Classics@18: Clivaz, Monier, Barda

MARCH 24, 2021 | Classics@

MARK16 as Virtual Research Environment: Challenges and Opportunities in New Testament Studies

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The first part of this article investigates the impact of the digital revolution on the landscape of the history of Greek New Testament (NT) editions. [1] Comparing digital culture to the beginning of print culture helps us to understand it by focusing on similarities and differences. The digital Greek New Testament can be evaluated in comparison to the *Novum Testamentum omne*, which is the title Erasmus gave to the first printed edition of the Greek New Testament, published in 1516. [2] This chapter of the history of editing highlights the ways in which a new writing material reshapes textuality, ideas, concepts, and technology.

The second and third parts of this article, based on the example of the

SNSF five-year project MARK16, argue that similar challenges are present today in the development of digital New Testament textual criticism (NTTC). After a general presentation of the MARK16 virtual research environment (VRE, 2.1), the article will focus on the MARK16 manuscript room (henceforth, MR) prepared in collaboration with the New Testament Virtual Manuscript Room (NTVMR) produced by the INTF in Münster. [3] Part 2.2 will highlight the capacity of a digital MR to reconfigure our relationship to NT textuality. This process requires negotiations between the actors who produce textuality and progressively reshapes the usual perception of ancient Christian texts categories (2.2). Similar to the case of the making of the first NT printed edition, technical and other fundamental challenges are present in the transcription and encoding of Mark 16 folios, as part 3 will demonstrate.

1. From Erasmus *Novum Instrumentum omne* to the Greek New Testament in digital culture

In the spring of 1516, a key moment of the modern history of the editing of the Greek New Testament occurred in Basel, an event described by R. Ward Holder in this way:

In 1516, Desiderius Erasmus's *Novum Instrumentum* rolled off Johann Froben's presses in Basel. In that instant, the Western theological and cultural world was changed, crossing a Rubicon, the aftereffects of which are still felt today. […] Full of printing errors, based on a narrow set of manuscripts, and unclear as to its real purpose, the book generated both significant engagement, and heavy criticism. In later editions, it would

serve as the New Testament used as the basis for Martin Luther's *Deutsche Bibel*, was most frequently examined by John Calvin in his biblical interpretations, may have been the source for William Tyndale's translation of the New Testament, was definitively the source for Robert Estienne's Geneva Bible, and was the textual basis for the King James version of the Bible. As an influential source, Erasmus's edition of the New Testament stands without parallel, both in the early modern period and in the present day. [4]

Holder's description clearly illustrates how Erasmus's project evolved, its diffident contemporaneous reception, and its later unrivalled influence. Will the digital revolution influence in the same way the history of textual editing and give a particular role to the Greek New Testament in digital editing? It is certainly too early to answer this question, but this article hopes to convince its readers that it is worthwhile to evaluate the digital revolution within the larger historical context of the events surrounding the transition from the wide pool of NT manuscripts to the emergence of a printed critical edition, with the *Novum Instrumentum omne* as a starting point. On the one hand, it presented a deep act of negotiation between diverse actors, and, on the other hand, it promoted the concept of "new total instrument," an expression that could fit quite well with the expectations of NT scholars for a digitized Greek New Testament. Regarding the first point, Patrick Andrist has underlined that the *Novum Instrumentum omne* had indeed resulted from a negotiation, a partnership between the author/editor and the printer/publisher, including the content itself of the work:

Lorsqu'en août 1514, [Érasme] frappa incognito à la porte de Iohannes

Froben, [il] n'avait, en ce qui concerne le texte biblique et pour autant que nous puissions le savoir, que l'intention de publier ses *Annotationes*. La recherche récente est très claire sur ce point: il n'avait, dans ses bagages, ni texte grec suivi, ni nouvelle traduction latine complète du Nouveau Testament. Et ce n'est qu'après leur rencontre, et peut-être grâce à elle, qu'Érasme a décidé d'ajouter son commentaire une édition du texte grec ainsi qu'une nouvelle traduction latine. [5]

In this great encounter the profile of this future printed edition was born. It was "clearly intended as a counterpoint to the then current text of the Bible, the Latin Vulgate." [6] This intention was a real provocation for the Faculties of theology and the Church, "because [Erasmus's] very project was re-defining the nature of theology." [7] In such a vibrant context, his partnership with Froben had become the key element that enabled Erasmus to dare to produce this new kind of edition: the *princeps* edition (1516). This edition starts with an inscription written by Froben, [8] followed by Erasmus writing to the pope Leo X and to the reader. This mutual support between the printer/publisher and the author/editor has remained a central point even up to this day, with particularly difficult times or examples in history. [9]

The printing of an edition thus began as a risky adventure, as a place of negotiation between the printer/publisher, the authorities and the readers, as the title of the *princeps* edition itself shows, addressing the reader directly: "If so, whoever you are, you love the real theology, read, get knowledge and judge afterwards." [10] Erasmus's rebellious *emendationes*, in Greek or in Latin, signal his wish to wrestle with the *Vulgate* edition by relying on the authority of former theologians,

without being afraid of changing or erasing, according to Jan Krans. [11] This context allows us to appreciate the three terms of the *princeps* edition title, *Novum Instrumentum omne* usually abbreviated *Novum Instrumentum*, [12] as one can verify it online. [13] The following is the beginning of the title, majuscules and minuscules included:

NOVVMIN
ftrumentum omne, diligenter ab ERASMO ROTERDAMO
recognitum & emendatum...

Omne – complete, total, entire – is the third word of the title and one can wonder why this 1516 title is systematically abbreviated without *omne*, probably by mimetic with the final title *Novum Testamentum*. The 1519 and 1520 editions present an intermediate title, *Novum Testamentum omne*. Thanks to the Basel website e-rara.ch, it is possible to compare these different editions online. The "instrumental" and holistic aspect highlighted in the *princeps* edition title should be kept when one quotes this book. Beyond all theological polemics, [14] the printed edition of the Greek New Testament with *annotationes et emendationes* represents a technological tour de force, an artistic innovation. It was par excellence a totally new tool.

This technical aspect is clearly visible in the Basel manuscript AN.IV.1 or Gregory-Aland 2 (GA 2): [15] it is the composition manuscript used by Erasmus for the Gospels. Andrist states that it contains 130 textual corrections by the hand of Erasmus, as well as the red marks from the hand of the composer, signaling a change of page. [16] For example, one can observe them in the folio 188r of GA 2 in Mark 16,8–9. [17] This transition of writing material, inscribed in the text itself, leads us to think

of its equivalent terms in our digital era, such as encoding. This also includes developing new solutions that facilitate migration from a handwritten edition to electronic writing, as we discuss in part 3. In the following screenshot, we can observe the example of a gray arrow [18] indicating a change of verse in the HTML code of folio 220r, GA 1 (Basel AN.IV.2), and in red and purple the marginal notes of the manuscript, as encoded in the MARK16 project:

GA 1, f. 220r; transcription and encoding by Mina Monier with the

collaboration of Tommy Wasserman for the marginal notes, [19] SNSF MARK16 ©CC BY-4.0. [20]

A transition of writing material – from manuscript to print, and from print to digital – raises technical challenges that build a bridge between the duo Erasmus/Froben and the challenges we are facing today in a project like MARK16 (see part 3). Another common point is the transformation or reshaping of partnership and collaborations between the different actors involved in the production of a text (see 2.2). A third issues is the transformation of the textual work itself, the possibility to *annotate*, to *emendate*, and to reconsider the usual categories (see 2.2). We shall start by situating the specific role of the VRE MARK16 in the recent developments of the digital NTTC (2.1).

2. MARK16 as Virtual Research Environment (VRE): the manuscript room

2.1 MARK16 and the digital developments of the New Testament textual criticism

A recent issue of *Early Christianity*, published in the spring of 2020 and edited by Clare Rothschild, has drawn a general picture of NTTC, including a notable article by H. A. G. Houghton, David C. Parker, Peter Robinson, and Klaus Wachtel. This article was an overview of the landmarks in twenty years of digital collaboration. [21] As they describe it, the recent developments of the *Editio Critica Maior* (ECM) are the results of "…the twentieth century [that can] may be seen as a period of

preparation for an edition of the New Testament on an unprecedent scale." [22] The multilingualism aspect is notably a clear sign of the ECM's intention to reach the state of *instrumentum omne*: "New Testament quotations made by Greek authors up to the beginning of the sixth century are also included in the apparatus, as are readings from early translations believed to be based directly on Greek: in addition to Latin, Coptic and Syriac, the latter includes Armenian, Old Church Slavonic, Ethiopic and Gothic." [23] The creation and development of the NTVMR, using the VRM software program developed by Troy A. Griffitts and reused in several projects about ancient manuscripts, [24] is also clearly an *instrumentum omne*. As of September 9, 2019, the NTVMR had 1,530,740 images of manuscripts, of which 286,673 had been indexed and 78,440 transcribed, with hundreds of scholars registered at the NTVMR and participating more or less intensively in its discussions and development. [25] As we can see, the NTVMR belongs fully to the field of Big Data digital humanities.

In the making of the ECM of John, an exhaustive study of all extant manuscripts of a chapter has been completed, with the transcription of 1,800 manuscripts of John 18, led by David Parker in 2001–2003. [26] It is hardly imaginable, in terms of finances and resources, to get the work done for all chapters of the New Testament. New Testament scholars are evidently not the only ones to face this kind of new challenges raised by the digital editing possibilities. In a 2019 conference entitled "For a Digital Philology of the Drafts," Elena Pierazzo presented the issues and possibilities raised by the digital edition of the *I promessi sposi* (Alfredo Manzoni, 1827). For this modern author, a genetic edition can be

prepared including drafts from the first lines of the writing process to the different published editions of the work. Regarding the amount of material available, Pierazzo has already announced that the digital editing of *I promessi sposi* can no longer be imagined as the task of one team. The work will have to be shared by several academic teams, representing a huge shift in the history of the editing of *I promessi sposi*. [27] If this shift happens even in the context of the work of a modern author, it would be hardly surprising to encounter changes in the next chapters of the story of the New Testament's production, being rewritten as a collective effort. In such a collaborative spirit, the SNSF project MARK16 has been honored to become an NTVMR partner, with specific "MARK16" tabs that indicate our own contribution.

GA 1230, f. 147r; transcription and encoding by Mina Monier. SNSF MARK16 ©CC BY-4.0. [28]

Exchanging encoded data with the INTF team, we are developing our own VRE (https://mark16.sib.swiss). Its main purpose is to become a bridge between NTTC and an exegetical approach to the last chapter of Mark, a famous text critical enigma, [29] by providing a portal of reference for research as well as for the training of students. This second part of the paper presents the first part of this VRE, the manuscript room. MARK16 is the first VRE to focus on a biblical chapter, and its goal is to foster the development of new VRE models in digitized Humanities. A VRE is an interactive working web-based, community-related, open, flexible model that allows the dissemination of research results, according to the 2013 definition by Leonardo Candela et al.:

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… ; (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) 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. [30]

Based on this theoretical background, a 2019 publication has described the MARK16 VRE in detail, [31] but to summarize here, the MARK16 VRE is divided into four parts. The first one, the "Manuscript Room," hosts a selection of manuscripts in Greek, Latin, and other ancient languages that are particularly significant for the study of Mark's last chapter. The perspective is consequently not to gather all Mark 16 witnesses as it has been done for John 18 in the preparation of the John ECM, but to apply a close reading that sheds light on the complexity of this subject and to introduce new elements to this file. The second part, "Interpretations," underscores the diversity of scholarly voices on Mark 16 through the use of a new multimodal editing tool, eTalks. [32]

The third part, "Material," provides all useful references to MARK16 research, as well as access to this material when it is in open access. The fourth part, "Data Visualization," will present a spatio-temporal representation of the data gathered in part 1, in collaboration with the DH project Pelagios. [33] The project is accompanied by an international scientific committee that includes Leif Isaksen (Exeter University, UK), Jennifer Knust (Duke University, USA), Valérie Nicolet (IPT, FR), Laurent Romary (INRIA et DARIAH, FR), Joseph Verheyden (Leuven, BE), and Peter Williams (Cambridge, UK). The MARK16 team is composed of Claire Clivaz (PI), Mina Monier (post-doc), and Jonathan Barda (software developer). [34]

2.2 The MARK16 manuscript room: how to

reconfigure the relationship to NT textuality

The patient and continuous work on manuscript transcription and encoding has led us to the creation of a large harvest of new data on Mark 16. [35] Our research has resulted in two main points so far. First, it shows us that a thoroughgoing discussion about Mark's endings has existed through the centuries. Second, the Latin Codex k, otherwise known as VL 1, shows an alternative reading of the shorter ending that opens the way for further inquiry. Despite its efficiency, it should never be forgotten that a VRE's purpose serves basic research in a new digital format. The harvesting of new evidence has led us to realize that the MR is probably becoming the most important part of the VRE. It is a good example to confirm that basic research is a major factor in the making of a VRE. This section of the article (2.2) develops two major features in the life of the manuscript room: the collaboration with diverse partners and the production of research data (2.2.1) and the reconfiguration of textual categories by focusing on the entire content of a manuscript page (2.2.2).

2.2.1 MARK16 as a collaborative VRE: the digital production of research data

Currently, our manuscript room contains seven manuscripts with folios of Mark 16 in Greek, Coptic, Arabic and Latin: arb 2, GA 03, GA 1, GA 304, GA 1230, sa 393var, VL 1. Multilingualism is a core value, in the spirit of the ECM developments (see 2.1). We wished to use at the same time Troy Griffitts's VRM software – thanks to our partnership with the NTVMR – and the images viewer software Mirador. [36] Our attention was also focused on the security aspects related to maintaining the images

under copyright. Thanks to Jean-Bernard Dugied, MARK16's former software developer, we have created a first draft version of the MR application programming interface (API) using technologies from other projects such as eXist-db [37] and Cantaloupe, [38] which is the image server used to display images in Mirador. [39] Then Jonathan Barda, a Core-IT colleague who is working presently for the MARK16 project, rewrote the MR API to simplify the project architecture and to improve manuscript management by users.

This required first the replacing of eXist-db by developing a complete extensible markup language (XML) and resource description framework (RDF) [40] parser for the manuscripts metadata and hypertext markup language (HTML) [41] files. Secondly, Barda has replaced Cantaloupe by developing a complete IIIF [42] specified implementation to cover both API image and API presentation in the scripting language PHP. [43] He is developing the API backend and focuses on security aspects in the making of the API, including the maintenance of images under copyright. The development of a complete IIIF specification implementation was necessary because no complete solution was available in PHP at the time of development. Other projects have already looked for similar solutions, but not with PHP. For example, the *Brucheion project*, [44] whose code is available in open source on GitHub, uses GO and NodeJS, [45] with a JavaScript [46] front end. [47] In the IIIF awesome-list, [48] one can find an API to integrate images in PHP [49] and another one to present them in a PHP API, [50] but there is no API that combines both the images and the presentation API. The MR API code will be provided in open source on GitHub. The writing of the

code is definitely to be considered as a writing, as argued by Clivaz in 2019, [51] and MARK16 is happy to welcome Jonathan Barda among the co-authors of this article, as the main writer of the MR API code. [52]

In the MR, we provide translations for the manuscripts that are not in Greek or Latin, or for non-biblical texts (see already published: GA 304, GA 1230, sa 393var, arb2). We are also working in partnership with numerous scholars, especially for the diversity of linguistic material. Arabic is provided by Sara Schulthess and Mina Monier. For our first Coptic document, we have collaborated with Gregor Emmenegger, who transcribed and translated the Coptic Amulet sa 393var. Further collaborations are running, for example, with Katharina D. Schröder and Siegfried G. Richter for the Coptic Mark 16 folios in sa 9 and sa 14; with Damien Labadie for Ethiopic manuscripts BL Or 569, Par. Eth. 32, EMML 1832 and NLMS 28 (Eth 1, Eth 2, Eth 3, and Eth 4); with Damien Labadie and Alexey Morozov for the Glagolitic Zographensis manuscript (Slav 1); with Ani Ghazaryan Drissi for the Armenian manuscript Matenaderan 2374; with Sara Schulthess and Albert Frey for the Syriac Vat. 268 and Chester Beatty Syriac 703; with David Taylor for the Syriac Curetonian manuscript; with Sebastian Brock for the Sinai Syr. 30; with Samer Soreshow Yohanna for the Syriac Alqosh 25; with Carla Falluomini for the Gothic Codex Argenteus; with Bernard Outtier for the Georgian manuscripts of the Hädich Gospels and Iviron 83; with Anthony Royle and Garrick Allen for GA 2604; and with Zachary Skarka for GA 800. An “About page” explains the choices we have made thus far. [53] By definition, our manuscript room is a collaborative VRE, and we ensure that the names of the transcribers and encoders (when different)

are clearly stated, beside the logos of the diverse libraries that are important partners. [54]

The creation of such a MR is an act of negotiation between the different actors implied in the production of a text, as Erasmus and Froben previously experimented. What could and should be the role of the publishers in this process, or of the software developers or librarians? Scholars are invited considering all these partnership by creating a VRE, and developing them from a project to another one. In a former SNSF project led by Claire Clivaz, HUMAREC 2016–2018, an ISSN had been requested through the National Swiss Library, and the VRE figures in the Helveticat library catalogue. [55] A similar choice has been scheduled in the MARK16 grant application, but we have decided to step back from this approach. Meanwhile, the project has entered in the sphere of the open research data. The data management plan of the project includes a prospective partnership with the open public depository Nakala, provided by Huma-Num (CNRS, France). [56] A MARK16 account has been opened on Nakala for the project, and we have been able to begin to upload our research data to it. They appear through a HANDL persistent identifier on the SNSF database, with links to the metadata. [57] Nakala also offers the possibility to have the data presented on an Isidore account, which are consequently harvested at European and international levels through the efficient SSH research tool. [58]

Discovering Nakala and Isidore landscapes has helped us to specify what, in our opinion, the specificities of the Humanities data are. They are certainly not technically different from other data; a jpeg image is always a jpeg image. But Humanist researchers take a particular care of their

metadata. An important amount of knowledge is provided in the metadata of the research data. It is the reason why it is crucial that the Humanist scholars become capable of entering metadata themselves, or within their team, according to the Dublin Core norms, making their data FAIR. [59] Thanks to Nakala and Isidore, the material carefully encoded and downloaded in the NTVMR is expressed as FAIR data and put in touch with international research. Moreover, in the H2020 project OPERAS-P, Claire Clivaz and Elisa Nury (SIB, DH+), participating on work package 6.5 about new scholarly models of writing, have argued with OPERAS colleagues that the production of research data is a new model of scholarly writing. [60] Some publishers have already considered this aspect, like Brill that publishes a journal devoted to the publication of SSH open research data, in collaboration with the National Dutch SSH data center DANS. [61] The data could themselves become a publication, and this point could in the middle term change drastically the question of the certification of VREs. [62] All the work invested, often by junior researchers on open research data, could and should lead the VREs to a certification status, hence Open Science in action.

We conclude this part with praise for publishers who include the open data into the research process. Indeed, as far as we are able to examine in MARK16, it appears crucial to maintain the distinction between raw data – in our case manuscripts transcription – and the edited data. From this perspective, it means that a transcription, as developed in 2.2.2, should be as close as possible to the image of the folio itself, as if the researcher were an infallible OCR robot. This means that interpretation is, as much as possible, delayed to the next step, the edition of the data, that should take

place in a published work. The academic value attributed by a confirmed publisher allows innovation in science to emerge, as Froben did for Erasmus at his time. This author/publisher partnership is a key value for the academic world. Such a partnership allows researchers to communicate with citizens and demonstrate the added value of Humanities research for society. We would recommend that publishers and open public depository institutions create open dialogues and foster common projects, much the joint Brill and DANS data project. It should be noted that articles in the journal *Research Data Journal for the Humanities and Social Sciences* are already elaborate. An innovative way to crystalize the role of the publishers in an open public depository could be adding a publisher's logo to datasets available in a public open repository.

2.2.2 MARK16 as participating in the reshaping of textual categories

The main MARK16 MR partnership is this one with the NTVMR (INTF). When MARK16 is working on a manuscript not included in the INTF Liste, [63] like sa 393var (601393), arb 2 (900002) and VL 1 (200001) in the seven items published so far on MARK16 MR, we request the INTF to assign a new Doc ID number. Transcription of folios, in TEI/XML, are exchanged. They are available on the NTVMR and on MARK16 MR in TEI/XML and in HTML, in open license CC BY 4.0. We also develop our HTML transcriptions in order to add metadata in a more flexible way, notably for copyrights. We explicitly state the researchers responsible for transcription and the encoding, if they are different, like in this example for sa 393var:

sa 393var transcription by Gregor Emmeneger and encoding by Mina Monier. SNSF MARK16 ©CC BY-4.0.

We have also made the marginal notes next to the biblical text (see the image of GA 1 f. 220r encoding in part 1 above) visible, and we have proposed to the NTVMR that they publish the commentaries present in a folio, and not only the biblical text. As far as we know, Mark 16 in GA 304 (folios 240r, 241r, 241v) has been the first example of a published commentary text in the NTVRM. [64] It sounds all the more important for GA 304 that this minuscule [65] presents, like GA 888 for example, in

a continuous way the biblical text and the *catenae*, without isolating the biblical text at the middle of the page, as is often the case:

GA 304, f. 240r; transcription and encoding by Mina Monier. SNSF MARK16 ©CC BY-4.0.

The folio is presented as a document: in our vision, the style of the transcription should be as close as possible to the image, but readable by contemporary readership. It leads us to a new perception of what we

consider to be the "biblical text", including material that could be imbedded – if not immerged – within commentaries: the materiality of the folio is able to modify our perception of the categories of text in Early Christianity. In 2011, [66] Clivaz already suggested that the digital culture was leading the way to reconsidering these categories, a hypothesis developed later in a 2016 article [67] and in a chapter of a 2019 book. [68] The extension of the manuscripts from biblical text to commentaries acquires also still another dimension in the digital test edition of the ECM of Acts, [69] an edition that Klaus Wachtel has described in a blog as "an interactive textual commentary of Acts":

The textual commentary as a documentation of work on the text: in the left margin of the online apparatus there are two symbols: a blue balloon and a circle with an arrow. Clicking on the balloon will take you to the Textual Commentary section of the NTVMR Forum. Each commentary printed in the Studies volume of ECM Acts was reproduced here. The arrow symbol is linked to the coherence diagrams for the relevant passage in the Genealogical Queries interface. [70]

Online publication of NT transcriptions opens further avenues for considering the biblical text itself in the middle of the discourses that accompany it. It is the realization of what had been designated in a 1998 article as the *scriptura* in *koinonia*. [71] Another example of this phenomenon is VL 1, or Codex Bobbiensis in Mark 16. It is well known for having an entire passage added between Mark 16,3 and Mark 16,4, edited and translated in this way by Hugh Houghton:

Subito autem ad horam tertiam tenebrae diei factae sunt per totam orbem

terrae et descenderunt de caelis angeli et surgent in claritate uiui dei; simul ascenderunt cum eo et continuo lux facta est. tunc illae accesserunt ad monimentum…

But suddenly at the third hour the shadows of the day came across the whole globe and the angels descended from the heavens and they will arise in the glory of the living God; at the same time they ascended with him and straightaway it was light. Then the women went to the tomb… [72]

The passage is mentioned as an apocryphal Gospel fragment in the first volume of the *Ecrits apocryphes chrétiens* and compared with Gos. Pet. 35–44, [73] but David W. Palmer demonstrated convincingly that it is close to the *Gospel according to Bartholomew* I,6–9 [74] . On the right side of the HTML files produced by the NTVMR, one can read the modern verses of the biblical texts, not included in ancient manuscripts. What should we write next to this added passage in VL 1 f. 40r not present in the usual NT manuscripts, editions and translations? We have left an empty space in the margin of the added passage, and then came back to Mark 16,4b on the next folio f. 40v. The first part of Mark 16,4a is indeed missing as such.

VL 1, f. 40v; [75] transcription by Mina Monier and Claire Clivaz, based on the MS and on Wordsworth et al. edition; [76] encoding by Mina Monier; SNSF MARK16 CC-BY-4.0.

3. MARK16: Transcription and Encoding

3.1 Maintaining Balance between Data and Visualization

The journey of a text from an old manuscript to a digital platform has no standard route that could be applied to all cases. The complexity of that process is evidenced by the multi-layered encoding process that was developed for this reason. The rationale of that journey is extracting as much data as possible from a relatively inaccessible source, and putting it in a processable and accessible condition.

Thence the primacy of XML encoding stems as a language that is capable of marking every *identifiable* detail in order to be processed. However, the second aspect, accessibility, requires going the extra mile by providing the initial manuscript in a presentable form through which all details, whether they are *markable* or not, are visually accessible. This visual accessibility, that the ancient manuscript lacked, enables future researchers from different backgrounds to draw further information that were not marked in the provided TEI/XML code. This breaks the circularity of confining research within what has already been researched, identified and given a specific tag. Furthermore, visualizing the details of a manuscript does not only open the way for gaining more insights, but it also enables the researcher to engage in a constructive dialogue with the crude data of the produced XML file. For the latter, encoding certainly does not lack the subjective element of interpretation that appears in the stream of choices the digital scribe makes while tagging every detail in the transcription.

The balance between raw data and visualization has not always been satisfactorily maintained. In her doctoral research at King's College London, our colleague Elisa Nury tested the most prominent digital platforms by transcribing a collection of Latin texts written by Calpurnius Flaccus. [77] Nury's assessment shows a variety of approaches to this problem. For example, the T-Pen platform attempts to associate the transcription with its corresponding image by transcribing on the image itself. [78] Although it is an innovative approach, Nury experienced some technical problems such as the platform's inability to handle skewed lines. [79] The interaction between text and images was further developed by

TextGrid's Text-Image-Link-Editor. [80] Kevin Kiernan underscored the importance of this balance between reporting and visualizing data by saying that: "XML markup is good at distinguishing different letterforms, such as insular, caroline, and uncial s, for searching of text, but to be of real value, the editor and the researcher should be able to link any search results to the specific instances in the manuscript images." [81] Therefore, as early as 2011 he warned that the upcoming hype of TEI will not last "without extensive integration of images." [82] However, one might wonder: would such a direct text-image linking be useful with an old microfilmed image that is almost illegible? [83]

An efficient mediator that can maintain the balance between manuscript data and its image must be produced by the scholar who has an expert's eye that can harvest more details than the average user, has studied the description of the material in the corresponding catalogues and, in dire cases, has physical access to the manuscript in hand. This is precisely what justifies the indispensable role of HyperText Markup Language (HTML) as another layer of encoding towards maintaining the aforementioned balance. This is a fundamental factor in the successful story of the Transcription Editor tool of the Workspace for Collaborative Editing, which is a joint project between the IGNTP and INTF in Münster. The NTVMR's ability to produce an HTML edition, next to both the image and the TEI transcription, makes interaction between the user and the text more constructive than any of its parallels in the field. Providing an evaluation of the different transcription platforms is beyond our scope. We hope to share our own experience of the process, the lessons learned and prospects for future development.

As one of the project's objectives is to analyze the different witnesses of Mark's ending, we met a plethora of peculiar cases that required a careful process of transcription that could do justice to their complexities. As soon as the transcription process started, the need to develop a different course of action appeared. An interface developed for the transcription of strictly biblical material would not be able to provide for a text in which biblical and paratextual materials are intermeshed.

The case of GA 019 is a good example. Currently preserved in the BNF of Paris, this eighth-century uncial manuscript features Mark 16 in folios 112v, 113r, and 113v. In folio 113r, Mark 16:8 (at the end of the first column) is followed by the shorter ending. The shorter ending is introduced by a framed heading, saying: "this is also extant (φερετε που και ταυτα [84])." This is followed by the longer ending (verses 9–20), which is also introduced by a heading that says: "This is also extant after 'for they were afraid' (εστην δε και ταυτα φερομενα μετα το εφοβουντο γαρ)." This manuscript indicates how a scribe is aware of the various endings of Mark, yet he decided to record them all, without harmonising or confusing these traditions. Looking into the TEI/XML code behind a transcription uploaded to the NTVMR, [85] we will see some interesting points. The transcriber clearly defined the beginning of verse 8: <ab n="B02K16V8″>. However, the element's closing bracket appears after the shorter ending, not at γαρ. Even before closing the tag of verse 8 </ab> the heading of the longer ending was squeezed in as a note. [86] This stretches verse 8 to include the original verse, the shorter ending and the two headings. For a machine-learning process, this would inevitably compromise the accuracy of any comparative analysis conducted on the

text of verse 8 in the different manuscripts. The problem also appears in the HTML presentation that shows a discrepancy in the number of the lines between the two columns due to the encapsulation of the second heading (that originally occupies 7 lines in the manuscript) in a superscript note that appears on hover. [87]

This is not an arbitrary error due to, for example, a misplaced closing bracket. It recurs in other cases such as the transcription of GA 099 in which the transcriber, this time, chose to ignore the headings in order to avoid its associated technical complications. The problem is due to the limitedness of the scope of the interface used for the transcription. The transcriber had to connect the successive verses continually, and therefore had to make a decision regarding the place of the interruptive headings as well as the shorter ending. The latter had another problematic aspect, that is, whether to consider these headings as part of the canonical text brackets or not. So, the transcriber took the transcription decisions that were automatically converted into XML encoding and then HTML, by a built-in algorithm. This automated process guarantees the swift production of large materials, but it also bequeaths any problems from a file to another.

Interface transcription

As the MARK16 project is dealing with a particular textual problem that has no unified pattern, it had to break the pattern of this process and reorganize it in a way that could unlock and optimize what each encoding format could offer. First, we produced the transcription, in a plain text format, without using any interface. This was followed by two parallel manual encodings: TEI/XML and HTML.

MARK16 Encoding Process

Following this procedure, we were able to analyze paratexts and present the peculiarities (through the HTML format) that may not be covered by the standard New Testament guidelines usually followed in this field. [89] For instance, this matter enabled us to report the large gap that follows the decorated short ending, which would encourage the readers to further discuss whether that gap reflects the copyist's reluctance to add the long ending or not. With Codex Bezae, we followed the exact layout of the two columns next to each other to show the difference between Greek and Latin texts in folio 348v as well as report the blue ink used for the colophon. [90] This ink plays a key role in dating this folio, which contains Mark 16:15–20. [91] An important case is GA 304's concluding epigram that reflects possible tension between successive manuscript holders over the proper end of the work (which happens to be Mark's ending as well) [92] as can be observed in MARK16 MR. [93]

Processing scribal cross-references in some catenae is an important example on how our manual process is tailored to avoid the loss of other types of paleographic or codicological information in the digitization process. In several catena manuscripts, copyists clearly indicate which scholion corresponds to the biblical lemma using obelisms or numbers. [94] Like our contemporary footnote habits, some manuscripts start

counting these numbers in each folio, while others have a continuous counting through the catena folios. This feature is important, and it should not go unnoticed because it defines exactly the beginning and end of the biblical lemma and its corresponding interpretation. Using the available TEI resources, Monier developed a solution by using pointers <ptr> with an identifier and number to connect the biblical lemma with its corresponding catena, after breaking the latter down into identified and numbered scholia (as elements), following the scribe's own divisions. This way, the computer will detect the scribe's signs and, more importantly, understand their cross-referencing role. On the level of HTML, Monier carefully reported the exact style of these cross-references as they appear in the manuscript and, thus, leaving nothing behind. [95]

Beyond Greek and Latin, we also covered interesting cases such as the Coptic Amulet (sa 393var) that reports the beginning and ending of each Gospel, between an edition of *Christ's Letter to King Abgar* and intercessory prayers, as visible in MARK16 MR. [96] Another structural case that required special attention was Codex Pandeli's Arabic Gospels (arb3) in which the scribe understands the long ending as a separate chapter.

It is not the intention of this paper to dismiss platforms with automated encoding. As it is difficult to envisage the possible existence of a universal interface, like Stephen Hawking's *Theory of Everything*, that acts as a framework for every sort of transcription, our approach specifically deals with special cases, such as Mark's ending, where there is no pattern to follow. As for recurring patterns, it is certainly suitable to use a coding script that is able to produce texts en masse. For example, in the

production of a digital edition of Codex Zacynthius, Catherine Smith of ITSEE built a set of Python scripts that manage the conversion to XML code and HTML presentation. This happened "by creating a single HTML file for each page of the undertext by combining the XML transcriptions of the biblical text and the catena. The resulting layout in a browser aims to mirror the manuscript page as closely as possible using HTML and a cascading style sheet (CSS)." [97] This approach was necessary for the input transcription to conform to the special layout of the catena, which differs from those of continuous texts and lectionaries. [98] Therefore, the NTVMR remains the common denominator for the vast majority of available New Testament manuscripts that share common layouts.

In conclusion, as part 3 underlines together with parts 2.1 and 2.2, the transition towards the digital world presents a major shift for the Greek NT edition as the transition from manuscripts to printed material. Part 3 has demonstrated how much the daily digital transcription of the NT manuscripts highlights the digital NT as a *Novum Testamentum omne*. Part 2.1 and 2.2 have highlighted that the new digital NT is a place of dialogue between different partners, and this leads to reconsider the categories of texts in Early Christian studies. All these features remind us of Erasmus and Froben adventure in producing a printed edition of the Greek NT. As pointed out by Holder, when Erasmus brought to Froben in March 1516 his *Novum instrumentum omne* "in that instant, the Western theological and cultural world was changed, crossing a Rubicon, the aftereffects of which are still felt today." Will the digital revolution mean a similar Rubicon crossing for theology? Let us see.

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Footnotes

[back] **1.** Some paragraphs are translated from a French article, Clivaz 2020a. We thank *Les Cahiers bibliques. Foi et Vie* warmly for their permission of translation.

[back] **2.** Erasmus 1516.

[back] **3.** NTVMR: https://ntvmr.uni-muenster.de/. All hyperlinks were last checked on February 18, 2021.

[back] **4.** Holder 2016:491–492.

[back] **5.** Andrist 2018:139; Krans 2006:14n17.

[back] **6.** Krans 2006:13.

[back] **7.** Holder 2016:494.

[back] **8.** *Novum Testamentum omne*, "Io. Frobenius pio lectori," without page number, written behind the title page.

[back] **9.** See the example of Quevedo *Dreams and Discourses*, endorsed by the printer/publisher Sapera in Barcelona in 1627. Quoted in Clivaz 2014:25.

[back] **10.** *Novum Instrumentum omne*, from the title: "Quisquis igitur amas veram Theologiam, lege, cognosce, ac deinde judica."

[back] **11.** Krans 2006:14. In footnote 17 he quotes Erasmus, *Epistula* 337, ll. 905–911.

[back] **12.** Krans 2006:12–15, 25, 60, 127, 145, 335; Holder 2016:491.

[back] **13.** https://www.e-rara.ch/bau_1/doi/10.3931/e-rara-2849.

[back] **14.** Holder 2016:494–496.

[back] **15.** Andrist 2018:144.

[back] **16.** Andrist 2018:142: "D'habitude, les exemplaires de composition conservés portent des marques apposées par les compositeurs, généralement rouges et épaisses, notamment pour indiquer les lieux prévus pour les changements de pages, du moins ceux où ils ont effectivement eu lieu."

[back] **17.** https://ntvmr.uni-muenster.de/manuscript-workspace?docID=30002&pageID=2430.

[back] **18.** This feature has been produced in the VMR software produced by Troy A. Griffitts and presented below (http://www.vmrcre.org/).

[back] **19.** https://mr-mark16.sib.swiss/show?id=R0Ex.

[back] **20.** https://doi.org/11280/7826242b: persistent identifier of the data, stored on the public open depository Nakala (https://nakala.fr).

[back] **21.** Houghton 2020a.

[back] **22.** Houghton 2020a:98.

[back] **23.** Houghton 2020a:99.

[back] **24.** Houghton 2020a:115–116. For the open source code, look at *Virtual Manuscript Room Collaborative Research Environment* (VMR CRE), http://www.vmrcre.org/. The ECM is based on the Coherence-Based Genealogical Method (CBGM): its presentation and discussion stand beyond the scope of this article.

[back] **25.** Houghton 2020a:106n32.

[back] **26.** Houghton 2020a:103.

[back] **27.** This paper has been given in Nice on September 4, 2019; we thank warmly our colleague Elena Pierazzo for having provided to us the slides of the lecture.

[back] **28.** With the English translation on the VRE MARK16: https://mr-mark16.sib.swiss/show?id=R0ExMjMw.

[back] **29.** Several publications have been produced by the team on the

fundamental research of Mark 16, with two main important results: the discussion about Mark endings has continued through centuries, and the shorter ending, such as formulated in VL 1 (Codex k or G.VII.15) offers clues to reconsider Mark 16 enigma. For the list of publications, see http://p3.snf.ch/project-179755.

[back] **30.** Candela 2013:75.

[back] **31.** Clivaz 2019a.

[back] **32.** https://mark16-etalk.sib.swiss/search.php.

[back] **33.** https://pelagios.org/.

[back] **34.** We are very grateful to Martial Sankar and Jean-Bernard Dugied (software developers) who have been also employed earlier in the MARK16 project, as well as to Sara Schulthess, research scientist until February 2021.

[back] **35.** Clivaz 2019b; Monier 2019; Clivaz 2020b.

[back] **36.** https://projectmirador.org/.

[back] **37.** http://www.exist-db.org. We thank our colleague Dr. Elisa Nury who suggested the combined use of Mirador and eXist-db, based on her experience in the SNSF project *Grammateus*, led by Prof. Paul Schubert: https://grammateus.unige.ch/.

[back] **38.** https://github.com/cantaloupe-project/cantaloupe.

[back] **39.** https://projectmirador.org/.

[back] **40.** https://en.wikipedia.org/wiki/XML; https://en.wikipedia.org

/wiki/Resource_Description_Framework.

[back] **41.** https://en.wikipedia.org/wiki/HTML.

[back] **42.** IIIF means " international image interoperability framework"; see https://en.wikipedia.org /wiki/International_Image_Interoperability_Framework; https://iiif.io /technical-details/.

[back] **43.** https://en.wikipedia.org/wiki/PHP.

[back] **44.** The *Brucheion project* has been presented at the VREs and Ancient Manuscript conference by Thomas Köntges (Leipzig University), "Livin' on the Hyperedge – Using *Brucheion* to Produce Digital Scholarly Editions as Hypergraphs," https://mark16.sib.swiss/conference.

[back] **45.** https://golang.org/; https://nodejs.org/en/.

[back] **46.** https://fr.wikipedia.org/wiki/JavaScript.

[back] **47.** https://github.com/Brucheion/Brucheion.

[back] **48.** https://github.com/IIIF/awesome-iiif.

[back] **49.** https://github.com/conlect/image-iiif.

[back] **50.** https://github.com/yale-web-technologies/IIIF-Manifest-Generator; https://github.com/digirati-co-uk/iiif-php.

[back] **51.** Clivaz 2019c.

[back] **52.** We thank warmly our Core-IT colleague Vassilios Ioannidis for his collaboration to this technical part.

[back] **53.** https://mr-mark16.sib.swiss/about.

[back] **54.** See for example the Biblioteca Apostolica Vaticana logo: https://mr-mark16.sib.swiss/show?id=R0EwMw==.

[back] **55.** ISSN 2504-5075; http://permalink.snl.ch/bib/sz001893712.

[back] **56.** https://nakala.fr.

[back] **57.** http://p3.snf.ch/project-179755.

[back] **58.** https://isidore.science/collection/10670/2.o3awx1.

[back] **59.** https://www.go-fair.org/fair-principles/.

[back] **60.** Geneva Data Research Day, October 22, 2020, Claire Clivaz and Elisa Nury: "Research Data as a New Model of Scholarly Writing in SSH (H2020 project OPERAS-P)"; https://www.dlcm.ch/swiss-research-data-day-2020/programme/session/view_express_entity/599 and https://doi.org/10.34847/nkl.f734kiqd.

[back] **61.** *Research Data Journal for the Humanities and Social Sciences*, https://brill.com/view/journals/rdj/rdj-overview.xml.

[back] **62.** See the paper given at the VREs and Ancient Manuscript conference by Erzsébet Tóth-Czifra (DARIAH-EU), "Rethinking text, techné and tenure-VREs as an evaluation and peer-review challenge in Humanities"; https://mark16.sib.swiss/conference.

[back] **63.** http://ntvmr.uni-muenster.de/liste.

[back] **64.** https://mr-mark16.sib.swiss/show?id=R0EzMDQ=; https://ntvmr.uni-muenster.de/manuscript-workspace?docID=30304&

pageID=4900. Results of the GA 304 analysis have been published in Monier 2019.

[back] **65.** There are several other examples, like GA 888.

[back] **66.** Clivaz 2011.

[back] **67.** Clivaz 2016.

[back] **68.** Clivaz 2019c.

[back] **69.** http://ntvmr.uni-muenster.de/ecm.

[back] **70.** Wachtel 2018.

[back] **71.** Clivaz 1998:558.

[back] **72.** Houghton 2016:161.

[back] **73.** Bovon and Geoltrain 1997:403.

[back] **74.** Palmer 1976:122: "In short, the interpolation seems to be an account of the assumption of Jesus from the cross, which was transposed to its present position at the time of the Latin translation of Mark, in order to give the impression of a visible resurrection from the tomb." For a recent update on Codex Bobbiensis and Mark 16, see Clivaz 2021.

[back] **75.** https://mr-mark16.sib.swiss/show?id=Vkwx; we thank Hugh Houghton for his kind Latin checking.

[back] **76.** Wordsworth 1886:23. The edition of the text is now in public domain.

[back] **77.** Nury 2018:182–204.

[back] **78.** The Transcription for Paleographical and Editorial Notation (T-PEN) project is coordinated by the Center for Digital Theology at Saint Louis University (SLU) and funded by the Andrew W. Mellon Foundation and the NEH. Accessible: http://t-pen.org/TPEN/.

[back] **79.** Nuri 2018:184–185. Until recently, T-Pen did not provide exportation of TEI/XML encoded transcription.

[back] **80.** For a complete analysis of this tool, see Al-Hajj and Küster 2013.

[back] **81.** Kiernan 2006.

[back] **82.** Kiernan 2006.

[back] **83.** For example, the condition of GA 099 on the *Bibliothèque Nationale de France* website, makes it almost impossible to identify the correct orientation of the images.

[back] **84.** The Greek text is provided in a diplomatic edition.

[back] **85.** https://ntvmr.uni-muenster.de/community/vmr/api/transcript/get/?docID=20019&indexContent=Mark%2016:6-9&pageID=2300&format=teiraw.

[back] **86.** <note type="editorial" xml:id="B02K16V8-019-1">εστην δε και ταυτα φερομενα μετα το εφοβουντο γαρ</note>.

[back] **87.** https://ntvmr.uni-muenster.de/community/vmr/api/transcript/get/?docID=20019&indexContent=Mark 16:6-9&pageID=2300&format=html.

[back] **88.** https://doi.org/11280/424f209.

[back] **89.** The IGNTP instructions document offers the standard guidelines followed by the vast majority of scholars. http://epapers.bham.ac.uk/2161/1/Transcription_Editor_Guidelines_1-2.pdf.

[back] **90.** https://cudl.lib.cam.ac.uk/view/MS-NN-00002-00041/677.

[back] **91.** Parker 1992:45–48.

[back] **92.** Monier 2019.

[back] **93.** https://mr-mark16.sib.swiss/show?id=R0EzMDQ=.

[back] **94.** See for example: GA 12, 18 137, 143, 222, 2604 et al.

[back] **95.** See for example Monier's encoding of catena GA 2604 in Royle and Allen 2021.

[back] **96.** https://mr-mark16.sib.swiss/show?id=c2EzOTN2YXI=.

[back] **97.** Houghton and Parker 2020:15.

[back] **98.** https://cudl.lib.cam.ac.uk/view/MS-ADD-10062-UNDERTEXT/1.