-access web service, available to any software or database able to call its API using the correct parameters. We close with a preview of new features currently under development, including the ability to "reconstruct" a manuscript whose composite parts are presently in different repositories.

Keywords: codex, codicology, open source, visual model, the Bible, syntactical description, Greek New Testament, database, web tools, paratexts

Introduction

In this paper we would like to introduce a tool which offers scholars a new way to visualize the structure of medieval manuscripts.[1] The Structural Visualization of Manuscripts (StruViMan)[2] came into being as an ERC proof-of-concept project and was developed between 2017–2018 as a practical extension of the Paratexts of the Greek Bible (ParaTexBib)[3] project, a larger, five-year ERC project based at the Ludwig Maximilian University in Munich, begun in 2015 and led by Martin Wallraff and Patrick Andrist.[4] Although StruViMan was developed within the context of a project dedicated to the Greek Bible, it has been our express goal from the outset to create a tool which can serve any database dealing with any kind of manuscripts. We will begin by looking briefly at the tool's genesis.

The ParaTexBib project has as its central aim to present a comprehensive survey of the paratextual material in manuscripts of the Greek Bible (mostly Gospels) from the 2nd to the 16th century. On the basis of digital reproductions each manuscript is carefully reviewed and the presence of biblical texts and paratexts is documented within the framework of the Pinakes database. As we compiled these descriptions it became apparent that while traditional cataloguing methods, focusing on building sequential lists of the pieces of content found in individual manuscripts, have a great deal to offer in terms completeness and precision, they lack the intuitive

1 The authors wish to thank the editors and the two anonymous reviewers for their helpful feedback.

2 https://www.struviman.gwi.uni-muenchen.de (accessed 21 May 2019).

3 http://www.paratexbib.eu (accessed 21 May 2019).

4 For a more extensive overview of the ParaTexBib project, please see Wallraff and Andrist, "Paratexts of the Bible: A New Research Project on Greek Textual Transmission," 237–243.

***Corresponding author: Patrick Andrist,** Ludwig Maximilian University, Munich, Germany;
E-mail: patrick.andrist@evtheol.uni-muenchen.de
Saskia Dirkse, Martin Wallraff, Ludwig Maximilian University, Munich, Germany

view of the codex as a structured and multi-layered object that a visualization can convey. It is with this idea of the codex as an object bearing the physical traces of its evolution over time, both in its structure and content, that StruViMan was conceived as a supplement to more traditional manuscript databases and as a way to translate the different stages in a manuscript's development – what one may call its "stratigraphy" – into a visual model. First, we will briefly describe the research context from which the tool emerged, as well as the methodologies that underpin its development. After a short exploration of the design concept, we will demonstrate its various features by applying it to two sample manuscripts, and finally we will touch on the tool's wider application and some future prospects.

1 Pinakes, NTVMR and *La syntaxe du codex*

In order to understand how the StruViMan tool came into being, let us first look briefly at the research project from which it emerged, since the ParaTexBib project's approach to working with biblical manuscripts proved formative in the tool's development. In an age when a great many key resources for studying such material (including digital images, databases, and catalogues) are available – sometimes exclusively – on the internet, there is an increasing need to organize and present such data in a way that is easy to access and understand. Accordingly, two decisions were made at the beginning of the project which gave shape to how the project data were handled. The first concerned the processing and storing of the data: rather than constructing a new database from scratch, the project leaders decided to seek partners with pre-existing databases, so that the data could be built up and stored in a well-established and curated environment. This policy paved the way for two fruitful partnerships: the *Section grecque* of the *Institut de recherche et d'histoire de textes* maintains Pinakes,[5] the largest and most important online database of Greek manuscripts, and it is within their framework that we were able to build a series of new fields and functions that answered our data requirements. Secondly, the ParaTexBib project cooperates with The New Testament Virtual Manuscript Room (NTVMR) at the University of Münster,[6] which houses the largest collection of images of New Testament manuscripts on the internet. Our own ParaTexBib members annotate the paratextual content clustered around the biblical material in each manuscript directly on the relevant digital image in NTVMR and this information is then imported into Pinakes through a bridge (in the form of an API) that was programmed specially for this purpose.

The second decision concerned the presentation and organization of the information gathered. The ParaTexBib project's approach to manuscript description is based on the methodologies set out in *La syntaxe du codex*, first published in 2013 and soon to appear in English as *The Syntax of the Codex*.[7] A medieval manuscript is often a complex, dynamic, and layered object from its very beginning. Sometimes its journey through the centuries leaves an imprint that is not difficult to discern, but at other times more detective work is required to reveal the various layers and transformations that led to the object as it is preserved today. The authors of *La syntaxe* thus sought to develop a methodological approach that is both comprehensive and finely articulated in its ability to accommodate the many variables and intricacies of composition and structure that one may encounter in medieval codices. Another important feature of *La syntaxe* is its emphasis on the points of intersection between a manuscript's codicological and textual features, as well as the development of a descriptive language which can navigate and disentangle the often complicated diachronic interplay between them.

2 Summary descriptions according to the syntactical model

La syntaxe du codex is able to cater to a level of manuscript complexity that goes beyond the needs of the manuscript descriptions one commonly finds in online manuscript databases. These descriptions are partial in nature and focus largely on the content rather than on the codicological features. The important thing for understanding how our descriptions are organized in Pinakes (and how in turn the StruViMan tool takes manuscript data and transforms them into a visual representation) is the following: our descriptions are arranged according to a so-called syntactical model which allows the reader to approach the codex both "vertically" (meaning that one can see at a glance the different stages of development over time) and also "horizontally" (in the writing, or rather the reading order, meaning what pieces of content appear where in the manuscript).[8]

5 https://pinakes.irht.cnrs.fr (accessed 21 May 2019).

6 http://ntvmr.uni-muenster.de (accessed 21 May 2019).

7 Andrist, Canart, and Maniaci, *La syntaxe du codex: Essai de codicologie structurale*.

8 Gumbert, "Codicological Units," 22.

The "horizontal" survey of a manuscript's contents is realized in much the same way one would find such in a traditional catalogue: each content item that has been annotated on the digital manuscript images in NTVMR is imported into Pinakes and listed in the reading order in the manuscript. For the "vertical" aspect of the description, each piece of content is then assigned to what is called a *production unit* – all the parts of the codex which are "the result of one and the same act of production."[9] Production units depend heavily on the quire structure of the codex but also define an intermediate historical structure between the quire and the complete codex. A description according to the syntactical model thus operates on three data levels: the data level related to the codex as it is today; the data level related to its constitutive production units (i.e. its historical parts); and the data level of the pieces of content (mostly texts, but also images or musical pieces), always situated within a production unit.

3 Visualization design concept

Pieces of manuscript content arranged into their respective chronological layers thus make up the basis of the information which StruViMan translates into a visual model. We will now look more closely at the manuscript visualization that StruViMan can generate. This graphic was designed to reflect the image of a book lying on its side (figure 1).

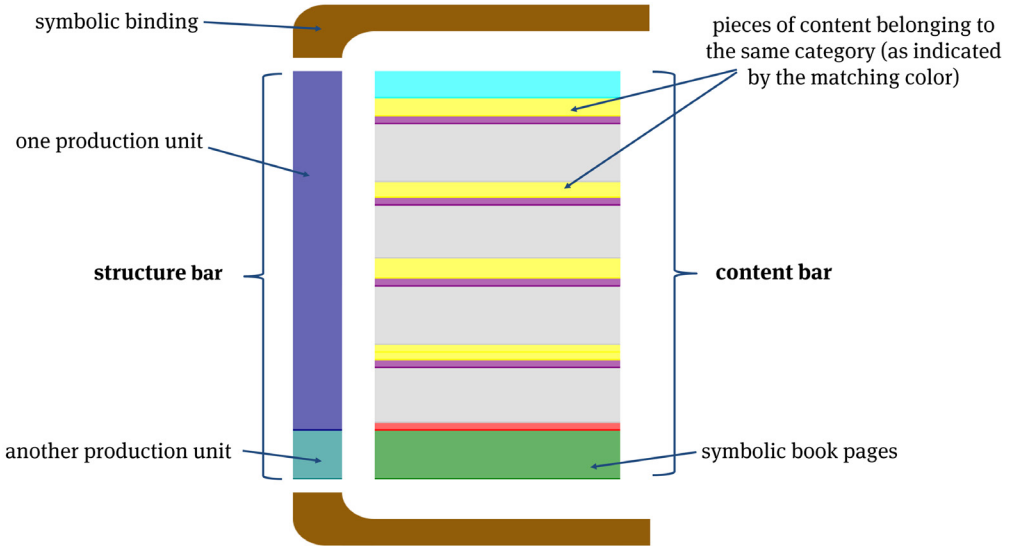

Figure 1. Sample Visualization of a Manuscript in StruViMan[10]

The visualization has two parts:

Structure bar: the "spine" of the book consists of a bar divided into two differently-colored sections. It shows how many production units are present in the manuscript and where they occur.

Content bar: the "pages" of the book not only give an overview of the pieces of content within the codex, but also show roughly how much space each item occupies in the manuscript. The different colors show which pieces of content belong to the same types of content (in the case of biblical paratexts this would mean that all prologues have the same color, all the subscriptions another one, and so forth; the same holds for chapter lists, evangelist portraits, etc.).

4 Example 1: Codex Bodmer 115

Having briefly surveyed the methodology underpinning our descriptions and the ideas behind the tool's visual design concept, we will now look at the tool in action as it transforms manuscript data into a graphic visualization. Even though in the ParaTexBib project our focus is, as mentioned, exclusively on manuscripts with

9 Andrist, Canart, and Maniaci, *La syntaxe*, 59 ("le résultat d'un même acte de production").

10 StruViMan is under CC BY-SA license (https://www.struviman.gwi.uni-muenchen.de/struviman.html).

biblical content, we begin here with a non-biblical codex, in order to show the wide and intended applicability of the tool to manuscripts of all kinds. The Codex Bodmer 115 is a collection of treatises on military science written in Greek and currently held at the Fondation Martin Bodmer in Cologny, Switzerland. The catalogue for the Greek manuscripts of that collection, which appeared in 2016, applies the syntactical model of manuscript description set forth in the *La syntaxe du codex*. It gives the following summary of the contents of Codex Bodmer 115 ahead of the full description (figure 2).[11]

Codex Bodmer 115 – Traités de sciences militaires

(olim Phillipps 3558)
Papier. – 169 f. = (1) 103, 32, 18, 16 (1).

Foliotage récent, en gris ; irrégulier, au moins tous les 10 folios : 1 f.s.n., 1 à 167, 3 f.s.n. Numérotation utilisée ci-dessous, sans autre indication : I, 1-169, II. – (f. 117) autrefois numéroté 115, sans conséquence pour la suite ; numérotation fautive aujourd'hui effacée.

Sommaire

Reliure, s. XVI, ca. 1570-1600.
(<I>) gardes ant.

A. (f. 1-103) s. XVI, ca. 1570-1582. – Main de <Camillo Zanetti>.
1. (f. 1r-102r sup.) ***Mauricii Strategicon***, paraphrase ambrosienne.
- (f. 102r inf.-103v) vides, sans notes.

B. (f. 104-135) s. XVI, ca. 1571-1572. – Main de <Camillo Zanetti>.
2. (f. 104r-134v sup.) **Ps. Nicephorus**, *De velitatione bellica*.
- (f. 134v inf.-135v) vides, avec graffiti.

C. (f. 136-152, 169) s. XVI, ca. 1571-1572 (apparemment). – Main de <Camillo Zanetti>.
3. (f. 136r-152v) <**Iulius Africanus**, *Cesti*> (extraits du Septième Ceste).
- (f. 169rv) vides, sans notes.

D. (f. 153-168) s. XVIII, 20 août 1761, <Italie du Nord>. – Main de Giuseppe X, cf. souscription f. 167r inf.
4. (f. 153r-167r sup.) *Apparatus bellicus* (seconde partie).
- (f. 167r inf.-168v) vides. – (f. 167r inf.) deux souscriptions et une annotation.

(f. 169) cf. supra.
(<II>) gardes post.

Figure 2. Summary Description of the Codex Bodmer 115, reproduced with the kind permission of the publisher.

The Codex Bodmer 115 contains four discrete production units: the first three (A–C) are all the work of the same scribe, Camillo Zanetti, and their time of production can be situated at different points in the second half of the 16th century with reasonable certitude. The last production unit (D) is dated to 1761. From a "horizontal" perspective we see that there are also four different pieces of content, organized by author and by work. These are a paraphrase of the emperor Maurice's *Strategicon*, the *De velitatione bellica* attributed to the emperor Nicephorus Phocas, excerpts from book 7 of the *Cesti* by Julius Africanus, and the second part of the *Apparatus bellicus* (it should be noted that the excerpts of bBook 7 of the *Cesti* form the first part of this work in the manuscript tradition).[12]

The process then unfolds in the following way: the calling software (in this case, Pinakes) translates the description information into an XML document. Through an API it then communicates with the StruViMan web service and sends XML data corresponding to the manuscript that the user wishes to have displayed. This may be a single long string containing all the required XML data. As StruViMan opens, the manuscript visualization appears in a new browser window; here we see the visualization for Codex Bodmer 115 (figure 3).

11 Andrist, *Manuscrits grecs*, 117.

12 For more on the last two texts see Mecella, "Die Überlieferung der Kestoi des Julius Africanus in den byzantinischen Textsammlungen zur Militärtechnik."

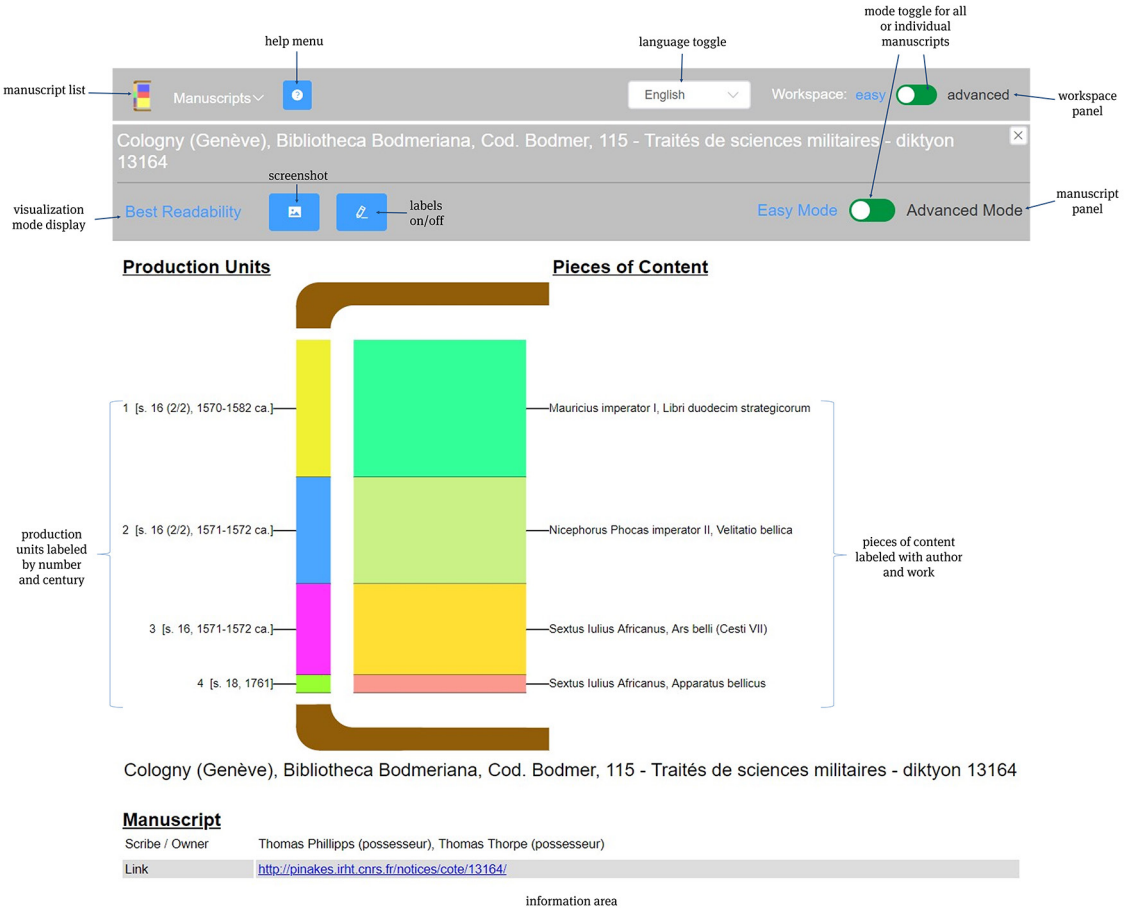

Figure 3. StruViMan Visualization of Codex Bodmer 115 (condensed)[13]

5 Brief survey of the features and functions in "easy" mode

5.1 The workspace panel

Beginning in the upper left-hand corner of the graphic is a bar called the *workspace panel*, which contains a clickable drop-down menu (*manuscripts*) with the manuscripts that have been sent to StruViMan by the calling software. In the example above this is a single manuscript. Next to it are the *help menu* and the *language toggle* button, which allows users to select an English, French, or German interface. These form the basic features of what is called the *easy workspace* panel, the default setting when the tool is opened. A greater range of display options for the more advanced user can be activated with a click on the green slider button on the right-hand side; we will return to that later.

5.2 The manuscript panel

Below this is the *manuscript panel*, in which we see the manuscript's identifying information; in this case the repository, shelfmark, title assigned to it in Pinakes, and its Diktyon number (a unique numerical identifier for Greek manuscripts).[14] It also contains another row of buttons, the first being the tag *best readability*. In easy mode the default (and only) visualization mode is this so-called best readability one, which means that if the manuscript features content of widely varying lengths, the longer pieces of content are scaled down while the size of any smaller

13 Under CC BY-SA license (https://www.struviman.gwi.uni-muenchen.de/struviman.html).
14 Binggeli and Cassin, "Le projet Diktyon," 201–206.

piece of content is enhanced (more on this below).[15] The blue button next to it allows the user to create a screenshot of the visualization which can be saved to their computer; the next button with the pencil icon lets the user choose whether or not the various labels appear in the visualization (and the screenshot). At the end of the manuscript panel is also the mode *toggle* alluded to above; when the user changes the mode in the manuscript panel, the changes apply only to that particular manuscript.

5.3 The graphic representation (StruViGraph)

Next we find, taking up the largest part of the screen, the book-shaped visualization with its two main parts: the *structure bar* in the book's "spine," which is divided into four differently-colored sections. These represent the four production units contained in Codex Bodmer 115 and are labeled with their corresponding number and date; the *content bar*, located in the "pages" of the stylized "book," gives an overview of the pieces of content in the manuscript and how much space each occupies. The production units each have a different color, since every unit is the result of a separate act of production.

5.4 The information area

At the lower end of the graphic there is a table, the *information area*, with further information about the manuscript, including any known owners and scribes, comments (if any), and a link to the Pinakes entry.

What appears in the information area varies according to where the user clicks on the visualization. If a production unit is selected, the selection is highlighted in the visualization. The information in the table below changes to give a more detailed overview of the unit in question, including the folios it covers, the date, the scribe (if known), and any comments. Similarly, if one clicks on a piece of content, that piece of content is highlighted in the visualization and the table shows information about the work, including its relation to that production unit and any comments.

6 Example 2: Codex Vaticanus graecus 364

The Codex Bodmer 115 is a relatively straightforward manuscript in terms of its structure and content. Now we consider a manuscript in StruViMan with a greater number of production units and content of more varying sizes. The manuscript Vaticanus graecus 364, held in the Biblioteca Apostolica Vaticana, is a 10th-century Gospel book which saw the addition of a set of liturgical tables in the 11th century and the restoration of a number of leaves at the end of the manuscript in the 14th century to compensate for the loss of the final portion of the liturgical tables. In terms of content it has not only the four Gospels but also a modest selection of standard biblical paratexts comprised of synoptic concordance tables at the beginning of the manuscript, along with a letter containing instructions on how to use them (both attributed to the church historian Eusebius of Caesarea, lists of chapter titles, some rather splendid miniatures (including evangelist portraits), and the aforementioned liturgical tables, which tell the reader what portions of the Gospel are read at different times during the liturgical year. In order to give a summary of the contents, we have opted for a highly abbreviated type of description called a *skeleton box*, which gives an overview of the manuscript's contents arranged into production units without any pretense to being exhaustive (figure 4).[16]

Most Gospel paratexts fall into two categories, either pertaining to all four Gospels as a collection or relating to one single Gospel in particular. As the brief description shows, some of the paratexts in this manuscript belong to the former category. The Eusebian material at the beginning (which shows concordances) and the liturgical tables at the end (which show lectionary readings) apply to the four Gospels as one textual unit. Around each Gospel, however, we find that the paratexts have been arranged into small, similarly-patterned clusters. These are the patterns which, in addition to delineating a manuscript's production units, we sought to emphasize most when developing the tool, and this is why it was important to have a visualization mode that could display small but relevent textual elements.

The visual advantages of this mode are especially apparent in the following visualization (figure 5), where smaller paratexts are enhanced, ensuring that the brightly colored slices of the images and chapters are not

15 This is achieved through the logarithmic formula "ln(a+1)."

16 This overview is based on our description in the Pinakes database (pinakes.irht.cnrs.fr/notices/cote/66995). See also Devreesse, "Codices," 51–53 and Perria, "Tetravangelo," 207–208.

dwarfed by the larger, gray-toned Gospels around them. It acts as a visual supplement to the more traditional and lengthy description (or electronic manuscript), so that not only are the different layers and elements individually (and at a glance) revealed, but we also see graphically laid out their proximity and relative length and how they interact with each other. In the visualization the later interventions in the codex become clearly discernible: we see the liturgical tables distinct from the rest of the original production unit, while the restored folios at the end of the manuscript are thrown into relief by the change in color in the structure bar.

Città del Vaticano, BAV, Vat. gr. 364 (diktyon 66995)

1.A (f. 1-260) main unit
S. X(3/4).–Parchment–Main hand–22 lines

1. (f. 1v-8r) Eusebiana (f. 1v) a. image (f. 2r-2v) b. Epistula ad Carpianum (f. 3v-8r) c. **Canon tables.**
2. (f. 9r-11r) paratexts on Matth. (f. 9r-10v) a. chapters. (f. 11r) b. portrait. (f. 12r-82v) **Gospel according to Matthew**.
3. (f. 83r-84r) paratexts on Mark. (f. 83r-83v) a. chapters (f. 84r) b. portrait. (f. 85r-128v) **Gospel according to Mark**.
4. (f. 129r-130v) paratexts on Luke. (f. 129r-130v) a. chapters (f. 131r) b. portrait. (f. 132r-203v) **Gospel according to Luke**.
5. (f. 204r-205r) paratexts to John. (f. 204r-204v) a. chapters (f. 205r) b. portrait. (206r-260v) **Gospel according to John.**

- (f. 260v) owner's note added by a much later hand.

2.S (f. 261-296) supplementary unit
S. XI2/2–Parchment–Supplementary Hand–20 lines

6. (f. 261r-296v) liturgical tables including a synaxarium and a menologium.

- (f. 294r marg. inf.) obit dated to March 2, 1264.

3.R (f. 297-300) restoration quire
S. XIV–Parchment–16 lines on half a folio

7. (f. 297r lines 1-6) liturgical table

Figure 4. Abbreviated Description of Vat. gr. 364

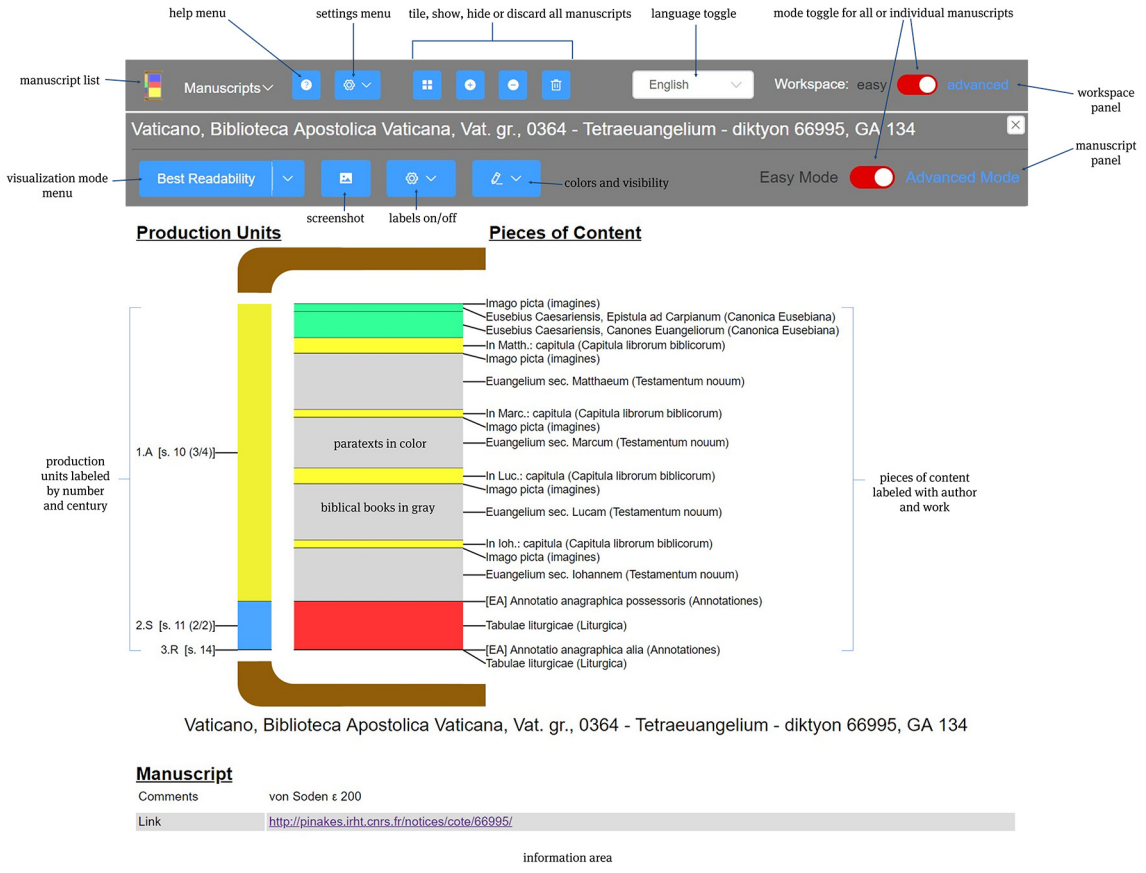

Figure 5. StruViMan Visualization of Vat. gr. 364 (condensed)*

* Under CC BY-SA license (https://www.struviman.gwi.uni-muenchen.de/struviman.html)

7 Brief survey of the features and functions in "advanced" mode

One of the particular challenges we faced in establishing a workable visualization was dealing with pieces of content of such varying sizes. In this manuscript the Gospel of Luke covers a little over 70 folios, while the chapter list and the evangelist portrait that precede it take up a mere three folios combined. This is where the *advanced* mode, alluded to earlier on, offers a greater degree of customizability in the display for those users wishing to highlight or minimize particular aspects of a manuscript in a visualization. Once again, the user can elect to do this in the workspace panel, which will apply all changes to all open manuscript visualizations, or they can make alterations to individual manuscript visualizations by changing the settings in the manuscript panel for each manuscript display window.

As we see in figure 5, a new button has appeared next to the help menu in the workspace panel: the settings button allows the user to fine-tune the customizations available to individual manuscripts in the easy workspace and then to apply these changes at once to all open manuscripts. This is followed by various buttons for tiling, showing, hiding or deleting multiple manuscripts if they are present on the workspace or in the manuscripts menu (more on this below).

The manuscript panel also offers new features: the visualization default mode remains "best readability," but the visualization mode tag has now become a drop-down menu where the user can select two alternative display modes in addition to the default: *proportional*, which displays content by the number of folios it occupies, and *all content equal*, which of course causes some loss to the sense of spatial distribution of different pieces of content, but which has the advantage of showing the sequence of pieces of content very clearly. Next to the screenshot button, the *labels on/off* button offers further options here as well: the user can opt to display only certain labels (for example, for only a single type of content) and hide all others.

In the *colors and visibility* menu the user can choose, for example, to omit all production units but one, while also adjusting the color scheme to personal preference. This allows one, for example, easily to visualize a manuscript before it was restored or supplemented with extra material.

It is also possible in the advanced workspace to change the size of the visualization window, so that in the case of manuscripts with a large amount of content one can see the entire visualization on the workspace.

If we return briefly to the workspace panel and press the *tile* button, we see that Codex Bodmer 115 and *Vaticanus graecus* 364 now appear next to each other on the workspace, allowing for a direct comparison of their relative manuscript structures (figure 6).

Up to fifteen additional manuscripts can be added to the manuscripts menu in the workspace panel, which can then be opened invidually or all at once. Opening and tiling a great number of manuscripts at the same time exceeds the capacity and width of most computer monitors, but on a regular-sized screen one can easily open up to four manuscript visualizations for side-by-side comparisons. The session in the StruViMan web tool continues as long as the browser window remains open. If a browser tab with a particular manuscript visualization on the workspace is closed, StruViMan can be reopened in a new browser tab and the manuscript will be preserved in the manuscripts menu in the new tab. The same occurs if multiple manuscripts are opened on a single workspace: if an individual manuscript is clicked away, the visualization disappears but the manuscript remains stored in the manuscripts menu in the workspace panel. Closing the browser window effectively ends the session, along with its data and settings.

8 Programming and technical aspects

The programming and technical development of StruViMan were undertaken by Caroline Strolz of the IT-Gruppe Geisteswissenschaften[17] at the Ludwig Maximilian University in Munich in collaboration with Frank Percival. StruViMan is a web application built using JavaScript and other common web technologies such as HTML5 and CSS3. Our programmers built the tool entirely using a JavaScript web framework called Vue. StruViMan is open source and will be made available to the public in 2019, through a web service installed on a server of the Ludwig Maximilian University in Munich.[18] Thus, StruViMan does have a server-side component. This is necessary because it is not hosted on the same server as Pinakes and it is therefore easier for the StruViMan server to collect and parse the Pinakes XML data before forwarding it to the browser. As such, it can also be easily extended to interact with other systems or servers to provide similar visualization functionality. There are also plans to create a standalone download that can then be embedded into other platforms.

17 https://www.itg.uni-muenchen.de (accessed 21 May 2019).

18 There is currently no publicly accessible Git repository (or equivalent) because presently StruViMan is still under development, but we plan to make the software openly accessible.

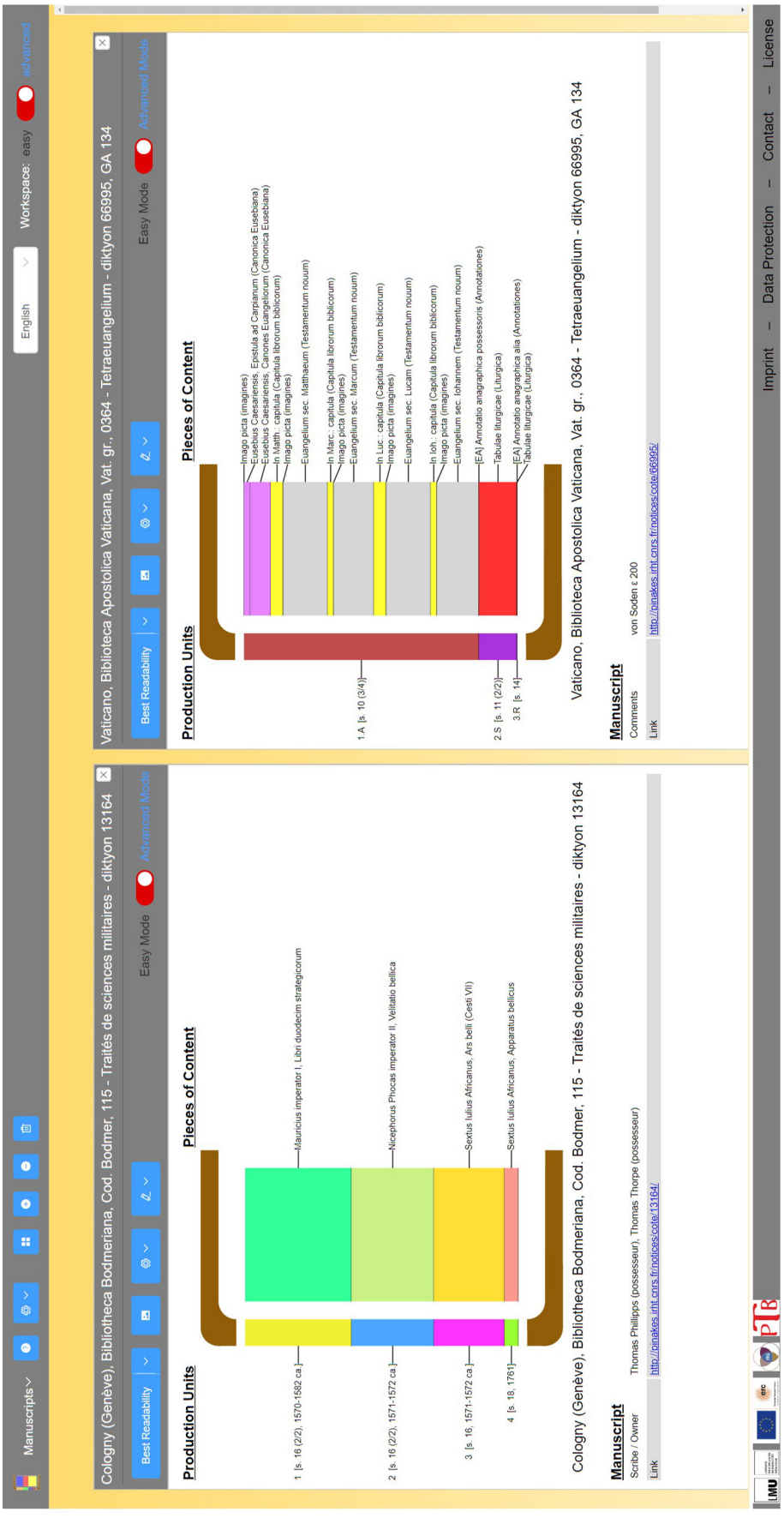

Figure 6. Side-by-side Comparison of Two Manuscripts on the Workspace. Under CC BY-SA license (https://www.struviman.gwi.uni-muenchen.de/struviman.html).

9 General applicability and wider use

StruViMan was originally designed as an extension of the ParaTexBib project as a tool for visualizing the structure of the medieval Byzantine manuscripts that form the core of our project. The examples presented in this paper are drawn from descriptions in Pinakes, as this database hosts our project data. We would like to stress, however, that the descriptive parameters used in the visualizations presented in this paper are not binding. Instead of using the production unit as the main structuring element, one might elect to use quire structure, scribal hands, watermarks, or any number of different elements to distinguish between different "layers" in a manuscript.

As such, StruViMan can generate a manuscript visualization for any software or database able to provide the appropriate XML data. The XML data format should allow the tool to be adaptable to manuscripts of all kinds and render it highly customizable. Given that the StruViMan tool is not a website with public screens or windows, but rather a web service with a web application available for interacting with any compatible program on the web, it is easily accessible. The parameters (in the technical sense) for calling the API will be described in greater detail on the StruViMan demonstration site.[19]

10 Conclusion

As it exists currently the tool represents a first version, which we hope in the future to enrich with further features and functions. Among these, some of the more promising avenues of development include integrating into the manuscript visualization a parallel display for pieces of content appearing next to each other on a single folio (one might think, for example, of a text with commentary written around it, as in the case of biblical catena manuscripts). Another feature under development for the second version is a *reconstruction mode* for the creation within the tool of an "empty" codex allowing for the "reconstitution" of codices whose parts are currently held in multiple repositories; it will be possible to save the reconstructed manuscripts. We believe that these additional features will allow scholars to visually define on a very granular level what content elements belong to a certain layer in a manuscript's history and where discontinuities, changes, and additions occur. While StruViMan was developed in the service of a project focusing on biblical paratexts, it is our hope that it will prove itself a useful tool for scholars working with manuscripts of every kind.

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19 See footnote 2 above.

Digital Humanities in Biblical Studies and Theology

Vincent van Altena*, Jan Krans, Henk Bakker, Balázs Dukai, Jantien Stoter

Spatial Analysis of New Testament Textual Emendations Utilizing *Confusion Distances*

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Abstract: Before the interpretation of any text can start, the original wording of the text itself must be critically established. Conventionally, this is done following qualitative criteria. This article, however, explores the application of spatial analyses to New Testament textual criticism by demonstrating how the Levenshtein edit distance could be adapted to calculate confusion distances for variant readings in New Testament manuscripts, i.e. the possibility that a (combination of) letter(s) is confused by another (combination of) letter(s). Subsequently the outcomes are translated to Euclidian space using classical Multi-Dimensional Scaling, which enables visualisation and spatial analyses (in this case not related to geographical space). The article focuses on the data preparation and algorithm to make the data suitable for spatial analyses, thus providing the New Testament textual critic with new analytical tools.

Keywords: spatialization; distant metrics; textual criticism; conjectural criticism; spatial analysis

Introduction

The original documents of almost all ancient writings have been lost, and the writings of the New Testament form no exception. Therefore, before any interpretation of a New Testament text, a researcher first must face the challenge of establishing its original wording by critically evaluating the differences in the existing manuscripts. The discipline of textual criticism provides criteria for systematic evaluation of such texts. Besides identified differences, there are texts where the different manuscripts do correspond, but where the content of the text puzzles the researcher. In these cases, some researchers assume a corruption of the text and emend the text by conjecture. Both the establishment of the original text from differing manuscripts and conjectural emendation are traditionally based on qualitative criteria, which is not to say that the discipline does not utilize quantitative methods.[1]

In this paper, we propose a method to estimate the probability of palaeographic confusion to explain the origination of conjectural emendations. Therefore, we introduce the *confusion distance*, a quantitative

1 Two prominent projects are *Text und Textwert* (*TuT*) and the *Coherence-Based Genealogical Method* (*CBGM*). The *TuT* volumes offer an inventory of differences between New Testament manuscripts for a selection of test passages. The goal of the *CBGM* is to gain an overall understanding of the origin and history of the transmission of a text, and it therefore uses a set of computer tools to combine the results of text critical decisions for the composition of genealogical trees in the most effective and simple way. Cf. Aland, *Text und Textwert der griechischen Handschriften des neuen Testaments* and Wasserman and Gurry, *A New Approach to Text Criticism*.

***Corresponding author: Vincent van Altena,** Faculty of the Built Environment and Architecture, Delft University of Technology, Delft, the Netherlands; E-mail: v.p.vanaltena-1@tudelft.nl / Faculty of Religion and Theology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands; E-mail: v.p.van.altena@vu.nl
Jan Krans, Henk Bakker, Faculty of Religion and Theology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands
Balázs Dukai, Jantien Stoter, Faculty of the Built Environment and Architecture, Delft University of Technology, Delft, the Netherlands

metric which indicates the relative proximity in orthography of alternative readings. This metric is based on the Levenshtein edit distance but is here expanded in two directions. First, our algorithm now accounts for the probability of a particular combination of (adjacent) letters; these combinations can be provided by the user as a confusion table. The table used in our experiments (see Table 5 in Appendix) was derived by the authors using data from Metzger[2] and Rutgers,[3] and provides a first *approximation* of the ease with which certain letters or combinations of letters could be confused. The probability score was based on the experience of a textual critic in dealing with manuscripts.[4] Second, our algorithm evaluates three additional operations (contraction, explosion, and complex substitution) besides the three operations provided in the original Levenshtein algorithm (which are substitution, insertion, and deletion). The resulting distances of words are subsequently spatialized, i.e. translated to a two-dimensional non-geographical space utilizing Multi-Dimensional Scaling. To demonstrate the potential of our confusion distance, we apply spatial analysis to evaluate the probability of the originality of variant readings. To our understanding this is the first time spatial analysis and a quantitative metric are used to compare the orthographic features of textual variants in New Testament manuscripts.

This article is structured in seven sections. Since spatial analyses are relatively new to the field of New Testament textual criticism and, conversely, textual criticism may be an unexplored area for the spatial scientist, sections 1 and 2 contain some background information and references to important literature. In section 1 we elaborate on the transmission of manuscripts and introduce the reader to the disciplines of textual and conjectural criticism. Section 2 provides criteria for equating words, evaluates the appropriateness of existing metrics to establish edit distances, and describes our adaptations to the Levenshtein algorithm to better simulate transcriptional confusion. In section 3 and section 4, we use two case studies to experiment with the application of spatial analysis to the results from our algorithm. We conclude with a discussion of our findings and recommendations for further research in section 5 and section 6.

1 Scribal errors in the transmission of manuscripts

Before the invention of printing (around 1450 CE in the Western world), the multiplication of documents was performed by copyists. In a digital age like ours, the painstaking effort, which was basic to the multiplication of written documents in the past, is easily overlooked. Metzger and Ehrman illustrate the physiological effects of the prolonged labour of copying by a traditional formula appearing at the close of many manuscripts: "Writing bows one's back, thrusts the ribs into one's stomach, and fosters a general debility of the body."[5]

The available manuscripts for the New Testament works show both resemblance and variance with the textual traditions of other ancient works. Like other ancient texts, the *autographa* (the original manuscript from the original author) of the New Testament are not available.[6] The perishable materials used for writing had a significant impact on the sustainability of the manuscripts. While moisture was devastating for papyrus, drought was disastrous for wooden writing materials. Only a few places offered the right conditions for the conservation of ancient texts.[7] Considering the availability of manuscripts on the other hand, more than 5,000 ancient manuscripts for the Greek New Testament are extant, which is an unusual amount of textual evidence for ancient manuscripts.[8]

2 Metzger, *Textual Commentary*.

3 Rutgers, "Index Palaeographicus."

4 In future experiments, this confusion table could, and likely should, be replaced by a table based on frequency statistics on the occurrence of character combinations in textual variants. It is important to note that although such a refinement will yield better results in recognizing patterns and trends, this must not be confused with objectivity. The capriciousness of scribes in deviating from their own habits illustrate the complexity of the issue.

5 Metzger and Ehrman, *The Text of the New Testament*, 29.

6 Wasserman and Gurry, *A New Approach to Text Criticism*, 1.

7 Richards, "Reading, Writing, and Manuscripts," 345.

8 Cf. Metzger and Ehrman, *The Text of the New Testament*, 50–51; and Aland, "New Testament Textual Research, Its Methods and Its Goals," 18.

The first substantive portions of the New Testament text date from the third and fourth centuries CE.[9] Although the texts have been transmitted from generation to generation with great care, inevitably differences between the several manuscripts exist.

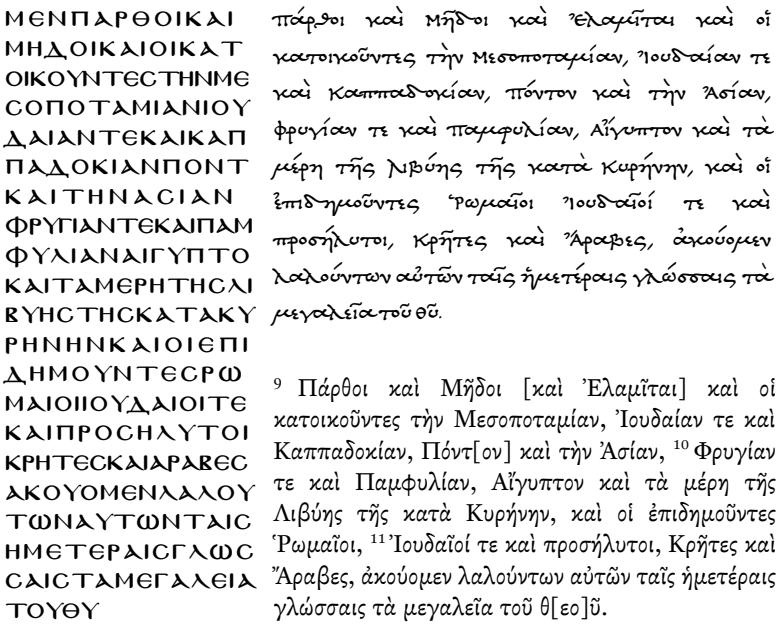


Figure 1. Three representations of Acts 2:9–11: on the left in majuscule script, top right in minuscule script, and bottom right in modern script with verse numbers and some editorial information. Words in brackets are omitted or abbreviated in the ancient manuscript.

Over the ages, writing style, script, and material used for manuscripts evolved.[10] The earliest New Testament texts have survived in papyrus codices, but parchment and eventually paper gradually became the common media for copying the texts. The choice of script also changed from majuscule script (which shows resemblance with our system of capital letters) to minuscule script (which could be compared to modern small italic letters). In the case of majuscule scripts, *scriptio continua* was usually applied. In effect, spacing between words and punctuation are scarce, and words are often split across lines without hyphens. Minuscule script, in contrast, contained spaces between words. An impression of the different scripts can be gained from Figure 1.[11]

Nowadays, Greek New Testament manuscripts are classified into four categories: papyri, majuscules, minuscules, and lectionaries.[12] The classification system is based on three criteria: writing material, type of script, and content. The timeline in Figure 2 summarises the history of textual transmission.

9 The earliest known example of the New Testament, 𝔓52, contains a fragment of John 18 and is dated approximately 125–150 CE. This dating is contested. Alternatively, a window between the second half of the second and the first quarter of the third century is proposed as the possible date of 𝔓52 by Nongbri, "The Use and Abuse of P52."

10 Parker, *An Introduction to the New Testament Manuscripts and Their Texts*.

11 The image on the left resembles the script of Codex Sinaiticus, the earliest extant complete copy of the Christian New Testament written in the middle of the fourth century. Its hand-written text is in Greek. Images can be found online, http://www.codexsinaiticus.org. The image on the top right is a free rendering of minuscule script. A digital example of an original manuscript in minuscule hand, GA 133, is available online (for scholarly research only) from the Institut für neutestamentliche Textforschung, http://ntvmr.uni-muenster.de/community/modules/papyri/?site=INTF&image=30133/undefined/3480/20/2293. This manuscript originates from the eleventh century and is currently located in the Vatican Library.

12 About 135 papyri have been discovered, some of which contain the oldest witnesses to the text of the New Testament. Currently, ca. 300 majuscules (parchment codices) and ca. 3,000 minuscules are known. Papyri, majuscules, and minuscules can be consulted online, cf. Institut für Neutestamentliche Textforschung, "Liste."

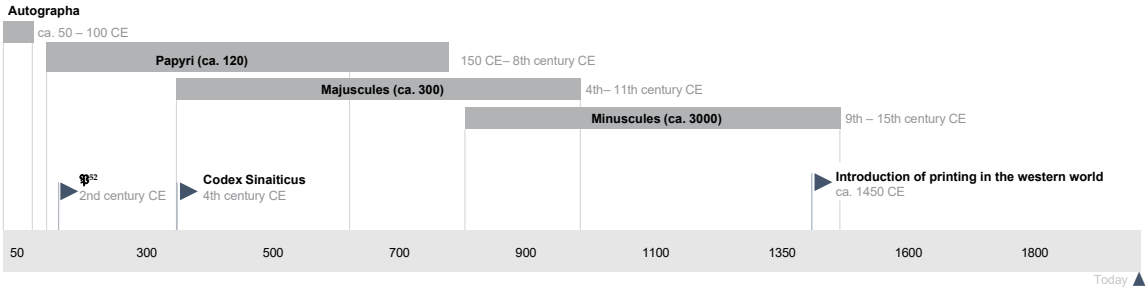


Figure 2. Different types of manuscripts and dates of occurrence.[13]

1.1 Textual criticism

Mistakes in the transmission of texts were likely to occur during activities of reading (or hearing), remembering, and writing the contents of the original manuscript and were easily made due to bad sight, letter confusion, sloppy handwriting, misinterpretation of abbreviations, attrition, lack of attention or simple stupidity. In effect, variant readings were produced containing differences in punctuation and misspellings, but also alterations of words or omission of complete verses or paragraphs.[14] In addition to this unintentional production of errors, copyists sometimes also intentionally altered the reading of the same text, perhaps motivated by their understanding or dogmatic convictions.[15]

To account for this existence of variant readings, and given the lack of autographs (originals), the aim of textual criticism was traditionally perceived as the reconstruction of the *original* text from available manuscripts.[16] However, this definition has been increasingly criticized due to the ambiguity of the terminology.[17] For our discussion, we adopt the goal of the *Editio Critica Maior* (ECM): textual criticism aims to establish the "initial text" or *Ausgangstext* of a document. This *Ausgangstext* (hereafter, *Aus*) must be distinguished from the "original text" or *Urtext*.[18] Very early in the process of copying the *Urtext*, the original readings might have been lost without leaving a trace in the surviving manuscripts.[19] On the other hand, *Aus* must also be distinguished from the "established text" in our critical editions for the simple reason that some readings cannot be attributed to *Aus* with sufficient certainty. In such cases, the only reasonable conclusion for the editor is postpone the decision and to inform the reader about the difficulties in establishing *Aus*. For the following discussion on conjectural emendations, it is important to note that scribal changes are both presumed between *Urtext* and *Ausgangstext* or between attested readings and the *Ausgangstext*.[20]

To establish *Aus*, generally agreed principles are applied to distinguish between intrinsic (how would an *author* have written) and transcriptional probabilities (how would a *scribe* have transcribed) in the transmission process of the text. This is accomplished by asking whether any of the readings may be the result of "scribal slips, errors, or alterations in the copying process [... or ...] scribal tendencies to smooth over or resolve difficulties rather than create them, to harmonize passages, and to add rather than omit material ... the variant most likely to be original is the one that best accounts for, in terms of both external and internal considerations, the origin of the others."[21]

13 Loader and Wischmeyer, "Twentieth Century Interpretation"; Parker, *An Introduction to the New Testament Manuscripts and Their Texts*.

14 Holmes, "Reconstructing the Text of the New Testament."

15 Cf. Metzger and Ehrman, *The Text of the New Testament*, 259–271.

16 Holmes, "Reconstructing the Text of the New Testament."

17 Cf. Wasserman and Gurry, *A New Approach to Text Criticism*, 11. For an overview of the debate, see Holmes, "From 'Original Text' to 'Initial Text.'"

18 Aland, "New Testament Textual Research, Its Methods and Its Goals," 16–17.

19 Cf. "Between the autograph and the initial text considerable changes may have taken place for which there may not be a single trace in the surviving textual tradition. Even if this should not be the case, differences between the original and the initial text must be taken into account." Aland, "New Testament Textual Research, Its Methods and Its Goals," 17.

20 So far ECM has adopted conjectures at 2 Pet 3:10 (cj11713) and Acts 13:23 (cj10092).

21 Holmes, "Reconstructing the Text of the New Testament," 180.

Traditionally, the discipline has been concerned with existing variant readings, which are known from manuscripts, glosses, and lectionaries; however, the discipline has broadened its scope to gain insight into the transmission history of texts and, hence, into the convictions and guiding principles of the transmitting communities.

1.2 Conjectural criticism

Sometimes deciding between existing competing variant readings is not enough. Scholars sometimes face difficulties in the text, such as logical contradictions and inconsistencies, and "cannot assert that the original form of the text has for certain survived at every point somewhere or other among our witnesses."[22] According to Metzger and Ehrman, therefore, the "only remaining resource is to conjecture what the original reading must have been."[23] These so-called conjectural emendations (speculative alterations of the texts for which no manuscript evidence exists) have also become the object of scrutiny for the textual critic.[24]

1.2.1 John the Baptist's food as an example

The practice of conjectural emendation can be illustrated from Matt 3:4 and its parallel text Mark 1:6. In these passages the character of John the Baptist is introduced in the narrative. John wears a camel skin garment and is girded with a leather belt. According to the textual evidence John ate *locusts and wild honey* (ἀκρίδες καὶ μέλι). Although there is no reason to doubt the reading uniformly attested by the manuscript evidence, the text nicely sketches how conjectures originate and is therefore suitable to illustrate the study of conjectures as historical phenomena. In this study, the researcher is not so much concerned with emending the text with the most suitable conjecture, but rather with the reconstruction of the reasoning which led to the origination of the conjectures for the particular locus.

Any conjecture starts with an observation on the text, in which a critic is guided by some pre-understanding that leads to the detection of an oddity. In our example text, the substance of John's food has puzzled some critics: how could someone possibly eat insects? Others presumed John must have been a vegan and they therefore raised objections to the reading "locusts."

After the detection of the textual problem, the critic needs to suggest an alternative that (1) fits the grammatical function of the disputed reading, (2) makes sense in the internal logic of the text, and (3) solves the assumed difficulties. In John the Baptist's case, some critics have suggested emendations, including *cake* (ἐγκρίδες),[25] *coconuts* (καρίδες), *sea-crabs*/*shrimps* (γαρίδες), *wild pears* (ἀχράδες), *crops* (ἀκρεμώνες) or *root and fruit* (ῥίζας καὶ καρπόν).[26] Here we observe that speculations cannot be boundless: (a) the proposed alternative must have the same grammatical function in the text and should therefore be a noun. (b) However, not every available noun in Greek is suitable, since the internal logic of the text demands something that can be eaten. (c) Likewise, not everything that can be eaten is suitable since it must fit within the contemporary context. Having John eating a Big Mac would be anachronistic (and ridiculous). (d) Furthermore, not all food available during the time of John fits in the geographical context of the narrative.

22 Kilpatrick, "Conjectural Emendation in the New Testament," 351.

23 Metzger and Ehrman, *The Text of the New Testament*, 227.

24 A more extensive introduction on *Conjectural Emendation* can be found in Krans, "Conjectural Emendation and the Text of the New Testament." Conjectural Emendations themselves are collected systematically and presented online in the Amsterdam Database of New Testament Conjectural Emendation. See Krans and Lietaert Peerbolte, "The Amsterdam Database of New Testament Conjectural Emendation."

25 Despite the fact that Epiphanius' attribution of ἐγκρίδες to the Ebionites is apparently incorrect; this conjecture has a historically interesting reception history.

26 Examples are taken from ADNTCE and can be located by their identifier at cj10147 (ἐγκρίδες), cj11182 (καρίδες), cj11183 (ἀχράδες), cj13821 (ἀκρεμώνες) and cj12987 (ῥίζας καὶ καρπόν). See Krans and Lietaert Peerbolte, "The Amsterdam Database of New Testament Conjectural Emendation." The conjecture γαρίδες is not yet available in the ADNTCE.

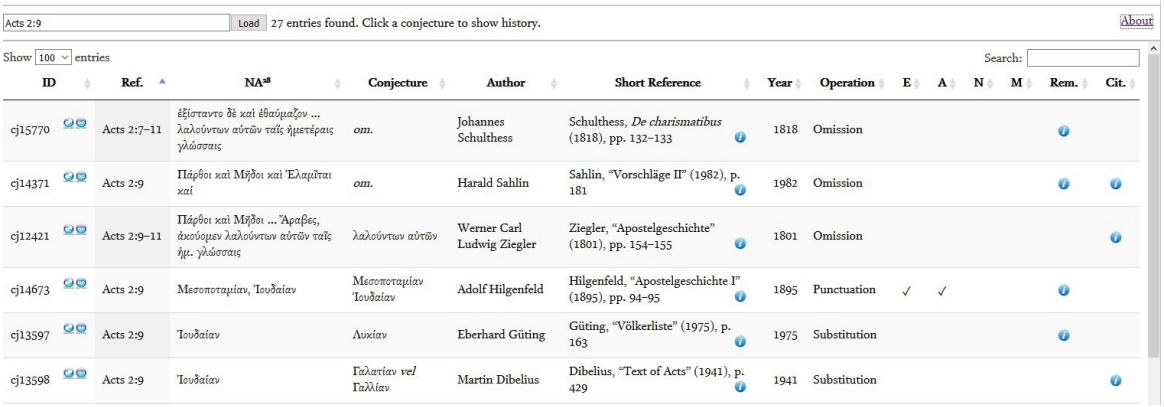
It is, for instance, hard to conceive how John, living in the desert, would have been able to catch shrimps. To summarize, the credibility of a conjecture is restricted by grammar, semantics, and its historical, cultural, and geographical suitedness.

Finally, the critic must also explain how the attested reading or readings could have originated from the proposed conjecture. Usually, a very early corruption during the transcription process is assumed, which could have been caused by palaeographic or phonetic confusion of letters.

In the example of John the Baptist's food, it is not hard to understand how ΑΚΡΙΔΕϹ[27] (*locusts*) could easily be confused with ΚΑΡΙΔΕϹ (*coconuts*). Such a confusion only requires the transposition of the letters Α and Κ. In the case of ΓΑΡΙΔΕϹ (*sea crabs*), two confusions might have occurred: first the substitution of the letters Γ and Κ and second the transposition of the letters Α and Κ. This second example is a bit more complex, but the combination of a phonetic and a palaeographic confusion is still conceivable. The other alternatives seem less likely due to palaeographic confusion.

1.2.2 Amsterdam Database of New Testament Conjectural Emendation

An important tool to study the conjectures critically is the Amsterdam Database of New Testament Conjectural Emendation (ADNTCE).[28] This database contains approximately 6500 conjectures for the New Testament text, collected from theological literature, such as commentaries. It also includes data on the discussion of particular emendations. Unfortunately, the data is thus far presented in tabular form (see Figure 3) which restricts analysis to individual conjectures and makes an analysis of the filiation of conjectures difficult.


Acts 2:9 Load 27 entries found. Click a conjecture to show history. About

Show 100 entries Search:

ID	Ref.	NA[28]	Conjecture	Author	Short Reference	Year	Operation	E	A	N	M	Rem.	Cit.
cj15770	Acts 2:7–11	ἐξίσταντο δὲ καὶ ἐθαύμαζον ... λαλούντων αὐτῶν ταῖς ἡμετέραις γλώσσαις	*om.*	Johannes Schulthess	Schulthess, *De charismatibus* (1818), pp. 132–133	1818	Omission						
cj14371	Acts 2:9	Πάρθοι καὶ Μῆδοι καὶ Ἐλαμῖται καί	*om.*	Harald Sahlin	Sahlin, "Vorschläge II" (1982), p. 181	1982	Omission						
cj12421	Acts 2:9–11	Πάρθοι καὶ Μῆδοι ... Ἄραβες, ἀκούομεν λαλούντων αὐτῶν ταῖς ἡμ. γλώσσαις	λαλούντων αὐτῶν	Werner Carl Ludwig Ziegler	Ziegler, "Apostelgeschichte" (1801), pp. 154–155	1801	Omission						
cj14673	Acts 2:9	Μεσοποταμίαν, Ἰουδαίαν	Μεσοποταμίαν Ἰουδαίαν	Adolf Hilgenfeld	Hilgenfeld, "Apostelgeschichte I" (1895), pp. 94–95	1895	Punctuation	✓	✓				
cj13597	Acts 2:9	Ἰουδαίαν	Λυκίαν	Eberhard Güting	Güting, "Völkerliste" (1975), p. 163	1975	Substitution						
cj13598	Acts 2:9	Ἰουδαίαν	Γαλατίαν *vel* Γαλλίαν	Martin Dibelius	Dibelius, "Text of Acts" (1941), p. 429	1941	Substitution						

Figure 3. Interface of ADNTCE

1.3 Summary

An enormous amount of manuscripts are available for the New Testament, but due to differences, lack of the originals and additional speculation, textual criticism aims (1) to reconstruct the initial texts and (2) to study the history of textual transmission to gain insights in the convictions of the transmitting communities. Today both are not limited to existing manuscript evidence (variant readings), but also encompass speculations (conjectural emendations). This material will be used in the following analyses.

In previous paragraphs, we discussed the ways in which textual critics deal with transcriptional and internal difficulties to reconstruct the original text and what insights are gained from the history of textual

27 In the remainder of this article we use Greek majuscule script. In the earliest period of textual transmission this was the commonly used type of script and, therefore, it best simulates the palaeographic appearance of the earliest texts and provides insights in the probability of confusion of typical letter combinations.

28 Krans and Lietaert Peerbolte, "The Amsterdam Database of New Testament Conjectural Emendation."

transmission. One of these insights is that not every suggestion is equally probable. Some alternatives are more related, (i.e., in closer proximity) while others are more distant (i.e., unlikely). As we have seen, textual criticism tries to establish how one reading could have originated from another using qualitative evaluation criteria. Palaeographic confusion is a feature of textual transmission that often explains the origin of different readings.

2 String matching and edit distances

Algorithms for string matching which have been developed within the field of computer science might be helpful for approaching textual variation from a different angle.[29] These algorithms calculate edit distances to quantify the relationship(s) of strings. In this section, we first establish criteria for assessing the applicability of algorithms. Next, we explore existing algorithms and evaluate their applicability to textual criticism. Finally, we propose our own algorithm, which basically is an extension of an existing algorithm.

2.1 Evaluation criteria

An algorithm should simulate the process of textual corruption in the case of transcriptional confusion and should be based on the palaeographic appearance of characters. Therefore the algorithm must at least account for (1) the comparison of strings of different length, since the length of a conjecture is not always equal to the length of the reading found in the manuscripts; (2) a minimal set of operations to change a string into another string, i.e., insertion, deletion, substitution, and transposition of characters; (3) the dissimilarity of words instead of their resemblances, i.e. we are interested to know in which way strings differ; (4) the outcome must be reciprocal, i.e., the calculated distance based on the operations to change string *a* into string *b* should be the same as the calculated distance to change string *b* into string *a*; and (5) the probability of confusion of characters. The underlying assumption is that the more similar two characters are, the more likely they can be confused.

In a handwritten English text, it is easy to confuse a small letter L (l) with a capital letter i (I) or even with the number 1. Likewise, when writing a text in majuscule script, it is, for instance, more likely to confuse an Λ for a Δ than an Λ for an Θ. To elaborate on this a bit more, specific combinations of characters also are likely to be confused. For example when Γ and Ι appear as adjacent characters (ΓΙ) within a word, a confusion with Π is not difficult to perceive.

2.2 Edit operations and existing string matching algorithms

Multiple functions have been developed outside the domain of the New Testament to measure the (dis-) similarity between strings and these all conform to a basic form:

> The distance $\delta(x,y)$ between two strings x and y is the minimal cost of a sequence of *operations* that transform x into y (and ∞ if no such sequence exists). The cost of a sequence of operations is the sum of the costs of the individual operations. The operations are a finite set of rules of the form $\delta(z,w) = t$ where z and w are different strings and t is a non-negative real number. Once the operation has converted a substring z into w, no further operations can be done on w.[30]

Most commonly implemented operations in string matching are insertion, deletion, substitution, and transposition (see Table 1), although the actual number of operations implemented within several functions differs.

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29 The concept *string* is used in computer processes to define a piece of text consisting of letters, numbers, and/or symbols. *String matching* is a process to establish the (dis-)similarity of strings. An *edit distance* is a metric (i.e. unit of measurement) to express the (dis-)similarity of strings and it quantifies the number of operations to change string *a* into string *b*.

30 Navarro, "A Guided Tour to Approximate String Matching," 37.

Table 1. Common edit operations in string matching

Operator	Function	constraints	Description
Insertion	$\delta(\varepsilon,a)$		inserting the letter *a*
Deletion	$\delta(a, \varepsilon)$		deleting the letter *a*
Substitution	$\delta(a, b)$	$a \neq b$	substituting letter *a* by letter *b*
Transposition	$\delta(ab, ba)$	$a \neq b$	swap the adjacent letters *a* and *b*

According to Navarro,[31] four metrics are most prominent in string matching, but despite the fact they are commonly used, we should discard the Hamming distance,[32] the longest common subsequence (LCS),[33] and episode matching.[34] These metrics do not fit the required type of operations. (Hamming only allows substitution, LCS only allows insertions and deletions, and episode matching only allows insertions.) Furthermore, they do not meet our criteria of complexity, dissimilarity, and reciprocity.

The Levenshtein distance,[35] however, has potential for estimating the probability of palaeographic confusion to explain the origination of conjectural emendations (and likewise, but secondary, textual variants). It measures the minimal number of insertions, deletions, and substitutions of one character for another that will transform one string into the other. The distance is also reciprocal and might "be useful in spelling correction, where for example because of the conventional keyboard arrangement it may be far more likely that a character 'A' be mistyped as an 'S' than as a 'Y.'"[36] We will use the Wagner-Fischer implementation since it is available in many programming languages, including Python.[37]

2.3 Expansion of the algorithm

To even better meet our requirements, we have tailored the Levenshtein algorithm (1) by providing a confusion table (see Appendix) which contains character pairs together with an integer indicating the probability of palaeographic confusion; and (2) by adding three sophisticated operations to simulate better the origination of scribal errors.

Table 2. Sophisticated edit operations in string matching

Operator	Function	constraints	Description
Complex substitution	$\delta(ab, cd)$	$a \neq b \neq c \neq d$	substituting the adjacent pair of letters *ab* by a different pair of adjacent letters *cd*
Contraction	$\delta(ab, c)$	$a \neq b \neq c$	substituting the adjacent pair of letters *ab* by a single letter *c*
Explosion	$\delta(a, bc)$	$a \neq b \neq c$	substituting a single letter *a* by a pair of adjacent letters *bc*

31 Navarro, "A Guided Tour to Approximate String Matching."
32 Hamming, "Error Detecting and Error Correcting Codes."
33 Needleman and Wunsch, "A General Method Applicable to the Search for Similarities in the Amino Acid Sequence of Two Proteins."
34 Das et al., "Episode Matching."
35 Levenshtein, "Binary Codes Capable of Correcting Deletions, Insertions, and Reversals."
36 Wagner and Fischer, "The String-to-String Correction Problem," 169.
37 Wagner and Fischer, "The String-to-String Correction Problem."

We can summarize our adaptation of the Levenshtein algorithm using a mathematical function: the confusion distance between two strings *a*,*b* (of length |*a*| and |*b*| respectively) is given by $confdist_{a,b}|a|,|b|$ where

$$confdist_{a,b}(i,j)\begin{cases}\max(i,j) & \text{if } \min(i,j)=0\\ \min\begin{cases}confdist_{a,b}(i-1,j)+del\\ confdist_{a,b}(i,j-1)+ins\\ confdist_{a,b}(i-1,j-1)+sub[i,j]_{(a\neq b)}\\ confdist_{a,b}(i-1,j)+\ cont[(i,i-1),j]\end{cases} & \text{if } i>1 \text{ and } j=1\\ \min\begin{cases}confdist_{a,b}(i-1,j)+del\\ confdist_{a,b}(i,j-1)+ins\\ confdist_{a,b}(i-1,j-1)+sub[i,j]_{\ (a\neq b)}\\ confdist_{a,b}(i,j-1)+\ expl[\mathrm{i},(\mathrm{j},\mathrm{j}-1)]\end{cases} & \text{if } i=1 \text{ and } j>1\\ \min\begin{cases}confdist_{a,b}(i-1,j)+del\\ confdist_{a,b}(i,j-1)+ins\\ confdist_{a,b}(i-1,j-1)+sub[i,j]_{(a\neq b)}\\ confdist_{a,b}(i-1,j)+\ cont[(i,i-1),j]\\ confdist_{a,b}(i,j-1)+\ expl[i,(j,j-1)]\\ confdist_{a,b}(i-2,j-2)+\ com_{\in}(0\ldots1)\end{cases} & \text{otherwise}\end{cases}$$

where the value of a substitution *sub*[*i*,*j*] is expressed as

$$sub[i,j]=\begin{cases}0, & if\ i=j\\ D, & if\ (i,j)\text{ in }conftable\\ 1, & \text{otherwise}\end{cases}$$

the value of a contraction *cont*([*i*,*i*-1),*j*] as

$$cont[(i,i-1),j]=\begin{cases}D, & if\ [(i,i-1),j)\text{ in }conftable\\ 3, & \text{otherwise}\end{cases}$$

the value of an explosion *expl*[*i*,*(j*,*j-1)*] as

$$expl[i,(j,j-1)]=\begin{cases}D, & if\ [i,(j,j-1))\text{ in }conftable\\ 3, & \text{otherwise}\end{cases}$$

and the value of a complex substitution as

$$cont[(i,i-1),(j,j-1)]=\begin{cases}D, & if\ [(i,i-1),(j,j-1)]\text{ in }conftable\\ 5, & \text{otherwise}\end{cases}$$

The confusion distance then equals the sum of the minimal costs of the sequential individual operations to translate string *a* into string *b*. The function $confdist_{a,b}(|a|,|b|)$ will compute values for all possible operations on the individual (i,j) and complex character combinations (*i*, (*j*,*j*−1); (*i*,*i* −1),*j*; [(*i*,*i* −1),(*j*,*j* −1)]) for both strings *a* and *b*.

To avoid bias, we added two constants: 3 for contractions and explosions and 5 for complex substitutions. These values guarantee that a combination not present in the confusion table will always result in a value higher than the ones resulting from other, simpler, operations. Furthermore, using the different constants 3 and 5 resembles the complexity of the operation.

3 Methodology

Until now, researchers evaluated textual differences and conjectural emendations by well-established qualitative norms, but the central thesis of this paper is that the probability of palaeographic confusion can also be evaluated by quantitative means utilizing spatial analysis methods.

The expressions “he is a close relative of mine” or “their views were miles apart” illustrate that spatial metaphors are omnipresent in everyday language to explain abstract concepts and their relatedness.[38]

38 Skupin and Fabrikant, “Spatialization.”

To take advantage of this spatial language for visualisation, several researchers developed methods for information visualization and analysis. These methods are identified under the umbrella "spatialization," which Yuan defines as the process of transforming "non-geographic data to spatial forms for visual analysis."[39] As such, spatialization should be distinguished from various geocoding techniques that aim to extract geographical references from unstructured text.[40]

Transforming raw data into a visual form is dependent on the data's degree of structure and size. Data can be structured, semi-structured, or unstructured and this characteristic influences the necessity for pre-visualisation manipulation. Furthermore, the size of the raw data determines whether a specific technique is applicable. Self-Organizing Maps (SOM) are for instance very suited for large text corpora, while Multi-Dimensional Scaling (MDS) best fits small data sets.[41] Due to the limited size of the conjectural data, we will apply MDS for spatialization.

MDS has been applied previously to visualise unknown geographical data in geographical space. For example by Tobler and Wineburg to estimate the geospatial locations of merchant colonies in Bronze Age Anatolia.[42] The technique has also been used by Louwerse et al.[43] and Louwerse and Zwaan[44] to visualize locations from large text corpora like newspaper archives. These two researches obtained the locations from the texts using Latent Semantic Analysis. Davies applied MDS to explore the geographic component of large-scale semantic networks contained in text and cognitive geographies.[45] Additionally, MDS has been used to visualize non-geographic data in non-geographical space, for instance by Goodchild and Janelle to spatialize the interrelatedness of special interest groups within the American Association of Geographers;[46] by Skupin to spatialize articles from the New York Times based solely on the information content;[47] and by Old to enable spatial analysis and visualization of co-citation data.[48]

Although all these studies spatialize the individual entities of interest using MDS, our approach deviates from these studies in several ways. Considering pre-visualisation manipulation techniques to define the mutual distances between the entities, Louwerse et al.,[49] Louwerse and Zwaan,[50] and Davies[51] used Latent Semantic Analysis (LSA); Tobler and Wineburg[52] interactively defined them, and Old[53] re-used data from previous research without explicitly stating the distance retrieval methods. In contrast to these studies, our study proposed the palaeographic confusion distance to establish these distances.

Furthermore, Tobler and Wineburg,[54] Louwerse et al.,[55] Louwerse and Zwaan,[56] and Davies[57] aim to establish the geographical location of unknown geographical places, while we are approximating the relative locations of conjectures in palaeographic confusion space. We exemplify this space using two cases: one use case examines the food of John the Baptist, and another looks at alternatives for the toponym Judea. As such our study is more related to studies that apply MDS to abstract spaces.[58]

39 Yuan, "Mapping Text," 111.
40 Melo and Martins, "Automated Geocoding of Textual Documents."
41 Skupin and Fabrikant, "Spatialization Methods: A Cartographic Research Agenda for Non-Geographic Information Visualization."
42 Tobler and Wineburg, "A Cappadocian Speculation."
43 Louwerse et al., "Cognitively Inspired NLP-Based Knowledge Representations:."
44 Louwerse and Zwaan, "Language Encodes Geographical Information."
45 Davies, "Reading Geography between the Lines: Extracting Local Place Knowledge from Text."
46 Goodchild and Janelle, "Structure and Organization."
47 Skupin and Buttenfield, "Spatial Metaphors."
48 Old, "Utilizing."
49 Louwerse et al., "Cognitively Inspired NLP-Based Knowledge Representations."
50 Louwerse and Zwaan, "Language Encodes Geographical Information."
51 Davies, "Reading Geography between the Lines: Extracting Local Place Knowledge from Text."
52 Tobler and Wineburg, "A Cappadocian Speculation".
53 Old, "Utilizing."
54 Tobler and Wineburg, "A Cappadocian Speculation."
55 Louwerse et al., "Cognitively Inspired NLP-Based Knowledge Representations.
56 Louwerse and Zwaan, "Language Encodes Geographical Information."
57 Davies, "Reading Geography between the Lines."
58 Skupin and Buttenfield, "Spatial Metaphors"; Goodchild and Janelle, "Structure and Organization"; Old, "Utilizing."

In the remainder of this article, we develop a methodology to measure palaeographic confusion between textual variants and experiment with spatial analysis, thus integrating concepts from textual criticism, computer science, and spatial science.

Starting with a set of conjectural emendations for a particular text, the first step in our approach is to adapt this set for processing in our algorithm. Therefore, an array containing all individual variants/conjectures is translated to a table. In addition, we developed an algorithm which we implemented in Python to calculate the confusion distance for each combination of words in the array.[59] This algorithm results in a distance matrix.

Next, we translate the data in the distance matrix to Euclidean space using an existing Python implementation of classical MDS. MDS is a visualization technique to analyse the (dis)similarity of data. It attempts to model such data as distances among points in a geometric space. This is useful when one "wants a graphical display of the structure of the data, one that is much easier to understand than an array of numbers." Since MDS seeks to find the most optimal visualisation of multi-dimensional phenomena in lower dimensional space within a given time frame and with a minimum of distortion, the results are only an *approximation* of this correlation.

Our MDS analysis results in a file containing x,y coordinates for each entry in the array. Finally, we analysed the data with proximity tools and visualization techniques. This approach is summarized in Figure 4.

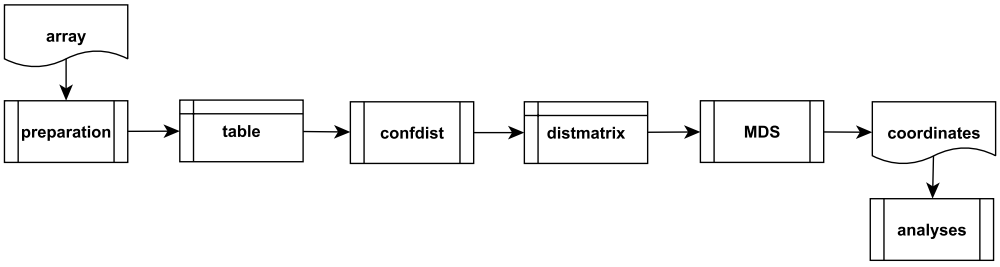

Figure 4. Overview of processing steps to "spatialize" textual variants.

4 Results

We test our approach with two case studies. The first case study uses the example on the food of John the Baptist, while the second scrutinizes the conjectures on the toponym Judea in Acts 2:9.

4.1 Case study 1: the food of John the Baptist

In section 1.2.1 we used the conjectures which were proposed for the food of John the Baptist as an example. We will now apply our approach to this case to demonstrate the preparation of the data for calculation of a confusion matrix and its subsequent translation to Euclidean space and apply spatial analyses. As we have already mentioned, several conjectures have been suggested as a substitution for the *locusts and wild honey* (ακριδες και μελι) in the diet of John the Baptist: *coconuts and wild honey* (καριδες και μελι), *cake and wild honey* (εγκριδες και μελι), *shrimps and wild honey* (γαριδες και μελι), *wild pears and wild honey* (αχραδες και μελι), *crops and wild honey* (ακρεμωνες και μελι), and *root and fruit* (ριζας και καρπον). Feeding this array of conjectures into our algorithm results in a distance matrix, shown in Table 3.

59 The software *confdist* is implemented as a command line application in the Python programming language and can be run on all three major operating systems. As input it takes a table of confusion distances and a table of word pairs. As output it returns the table of word pairs with the computed distances. The algorithm is freely available and its source code is open. It can be downloaded from https://github.com/balazsdukai/confdist [accessed 10 March 2019].

Table 3. Confusion distances for the food of John the Baptist

	ακριδες και μελι	καριδες και μελι	εγκριδες και μελι	γαριδες και μελι	αχραδες και μελι	ακρεμωνες και μελι	ριζας και καρπον
ακριδες και μελι	0	1	2	2	2	4	7.105
καριδες και μελι	1	0	3	1	3	5	7.105
εγκριδες και μελι	2	3	0	2	4	6	7.188
γαριδεσκαι μελι	2	1	2	0	3	6	6.188
αχραδες και μελι	2	3	4	3	0	5	7.155
ακρεμωνες και μελι	4	5	6	6	5	0	9.135
ριζας και καρπον	7.105	7.105	7.188	6.188	7.155	9.135	0

Figure 5 visualizes the outcomes of MDS and provides insight into the correlation and proximity between the conjectures and ακριδες (*locusts*), i.e. the text included in the critical edition of the New Testament.

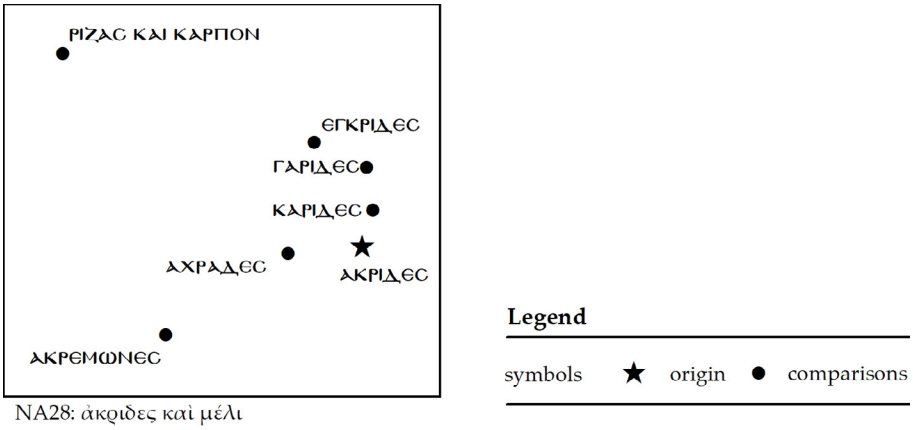

Figure 5. MDS visualization of conjectures on the food of John the Baptist.

We can, for instance, perceive which conjecture is closest to ακριδες (*locusts*), i.e. καριδες (*coconuts*); but it also builds a lineage of conjectures. For instance, is it necessary to presume a direct connection between a conjecture and ακριδες? We could argue on the basis of this figure that there could have been a sequence of scribal errors with its accompanying error propagation. Just as an experiment, we could assume γαριδες (*shrimps*) must have been the original, which was first corrupted into καριδες (*coconuts*), which was in turn corrupted into ακριδες (*locusts*). The MDS visualization supports this kind of reasoning, although it remains speculative.

This experimental analysis could be taken one step further. From the x,y plot in Figure 5 we gain a general understanding of the clustering and grouping of the conjectures. However, we can simultaneously visualize the specific confusion distances for a particular conjecture, which is a single column in the distance matrix. In this way, we are able to equate the structure in the proximity for individual conjectures. We therefore applied the Natural Neighbor tool within ArcGIS 10.5, which interpolates a raster surface based on the weighted confusion distances with a particular conjecture and repeated this for each column (see Figure 6).

From the results in Figure 6 we can observe the following:

– A palaeographic confusion of ριζας και καρπον (cj12987, *root and fruit*) with either of the other conjectures is unlikely. This can be concluded from the results of the proximity analysis, which are definitely different than the results for the other conjectures and also from the distances with all other conjectures. A similar conclusion could be drawn for ακρεμωνες (cj13821, *crops*), but one should observe that the majority of other conjectures is less distant than in the case of ριζας και καρπον. In other words, if we had to choose between ακρεμωνες or ριζας και καρπον, we deem the first to be more likely the consequence of palaeographic confusion.

– The results of the proximity analyses for ακριδες (NA28, *locusts*), αχραδες (cj11183, *wild pears*), and καριδες (cj11182, *coconuts*) are most equivalent in their graphical visualization. From this we can conclude that in these three cases the mutual confusion distances between the different conjectures show significant correspondence. Likewise, γαριδες (cj*, *shrimps, sea crabs*) and εγκριδες (cj10147, *cake*) are correlated.

In the end, we cannot discard a conjecture based solely on this analysis, since these results need to be interpreted with caution (the results of MDS remain an approximation), and other considerations and arguments such as semantics, grammar, phonetics or even geography might add weight to the probability of a particular conjecture. For instance, although a palaeographic confusion with γαριδες might be probable, the suggestion does not fit the geographical setting of the narrative. However, this analysis is helpful to discern grouping and clustering in the data and stimulates reasoning about lineages between the conjectures. This provides another perspective to the domain of conjectural criticism.

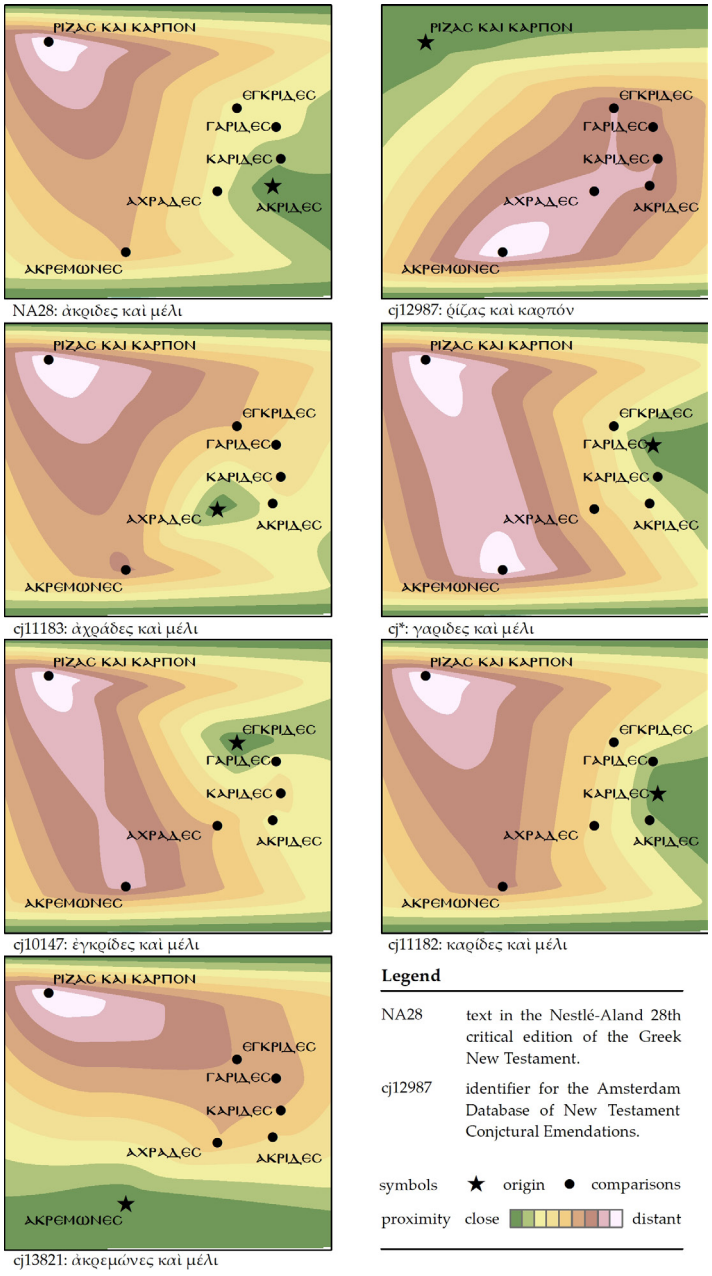

Figure 6. Proximity analysis of confusion distances for individual conjectures.

4.2 Case study 2: Judea in the table of nations in Acts 2:9–11

A second example of an intrinsic difficulty in interpretation of a New Testament text which led to a vast amount of discussion and numerous conjectures can be found in the list of nations in Acts 2:9–11:[60]

> "Parthians and Medes and Elamites and residents of Mesopotamia, Judea and Cappadocia, Pontus and Asia, Phrygia and Pamphylia, Egypt and the parts of Libya belonging to Cyrene, and visitors from Rome, both Jews and proselytes, Cretans and Arabians—we hear them telling in our own tongues the mighty works of God" (Acts 2:9–11, ESV).

Mapping these locations results in Figure 7:

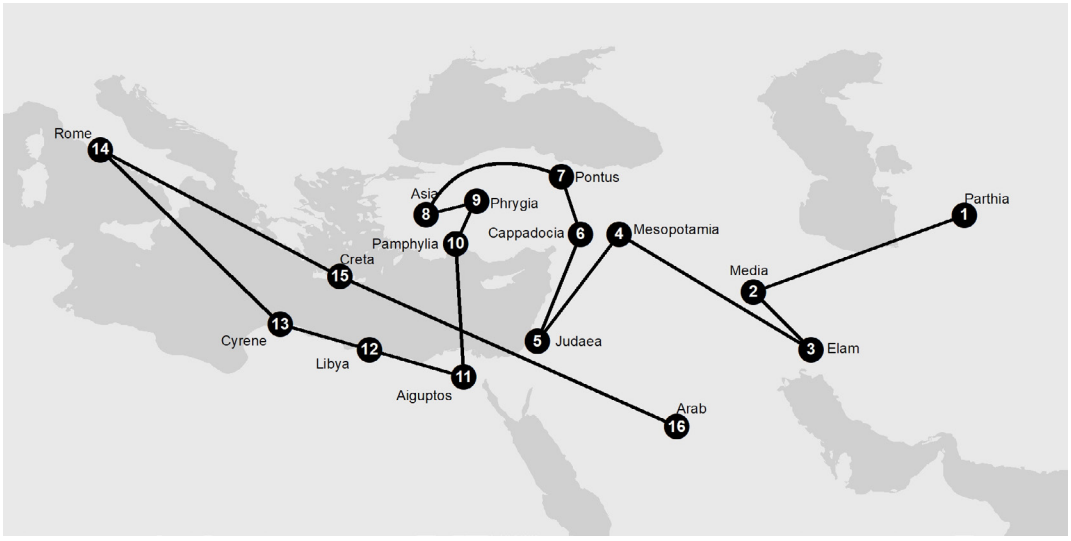

Figure 7. The geographical structure of the list of nations in Acts 2:9–11.

Several scholars observed three difficulties in this text which led them to question the authenticity of the nation Judea. We will only briefly summarize these issues to provide a basic understanding of the context:[61] (1) the reference to Judea and hence Jews in verse 9 seems awkward since the list refers to Jews anyway;[62] (2) the reference to Judea does not fit very well in the geographical arrangement[63] between Mesopotamia in the east and Cappadocia in the north;[64] and (3) the Greek word ιουδαιαν (Judea) should be regarded as an adjective, not as a noun and therefore does not fit the grammatical function in the sentence.[65]

To solve these difficulties, several critics have proposed to exchange Judea for an alternative location. To date, at least eighteen[66] alternative geographic locations have been suggested: Cilicia, Armenia, Ida (a mountain range on Crete), Iounaia, Ionia, Yaudi,[67] Iberia, Bithynia, Adiabene, Aramea, Idumea, Lydia, Gorduaia, Lycia, Galatia, Gallia, India, and Syria.[68] These locations are mapped in Figure 8.

60 The geographical scope is rather exceptional for conjectures. We will use it as an extra dimension in our analyses.

61 The commentaries of Pervo and Keener could be consulted for a fuller discussion of the issues. See Pervo, *Acts: A Commentary*; Keener, *Acts: An Exegetical Commentary – Introduction and 1:1–2:47*.

62 Metzger, "Ancient Astrological Geography and Acts 2:9–11"; Bruce, *The Book of the Acts*; Witherington, *The Acts of the Apostles*.

63 Barrett, *A Critical and Exegetical Commentary on the Acts of the Apostles*.

64 Bishop, "Professor Burkitt and the Geographical Catalogue," 84–85; Metzger, "Ancient Astrological Geography and Acts 2:9–11"; Witherington, *The Acts of the Apostles*.

65 Metzger, "Ancient Astrological Geography and Acts 2:9–11"; Bruce, *The Book of the Acts*; Barrett, *A Critical and Exegetical Commentary on the Acts of the Apostles*.

66 *Syria* and *Judean Syria* are counted as a single emendation.

67 *Yaudi* is an interesting suggestion. Instead of assuming some sort of corruption, the creative suggestion is to presuppose a Hebrew source from which the root יאדי, which could be rendered Judea equally well as Yaudi. In such a case, the palaeographic confusion distance would be 0, but since the Hebrew root for Judea is יהודה and not יאדי, this suggestion can be safely rejected.

68 The Greek conjectures are: Κιλικίαν, Ἀρμενίαν, Ἰδαῖᾶν, Ἰουναίαν, Ἰωνίαν, Ἰβερίαν, Βιθυνίαν, Ἀδιαβαίαν, Ἀραμαίαν, Ἰδουμαίαν, Λυδίαν, Γορδυαίαν, Λυκίαν, Γαλατίαν, Γαλλίαν, Ἰνδίαν, Συρίαν.

Figure 8. Alternative locations to Judea. The cj-numbers refer to the corresponding entries in the ADNTCE.

Since "ancient and modern times no one conjecture has proved generally acceptable,"[69] and therefore we will use this case to test our methodology. First, we calculated the palaeographic confusion distance and created a distance matrix for the array of conjectures.[70] These results are reflected in Table 4. Next, using classical Multi-Dimensional Scaling, we created Figure 9 from the distance matrix. This representation gives an approximation of the palaeographic distances among the conjectures and the reading found in NA28.

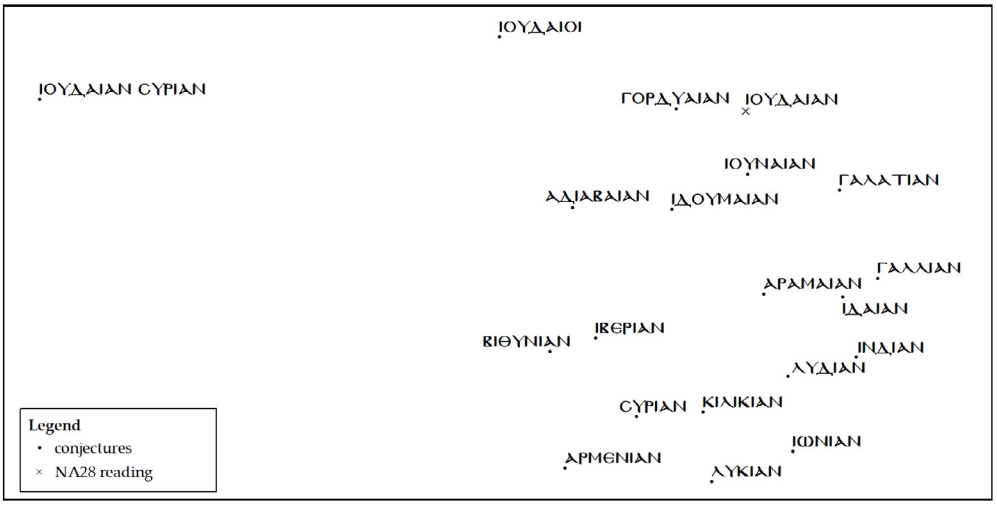

Figure 9. Two-dimensional representation of palaeographic confusion distances for Judea.

Finally, instead of applying the same visualization techniques we used for representing the palaeographic confusion distances for John the Baptist's food (see Figure 5), we took advantage of the geographical character of these conjectures to experiment with multi-criteria evaluation (MCE).

In this experiment, we used the geographical locations and added the palaeographic confusion distance with ΙΟΥΔΑΙΑΝ (Judea) as an attribute. Next, we used the Natural Neighbor tool in ArcGIS 10.5

69 Kilpatrick, "Conjectural Emendation in the New Testament," 351.

70 Yaudi was excluded from this analysis as it presupposes a Hebrew transliteration which would cause bias in the results for all Greek conjectures, see note 67.

to create a palaeographic confusion raster – an interpolated continuous surface based on the weighted confusion distances of each toponym with Judea. Finally, we created a visualisation (see Figure 10) in which we displayed the geographical data on top of the palaeographic confusion raster and also added the original geographical arrangement which is found in Acts 2:9–11 (see Figure 7). This representation can be used to simultaneously evaluate the probability of the conjectures against the criteria of (1) palaeographic confusion and (2) geographical arrangement.

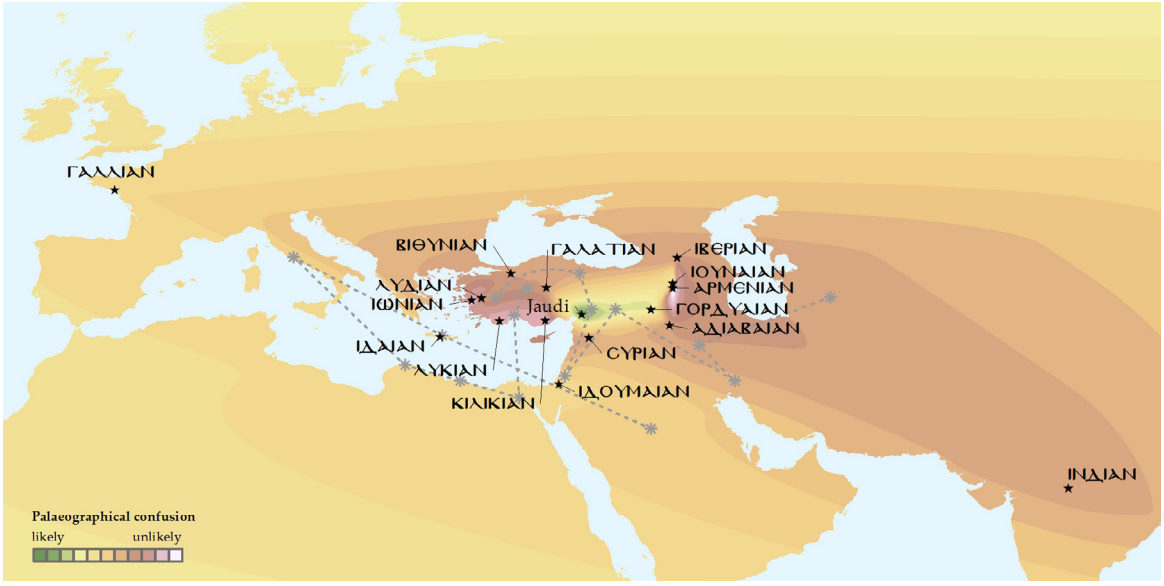

Figure 10. Palaeographic confusion distances super-imposed on geographical arrangement.

As illustrated in Figure 10, the proposed conjectures are widely dispersed. Several conjectures are more likely in respect of palaeographic confusion (e.g. ΙΔΑΙΑΝ [Ida], ΙΝΔΙΑΝ [India], and ΓΑΛΛΙΑΝ [Gallia]), but should be discarded because they violate the geographical arrangement. Other conjectures better suit the geographical arrangement, but are less likely the result of a palaeographic confusion (e.g. ΙΒΕΡΙΑΝ [Iberia], ΑΡΜΕΝΙΑΝ [Armenia], and ΑΔΙΑΒΑΙΑΝ [Adiabaia]).

Although our method does not provide conclusive results, as a preliminary result ΓΟΡΔΥΑΙΑΝ (Gorduaia) or ΙΟΥΝΑΙΑΝ (Iounaia) provide the best fit to both geographical and palaeographic criteria. To settle the issue – and it is doubtful if this even can be done – would require weighing more criteria. For our purpose, we demonstrated, however, the suitability of spatial analysis and multi-criteria evaluation as an approach to evaluate the probability of conjectures in more detail.

5 Discussion

As we can see from the results of both case studies, the method proposed in this article provides a new approach to weighing the probability of palaeographic confusion for conjectural emendations. Furthermore, when spatial analyses are applied to these results, patterns and correlations can be made visible that otherwise remain hidden in the data. We have observed this specifically in the results of the first case study on the food of John the Baptist.

It should be noted, however, that although MDS has a certain potential to spatialize relationships of non-spatial phenomena for subsequent visualization and analysis, no objectively repeatable results will be generated. This is mainly due to the fact that MDS gives an approximation of the higher dimensional "distances" of phenomena in a lower dimensional space.

Conversely, the method offers two opportunities to reduce the subjectivity. First, this approach unlocks a new tool that makes quantitative analysis possible. Second, it enables the researcher to literally visualize

Table 4. Confusion distances for alternatives to Judea in the list of nations

	ΙΟΥΔΑΙΑΝ	ΙΔΟΥΜΑΙΑΝ	ΛΥΔΙΑΝ	ΙΝΔΙΑΝ	ΓΟΡΔΥΑΙΑΝ	ΚΙΛΙΚΙΑΝ	ΑΡΜΕΝΙΑΝ	ΒΙΘΥΝΙΑΝ	CYPIAN	ΑΔΙΑΒΗΝΙΑΝ	ΑΡΑΜΑΙΑΝ	ΛΥΚΙΑΝ	ΓΑΛΑΤΙΑΝ	ΓΑΛΛΙΑΝ	ΙΩΝΙΑΝ	ΙΒΕΡΙΑΝ	ΙΟΥΔΑΙΑΝ CYPIAN	ΙΟΥΔΑΙΟΙ	ΙΔΑΙΑΝ	ΙΟΥΝΑΙΑΝ
ΙΟΥΔΑΙΑΝ	0	2.000	3.000	3.000	1.083	4.050	5.000	3.010	3.010	3.060	3.060	4.000	3.043	2.053	4.000	3.060	6.000	2.000	2.000	1.000
ΙΔΟΥΜΑΙΑΝ	2.000	0	3.020	3.060	3.083	4.060	4.060	3.060	4.010	4.000	3.010	4.010	4.043	3.053	4.050	3.060	7.100	4.000	3.000	1.050
ΛΥΔΙΑΝ	3.000	3.020	0	2.000	3.020	3.050	3.060	4.000	2.000	3.070	2.070	1.000	3.020	2.020	3.000	4.000	8.070	5.000	2.010	3.010
ΙΝΔΙΑΝ	3.000	3.060	2.000	0	4.033	2.025	3.100	4.000	3.000	3.060	2.110	3.000	2.076	1.076	2.000	3.000	9.000	5.000	1.010	2.010
ΓΟΡΔΥΑΙΑΝ	1.083	3.083	3.020	4.033	0	3.110	5.000	4.043	3.110	3.060	3.010	4.010	3.043	3.020	5.033	4.043	5.133	3.083	3.033	2.083
ΚΙΛΙΚΙΑΝ	4.050	4.060	3.050	2.025	3.110	0	4.050	3.050	3.100	4.010	3.060	2.050	4.000	3.043	3.025	4.000	8.060	6.050	3.010	3.075
ΑΡΜΕΝΙΑΝ	5.000	4.060	3.060	3.100	5.000	4.050	0	3.050	4.050	4.050	3.000	3.060	5.000	3.066	3.050	3.050	7.110	7.000	4.050	4.050
ΒΙΘΥΝΙΑΝ	3.010	3.060	4.000	4.000	4.043	3.050	3.050	0	3.010	5.000	4.050	4.000	5.000	3.066	3.000	2.060	8.010	5.010	4.000	2.010
CYPIAN	3.010	4.010	2.000	3.000	3.110	3.100	4.050	3.010	0	5.050	4.050	2.000	5.000	4.000	3.000	3.000	8.000	5.010	3.000	3.010
ΑΔΙΑΒΗΝΙΑΝ	3.060	4.000	3.070	3.060	3.060	4.010	4.050	5.000	5.050	0	2.050	4.060	4.010	3.030	5.000	5.000	7.020	5.060	3.010	4.050
ΑΡΑΜΑΙΑΝ	3.060	3.010	2.070	2.110	3.010	3.060	3.000	4.050	4.050	2.050	0	3.060	3.033	2.043	3.100	4.050	7.100	5.060	2.060	3.050
ΛΥΚΙΑΝ	4.000	4.010	1.000	3.000	4.010	2.050	3.060	4.000	2.000	4.060	3.060	0	4.000	3.010	3.000	4.000	9.010	6.000	3.000	4.000
ΓΑΛΑΤΙΑΝ	3.043	4.043	3.020	2.076	3.043	4.000	5.000	5.000	5.000	4.010	3.033	4.000	0	1.010	3.066	4.033	6.086	5.043	2.043	3.066
ΓΑΛΛΙΑΝ	2.053	3.053	2.020	1.076	3.020	3.043	3.066	3.066	4.000	3.030	2.043	3.010	1.010	0	1.083	3.033	7.063	4.053	1.053	2.076
ΙΩΝΙΑΝ	4.000	4.050	3.000	2.000	5.033	3.025	3.050	3.000	3.000	5.000	3.100	3.000	3.066	1.083	0	3.000	9.000	6.000	2.000	3.000
ΙΒΕΡΙΑΝ	3.060	3.060	4.000	3.000	4.043	4.000	3.050	2.060	3.000	5.000	4.050	4.000	4.033	3.033	3.000	0	8.010	5.060	3.000	3.060
ΙΟΥΔΑΙΑΝ CYPIAN	6.000	7.100	8.070	9.000	5.133	8.060	7.110	8.010	8.000	7.020	7.100	9.010	6.086	7.063	9.000	8.010	0	6.010	8.000	7.000
ΙΟΥΔΑΙΟΙ	2.000	4.000	5.000	5.000	3.083	6.050	7.000	5.010	5.010	5.060	5.060	6.000	5.043	4.053	6.000	5.060	6.010	0	4.000	3.000
ΙΔΑΙΑΝ	2.000	3.000	2.010	1.010	3.033	3.010	4.050	4.000	3.000	3.010	2.060	3.000	2.043	1.053	2.000	3.000	8.000	4.000	0	3.000
ΙΟΥΝΑΙΑΝ	1.000	1.050	3.010	2.010	2.083	3.075	4.050	2.010	3.010	4.050	3.050	4.000	3.066	2.076	3.000	3.060	7.000	3.000	3.000	0

connections in the data, thus providing insight into indirect relationships of phenomena. This distinguishes the tool from being a mere heuristic exercise. Though the tool provides insights which can be achieved by, for instance, philological observation, its additional benefit is that it visualizes implicit relationships, which are not easily perceived from the raw data itself, especially in the case of larger datasets. Beside these general remarks we will elaborate on the potential and limitations of our approach and point at further research for both the algorithm and the spatial analyses.

5.1 Confusion distances algorithm

Our expansion of the Levenshtein distance with three operations and the implementation in Python where specific distances can be calculated for specific letter combinations has proven to be a valuable tool in providing insight into the relations between different conjectures. Furthermore, the algorithm can be applied in other domains. In this article we have developed an application for Greek texts, but such palaeographic confusion distances can be determined as well for other ancient or modern scripts, for example, Latin or Hebrew. Moreover, the algorithm is generic in another way: it could be used equally well to calculate the probability of typing errors or phonetic confusion. The only requirement for such an application is to have an expert from the discipline design the specific confusion table.

Our implementation, however, also has limitations in the way it simulates palaeographic confusion. Palaeographic errors that could occur while copying texts are not fully covered by the six operations operators we implemented, and the algorithm could be refined by taking *haplography*,[71] *dittography*,[72] *compendia*,[73] and abbreviations (e.g. *nomina sacra*[74]) into account as well.[75]

Besides this finetuning of the algorithm, the confusion distance table (see Table 5) could be improved by calculating frequency statistics on the occurrence of character combinations in textual variants.

5.2 Spatial analysis

Despite its exploratory nature, the application of spatial analysis and visualisation techniques offer fundamental insights into the (im)probability of textual variants based on palaeographic confusion. Based on our analyses, we can trace palaeographic relationships between conjectures and textual variants. From our experiments, spatial visualisation and analysis have proven to be helpful literally to "look" at the reciprocal proximity of the several proposals.

However, we have only scratched the surface of spatial analyses for this application since our activities were solely restricted to the visualization of proximity relationships between textual variants based on palaeographic confusion distances. As we have argued above, several criteria to distinguish unlikely from likely readings should be taken into account. In future work, we will use the potential of GIS for more sophisticated multi-criteria evaluation (e.g. semantics, grammar, palaeography, phonetics, and even geography) to identify more suitable textual variants. GIS has proven itself to be useful for this kind of analysis in other fields such as land use suitability assessment. Application of this type of analyses, however, requires standardization and quantification of qualitative data. While not impossible, careful consideration is needed to translate the data to appropriate scales of measurement.

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71 *Haplography* is the omission of a letter or word due to a similar letter or word in the immediate context.

72 *Dittography* is a duplication of a letter or word.

73 *Compendia* or *ligatures* are monograms created from a combination of two (or more) alphabetic characters.

74 *Nomina sacra* are a collection of words written in special abbreviated forms in Christian sources, i.e. $\Theta\overline{\Sigma}$ = θεός, $\text{X}\overline{\Sigma}$ = χριστός, and $\text{K}\overline{\Sigma}$ = κύριος.

75 This list is far from comprehensive and also neglects other factors which influenced the copying process. For an introduction on scribal habits, see Royse, "Scribal Tendencies in the Transmission of the Text of the New Testament."

6 Conclusions

The aim of this article was to calculate confusion distances to enable spatial analysis of New Testament textual emendations. Although our research was limited to palaeographic confusion and only visualised proximity relationships of conjectural emendations, we have demonstrated the applicability of distance metrics to conjectural criticism and the subsequent potential of spatial analysis and visualisation. Therefore, our method provides an additional toolset to analyse conjectural emendations and, supposedly, extant textual variants. It also reveals insights which otherwise remain hidden in the data. As such, it can provide additional arguments and will not replace classical text critical reasoning. In the end it is up to the scholar to weigh the evidence and to decide to what extent to give the method any credence.

An obvious extension of this work is to expand the algorithm to support other types of scribal errors. Additionally, we propose a refinement of the proposed palaeographic confusion table based on frequency statistics of textual variants, and the provision of additional confusion tables (e.g. based on phonetics). Furthermore, insights about the semantic proximity and grammatical relatedness of textual variants and conjectures could also be translated to quantifiable measures.

These kinds of refinements and expansions will enable textual critics to engage more fully with research on multi-criteria evaluation using GIS. Not only is a fuller assessment of MCE needed, but also a more thorough consideration for translating qualitative criteria to quantitative measurement scales. This involves a close collaboration between the disciplines of spatial analysis and textual criticism.

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Appendix: Confusion table

Table 5 is based on Metzger[76] and Rutgers,[77] and provides a first approximation of the ease with which certain letters or combinations of letters could be confused because of their orthographic – not phonetic – resemblance (cf. the column weight). It is then used to calculate the transcriptional distance between two readings. The probability index *P* for each operation is easily inverted to a confusion distance *D* using the formula

$$D = \frac{1}{P}$$

Needless to say, the table cannot be exact.[78] Letter forms changed over time, and scribes must have had their individual patterns of error.

76 Metzger, *Textual Commentary*.

77 Rutgers, "Index Palaeographicus."

78 Textual critics can make remarks such as "confusion between τωικανωσαντι and τωκαλεσαντι would be easy" on Col 1:12. See Metzger, *Textual Commentary*, 553.

Table 5. Letter confusion table (s = substitution, cs = complex substitution, c/e = contraction / explosion)

1	2	*p*	examples	NT ref.	operation
Λ	Δ	100			s
Λ	Λ	100			s
Γ	Ι	30			s
Γ	Π	30	ΑΠΑΤΑΙϹ - ΑΓΑΠΑΙϹ	2 Pet 2:13	s
Γ	Ρ	30			s
Γ	Τ	40	ΑΡΑΓϵ - ΑΡΑΤϵ	1 Cor 6:20	s
			ΟΛΙΓΩϹ - ΟΝΤΩϹ	2 Pet 2:18	s
Γ	Υ	30			s
Δ	Λ	100	ϵΠΙΛϵΞΑΜϵΝΟϹ - ϵΠΙΔϵΞΑΜϵΝΟϹ	Acts 15:50	s
			ϵΚΔΥϹΑΜϵΝΟΙ - ϵΚΛΥϹΑΜϵΝΟΙ	2 Cor 5:3	s
ϵ	Θ	100			s
ϵ	Ο	100			s
ϵ	Ϲ	100	ΚΟΠΙΩΝΤΑϹ ΔϵΙ - ΚΟΠΙΩΝΤΑ ϵΔϵΙ	Acts 20:25	s
Η	Κ	20			s
Η	Ν	50	ΠΟΝΗΡΙΑ - ΠΟΡΝϵΙΑ	Rom 1:29	s
Η	Π	40			s
Θ	Ο	100	ΟϹ - ΘϹ	1 Tim 3:16	s
Θ	Ϲ	100			s
Ι	Ρ	20			s
Ι	Τ	30			s
Ι	Υ	20			s
Λ	Ν	30	ΙΟΥΝΙΑΝ - ΙΟΥΛΙΑΝ	Rom 16:15	s
Μ	Ν	20			s
Ν	Π	20			s
Ο	Ϲ	100			s
Π	Τ	40	ΑΠΑΤΑΙϹ - ΑΓΑΠΑΙϹ	2 Pet 2:13	s
Ρ	Υ	20			s
Τ	Υ	30			s
Τ	Ψ	40			s
ΗΙ	ΙΝ	40			cs
ΗΝ	ΜΙ	40			cs
ΙΗ	ΠΙ	30			cs
ΙΠ	ΠΤ	40			cs
ΙΤ	ΠΙ	20			cs
ΠΙ	ΤΗ	50			cs
ΓΙ	Π	100	ΑΠΟ - ΑΓΙΟΙ	2 Pet 1:21	c/e
ΔΙ	Ν	20			c/e
ϵΙ	Η	20			c/e
Ζ	Τ	10			c/e
Η	ΙΓ	20			c/e
Η	ΙΡ	30			c/e
Η	ΙΤ	30			c/e
Η	ΤΙ	40			c/e
ΙΙ	Η	20			c/e
ΙΙ	Π	20			c/e
ΙΙ	Τ	10			c/e
ΙϹ	Κ	100			c/e
ΙΤ	Ν	10			c/e
ΙΤ	Π	100			c/e
ΛΙ	Ν	40	ΟΛΙΓΩϹ - ΟΝΤΩϹ	2 Pet 2:18	c/e
ΛΛ	Μ	100	ΑΛΛΑ - ΑΜΑ	Rom 6:5	c/e
ΛΛ	Ν	20			c/e
Ν	ΤΙ	20			c/e
Π	ΤΙ	100			c/e
Π	ΤΤ	80			c/e

Digital Humanities in Biblical Studies and Theology

Communication

Stratton L. Ladewig,* Robert D. Marcello

Presentation of the Center for the Study of New Testament Manuscripts: Bridging the Gap between Ancient Manuscripts and Modern Technology

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Abstract: This article seeks to expound upon the first facet of CSNTM's mission: to capture firsthand digital images of Greek New Testament manuscripts with high resolution digital equipment. By cooperating with likeminded libraries, CSNTM accomplishes the preservation and presentation of cultural heritage artifacts via the utilization of the advances of technology. Details of collaboration, digitization procedures, and preservation and presentation practices are explored, providing a glimpse into this world of artifact digitization. The article then turns to the consideration of ways to improve both digitization and the end user's experience. While CSNTM engages libraries, archivists, researchers, and students, supportive partners serve to facilitate the work. All are essential, enabling CSNTM to preserve and provide access to timeless treasures.

Keywords: CSNTM; manuscripts; New Testament; digitization; digital humanities; multispectral imaging; preservation; collaboration; INTF

1 Introduction

The initial mission of the Center for the Study of New Testament Manuscripts (CSNTM) is to digitally preserve ancient manuscripts for the modern world.[1] In 2002, Daniel B. Wallace founded the Center to utilize emerging technologies to photograph and fully archive Greek New Testament manuscripts. The images produced are freely accessible on the Center's website – a searchable library of Greek New Testament manuscripts. We have collaborated with more than forty-five institutions on four continents to produce images of approximately 700 New Testament manuscripts. These images have been provided to their holding institutions at no cost. In the process, we have "discovered" over seventy-five New Testament manuscripts that had not been catalogued by the *Institut für Neutestamentliche Textforschung* (INTF), more than any

1 We want to express our sincere gratitude to Daniel B. Wallace, Jacob W. Peterson, and Andrew J. Patton for their beneficial feedback on the draft of this work.

***Corresponding author: Stratton L. Ladewig,** Center for the Study of New Testament Manuscripts, Plano, United States of America; E-mail: sladewig@csntm.org

Robert D. Marcello, Center for the Study of New Testament Manuscripts, Plano, United States of America; E-mail: rmarcello@csntm.org

other organization in the twenty-first century.[2] The Center is internationally recognized for its expertise in digitization. More than 50,000 users examine the images in our digital library each year. Accordingly, the Center's digitization work facilitates a partnership between manuscript owners, archivists, and researchers around the world. The following profiles the organization's cooperation with libraries to accomplish the preservation and presentation of cultural heritage artifacts via the utilization of the advances in technology.

2 Collaboration

Collaboration with various institutes and individuals in bringing a manuscript from the library's shelf to a researcher's computer screen is a central focus of the Center's mission. The Center collaborates with other organizations and individuals on a daily basis to ensure that images are made available to the greatest number of people possible. This is held in tension with our commitment to honor the contracts and wishes of each holding institute. While many digital libraries contain a single collection, CSNTM is exceptional in that we not only archive and display images of our own manuscript, GA 2882, but also images from scores of other libraries we have partnered with in the last two decades. This allows CSNTM to be a vehicle for scholars to access images they might otherwise not be able to view without visiting the library themselves. In fact, the majority of images on our website are images we digitized at remote libraries or monasteries. By partnering with these institutes, we are able to provide images and access to documents that would likely not be digitized in the near future. Further, this offers libraries the opportunity to have their collections digitally preserved when they may not have the means or expertise to engage in an exhaustive digitization project. The following sections highlight some of these international collaborations.

2.1 Contracts

Obtaining contracts with various libraries is one of the ongoing challenges the organization faces. Considering the broad distribution of libraries – including institutes, private collections, monasteries, and many others – and various political and cultural issues, working with these variables can take years to secure a contract. However, our International Advisory Board and the Center's track record for carefully and completely archiving each document continue to open doors to new opportunities for partnership.[3]

One aspect of our contract has always been that the library will retain all of the rights to the images.[4] We simply ask that we be allowed to display them on our website and keep a copy in our archives for preservation.[5] In this way, libraries know that their images will be properly archived, apart from the copy they receive, and that they will gain international attention by CSNTM giving free access to their images. In order to accomplish these things, CSNTM's viewer has various safety protocols that inhibit researchers from downloading images. Restricting downloads while providing free general access for viewing is not only a common practice in digital humanities but is also a protocol designed to steward the images entrusted to

2 A "discovered" manuscript refers to one that was previously unknown to the wider academic community because it is uncatalogued, although sometimes the librarians themselves were cognizant. At other times, CSNTM's researchers have been able to inform the library staff of a new finding that is in their collection. For announcements of these discoveries, see the CSNTM blog.

3 For example, our ongoing relationship with the National Library of Greece has allowed us to work with various monasteries in central Greece, thereby opening doors to historic collections.

4 For almost identical policies with regard to image rights and downloading, see the Hill Museum and Manuscript Library, http://hmml.org/about/ (accessed 25 October 2019). Unfortunately, there is no one Creative Commons license that encompasses the various types of contracts required by libraries in our digital archive. As such, we do not impose a single rights scheme for our website but view each collection individually, and we request researchers to gain access based on the library's requirements and permissions. If a library requests that their collection be held under a specific creative commons license, we are more than willing to accommodate those stipulations. The general principle is that we allow each library to make that determination.

5 In certain instances, the Center has only been allowed to have an archival copy for research purposes and is not allowed to display the images.

us. If CSNTM were to require that a holding institute's images be downloadable, such a stipulation would bring an end to many negotiations, particularly with non-western libraries and monasteries.

If any scholar wants additional access to images for personal copy, publication, presentation, or display, they may contact the library and us in order to request the complete archive.[6] CSNTM is happy to provide them without any cost to the researcher as long as the proper permissions are obtained from the holding institute which owns the rights. In this way, the Center acts as an intermediary between researchers and libraries by both providing access freely to all and honoring the wishes of the library.

Many researchers presume that all cultural heritage documents should be available with open access. However, libraries around the world are entrusted with caring, preserving, and archiving their collections to the best of their ability. This process is both costly and time-intensive, and researchers often lack sensitivity to such dynamics – especially with smaller libraries. International copyright laws are often unclear on many of these dynamics, and scholars ought to exercise ethical standards that supersede such laws. If a library requests that their images remain private or require various steps for access, scholars ought to enthusiastically support such measures since without these libraries protecting these cultural heritage documents, the world would lose valuable resources. The mere fact that a library has allowed their collection to be digitized demonstrates their commitment to preservation.

2.2 Scholars and institutes

The Center also collaborates with numerous scholars and institutes in various fields of study. This area is primarily focused on providing images for researchers: art historians, text critics, paleographers, papyrologists, codicologists, archivists, and other digitization experts on various projects. At any given time, the Center may be working on or contributing to various research projects. Of course, all of these projects fall within the confines of our library contracts, but these very restrictions make the content of our digitization efforts more widely accessible.

2.3 *Institut für neutestamentliche Textforschung*

One of the main groups the Center has collaborated with over the years has been the *Institut für neutestamentliche Textforschung*. The INTF was not only the first place where the Center digitized manuscripts but has also been a trusted partner in helping the organization gain access to libraries. Because of their aid, the Center was able to digitize the amazing collection at the *Biblioteca Medicea Laurenziana*. We have also provided countless updates to INTF's online and print versions of the *Kurzgefasste Liste*, as we travel to each location revising the information available regarding the library and their collections. As was previously discussed, our contracts only allow CSNTM to host images. Unfortunately, due to the difficulty of even obtaining our own contracts for digitization, the Center is unable to secure additional permissions for third-party organizations. However, we have worked with INTF to help them gain permission to host images on their website after a digitization project is complete.

The INTF began their New Testament Virtual Manuscript Room (NTVMR) a few years after the founding of CSNTM, and in doing so, they have become a fantastic resource for those researching the text of the New Testament. While the NTVMR has grown to provide multiple resources for *researching* manuscripts, the Center has remained a place for *viewing* manuscripts. In no way does the Center want to compete or provide redundant services with the NTVMR. Rather, CSNTM intends to provide the best viewing experience for the manuscripts we have digitized and others we have obtained. For example, our viewer was built on a responsive design, allowing all features to be available on either a desktop or a mobile device. Further, the viewer is intended to be the primary object on the screen – not competing with space for transcriptions and other features.

6 This is explained in more detail on the Center's website, under the "Terms of Use," Section 3b, which each user must agree to in order to view the digital library.

2.4 Additional partnerships

The Center works with various granting agencies, foundations, and individual donors who care about the work of digitization and preservation (e.g., Hillcrest Foundation, Bank of America, N.A., Co-Trustee). These groups understand the importance of digital preservation and grasp that the Center's services allow numerous collections to be freely available worldwide. Such collections would otherwise remain limited to microfilm or would be virtually inaccessible to researchers. Further, many individuals not only contribute financially, but they also contribute their time to aid CSNTM with website development, indexing, and other tasks that make future research easier. This also lowers the operating costs of the Center, permitting us to focus our efforts on accessing and presenting more manuscripts through our digital library. Thus, the Center collaborates with everyone from librarians and researchers to monasteries and museums in order to bridge the gap between state-of-the-art scholarship and ancient collections.

3 Digitization

The first facet of CSNTM's mission is to capture firsthand digital images of Greek New Testament manuscripts with high resolution digital equipment. The Center has dedicated itself to achieving this goal without charge to the owner of the manuscript. CSNTM has never accepted any form of compensation for the privilege of digitizing manuscripts. To clarify, the mission is to obtain *firsthand* images. "Firsthand" refers to the direct digitization of New Testament artifacts, as opposed to scanning a previously made photostat, for example. Although high-resolution photography has been the vehicle used to capture the manuscripts, such a descriptor is a sliding target. As technology advances, so does the Center's insistence on the highest available digital resolution. We started with a 4-megapixel point-and-shoot camera in 2002, at the time a medium- to high-end digital camera. That camera and its technology are now relics. Currently, the cameras that the Center uses are 50-megapixel professional cameras, and in the not-too-distant future these specifications will be superseded by yet another technological advancement with even greater capabilities. With refined protocols and superb equipment, a preservation outcome is achieved that is accessible and capable of duplication without deterioration. In the last decade, our standards now meet international guidelines set by the Library of Congress, the British Library, and the *Deutsche Forschungsgemeinschaft*. It is to this end that CSNTM pursues its purpose. There are two aspects to digitization: the manuscript examination and the manuscript capture. The capture can be subdivided into standard imaging and multispectral imaging. Digitization leads naturally into the preservation and presentation of the images.

3.1 Manuscript examination

The examination of a manuscript occurs as a prerequisite to its digitization. Internally, this is referred to as an autopsy, although such a term could be misleading. The manuscript is not deconstructed in any way, but its evaluation is relatively thorough nonetheless. Several types of routine data are collected: contents, date, material, physical dimensions, library's shelf number(s), columns, and lines per page. In addition to these specifications, CSNTM also records specialized data that is not often found in other catalogs, including details such as quire count, leaves in each quire, and depth measurements. The leaf count is particularly useful information because the digitizing team must have an accurate count and notes about when the numbering may have variations.[7] Following the examination, the manuscript is ready for the team to begin the process of digitally recording its contents.

7 It is fairly routine for the leaf and/or page numbering to have anomalies. For example, the numbering may skip or duplicate (3, 4, 6, 7, 8 or 3, 4, 4, 5, 6). The digitizers must be keenly aware of such inconsistencies so as to not make an error in their preservation efforts.

The autopsy is a vital part of the digitization process for a couple of reasons. First, because digitization records the artifact in a virtual state, precise details are essential for a researcher to comprehend the manuscript and utilize it properly. This researcher will likely not have the luxury of examining the manuscript herself – due to the expenses associated with travel or the difficulty of gaining in-person access to a library's treasure. In addition, these data points feed metadata collection processes. Accurate metadata is necessary to produce useful searches in a database and for a library's own records. CSNTM's website is searchable. This metadata is the lifeblood of such a presentation of these valuable records of the New Testament.

3.2 Manuscript capture

3.2.1 Standard imaging

Standard digital imaging has traditionally involved digital single-lens reflex (DSLR) cameras.[8] Professional level equipment utilized by an experienced staff person yields a virtually impeccable end product. CSNTM's standard for image quality is "perfection." The target of perfection is an amalgam of principles that work together to constitute a good image: image focus, 3:2 vertical ratio (see below), horizontal alignment, square page, top and inside margin alignment priority, stylus pressure, and hole awareness. Many times, the manuscript itself will physically present obstacles to this standard. For example, a tight binding may cause pages to create a natural waterfall effect,[9] which in turn affects the squareness of the page in the image and results in a trapezoidal appearance. A trapezoidal page also violates the principle that seeks a straight top margin. In order to hold the page straighter, a stylus can be used, but too much pressure can cause the outer margin to dip undesirably. Balancing these standards is a tedious and sometimes time-consuming process. Over time, the articulation of that standard has been adjusted to "practical perfection."[10] Nevertheless, each image and the processes to produce it are scrutinized to deliver the best possible representation of the manuscript.

The typical equipment setup currently utilized includes a 50-megapixel camera, a custom-made mobile copy stand, and a laptop computer. The computer runs the image-capture software; thus, the digitization is controlled directly from the computer rather than from the camera. With a skilled manuscript holder and computer operator, image capture with standard imaging can occur quite rapidly. The skills involved, however, are not easily mastered, and many digitizing teams have been frustrated in attempting to achieve the Center's exacting standard. We have found that the teams do not reach a high level of proficiency until they have captured about 10,000 images.

Since its inception in 2002, CSNTM has transitioned through several versions of standards protocols. These protocols are the guidelines that govern the methods used to create page-by-page digital images of ancient texts. While it is unnecessary to reminisce about each of these, a description of some of the aspects of CSNTM's current practices may be instructive.

Digitization captures the entirety of the manuscript, page-by-page, and all six sides of a codex. In that way, the entire artifact is preserved – even if New Testament material comprises only a small portion of the contents of the manuscript. Capturing the entire artifact is a best practice that CSNTM fully supports. In terms of framing the page, the vertical spaces above and below the page are set at a 3:2 ratio. That is, the background of the page itself is at a 3:2 ratio – 3 parts on top of the page and 2 parts below. The rationale

8 New technology is emerging that uses a mirrorless camera. Time will tell whether this evolution will replace DSLR photography for manuscript digitization.

9 The "waterfall" effect is a situation that occurs when the pages fall over from the binding to the outer edge with the effect that the top or bottom is not straight. The goal is to capture the page as flat as possible without doing any damage to the binding.

10 This means that we strive for perfect images according to our standards, but it also allows for slightly increased margin or variation in positioning in order to ensure such standards do not slow down image capture to an impractical speed or damage the manuscript.

is simple. Medieval manuscripts were usually written with a top to bottom margin ratio of 1:2 or 1:3.[11] By inverting that space for digitization, more black space (when a black cloth is used as a background) is above the page. And the byproduct is that the text is approximately centered vertically in the image. It also results in an aesthetically pleasing appearance. CSNTM has always used one person to hold the manuscript during digitization and another to control its capture via a laptop. Such a setup provides a dedicated person, trained in artifact-handling, to attend to the manuscript at all times, ensuring its safety. This individual is responsible for positioning the manuscript in the field of capture along with preventing stress to the binding and pages during the project.

The postproduction of images that make up the manuscript digitization begins while on-site. Quality control processes are run in order to ensure that the caliber of every image meets "practical perfection." These checks include things such as reviews of focus, naming conventions, alignment relative to the inside margin (tight but without missing any portion while attempting to exclude text from the preceding page), all four sides being completely in the image without any portion clipped, avoidance of waterfall effects or trapezoidal appearance, relative consistency (size, color, etc.) from one page to the next, verification that all pages were captured without skipping or duplicating any, and file conversions. Following quality control, an initial backup of the project is made. After the digitizing teams return to the office, the images are moved onto the local server, and additional backup processes are conducted. The images of the manuscript are prepared for display on CSNTM's website (http://csntm.org), which includes tagging of important features and indexing.

The standard imaging digitization process is quite laborious but exceedingly profitable. The product yields fruit that is necessary for the work of many. Although the initially-envisioned users of CSNTM's online manuscript library were primarily students of the New Testament and textual scholars, history has demonstrated a wider audience. Byzantine art historians might utilize the vibrant images to research the icons in medieval manuscripts; paleographers might analyze handwriting; and Greek teachers might illustrate the shift from the written to the printed text. It is to this end – the digitizing of handwritten texts for the benefit of the humanities – that the Center makes its work freely available.

3.2.2 Multispectral imaging

Multispectral imaging (MSI) is a revolutionary, highly technical combination of equipment and software that facilitates the collection of data about a cultural heritage object to reveal details about that artifact.[12] MSI uses a method completely distinct from standard imaging to capture the artifact, yet its benefits are invaluable. Depending upon how the data is processed, MSI can produce results that were heretofore unimaginable. For example, MSI, when utilized properly, can reveal text that is either difficult or impossible to read with the unaided eye. Text could be illegible due to exposure to water, being a palimpsest, or some other condition. A skilled technician can then, through post-processing, reveal the hidden or obscured text and thus provide researchers with valuable testimony to a lost text. The results of MSI can also be analyzed to identify specific color compounds used to create icons.[13] With that information, the materials can be traced so as to potentially provide a place of origin for the artifact. An archivist can use data from periodic MSI sessions to track the rate of deterioration of a manuscript in its storage environment. Doing so can give the archivist tangible evidence that the storage conditions are adequate or that they might be improved. The applications of MSI are seemingly endless.

MSI digitization, which is more properly called data collection, begins with the equipment. CSNTM currently uses a system developed by MegaVision that is portable and designed specifically for cultural

11 The top margin of skillfully made medieval manuscripts was typically one-ninth the page's height; the bottom margin was two-ninths of the page's height; the inner margin was one-ninth of the page's width; and the outer margin was two-ninths of the page's width (Tschichold, *The Form of the Book*, 43–44; see also Johnston, *Manuscript & Inscription Letters*). Of course, variation exists between manuscripts, but the thrust of CSNTM's principle is that the top margin is larger than the bottom's to counter the manuscript's layout. CSNTM's practice moves the text toward the center of the page.

12 MSI actually has a much broader range of applications, but we are speaking here in terms of relevance to our work.

13 This can be accomplished by comparing color values of various portions of the image and what those values demonstrate as far as the component makeup of the ink.

heritage digital imaging. Twenty-five images, some of which also utilize filters, are captured across the ultraviolet, visible, and infrared light spectra with a monochrome sensor. Each of these images reveals different amounts and types of data. Depending upon the desired outcome, some of these may be more valuable than others in the post-processing stage. Additionally, a composite color image can be created by combining the individual images from the visible spectra. The resulting image does not *look* dramatically different from a color image taken with standard imaging equipment. However, the composite image vastly improves color accuracy by overcoming the obstacles inherent in the interpretation of color by the sensors in DSLR cameras. The outcome is a "highly accurate color reproduction of a very wide range of difficult subjects."[14] But the real magic occurs during the post-processing stage.[15] It is at this stage that the desirable outcomes can be achieved.

The intersection of New Testament textual studies and digital humanities has become a welcome union with great potential. The spectral attributes of the data that is collected from MSI along with the potential results from post-processing lend themselves to being used by the skilled researcher to reveal tremendous insights. When compared to standard imaging, MSI is exponentially more time-consuming because its process is far more exacting. This technology assists CSNTM to achieve its goal of "practical perfection" in image production.

4 Preservation and presentation

CSNTM serves as stewards of the images that it captures, both in terms of preservation and presentation. CSNTM provides a complete archival copy of images to the library. This copy includes whatever format of images a library requests including RAW, TIFF, and JPEG. The Center will provide any or all formats that a library requests. As was previously mentioned, these images will also be the sole property of the library, so they may use them however they wish without restriction. We simply ask for attribution for digitizing the collection.

The images are also backed up in a RAID (Redundant Array of Independent Disks) configuration on CSNTM's local server, which is both housed in a secure location and inaccessible without proper permissions. Our archives are stored in a climate-controlled server room with fire controls and multiple redundancies in order to ensure that the images last for generations to come. One such redundancy is that our images are also backed up at two separate international locations, further ensuring the future of the manuscript data. This backup is in standard archival formats and is done in accordance with best practices in order to guard against the obsolescence of the data.

While other sites host images of New Testament manuscripts and make them available freely, CSNTM is unique in that the majority of the manuscripts on our website are images we have digitized ourselves. In order to present the most accurate rendering of the artifact, the images are displayed in the viewer unaltered by digital editing software. These manuscripts have been personally examined by our staff, and information about that examination is also freely available alongside the manuscript viewer. Further, the viewer was designed to function with a searchable database, so that the images of the manuscript can be displayed based on the keyword searches. For example, if someone wants to view icons in a certain manuscript, they can easily search for the type of icon they want by clicking on the list to the left of the image viewer. This type of search is accomplished because of tagging. Anyone can contribute to image tagging by contacting the organization and getting private login credentials. Furthermore, as more and more verses are tagged on the website, the search becomes more robust. A researcher may type in a verse reference and every manuscript page that is tagged with that reference will quickly appear. This is all done through our manuscript viewer, which as discussed earlier prevents downloading of images. The library and the manuscript's characteristics are also displayed prominently, so it is clear where it is located and

14 "MegaVision Archival and Cultural Heritage Imaging."

15 The term "post-processing" is being utilized in a more expansive way than in the standard imaging section above. Post-processing of MSI includes those things in standard imaging but extends to the processing of the raw data to reveal additional information (e.g., faded text).

what features it has. This is done in order to create the best viewing experience possible, so searching and viewing are done easily and without multiple steps. All of these features and archival procedures are done to ensure that we remain faithful stewards of the digital collection that was entrusted to us.

5 What lies ahead?

CSNTM staff are constantly seeking for ways to improve both our digitization and the end user's experience. Three areas of expansion seem particularly beneficial: (1) comprehensive image metadata, (2) continual website improvements, and (3) optical character recognition.

5.1 Metadata

Metadata, which is "data about data,"[16] serves as the glue that binds together the raw materials of digital humanities. Without precise and relevant metadata, the images that the Center collects are not easily navigated, and the information they contain could be cumbersome to utilize. Metadata Encoding and Transmission Standard (METS) of the Library of Congress captures the importance of metadata well.

> Maintaining a library of digital objects of necessity requires maintaining metadata about those objects. The metadata necessary for successful management and use of digital objects is both more extensive than and different from the metadata used for managing collections of printed works and other physical materials. While a library may record descriptive metadata regarding a book in its collection, the book will not dissolve into a series of unconnected pages if the library fails to record structural metadata regarding the book's organization, nor will scholars be unable to evaluate the book's worth if the library fails to note that the book was produced using a Ryobi offset press. The same cannot be said for a digital version of the same book. Without structural metadata, the page image or text files comprising the digital work are of little use, and without technical metadata regarding the digitization process, scholars may be unsure of how accurate a reflection of the original the digital version provides. For internal management purposes, a library must have access to appropriate technical metadata in order to periodically refresh and migrate the data, ensuring the durability of valuable resources.[17]

Metadata collection has always been a part of the methodology used by the Center. However, there are ways that the collection and storage of this information might be improved so that it can meet additional standards and improve accessibility. A fruitful place to look for direction in this regard is the METS.[18] CSNTM is exploring ways to automate metadata collection, effective ways of storing information, and efficient sharing to constituents to boost collaboration.

5.2 Website renovations

Because the website is the face of the organization, staff members routinely improve the site, both in content and presentation. CSNTM has to be strategic in its implementation of improvements because of practical limitations. Two areas of future development provide significant promise for increased functionality of the site.

First, improved indexing and tagging of the images of manuscripts on the site would be tremendously beneficial. Indexing is the labeling of specific verses associated with a particular image of a page. For example, the first verse and the last verse on a particular page can be tagged. In that way, a search can

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16 Gilliland, "Setting the Stage," http://www.getty.edu/publications/intrometadata/setting-the-stage/. Gilliland continues to articulate the essence of metadata: "metadata is...the sum total of what one can say at a given moment about any *information object* at any level of aggregation."

17 "METS: An Overview and Tutorial."

18 "METS: Home." A broader list of other standards can be found at the site "Standards at the Library of Congress."

bring a user directly to the page that contains the desired passage. Currently, indexing occurs manually, so a method to increase the speed of indexing would greatly improve the user's experience. Further, indexing of biblical manuscript images has been accomplished by other organizations, so enabling our website to import such data would eliminate redundancy. In addition to general tagging, the further ability to provide micro-indexing – i.e., the tagging of a specific verse in its actual location in an image – would be invaluable to researchers. Finally, we are exploring ways of moving indexing to a more automated process within the digitization and processing workflow.

Second, researchers often have needs that extend beyond verse indexing. Supplementing the website's database with additional tags increases its usability. Fuller tagging of manuscript pages with headpieces, *ektheses*, icons, canon tables, etc. expands the ways the data captured in digitization can be used by researchers. Even more, if the website were to include a Spectral Curve Analysis with multispectral images, researchers could compare these metrics with subsequent images to verify that their preservation practices are indeed effective. These are ways that could dramatically impact facility with which a researcher utilizes the image data.

5.3 Optical character recognition

Since CSNTM's inception, its goal has been to leverage developing technologies to reduce the manual workload involved in creating a pool of all New Testament textual variants. A couple of technologies in particular were envisioned: MSI and optical character recognition (OCR). The first is now a reality; the second remains on the (distant) horizon.

OCR is essentially the usage of computer software to recognize typed or handwritten characters of a text based on a digital image. The end product would be a transcription of a manuscript in a machine-readable format. Any product of OCR would necessarily require a very high degree of accuracy to be of any practical use. It is true that most models fail to provide a sufficient level of accuracy, but we have seen some promising developments recently from some researchers that point to this vision becoming a reality. If successful, the creation of full transcriptions could be automated, with a review process in place, thereby increasing the speed of transcriptions exponentially. In turn, this would provide a significant increase in the available data for manuscript comparison and possess increased accuracy of such data.

5.4 Summary

Whether the Center moves forward with one of these methods to improve or some others, it will continue to strive to bring together technological advances to facilitate New Testament textual criticism. These proposed ways forward are in essence the outplaying of the broader scope of the Center's vision. They are in no way intended to be techniques that would supplant the first facet of CSNTM's mission: capturing firsthand digital images of Greek New Testament manuscripts with high resolution digital equipment.

6 Conclusion

While serving to bridge the gap between New Testament manuscript testimony and digital humanities, CSNTM engages libraries, archivists, researchers, and students. The intent is that these manuscripts are preserved for posterity, making them easily accessible to the present and the future. Technology is a tool that assists in that endeavor. None of it can be accomplished without partners. Some offer financial backing. Others volunteer technical know-how. Still others bring specialized knowledge of the Greek language and New Testament textual criticism. All are essential.

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