The Editio Critica Maior of the Greek New Testament

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Early
Christianity

New Testament Textual Criticism:
The State of the Question

Mohr Siebeck

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The *Editio Critica Maior* of the Greek New Testament

Twenty Years of Digital Collaboration

1 The Scale of the Edition

καὶ τὰ βιβλία μάλιστα τὰς μεμβράνας
Also the books, and above all the parchments
(2 Tim 4:13)[1]

The New Testament has the most extensive textual tradition of any Western work. Its writings are transmitted in over 5,500 Greek manuscripts, ranging from fragments of papyrus copied in the second or third century to substantial volumes produced as late as the nineteenth century. Early translations, most notably into Latin, Syriac and Coptic, derive from ancient Greek witnesses which are no longer preserved and account for several thousand more manuscripts in their own traditions. A second strand of indirect evidence, that of quotations in Christian writers, transmits readings which are no longer found in biblical manuscripts and may offer information about the time and place in which particular forms of text were in circulation. The importance of the New Testament to Christian communities across the centuries, including its role in defining doctrine and shaping social and political norms, demonstrates the sustained cultural significance of these writings. Accordingly, as the Bible maintains its position as the best-selling, most translated and most widely distributed book in the world, there continues to be a need for establishing an authoritative text and an accurate account of its transmission.

In the twentieth century, New Testament scholarship remained largely dependent on nineteenth-century editions, especially that of Constantin Tischendorf (1869–1872), the prodigious traveller and discoverer of important early manuscripts. As the number of known witnesses increased, so the challenge of producing a comprehensive edition became ever more difficult. The only major twentieth-century edition of the Greek New

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[1] All English biblical quotations are taken from NRSV; the Greek is from NA²⁸.

Testament, produced by Hermann von Soden and a team of collaborators (1902–1913), failed to gain wide acceptance, due in part to the textual theory on which it was based.[2] Instead, the hand editions of Nestle (later NA) and the British and Foreign Bible Society (later the United Bible Societies), offering a selection of variant readings and regularly updated to take account of the discovery of further papyri, became accepted as a temporary standard: *editiones minores* without an *editio maior.*

The volume of surviving material means that editors of the New Testament were particularly well placed to take advantage of the development of computing. Just as previous technological advances such as printing, facsimiles and microfilm had resulted in new standards being set for textual scholarship, so the creation of electronic tools and digital resources opened up fresh possibilities when applied to the textual tradition of the New Testament. Far from being an interlude (as suggested by Eldon Epp),[3] the twentieth century may be seen as a period of preparation for an edition of the New Testament on an unprecedented scale. An official catalogue of Greek New Testament manuscripts was instituted, full sets of images were acquired, biblical quotations were systematically collected, the evidence for the early translations was brought together, extensive collations were made, methods were invented for the detection of manuscript groupings and newly-discovered witnesses were carefully investigated. The fruit of all this, with the gradual move to a digital environment for collecting, analyzing and publishing the data, is to be seen in the *Novum Testamentum Graecum: Editio Critica Maior* (*ECM*), which is the topic of the present paper.

The *ECM* has as its goal to offer a new reconstruction of the earliest attainable text for each of the New Testament writings, termed the *Ausgangstext* or "Initial Text," and to present the evidence for the textual history of the Greek New Testament during the first millennium.[4] Around 200 Greek manuscripts are reported in full for each book, selected from all surviving witnesses (see further §4 below). New Testament quotations made by Greek authors up to the beginning of the sixth century are also

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2 Borrowing a description originally applied to the nineteenth-century edition of Westcott and Hort, the Alands describe von Soden's edition as "a failure, though a splendid one" (K. Aland and B. Aland, *The Text of the New Testament*, trans. E.J. Rhodes [Grand Rapids, Mich.: Eerdmans, 1987], 22).

3 Cf. E.J. Epp, "The Twentieth Century Interlude in New Testament Textual Criticism," *JBL* 93 (1974), 386–414.

4 On the *Ausgangstext*, see D.C. Parker, "Is 'Living Text' Compatible with 'Initial Text'? Editing the Gospel of John," in *The Textual History of the Greek New Testament: Changing Views in Contemporary Research*, ed. K. Wachtel and M.W. Holmes, TCSt 8 (Atlanta: SBL Press, 2011), 13–22, and H. Strutwolf, "Original Text and Textual History," ibid., 23–42.

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. Full references for quotations and translations, including comments on their text of each verse, are provided in a supplementary volume. A further volume is to be dedicated to studies and a commentary on the text of each book. The Initial Text is reconstructed using the Coherence-Based Genealogical Method (CBGM), a tool developed in conjunction with the *ECM* for addressing the problem of contamination during transmission (see below). While a printed edition remains the primary form of publication, a variety of electronic material including all the textual data and the decisions at each point of the CBGM has also been made available.

2 The Partners in the Collaboration

ἵνα συνεργοὶ γινώμεθα
That we may become co-workers
(3 John 8)

The principal responsibility for producing the *ECM* lies with the Institut für Neutestamentliche Textforschung (INTF) in Münster. Founded in 1959 by Kurt Aland, the INTF produces the NA and UBS hand editions and has also led the way in gathering the material required for the *ECM*. Aland assembled an extensive collection of microfilms of Greek New Testament manuscripts, and pioneered the selection of manuscripts for the edition by comparing all extant witnesses in a series of test passages.[5] He was also responsible for a revised edition of the Old Latin Gospels, appointing colleagues to work on the Syriac and Coptic New Testament traditions and a card-index of New Testament quotations in Greek authors. Aland's numerous other publications include synopses of the Gospels and an introduction to New Testament textual criticism. In 1983, he was succeeded as Director of the INTF by his wife, Barbara Aland, who continued to lead work towards the *ECM*, focussing first on the Catholic Epistles. Upon her retirement, Holger Strutwolf took over the directorship in 2004. Although part of the Westfälische Wilhelms-Universität in Münster, the INTF has been partially supported by a foundation set up in 1964, the Hermann Kunst-Stiftung, and also houses a Bible Museum. In 2007, the INTF's work

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5 K. Aland et al., *Text und Textwert der griechischen Handschriften des Neuen Testaments*, 18 vols., ANTF (Berlin: de Gruyter, 1987–2005).

on the *ECM* was adopted as a long-term project of the North Rhine-Westphalian Academy of Sciences, Humanities and the Arts: this includes the provision of dedicated posts for work on the *ECM* over a period of two decades.[6]

The International Greek New Testament Project (IGNTP) was founded in 1948. Its goal was to publish a comprehensive apparatus of readings in the textual tradition of the New Testament rather than a new critical edition. In this respect, it followed on from the volumes of Matthew and Mark edited by S.C.E. Legg for the Critical Greek Testament project.[7] The work was overseen by a North American and a British committee, with a two-volume apparatus to Luke appearing in 1983 and 1987.[8] Data for this was gathered by committee members, their students and a body of volunteers. Editorial work on John was then taken on by D.C. Parker and W.J. Elliott, which began with an edition of the papyri in 1995.[9] Parker was successful in securing funding for subsequent stages of the project from one of the national UK Research Councils (AHRB, later AHRC). These successive projects were based at the University of Birmingham, first in the Centre for Editing Texts in Religion and later in the Institute for Textual Scholarship and Electronic Editing (ITSEE). The informal collaboration with the INTF which began in 1997 was formalized in 2005 with an agreement that the IGNTP would produce the *ECM* volume of John. In 2007, the two committees of the IGNTP were merged into a single body, which was awarded successive small research grants by the British Academy. The election in 2016 of Hugh Houghton as IGNTP Executive Editor with responsibility for the Pauline Epistles marked the next stage in the project, building on the collaboration described in the present article.[10]

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6 More information may be found on the INTF website at http://egora.uni-muenster.de/intf/.

7 S.C.E. Legg, ed., *Evangelium secundum Matthaeum* (Oxford: Clarendon, 1935); id., *Evangelium secundum Marcum* (Oxford: Clarendon, 1940).

8 J.K. Elliott, ed., *The New Testament in Greek: The Gospel according to St Luke, Edited by the American and British Committees of the International Greek New Testament Project*, 2 vols. (Oxford: Oxford University Press, 1984–1987).

9 D.C. Parker and W.J. Elliott, eds., *The New Testament in Greek IV: The Gospel according to St. John, Edited by the American and British Committees of the International Greek New Testament Project*, vol. 1: *The Papyri*, NTTS 20 (Leiden: Brill, 1995).

10 See also the website at http://www.igntp.org.

3 Twenty Years in Overview

χίλια ἔτη ὡς ἡμέρα μία
A thousand years are like one day
(2 Pet 3:8)

The year 1997 saw the appearance of the first fascicle of the *ECM*, containing the full text of the Epistle of James.[11] This was presented by Barbara Aland at the Annual Meeting in San Francisco of the Society of Biblical Literature (SBL), where she also attended the meeting of the North American committee of the IGNTP with her colleagues. At the same conference, members of both projects, including Parker and Klaus Wachtel, attended a presentation by Peter Robinson of his electronic edition of part of Geoffrey Chaucer's *Canterbury Tales*.[12] Robinson's edition was built on a model of editing which Parker and Wachtel found attractive: the creation of full-text digital transcripts of all sources which were then collated by digital tools with full editorial control over the collation, using a collation tool which Robinson was developing.[13] There were various reasons for the appeal of this model. It entailed the creation of full transcripts of manuscripts, files which might retain information not represented in the summary printed collation apparatus but which could be useful for other purposes: this factor was especially interesting to Parker.

Following the 1997 meeting and discussions within the INTF, Robinson was invited to Münster to explore the possibility of the adoption by the INTF of full transcripts with digitally-assisted collation. This led to a considerable rewriting of the Collate program to meet the exacting editorial standards of the INTF. The support and interest of Barbara Aland, without whom none of this would have happened (or, at least, would have happened very differently and later) was key, as was Wachtel's advocacy and his experience with digital methods. A critical role was also played at a later date by the INTF's publisher, the Deutsche Bibelgesellschaft. The INTF was already using a database in the latter stages of preparation for print publication, and this provided the route for the integration of the digital

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11 B. Aland, K. Aland †, G. Mink, H. Strutwolf, and K. Wachtel, eds., *Novum Testamentum Graecum: Editio Critica Maior*, vol. 4.1: *The Letter of James* (Stuttgart: Deutsche Bibelgesellschaft, 1997).

12 P. Robinson, ed., *The Wife of Bath's Prologue on CD-ROM* (Cambridge: Cambridge University Press, 1996).

13 P. Robinson, *Collate: Interactive Collation of Large Textual Traditions, Version 2*, computer program distributed by the Oxford University Centre for Humanities Computing (Oxford, 1994).

transcription/collation model into the INTF production chain. Instead of converting manual collation information into digital form for input to the database, the collation information would be derived by collation of full-text transcripts, creating a digital record of variation which could be input directly into the database.

It was by no means certain that the full-text transcription/collation process, developed for the different context of editing a medieval literary text, would be appropriate to editing the Greek New Testament. Over the next years, Robinson, Wachtel and other members of the INTF team first tested whether this model would be viable, and then began to apply it through an ever-expanding set of experiments. In the same period, Robinson and Parker stayed in close contact; this partnership was aided not only by the proximity of Birmingham and Leicester (where Robinson was then based) but also by a shared interest in cricket. Seeing the developing adoption of the full-text transcription/digital collation model at Münster, Parker began to factor it into his own thinking about the work of the IGNTP.[14] A key moment was the decision by the INTF to use the full-text/collation method for the production of the *ECM* after the appearance of the Epistles of Peter in 1999, the last fascicle to be published using the earlier methodology of manual collation.[15] The *ECM* of 1 John and the other Johannine Epistles and Jude were built on full-text transcription and collation.[16]

At the same time, in the first years of the new millennium, Aland, Wachtel, Parker, Robinson, other members of the IGNTP and the INTF, and representatives of the Deutsche Bibelgesellschaft began to conceive a still grander ambition: not just the integration of digital methods into the production of a print edition but the creation of a full-scale digital edition. A step towards this was the creation of a digital version of the NA hand edition (first announced at the International SBL Meeting in Berlin in July 2002). Unfortunately the development of this project was discontinued

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14 See D.C. Parker, "The Text of the New Testament and Computers: The International Greek New Testament Project," *Literary and Linguistic Computing* 15.1 (2000), 27–41.

15 B. Aland, K. Aland †, G. Mink, H. Strutwolf, and K. Wachtel, *Novum Testamentum Graecum: Editio Critica Maior*, vol. 4.2: *The Letters of Peter* (Stuttgart: Deutsche Bibelgesellschaft, 1999).

16 B. Aland, K. Aland †, G. Mink, H. Strutwolf, and K. Wachtel, *Novum Testamentum Graecum: Editio Critica Maior*, vol. 4.3: *The First Letter of John* (Stuttgart: Deutsche Bibelgesellschaft, 2003); vol. 4.4: *The Second and Third Letter of John, the Letter of Jude* (Stuttgart: Deutsche Bibelgesellschaft, 2005).

after the launch of a prototype.[17] Robinson and Parker discussed how the IGNTP might also adopt these methods, and Parker based the Principio Project which ran at Birmingham from 2001 to 2003 on the digital full-text/ collation model.[18] This resulted in an edition of the majuscule manuscripts of John and complete electronic transcriptions of chapter 18 of John in all 1,800 extant continuous-text Greek manuscripts.[19] The latter was to supplement the test-passage analysis of John 1–10 by the INTF for selecting witnesses to be included in the *ECM* of John.

The *ECM* of the latter Catholic Epistles was marked not just by the use of Collate but also by the employment of the Coherence-Based Genealogical Method (CBGM), a new method for reconstructing the Initial Text developed by Gerd Mink of the INTF. The goal of the CBGM is to take account of contamination in the textual tradition, through an iterative process of constructing a stemma of the readings in each variation unit; the resulting local stemmata are then combined to indicate the proportion of prior and posterior readings in any two witnesses and the textual flow of the surviving tradition as a whole.[20] By being based on the complete text of each witness, the CBGM correlates with the innovative requirement for full-text electronic transcriptions as the building blocks of a critical edition, as introduced through the use of Collate. Following its introduction in 2003, the CBGM subsequently underwent further development, including the revision of all four fascicles of the *ECM* of the Catholic Epistles, with a

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17 Work towards this edition may still be seen at http://nestlealand.uni-muenster.de/; screenshots and a description are included in P. Robinson, "What Is a Critical Digital Edition?," *Variants* 1 (2002), 43–62.

18 D.C. Parker, "Through a Screen Darkly: Digital Texts and the New Testament," *JSNT* 25.4 (2003), 395–411.

19 U.B. Schmid with W.J. Elliott and D.C. Parker, eds., *The New Testament in Greek IV: The Gospel according to St. John, Edited by the American and British Committees of the International Greek New Testament Project*, vol. 2: *The Majuscules*, NTTSD 37 (Leiden: Brill, 2007); B. Morrill and D.C. Parker, eds., *Text und Textwert der griechischen Handschriften des Neuen Testaments*, vol. 5.2: *The Full Collation of Chapter 18*, 2 vols., ANTF 37–38 (Berlin: de Gruyter, forthcoming).

20 See further G. Mink, "Contamination, Coherence, and Coincidence in Textual Transmission," in Wachtel and Holmes, *Textual History* (see n. 4), 141–216; K. Wachtel, "The Coherence-Based Genealogical Method: A New Way to Reconstruct the Text of the Greek New Testament," in *Editing the Bible: Assessing the Task Past and Present*, ed. J.S. Kloppenborg and J.H. Newman, RBS 69 (Atlanta: SBL Press, 2012), 123–138; P.J. Gurry, "How Your Greek NT Is Changing: A Simple Introduction to the Coherence-Based Genealogical Method (CBGM)," *JETS* 59.4 (2016), 675–689; T. Wasserman and P.J. Gurry, *A New Approach to Textual Criticism: An Introduction to the Coherence-Based Genealogical Method*, RBS 80 (Atlanta: SBL Press; Stuttgart: Deutsche Bibelgesellschaft, 2017).

second edition published in 2013.[21] In the same year, the first new edition of the NA hand edition for nineteen years, NA[28], was issued by the INTF, taking account of the changes in the Initial Text of the Catholic Epistles in the *ECM*.

By 2005, both the IGNTP and INTF teams had fully adopted the model of digital full-text transcription and collation, as well as the CBGM based upon the availability of full collation data in digital form. The increasing closeness of the INTF and IGNTP and the move of Robinson and his team to Birmingham with the inauguration of ITSEE in 2005 opened up further avenues of collaboration. Chief among these was the Codex Sinaiticus transcription project, funded by the AHRC between 2006 and 2009 and building directly on the full-text transcription methods developed in the last decade.[22] In this groundbreaking electronic edition, reuniting the parts of a very early Greek Bible currently held in four different institutions and linking each word of the Greek text to the relevant place on each image, the transcription files for the New Testament were enhanced versions of those created by INTF for the digital NA. On a smaller scale, the same pattern was followed in the electronic transcription of Codex Bezae produced by the IGNTP for Cambridge University Library in 2011, with the files of the Greek text of Acts and the Synoptic Gospels being supplied by INTF.[23] As noted above, it was formally agreed in 2005 that the IGNTP would be responsible for the production of the *ECM* edition of John;[24] the collaboration was cemented by the election of the two senior members of the INTF to the IGNTP committee when it was unified in 2007. Transcriptions of the minuscule manuscripts of John were undertaken at Birmingham by two AHRC-funded projects, running from 2005 to 2010 and 2010 to 2015. A presentation by Wachtel at the Annual Meeting of SBL in San Diego in 2007 set out plans for the completion of the entire *ECM* edition: the INTF would edit the Synoptic Gospels after finishing its work on Acts, while the IGNTP would oversee the Pauline Epistles. The *ECM* of Revelation was

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21 B. Aland, K. Aland †, G. Mink, H. Strutwolf, and K. Wachtel, eds., *Novum Testamentum Graecum: Editio Critica Maior*, vol. 4: *Catholic Letters*, pt. 1: *Text;* pt. 2: *Supplementary Material*, 2nd ed. (Stuttgart: Deutsche Bibelgesellschaft, 2013).

22 The edition is at http://www.codexsinaiticus.org/; see also http://www.codexsinaiticus.org/en/project/transcription.aspx.

23 The edition is at https://cudl.lib.cam.ac.uk/view/MS-NN-00002-00041/; see also http://www.igntp.org.

24 K. Wachtel and D.C. Parker, "The Joint IGNTP/INTF *Editio Critica Maior* of the Gospel of John: Its Goals and Their Significance for New Testament Scholarship," paper delivered at the Annual Meeting of the SNTS, August 2–6, 2005, http://epapers.bham.ac.uk/754/.

taken on by a third partner, the Institut für Septuaginta- und biblische Textforschung (ISBTF) at the Kirchliche Hochschule Bethel-Wuppertal: led by Martin Karrer and funded by the Deutsche Forschungsgemeinschaft (DFG), this project began in 2011. All of these developments were predicated on digital methods as fundamental to every stage of the editorial process.

Work towards the *ECM* of John has also included editions of the Latin and Coptic traditions, as well as families of Greek manuscripts and an edition of the Byzantine text of John. In addition to printed publications, electronic editions featuring full-text transcriptions and a critical apparatus or synopsis have been available on a dedicated website since 2007.[25] Material gathered by the IGNTP for the Pauline Epistles, including transcriptions and a database of over 137,500 quotations in early Christian writers is hosted on a companion website which was launched in 2014.[26] Between 2003 and 2012, the INTF developed the NT Transcripts website, comprising a critical apparatus and full transcriptions of early and important Greek New Testament manuscripts.[27] Extensive online documentation for the CBGM was accompanied by a web application called Genealogical Queries, which enabled users to access and review the data behind the application of the CBGM to the Catholic Epistles: the first edition in 2008 was replaced by a second edition in 2013.[28] A special volume of the *ECM*, giving an apparatus for 38 pericopes shared between the Synoptic Gospels, was published in 2011: this was complemented by the release of digital resources enabling users to identify groups of manuscripts.[29] Finally, online lists of Coptic manuscripts (known as the Schmitz-Mink-Richter database) and of abbreviations and other palaeographic features of Greek minuscules copied between the ninth and sixteenth century are also available on the INTF website.[30]

Ten years after the adoption of digital tools by editors of the New Testament, the technical infrastructure of the Collate software required urgent attention. This was addressed by two projects, which are described below in more detail (see §6). One of these was the Workspace for Col-

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25 See http://www.iohannes.com.

26 See http://www.epistulae.org.

27 The prototype continues to be available at http://nttranscripts.uni-muenster.de/.

28 See http://intf.uni-muenster.de/cbgm/index.html.

29 H. Strutwolf and K. Wachtel, eds., *Novum Testamentum Graecum: Editio Critica Maior; Parallelperikopen; Sonderband zu den Synoptischen Evangelien* (Stuttgart: Deutsche Bibelgesellschaft, 2011), and http://intf.uni-muenster.de/TT_PP/.

30 See http://intf.uni-muenster.de/smr/ and http://intf.uni-muenster.de/NT_PALAEO/.

laborative Editing, conceived as the second stage of the Virtual Manuscript Room (VMR) developed by Robinson with Parker at Birmingham between 2008 and 2009; a companion site at Münster known as the New Testament Virtual Manuscript Room (NTVMR) was first put online in 2009.[31] Further development of the latter site, funded by the DFG between 2010 and 2013, including the incorporation of tools created as part of the Workspace for Collaborative Editing, have led to the NTVMR becoming the main online presence of the INTF: it currently includes the most authoritative form of INTF's register of Greek New Testament manuscripts, images of one and a half million manuscript pages (many of which have been indexed for their biblical content) and the publication of full-text transcriptions to accompany these images.[32] There are also pages for updates to NA[28], a database created by a team in Amsterdam of conjectural emendations to the New Testament and a discussion forum. With nearly 2,500 registered users, this is the pre-eminent site for the study of Greek New Testament manuscripts and continues to grow in both content and number of users. The initial adoption of shared electronic tools which facilitated the beginning of collaboration on editing the Greek New Testament has thus led to a new paradigm for the creation and publication of editions and their constituent data as well as the creation of a much larger community associated with these editorial endeavors.

4 The Workflow

λαληθήσεταί σοι ὅ τί σε δεῖ ποιεῖν
You will be told what you are to do
(Acts 9:6)

As the various stages currently required to produce the *ECM* have recently been set out elsewhere,[33] the present account will focus on the way in which these have been put into practice by the INTF and IGNTP and how parity of approach has been ensured.

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31 See http://vmr.bham.ac.uk/ and http://ntvmr.uni-muenster.de/.
32 As of September 9, 2019, there were 1,530,740 page images, of which 286,673 had been indexed and 78,440 had been transcribed.
33 H.A.G. Houghton and C.J. Smith, "Digital Editing and the Greek New Testament," in *Ancient Worlds in Digital Culture*, ed. C. Clivaz, P. Dilley, and D. Hamidović, Digital Biblical Studies 1 (Leiden: Brill, 2016), 110–127; see also D.C. Parker, *Textual Scholarship and the Making of the New Testament* (Oxford: Oxford University Press, 2012).

The selection of manuscripts to be transcribed in full for the edition is largely dependent upon the *Text und Textwert* comparison of test passages published by INTF between 1987 and 2005: setting a cut-off point of agreement with the majority text at 90 percent or less normally results in a selection of around 200 manuscripts.[34] In the case of John, however, the test-passage analysis of chapters 1–10 was complemented by a complete transcription of chapter 18. The greater number of variants in the latter resulted in a much higher overall agreement with the majority text: a cut-off point of 97 percent agreement in chapter 18 was required in order to produce the same number of witnesses identified by the 90 percent agreement in the test passages in chapters 1–10. As this resulted in a total of over 300 manuscripts, the cut-off point for John was reduced to 85 percent agreement with the majority text following careful analysis of the number of variant readings which would be lost.[35]

Both organizations observe the same practice of producing two independent initial transcriptions, made by adjusting a base text file to match the readings of the manuscript. Although the INTF base file consists of the NA editorial text while the IGNTP has used the Textus Receptus for John and Galatians, this difference is immaterial given that the final transcription represents the text of the manuscript.[36] The amount of information included in the transcription is specified in the transcription guidelines maintained by the transcription coordinators in each project, who work in conjunction with each other to ensure parity between the English and German versions of this document. In addition to ensuring that the text of the copyist and all subsequent correctors are recorded, information about page layout, abbreviations and punctuation may also be transcribed. The initial transcriptions are made by trained undergraduate students in Münster; the IGNTP draws on a broader range of contributors, also including volunteers and postdoctoral scholars.[37] An automated comparison tool is used to generate a list of differences between the two

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34 See Aland et al., *Text und Textwert* (see n. 5).

35 D.C. Parker, K. Wachtel, B. Morrill, and U. Schmid, "The Selection of Greek Manuscripts to Be Included in the International Greek New Testament Project's Edition of John in the Editio Critica Maior," in *Studies on the Text of the New Testament and Early Christianity: Essays in Honor of Michael W. Holmes*, ed. D.M. Gurtner, J. Hernández Jr., and P. Foster, NTTSD 50 (Leiden: Brill, 2015), 287–328.

36 The rationale for using the NA text is that this approximates most closely to the earliest text; most manuscripts, however, correspond more closely to the Textus Receptus than to NA, so fewer changes are required to make the transcription.

37 Materials for training transcribers can be seen in the "Resources: Documents" section of the IGNTP website (http://www.igntp.org).

initial transcription files: these are reconciled by a third person (usually the transcription coordinator) with reference to the images of the manuscript, who creates a final file. Both organizations make their final XML transcriptions available under a Creative Commons license with the requirement that the original creators are acknowledged.[38] IGNTP practice is to publish the complete transcription of a book in a manuscript as a single XML file, with the header recording details of the file history and (starting with the Pauline Epistles) of contributors to the transcription. Many of these files have also been archived in the University of Birmingham Institutional Research Archive in order to ensure their long-term availability.[39] The INTF, however, makes transcriptions available as single pages through the NTVMR, without a detailed header; some of the IGNTP transcriptions of John have also been ingested into the NTVMR and are displayed in the same way.[40]

The individual reconciled transcription files form the basis of the critical apparatus. An initial apparatus is generated from these using a text-comparison algorithm (see further §6). The apparatus is then edited in order to correct any misalignments and ensure that it is organized on philological principles. The first of the three stages of editing is known as regularization. In this, the user eliminates spelling differences, errors or other peculiarities of individual manuscripts which are considered to be "noise" and are not deemed to be significant for the edition, by dividing them into two categories. The spelling found in standard lexica is treated as normative, and acceptable variant spellings are marked as orthographic alternatives, so that they will appear in the print edition. Other spellings such as itacisms and errors that make no sense are marked so that the manuscript is cited as supporting the underlying reading but with a modification of its siglum to show that the editor has adjusted the reading. Replacements can be made on a case-by-case basis or as a global rule to be applied throughout the document or book: they are stored as metadata, which enables the collation to be re-run as often as desired in order to achieve improved levels of accuracy. The second stage involves setting the

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38 See further H.A.G. Houghton, "Electronic Transcriptions of New Testament Manuscripts and Their Accuracy, Documentation and Publication," in *Ancient Manuscripts in Digital Culture: Visualisation, Data Mining, Communication*, ed. C. Clivaz, D. Hamidović, and S. Bowen Savant, Digital Biblical Studies 3 (Leiden: Brill, 2019), 133–153.

39 See http://epapers.bham.ac.uk/cgi/search/advanced?screen=Public&anyname=interna tional+greek.

40 The API of the NTVMR also permits the export of a single XML transcription file for a complete book in one manuscript, see http://ntvmr.uni-muenster.de/community/vmr/ api/transcript/get/.

position and length of variants. Errors in the automated collation, such as the assignment of a variant reading to the wrong word in the base text, can be altered by the editor. In addition, variant units can be combined or divided in order to organize the apparatus on scholarly principles. It is also possible to create overlapping variants, where changes in word order within a phrase are treated separately to different readings within the constituent units of the phrase. The third stage is to order the readings within each variant unit according to the guidelines of the *ECM*, with readings closer to the Initial Text appearing at the top and lacunae or omissions at the bottom. As this stage of the workflow is key to the subsequent analysis, the teams have always used the same software and shared information about the principles on which the apparatus has been edited, such as the orthographic possibilities permitted. As all editorial input is recorded as metadata, the software allows the possibility of tracking all interventions, although these are normally extremely numerous.

The edited collation can be exported for publication, but also forms the basis of a number of databases. One of these is used for the CBGM, which runs as a separate application: the CBGM only requires a selection of the full evidence as it does not take later corrections into account. For this analysis, the edited collation is processed in such a way as to identify all the similarities between any two witnesses, in order to establish their pre-genealogical coherence. An interface then permits the creation of local stemmata within each variation unit, which is then recorded in the database and builds up a picture of textual flow on the individual and global level. This is an iterative process, with users examining more difficult cases on the basis of straightforward relationships established earlier on. Decisions about the interpretation of the evidence are made in conjunction with other members of the editorial team, especially in places where the results of the CBGM suggest a change to the Initial Text. The reasoning behind such decisions is recorded in order to become part of the Textual Commentary.

Another database permits the addition to the apparatus of readings from early translations and quotations in Christian writers. These are evaluated by specialists in each tradition, who compile a list of relevant evidence for consideration by the editorial team. Practices differ between different editions as to the amount of information from these indirect traditions to be included in the apparatus, particularly given the number of occasions on which it is ambiguous. The database is used to store the location of each of these pieces of evidence, as well as a full-text reading in the original language, translations and a commentary in particularly prob-

lematic cases. These are published in the volume of supplementary material.

The final stage is the preparation of the edition for print publication. Any changes to the Initial Text are implemented in the apparatus, and the distribution of readings adjusted accordingly. Each page is typeset and delivered to the publisher as camera-ready copy. The production of every volume of the *ECM* by a single publisher, the Deutsche Bibelgesellschaft, is another means of achieving uniformity.

Consistency within and between the different editorial teams is managed in a number of ways. As almost all members of the INTF projects are based at Münster, it is easier to schedule regular face-to-face meetings. The IGNTP team working on John, which combined participants from a variety of countries, initially held residential meetings in conjunction with international conferences in order to discuss approaches to the data. After the signing of collaboration agreements for the *ECM*, week-long editorial meetings were instituted, held at one of the partner institutions. Taking place annually or biennially, these enable the sharing of information between projects and extended discussion of editorial practice, along with the opportunity to discuss particular matters arising. Coordination of the preparation of the *ECM* of John is also managed through a weekly video conference between members of the IGNTP and INTF, and meetings in Birmingham for scholars involved in adding versional material.

5 Data Standards

διακονηθεῖσα ὑφ᾽ ἡμῶν, ἐγγεγραμμένη οὐ μέλανι
Prepared by us, written not with ink
(2 Cor 3:3)

Given that the Collate software required a particular form of markup, it made sense for the IGNTP and INTF to coordinate their encoding practices in order to avoid duplication by making transcriptions interchangeable. Complete unanimity has not always been attained, but the ease of making global changes to electronic files at a later point allows for some variation in local practice. For example, the IGNTP chose to record punctuation and rubrication in its transcriptions of majuscule manuscripts, and sometimes used a more specific set of corrector identifiers, while the INTF supplied missing text from the NA base text, where appropriate, rather than an approximate count of missing characters. The task of ensuring parity of

approach has fallen to the transcription managers from each institution, who are responsible for maintaining the guidelines.[41]

At the initial adoption of Collate, transcriptions were made in a plain-text editor, using a substitutionary font (SymbolGreek) because of the restriction of Collate to ASCII characters. This meant that the same tokens were not always chosen for non-standard characters, such as punctuation, while editorial notes in Roman script were often impossible to read. In addition, tags used for markup could be multiplied at will. One particular area of confusion involved letters which could not longer be made out: these were variously tagged as [unr] for "unreadable," [ill] for "illegible," or placed within [∘] tags indicating a lacuna. For the publication of transcriptions at this point, the SGML markup used for Collate was converted into a minimal form of XML, with all Greek characters converted to entities; editorial notes were separated into a standalone file. The Anastasia publishing software (described in §6 below) combined all of these into a database from which HTML was generated for display within a web browser.

The arrival of Unicode first led to hybrid transcriptions, still made within a text editor, in which the standard markup for Collate continued to be used but all Greek was in Unicode. As part of the Workspace for Collaborative Editing, following the development of CollateX and the possibility of collating native XML files, a full XML specification for transcriptions and also for a critical apparatus was drawn up from the Text Encoding Initiative Guidelines (TEI P5).[42] The same project delivered the Online Transcription Editor, a browser-based text editor structured around this specification.[43] This enables transcribers to work in a "what you see is what you mean" environment, where the XML tags are hidden and the display of the transcription in progress largely matches that of the final published version. Markup no longer has to be typed by the transcriber, with the result that all transcriptions are automatically formally correct and additional tags can no longer be invented. However, as the interface permits

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41 For examples of these transcription guidelines, see http://epapers.bham.ac.uk/2948 (for the Principio Project, using Collate) and http://epapers.bham.ac.uk/2161 (for subsequent IGNTP XML transcriptions).

42 See further H.A.G. Houghton, "The Electronic Scriptorium: Markup for New Testament Manuscripts," in *Digital Humanities in Biblical, Early Jewish and Early Christian Studies*, ed. C. Clivaz, A. Gregory, and D. Hamidović, Scholarly Communication 2 (Leiden: Brill, 2014), 31–60.

43 H.A.G. Houghton, M. Sievers, and C.J. Smith, "The Workspace for Collaborative Editing," paper delivered at the Digital Humanities Conference 2014, Lausanne, Switzerland, 8–12 July 2014, http://dharchive.org/paper/DH2014/Paper-224.xml.

a wider range of markup than the minimum required for the *ECM* transcriptions, it is still necessary for the projects to coordinate their transcription guidelines so that the data will be correctly handled within the collation.

For other aspects of the *ECM*, the standards have been set by the published volumes. This extends from the sequence in which variant readings appear in the apparatus to the details required to cite versional or patristic evidence in the supplementary volumes. In some cases, the projects use the same tools; for others, separate databases or applications have been set up and it has not yet become necessary to agree standards for the electronic publication of this material.

6 Further Technical Development

μὴ πάντες δυνάμεις;
Do all work miracles?
(1 Cor 12:29)

2005, the year when the formal partnership was signed for the *ECM* of the Gospel according to John and when Robinson and his team moved to Birmingham, was a watershed for other reasons. Although the IGNTP and INTF teams had converged on the adoption of the central model of full-text transcription and digital collation, the tools used in both projects – centrally, the Collate software and associated file formats – were showing their age. Further, there had been a significant shift in practice and expectations. Collate was made in an era of distinct software tools, working end-to-end through a process where files were transcribed, processed through a chain of software tools, and then published in print or digital form.[44] By 2005 the world of Web 2.0 had opened up a much more dynamic process: the tasks of transcription, collation and publication could be collapsed into a single online environment. These developments are, of course, not unique to Greek New Testament editing, and the collaboration between the IGNTP and the INTF in pursuit of these aims has led to increasing partnership with other institutions. The Collate software and associated transcription systems continued to function well in the following years. Particularly with regard to the IGNTP's collation of 1,800 manuscripts of John 18, it was remarkable that the collation software worked so well out of the box for

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44 For more on the history of the Collate software, see http://www.sd-editions.com/blog/?p=15.

such an extensive tradition. Indeed, the software was still used in Münster as late as 2015, entailing the loving preservation of an ancient pre-Intel Macintosh to run it.

The replacement of the software was both a challenge and an opportunity: such a new infrastructure might be the base for many other editorial projects, notably those on which Robinson was working at the time. This opportunity was a prime motivation for Robinson and Parker in coming together to found ITSEE in Birmingham. With the obsolescence of the Macintosh Classic operating system, the need for a replacement for Collate became acute.[45] This was accomplished in several stages. New collation software, known as CollateX, was developed by Ronald Dekker as part of Interedition, a multi-partner collaboration funded by a European Science Foundation COST action from 2008 to 2012.[46] An innovation of this was that it produces a baseless collation, allowing the divergences in the textual tradition to be presented without assumptions about the earliest form of text. Although Interedition produced a number of microservices employing the algorithm, a graphical user interface for the generation and editing of the collation by philologists without specialist programming expertise was not provided. Instead, this was created by Catherine Smith as part of the Workspace for Collaborative Editing project, an initiative jointly funded by the AHRC and the DFG which brought ITSEE and INTF together with the Centre for Digital Humanities at the University of Trier.[47] This Collation Editor was specifically designed to address the user requirements of the *ECM*, as part of a suite of modular tools including the Online Transcription Editor described above and interfaces for the addition of versional and patristic evidence. One of the challenges of developing this software was the use of "live" data from the beginning, as work on the edition continued to progress. Although a general specification for the various tools was drawn up, numerous questions of detail arising from more complicated real-life scenarios led to more or less significant rewrites. In this way, the textual tradition and the requirements of the edition dictated the shaping of the software. While the use of the Collation Editor by the *ECM* alone would have justified its creation, its adoption by other users (from doctoral research projects to a major collaborative edition of a different tradition, the Avestan Yasna) indicates its wider potential.

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45 See P. Robinson, "Towards a Scholarly Editing System for the Next Decades," *Lecture Notes in Computer Science* 5402 (2009), 346–357.

46 See further http://www.interedition.eu and https://collatex.net.

47 See http://www.birmingham.ac.uk/workspace.

Although Collate provided various export tools for the data created within the program, including the individual transcription files and data from the edited collation, the online publication of the first electronic editions relating to the *ECM* was by means of the Anastasia software, also developed by Robinson. This XML publishing system combined all the Collate outputs (transcriptions, apparatus, editorial notes) into an extensive database file, known as an Anastasia grove, from which the edition was generated.[48] While the single database approach worked well for self-standing editions published on CD-ROM, it was more cumbersome for web-based use. In addition, the database had to be regenerated every time a change was made to one of the constituent files. More problematically, continual updates to operating systems required numerous fixes to Anastasia.[49] One potential successor was the XML publishing system Pixelise, although this was never formally released and development ceased in 2009 with the move of the chief developer, Andrew West, to a different field.[50] Increasing security vulnerabilities related to the Apache server in Anastasia meant that the editions hosted by ITSEE were taken offline in 2014 and replaced by separate XML files of the transcriptions and apparatus, rendered by XSLT and Javascript. This lightweight solution has proved an effective way of making available and updating work-in-progress related to the edition, but no integrated solution for the final publication of an electronic edition related to the *ECM* has yet been developed.[51]

The programming behind the CBGM has been the work of Gerd Mink, Volker Krüger and Klaus Wachtel at Münster. Initially it consisted of a series of related FoxPro databases. A more integrated approach has long been a desideratum: some work was done on the scripts as part of the Workspace for Collaborative Editing, but major steps have only been taken in the last year with the involvement of the Cologne Center for eHumanities (CCeH). As part of a doctoral project on phylogenetic analysis at the University of Birmingham, a system was also developed which repli-

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48 The NT Transcripts prototype site continues to rely on Anastasia (http://nttranscripts.uni-muenster.de/, last visited on September 9, 2019).

49 On the obsolescence of Anastasia by 2006, see the blog post by P. Robinson at http://www.sd-editions.com/blog/?cat=3.

50 The code which was created may be seen at https://launchpad.net/pixelise/.

51 A projected standalone mobile application of NA[28] outlined at an Annual Meeting of the SBL was never released. The edition has since been made available in a number of Bible software packages, including the SWORD project app which includes links to the NTVMR.

cates the stages of the CBGM.[52] As noted above, the CBGM data for each variation unit in the Catholic Epistles has been released online as through the Genealogical Queries website.[53] For *ECM Acts*, the new CCeH interface is available for viewing the CBGM data.[54]

7 The Impact of the Edition

ἐκ γὰρ τῶν λόγων σου δικαιωθήσῃ
By your words you will be justified
(Matt 12:37)

As the source of the new standard text of the Greek New Testament presented in the NA and UBS hand edition, the *ECM* is central to all scholarship on the New Testament. The first changes to the editorial text of these editions for almost two decades were a direct result of the application of the CBGM to reconstruct the initial text. These will be further diffused through their adoption in modern-language translations, scholarly and popular publications and the variety of ways in which these editions are deployed by their wide user base. At the same time, the fuller understanding of the history of the textual transmission has led to a new appreciation of different textual traditions, groups of manuscripts and individual witnesses for the quality of the text they preserve, stimulating further research.

Collaboration on the *ECM* has been at the heart of a number of the technical developments described in this paper. As noted above, the functionality of Collate had to be enhanced to deal with the requirements of the edition. The entire Workspace for Collaborative Editing project was set up with the goal of providing support for the creation of the *ECM*. Its standards and tools have been adopted within other projects, such as the digital Codex Bezae, the Multimedia Yasna and the Textual Communities project.[55] The collaborative research environment developed by Troy Griffitts from the NTVMR is currently in use by a variety of projects, including editions of the Coptic Old Testament, the Canons of Apa John

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52 A.C. Edmondson, "An Analysis of the Coherence-Based Geneaological Method Using Phylogenetics" (PhD thesis, University of Birmingham, 2019), https://etheses.bham.ac.uk/9150.

53 See http://intf.uni-muenster.de/cbgm2/GenQ.html.

54 See https://ntg.cceh.uni-koeln.de/acts/ph4/.

55 See http://multimediayasna.wixsite.com/muya and http://www.textualcommunities.org.

the Archimandrite, and the Syriac *Ladder of Divine Ascent.*[56] The move to born-digital data and new ways of examining its interrelation have led not just to the creation of the CBGM, but to partnerships with evolutionary biologists.[57]

The high-profile electronic edition of Codex Sinaiticus was, in part, reliant on the tools, methods and data created for the *ECM*. The same is true of the transcription of Codex Bezae which, along with Codex Sinaiticus, has also been incorporated in the Logos Bible software platform. Projects related to the *ECM*, such as an edition of the Old Latin versions of John, an examination of Coptic New Testament tradition and research on early Pauline commentaries have been successful in obtaining significant amounts of research funding. Numerous doctoral projects directly or indirectly associated with the *ECM* have not just created new knowledge but also resulted in new trained specialists to take work further in this discipline. A variety of partnerships have been developed, involving individual scholars and institutions more generally. The agreement made in 2011 with the ISBTF to produce the *ECM* of Revelation and, more recently, the establishment of projects in the USA and Greece to produce transcriptions of certain Pauline Epistles meeting the standards of the *ECM*, shows the potential of the edition to lead to yet more collaboration.

8 Future Prospects

οὐδ᾽ αὐτὸν οἶμαι τὸν κόσμον χωρῆσαι τὰ γραφόμενα βιβλία.
I suppose that the world itself could not contain the books that would be written.
(John 21:25)

The remarkable productivity of the last two decades and the variety of developments inspired by work on the *ECM* would have been hard to predict when the IGNTP and INTF began working together in 1997. Even snapshots taken along the way have tended to assume a more significant rate of progress on the *ECM* itself rather than the broader impact which the project has made. With the publication of the *ECM* of the Acts of the

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56 See http://www.vmrcre.org.

57 See A.C. Barbrook, C.J. Howe, N. Blake, and P. Robinson, "The Philogeny of *The Canterbury Tales*," *Nature* 394 (1998), 839; see also M. Spencer, K. Wachtel, and C.J. Howe, "The Greek Vorlage of the Syra Harclensis: A Comparative Study on Method in Exploring Textual Genealogy," *TC* 7 (2002), http://jbtc.org/v07/SWH2002/index.html.

Apostles,[58] the *ECM* of Mark and John nearing their final stages, the *ECM* of Revelation in preparation and plans in place for many of the remaining New Testament writings, there has been extensive progress. The online publication of the text and apparatus of *ECM Acts* has set a standard for the digital editing of ancient texts.[59] At the same time, the development of protocols for digital publications, software tools and analytical methods has consumed much time and energy over the last twenty years and contributed to the broader impact of the project. It is impossible to say at this point whether another twenty years will be sufficient for the completion of the edition, or whether keeping up with the constant advance of technology will lead to further delays. Nevertheless, one of the most valuable achievements of work on this edition has been the extent to which it has inspired further collaboration and resulted in developments in broader fields. This paradigm for the large-scale creation of a collaborative, born-digital edition has revivified the discipline of New Testament textual criticism.

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58 H. Strutwolf, G. Gäbel, A. Hüffmeier, G. Mink, and K. Wachtel, eds., *Novum Testamentum Graecum: Editio Critica Maior*, vol. 3: *The Acts of the Apostles*, pt. 1: *Text*; pt. 2: *Supplementary Material*; pt. 3: *Studies* (Stuttgart: Deutsche Bibelgesellschaft, 2017).

59 See http://ntvmr.uni-muenster.de/ecm. For an introduction focussing on the integrated textual commentary and CBGM analyses, see http://ntvmr.uni-muenster.de/intfblog/-/blogs/an-interactive-textual-commentary-on-acts.