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Incrementally Does It:
New Perspectives and New Opportunities in Early Medieval Digital Humanities

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Abstract:

This article engages with the Digital Humanities as they relate to the field of early medieval textual analysis in Ireland. The starting point for this piece is the Irish Research Council New Foundations "Early Medieval Digital Humanities" Project, coordinated by the author in 2019. These workshops fostered discussion and collaboration between two IRC Laureate Projects, "Ireland and Carolingian Brittany: Texts and Transmission", led by Dr. Jacopo Bisagni (Classics, NUIG), and "Irish Foundations of Carolingian Europe", led by Dr. Immo Warntjes (History, TCD), and numerous international scholars and experts in the field of early medieval DH. In addition to reporting some of the outcomes and insights of this project, this article also offers a selective survey of ongoing work in this field.

Keywords: Computus, Digital Editing, Early Medieval Latin, Exegesis, Philology

> Dans l'espace illimité que la technologie offre aujourd'hui à l'inscription, il convient de suspendre la constellation changeante de l'écrit médiéval.
> (Cerquiglini 1989, 114)

1. Introduction

This contribution to the present issue's call for an exploration of the development of Digital Literatures (DL) and Digital Humanities (DH) in Ireland focuses on a methodological process rather than on a specific area of research: the process of first identifying the digital methodologies and resources available to scholars of early medieval texts and manuscripts, assessing their utility to a given set of source materials and research questions, and finally identifying those that can pragmatically be integrated

into the scope of the research project[1]. This topic may at first seem either overly specific (in that it reflects the needs of a specific project) or conversely, overly broad (in terms of DH practices); however, by performing this process as part of a peer-based forum, a multitude of both opportunities and obstacles were revealed that continue to be encountered by researchers engaging in DH in early medieval textual studies, and indeed, in many cases, by those beyond it as well.

The starting point for this narrative was the awarding of Irish Research Council (IRC) Laureate funding to two distinct but closely related research projects: "Ireland and Carolingian Brittany: Texts and Transmission" (IrCaBriTT), led by Dr. Jacopo Bisagni in Classics at NUI Galway, and "The Irish Foundations of Carolingian Europe – The Case of Calendrical Science (Computus)" (IFCE), led by Dr. Immo Warntjes in History at Trinity College Dublin. Though differing in their goals and approaches to their subject matter and sources, both projects are engaged in a detailed analysis of early medieval texts and manuscripts. As a result, the respective members of each team were eager to come together and collaborate. Against this backdrop, an additional opportunity arose with the 2018 call for the IRC "New Foundations" grant. This funding included a stream dedicated to "Knowledge Exchange for Impact" helping scholars at various career stages to collaborate and maximise the value of their individual expertise and experience. Coordinated by myself, a proposal was put together to this end, comprising four days of workshops incorporating technical training, seminars, and presentations.

Entitled "Early Medieval Digital Humanities" (EMDH), the programme for this successfully funded project consisted of two principal events: the first took place in TCD in March 2019, it began with Dr. Warntjes's workshop on the history of calendrical science, of relevance to both projects, and was followed by one in which the developer of the *Classical Text Editor* software, Dr. Stefan Hagel, brought the participants through the varied functionalities of this specifically designed programme[2]. The broad-ranging applications of the software include critical editing, but also palaeographical features, phylogenetic analysis, and TEI XML markup. The second event comprised two consecutive days of workshops and presentations hosted at the Moore Institute at NUIG in September 2019. On the first day, a series of workshops presented preliminary introductions to and training in the use of TEI XML, including the use of the oXygen XML Editor, the open access *Edition Visualisation Technology* software, and digital project planning[3]. This training was offered by Dr. Justin Tonra (English, NUIG) and Mr. David Kelly (Digital Humanities Manager, Moore Institute, NUIG). In addition, we were also fortunate enough to have in attendance Dr. Pádraic Moran (Classics, NUIG) and Mr Jean-Paul Rehr (Université Lumière Lyon 2, CIHAM) whose extensive experience offered invaluable insights and additional perspectives on TEI and the use of XML databases in particular. The second day was a discursive roundtable-style workshop. Each of the participants presented an aspect of their work to date or a current project in progress, often focussing on current and past challenges faced in their work[4]. Projects represented at the workshop included Dr. Evina Steinová's Innovating

[2] <http://cte.oeaw.ac.at> (05/2022).
[3] <https://tei-c.org/> (05/2022); <https://www.oxygenxml.com/> (05/2022); <http://evt.labcd.unipi.it/> (05/2022).
[4] The programme of presentations comprised Jacopo Bisagni (IrCaBriTT, Classics, NUIG), Sarah Corrigan (IrCaBriTT, Classics, NUIG), Paula Harrison (IrCaBriTT, Classics, NUIG), Judith ter Horst (IFCE, History, TCD), Tobit Loevenich (IFCE, History, TCD), Christian Schweizer (IFCE, History, TCD), Immo Warntjes (IFCE, History, TCD), Pádraic Moran (Classics, NUIG), Jean Paul Rehr (*de Heresi*, Université Lumière Lyon 2, CIHAM), Evina

Knowledge, Mr. Thom Snijder's Computus.lat, and Prof. Dr. Mariken Teeuwen's Marginal Scholarship Database. The "EMDH" Project as a whole was closed with a roundtable discussion of topics and themes raised throughout the various stages of the workshops. In addition to training in technical skills and software use, a key component of the "EMDH" Project was that it allowed practitioners in early medieval DH to learn from the experiences, both positive and negative, successful and unsuccessful, of their peers. As in the case of many projects in DH, much of the work that early medieval researchers are endeavouring to accomplish in the digital sphere is ground-breaking in some way, and there is often no one clear path forward, which makes it vital to learn from the endeavours and insights of those that have gone before.

This article is specifically concerned with the field of early medieval texts of the Latin West, for the most part sources written in what is now western Europe between 600 and 1000. As is explained below, it is notable that the analysis of medieval texts in both their material and cultural contexts is an area of research that calls out for engagement with DH tools and methodologies, as print editions and traditional approaches often fail to capture the nuanced complexity of these sources. Consequently, early medieval DH in Ireland has seen both advances in textual analysis through the application of and corresponding advances in DH, driven by the work of medievalists[5]. It seems vital to first set the context by beginning with an overview of digital developments in early medieval textual analysis and then moving on to discuss the work in progress.

2. Why Early Medieval Latin Texts?

Although almost thirty years old, Ziolkowski's (1996) history of the study of medieval Latin literature and the challenges that it presents remains deeply relevant today[6]. Pointing out that the inherent variation and unpredictability of manuscript transmission introduces a complexity not present in printed texts, Ziolkowski argues that these sources require a distinct set of considerations:

The richness of Medieval Latin literature in both form and content cries out for a corresponding wealth of knowledge and approaches. […] Which methods we employ will depend upon the nature of the given text and our understandings of it. […] Much of Medieval Latin literature languishes, either poorly edited or altogether unedited, and still more has been edited but has not yet been interpreted even rudimentarily. […] If ever a rich lode of literature existed that awaited finders and appraisers, it is Medieval Latin. (Ziolkowski 1996, 529-531)

The reasons behind the fact that "much of Medieval Latin literature languishes" are numerous. Some will be encountered in the accounts of Irish DH projects below (section 3); however, some aspects of early medieval Latin texts, their complexities, and the obstacles they present to identification, let alone editing and thorough analysis, are best exemplified by the corpora of sources that are the focus of the "IrCaBriTT" and "IFCE" Projects: calendrical science, or *computus*, and biblical exegesis. Many of these texts are still suffering the fate that Ziolkowski describes, and due to the nature of their composition and manuscript transmission, a detailed understanding of them requires a wide range of approaches.

Steinová ('Innovating Knowledge', Huygens ING), Thom Snijders (computus.lat), Mariken Teeuwen (Huygens ING). See also Corrigan (2019).

[5] Note, for example, the substantial reference to medieval studies research in O'Sullivan's (2020) review of the development of DH in Ireland.

[6] A somewhat more recent survey is Hexter, Townsend (2012).

2.1 Computus *and Biblical Exegesis*

In the beginning, medieval calendrical science, or *computus*, the Latin term by which it is known, was primarily concerned with the calculation of the date of Easter for the purposes of the Christian liturgical cycle. Key components of *computus* were the science of time-reckoning and some specific astronomical mechanics, in particular the movements and changing appearance of the moon[7]. The complicated historiography of the study of *computus* is summarised recently in Bisagni's (2020, 3-4) contribution to the *Kathleen Hughes Memorial Lecture* series. Regarding the controversy surrounding the early medieval Irish calculation of the date of Easter, a topic widely debated in the Latin West, Bisagni (*ibidem*) notes that the documents behind this calculation only began to come to light in 1985, the first, *De Ratione Conputandi*, published in 1988 by Walsh, Ó Cróinín (1988, 113-213). Furthermore, an additional two principal works of Irish *computus*, integral to the later development of computistical thought throughout medieval Europe, went undiscovered or unedited until much later: the *Munich Computus*, which was was first recorded by Krusch (1880), but was edited by Warntjes (2010), and the *Computus Einsidlensis*, which was discovered by Warntjes (2005-2006) and is currently being edited by as part of IFCE.

The reasons behind the late discovery and edition of these works are perhaps best exemplified by turning to one of its editors: Warntjes (2010, CCIII) enumerates the challenges of editing the *Munich Computus*, many of which are commonly encountered by scholars of early medieval sources. To begin with, the text of the sole surviving witness has been highly corrupted by numerous stages of transmission and, aside from a few section headings, there is no internal division of the text or table of contents. Warntjes (2010) points out that the copyist was not only ignorant of the details of computistical concepts, but other errors indicate that they also worked very quickly. Finally, further confusion is caused by the incorporation into the main text of what were once marginal or interlinear glosses. The unique significance of this text makes it worthy of the effort of engagement, analysis, and critical editing; however, as one might imagine, many texts remain unidentified, incorrectly catalogued, and little analysed, let alone edited as a result of these kinds of challenges, and their potential significance remains unknown.

Another interesting case study demonstrating the sometimes random ways in which corpora of such complicated and understudied texts draw scholarly attention is that of early medieval exegesis. In a 1997 article, O'Loughlin points out three aspects of early medieval exegesis that have contributed to their significant neglect: they are frequently anonymous or pseudonymous, thus lacking the distinction of a named, potentially well-known author; much early medieval exegesis was concerned with the analysis and digestions of the extensive works of the Church Fathers in the early centuries of Christianity, often seeking to abridge these texts for teaching purposes; and finally many of these works are compilations or florilegia, gathering together important elements from authoritative works and lacking the prestige of a unified text[8]. Despite the fact that this phase in exegetical composition and its manuscripts remains integral to a full understanding of the intellectual culture of the early medieval period, and indeed that much original exegesis was also composed, the scholarly bias against this corpus meant that much of it remains unstudied.

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[7] See Warntjes (2016, 2017, 2021) for introductions to early medieval *computus*.
[8] For excellent overviews of this phase of biblical exegesis and the commentary traditions see Stansbury (1999) and Van Liere (2014, 141-158).

One exception to this was brought about by the scholar Bernard Bischoff, whose article, "Wendepunkte in der Geschichte der lateinischen Exegese im Frühmittelalter„ (1954), discussed numerous anonymous exegetical works in which he identified what he referred to as "*Irische Symptomen*" (author emphasis), or symptoms of Irish influence[9]. These distinguishing features have since been the subject of both heated debate and much misuse – as O'Loughlin (1996, 94) states, the most problematic aspect of Bischoff's "symptoms" is the tendency of scholars to interpret the presence of one or more of these as proof of a text's Irish origins, without further investigation[10]. Regardless of any debate around the article and its reception, what is entirely unambiguous is that the catalogue of texts that Bischoff presented in the article has drawn an exceptional degree of scholarly attention, including the *Scriptores Celtigenae* subsidiary of the eminent *Corpus Christianorum* series of editions by Brepols[11]. As Stansbury points out, "it not only provided a framework for studying an under-studied field, it also provided a roadmap for future scholars to begin working on previously unpublished texts" (2016, 119). Irrespective of the conclusions drawn on the Irish nature of the texts in question, the work that was accomplished as a result of Bischoff's article has and continues to advance the field of early medieval exegesis as a whole.

2.2 Philology: the Old, the New, and the Digital

Central to the research on early medieval texts is what Ziolkowski termed "a philologically grounded eclecticism" (1996, 530). Philology is a term and a specialism with a long history, during which it has been esteemed, marginalised, rediscovered, and reinvented. Although over a decade old, Yager (2010) remains an excellent guide to the key milestones of the journey of philology as a linguistic and then textual analysis methodology across the nineteenth, twentieth, and twenty-first centuries[12]. Fundamentally, Ziolkowski defined the philologist's task as being "to ask intelligent questions of texts and to set texts into contexts" (2008, 290). Pollock described it even more broadly as the "discipline of making sense of texts" (2009, 934). In the context of early medieval writing, this can entail an astonishingly broad range of academic fields, including translation, linguistics, palaeography, and codicology, as well as theoretical approaches such as intertextuality and new historicism. The "philologically grounded eclecticism" that medieval texts call for requires the researcher to draw on any and every resource in order to elaborate the full meaning of the text and to fully appreciate its cultural and historical significance.

Philology is also integrally tied to the act of editing texts. Here a key point of contention is the nature and purpose of an edition: traditional editing still frequently seeks to tend towards the original Lachmannian archetype or to Bédier's "best text", seeking to find and publish for the reader a version of the text closest to the author's "original". This is at times possible; however, even in optimal cases, editorial bias can deeply influence the ultimate edited text. A deeply significant moment in the history of medieval textual analysis is Bernard Cerquiglini's *Éloge de*

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[9] This article was reprinted in Bischoff (1966); and translated into English by O'Grady (1976).

[10] For an excellent recent assessment of the issue, see Stansbury (2016).

[11] <https://www.corpuschristianorum.org/ccsl-cccm-celtigenae> (05/2022).

[12] The renewal of the discipline of philology is a phenomenon that appears to have peaked in the 1990s and early 2000. See De Man (1986). Two themed journal issues published in 1990 – *Speculum* 65, "The New Philology", edited by Nichols (1990) and *Comparative Literature Studies* 27, "On Philology", edited by Ziolkowski (1990) – assemble many significant contributions to this discussion. The continuation of this debate is evident in the 2014 collection in *Postmedieval* 5, 4, "Philology and the Mirage of Time", edited by Warren (2014), and *Florilegium* 32, "Rethinking Philology: Twenty-Five Years after the New Philology", edited by Canitz (2015). For a more popular treatment see Turner (2014).

la variante: Histoire critique de la philologie (1989), translated ten years later as *In Praise of the Variant: A Critical History of Philology* (1999). Cerquiglini argued that, unlike printed texts, in the case of manuscripts the scribe was integral to the production of the resulting work, in their labour as copying but frequently also as intervenor, whether as editor, glossator, or commentator. This of course presents numerous challenges in print, beginning with how space-consuming it could potentially be and including the difficulties of presenting these variations in a coherent and useful manner; however, the digital medium is presenting new opportunities to accommodate this alternative conceptualisation of an edition. Cerquiglini takes pains to point out that this means far more than simply presenting the edition in a digital format:

> It is less a question, therefore, of providing data than of making the reader grasp this interaction of redundancy and recurrence, repetition and change, which medieval writing consists of – and to do so according to the two axes that we have brought to light. Vertically, along the thread that leads through the work, it can bring back all the things that each noteworthy utterance constantly echoes but which modern memory no longer hears; the screen unrolls the infinity of memorable context. Horizontally, it can compare the utterances within a pertinent and chosen range of variants that are paraphrases of one another from one manuscript to the next, even indicating by some symbol or note what the characteristics of this relationship are. (1999, 80)

Like Ziolkowski, Cerquiglini emphasises the importance of retaining the complexities of medieval texts when working on them and presenting to a wider readership. What is intriguing from the perspective of someone working on anonymous compilatory works such as collections of exegesis is that Cerquiglini is for the most part discussing what would be considered conventional works of literature: when he comments that "one could say that every manuscript is a revision, a version" (37-38), he is referring to vernacular romance narratives, unified works with a coherent narrative. In the case of the computistical and exegetical compilations discussed above, the components of the compilation are often fluid, increasing and decreasing in number and varying in arrangement from manuscript to manuscript, like structures built with Lego blocks that can be taken apart and reordered in new contexts and for new purposes. Furthermore, in these compilations the blocks themselves are also open to adaptation, rephrasing, and updating. In these cases, every variation is of integral importance to understanding the work, its significance, and its transmission.

Central to the recording and analysis of such variation is of course the ability to access the manuscripts in which they appear, which is now being made increasingly more feasible through projects across the globe working on the digitisation of manuscripts. In Ireland, this work is represented by the outstanding Dublin Institute for Advanced Studies "Irish Script on Screen" (ISOS) and the "Ogham in 3D" Project[13]. In the introduction to the very first issue of *Digital Philology: A Journal of Medieval Cultures*[14], Nichols and Altschul provide an excellent summary of the state of early medieval DH a decade ago, a summary that continues to have relevance today:

> Rare books, manuscripts, documents, and other resources are now available online for serious research – and increasingly so. Unlimited access does not simply affect the way we consult primary materials, however; to the extent it multiplies material available for consultation, it introduces issues of 'data mass.' Increased data, in turn, creates the opportunity to propose new research protocols, new questions,

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[13] <https://www.isos.dias.ie/> (05/2022); <https://ogham.celt.dias.ie/> (05/2022).
[14] <https://www.press.jhu.edu/journals/digital-philology-journal-medieval-cultures> (05/2022).

new hypotheses, fresh ways of seeing; in short, new dimensions for philological inquiry. […] It is our belief that the task of research will usher in the time when the digital humanities will ask radically new questions that can only be asked and resolved in digital environments. Today, digital media allows us to do the work we have done for generations in better ways; in time, digital environments will allow us to think beyond our current purview. (2012, 1-2)

The future of medieval DH lies in fully exploring the capabilities of the digital medium in order to capture and investigate the complete interconnected web of information offered by each word (and indeed image) in each text in each manuscript. As Cerquiglini puts it, "We would do well to hang the changing constellation of the medieval written word in the boundless space that technology offers inscription today" (1999, 80). The ultimate goal is to capture the complete ecosystem in which the text exists, to comprehensively record multiple contextual elements – work or image, text, folio, manuscript, codex, production environment, location – but to link each to the contextual elements of every iteration of the text, its sources, and instances of its reception.

A point that must be made is that the key to advancement is a distinction that Nichols and Altschul highlight, the distinction between the digitisation of and online access to manuscripts and texts, and the full potential of what the digital medium may have to offer those who seek to analyse and understand them. For example, in her concluding remarks, Yager declares Cerquiglini's vision fulfilled "in the multiform possibilities of hypertext and quickly accessible database" and comments that "Ironically, however, computer analysis as an arm of philological enquiry and editing has come full circle, to a kind of neo-Lachmannian analysis. Cladistic analysis, which classifies biological species in a manner similar to Lachmann's stemma, have given new attention to stemmatics" (Yager 2010, 1006). What Yager is referring to is the application of phylogenetics approaches to texts and manuscripts, as, for example, in the case of "The Canterbury" Project[15]. However, while this is indeed one aspect of computer analysis, even within that work, there is a huge amount of nuance, beginning perhaps with the fact that "not all phylogenetic analyses are tied to the assumption that a single ancestor is responsible for each extant copy and some copies are capable in principle of showing multiple affiliations" (Howe, Connolly, Windram 2012, 56). Furthermore, as illustrated by Tehrani and d'Huy's (2017) work on phylogenetics and folklore, the applications of this analytical approach extend beyond the critical edition. This phylogenetic approach highlights the overlaps between a stemma mapping the transmission of medieval texts and network analysis.

In DH the lines between network visualisation and network analysis frequently blur, but even in simple network visualisations the outcome is often a different perspective and a new way of interrogating evidence. As information is digitised, quantitative data analysis is also making its way into humanities fields such as medieval studies, a fact exemplified by the collected essays in Kenna, MacCarron, MacCarron's *Maths Meets Myths* (2017). As they summarise in their introduction,

Of course, we recognise that humanities scholars won't accept a number that is churned out by an algorithm as an end in itself or as a definitive answer. Instead, the quantitative approach may provide a heuristic device to discover patterns, much as they do in the natural sciences. These have then to be considered in the manner that is appropriate for the field and for the questions being addressed. In other words, quantitative tools may supply some answers but humanities provide the questions. (2017, 3)

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[15] <https://www.canterburytalesproject.org/my-project> (05/2022), see, for example, the recent publication by Bordalejo (2021). In computus, this approach was employed by Lohr (2013).

The concepts behind network analysis have the potential to allow us to explore in entirely new ways the connections between the words of a text, its manuscripts, its scribes and readers, and more importantly the connections between all of these aspects of one text and those of its cohort of intertextual associates. Vast swathes of information about both intellectual activity and regional scholarly interactions remains buried in early medieval texts and the quest to find ways to reveal and interpret it continues.

3. DH and Early Medieval Studies in Ireland

In order to further explore these approaches and their issues, it is valuable to take a look at some of the work in this field recently undertaken and currently underway in Ireland. In his 2020 overview of the development of the field of DH as a whole in Ireland, O'Sullivan points out that much of the initiative has been in the digitisation and publication online of texts. Reflecting some of the needs of medieval scholars touched on above, it is intriguing to note that some of the earliest forays into DH were centred on medieval sources, the prime example being the "Corpus of Electronic Texts" or "CELT" Project based in UCC[16]. Begun in 1997, it now constitutes a searchable online database of over sixteen hundred Irish literary and historical documents, including medieval Irish texts published by the Dublin Institute for Advanced Studies and the Irish Texts Society. As O'Sullivan points out, this online database of texts is indicative of the earliest waves of DH in Ireland, part of the process of both democratising literary and historical sources by making them freely available. However, one of the greatest achievements of digitalisation as a whole is the rendering of searchable huge libraries of texts, a process that has completely transformed literary studies in many ways. Projects like the "Chronicon Hibernicum" (ChronHib) in the University of Maynooth sought to combine the potential of digital analysis, statistics and linguistics[17]. The database at its foundation, Corpus PalaeoHibernicum (CorPH), is heavily annotated and provided the basis for the project's work on a statistical methodology for linguistically dating Old and Middle Irish texts (Lash, Qiu, Stifter 2020, 1-2; Qiu, Stifter, Bauer 2018).

A project showing the expansive range of research activity that can flourish around a corpus of digitised texts is the Dictionary of Medieval Latin from Celtic Sources (DMLCS)[18]. The DMLCS is part of a Europe-wide initiative recording regional variations of medieval Latin[19]. From its inception, the project determined to produce a "permanent electronic database containing the whole corpus of Celtic-Latin literature from the period 400-1200 A.D."[20]. This corpus was first catalogued and then published by Brepols as the Archive of Celtic-Latin Literature (ACLL), complementing their existing database of online texts: Library of Latin Texts (LLT)[21]. In addition to this database and the ongoing lexicon, the DMLCS is also demonstrating the sort of complementary work that can emerge from long-term projects attached to such databases, including the "St Patrick's *Confessio* Hypertext Stack Project"[22] and the *Scriptores Celtigenae* subsidiary series already mentioned previously.

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[16] <https://celt.ucc.ie/> (05/2022).
[17] <http://chronhib.maynoothuniversity.ie/> (05/2022).
[18] <https://journals.eeecs.qub.ac.uk/DMLCS/frameset_home.html> (05/2022).
[19] Published to date are Harvey, Power (2005) and Harvey, Malthouse (2015).
[20] < https://journals.eeecs.qub.ac.uk/DMLCS/frameset_ACLL.html> (05/2022).
[21] The catalogue was published as Lapidge, Sharpe (1985). <https://about.brepolis.net/archive-of-celtic-latin-in-literature-acll/> (05/2022).
[22] <https://www.confessio.ie/> (05/2022).

Continuing on the theme of lexicography, it is notable that not only the sources themselves are being digitised and therefore made more widely accessible, but the same is also true of reference materials. An outstanding example of this in Ireland is the initial digitisation and then further development of the RIA's Dictionary of the Irish Language (Royal Irish Academy 1913-1976), covering entries from around 700 to 1700[23]. Another example is housed in NUIG's Moore Institute Digital Lab: Dr. Mark Stansbury's "Early Latin Manuscripts" (ELMSS) Project[24]. This site offers an easily navigable and searchable digital edition of E.A. Lowe's monumental *Codices Latini Antiquiores: A Palaeographical Guide to Latin Manuscripts Prior to the Ninth Century* (1934-1971), which vitally incorporates the illustrative images from the original volumes in addition to linking to the digitised manuscript where available. In addition to this data now being searchable, this project has advanced on the original publication in being able to incorporate corrections and updates where appropriate, and indeed integrating new research on these manuscripts through its "Collections".

In addition to the digitisation of existing reference materials, the digital framework has also supported the emergence of many new resources for medievalists, for example, the database of the "Monasticon Hibernicum" Project at Maynooth, which produced a catalogue of early Christian ecclesiastical settlements in Ireland from the fifth to twelfth centuries[25]. The catalogue by the "Digital Framework for the Medieval Gaelic World" Project in QUB draws together the online resources available to scholars in the field, an indication of the proliferation of resources emerging internationally[26]. Another recent reference catalogue produced by Dr. Padraic Moran at NUIG is "MIrA: Manuscripts with Irish Associations", a handlist of early medieval manuscripts (before c. AD 1000) relevant to the study of Irish book culture which has the outstanding advantage of using the Mirador manuscript viewer to enable the user to view the manuscript in question where available[27].

Moran's research has also dealt very substantially with the collections of glosses, in both Latin and Irish. Between his work on the "Early Irish Glossaries" Project at Cambridge and the publication of his print edition of *De Origine Scoticae Linguae* (also known as *O'Mulconry's Glossary*) (Moran 2019), Moran also worked on the "St Gall Priscian Glosses" Project along with Bernard Bauer and Rijcklof Hofman[28]. This phenomenal resource allows the user to search and navigate the main text of Priscian's Latin grammar book and its glosses in a highly intuitive manner. In addition, it also links to the appropriate position in both the manuscript and the print edition of Priscian's work. This resource pulls apart the elements of the source – main text, glosses, manuscript medium – but does so in a way that increases the user's ability to view all aspects of each element, integrating the source material with the continuously developing scholarship.

The "Irish Foundations of Carolingian Europe" Project is using one area of intellectual culture in the early medieval Latin West to challenge the attribution of the entirety of this period's monumental intellectual developments to the Carolingian "Renaissance" of the late eighth and ninth centuries. Through a detailed study of *computus*, both in the century and a

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[23] <https://dil.ie/> (05/2022).

[24] <https://elmss.nuigalway.ie> (05/2022).

[25] <https://monasticon.celt.dias.ie/> (05/2022).

[26] <https://www.qub.ac.uk/schools/ael/Research/ResearchinLanguages/imdorus/DigitalProjectsforthe-GaelicWorld/> (05/2022); <https://monasticon.celt.dias.ie/> (05/2022).

[27] <http://www.mira.ie> (05/2022).

[28] <www.stgallpriscian.ie/resource> (05/2022).

half prior to the rise of Charlemagne and throughout the duration of the Carolingian period, this project is seeking to discover the extent to which intellectual activity throughout the Latin West, particularly in the Irish and Irish-influenced regions, but also Visigothic Spain, may lie behind the great advances in that field that were evident in the mainstream. The project comprises several distinct elements. The first is the critical edition of two key works, along with English translations and detailed commentaries: Mr Christian Schweizer is editing Dicuil's *Liber de Astronomia*, "Book of Astronomy" and Tobit Loevenich is editing the *Computus Einsidlensis*. Warntjes himself is working on a monograph synthesising the findings and conclusions of the project, and offering an assessment of the Irish impact on the discipline of *computus* in early medieval Europe.

A core element of the "IFCE" Project is the application of Object Oriented Cataloguing (OOC) to the data produced by the team. The development of the OOC framework is led by Dr. Warntjes and Ms. Judith ter Horst. International expertise will be accessed through a collaboration with Mr. Thom Snijders, the forerunner in the design and implementation of this methodological approach to this type of material[29]. This approach to digital analysis and cataloguing aims to disassemble the collection so that each constituent element of each text can be compared to those of others, and the data can then be applied to identifying the ways in which the text was transmitted, and by inference the networks through which it travelled.

3.1 IrCaBriTT

The goal of IrCaBriTT is to interrogate newly discovered and existing manuscripts and textual evidence and to investigate how this impacts our understanding of the intellectual culture of early medieval Brittany and its interactions with its geographical neighbours, in particular Ireland, Britain, and Francia[30]. The timeframe in question is roughly between 750 and 1000, a period known as the Carolingian age. The project comprises three components: the PI, Dr. Jacopo Bisagni is working on the detailed analysis and transmission of computistical texts as well as the broader perspective gained from the accumulation of evidence[31]. Central to this research is the use of diagnostic features – key phrases or concepts – that can be used to trace the transmission of ideas and textual units across the Latin West[32]. Early work has already been evidenced in *From Atoms to the Cosmos: the Irish Tradition of the Divisions of Time in the Early Middle Ages* (Bisagni 2020). The two other components of the project feed into this larger over-view: Ms. Paula Harrison is working on a detailed study and edition of a substantial number of scientific excerpts of Irish origin that were included in the early ninth-century compilation *De Astronomia* (On Astronomy), in Laon, Bibliothèque Municipale, 422. My own research concerns the exegetical evidence at the heart of which is a compilation in the tenth-century Orléans, Médiathèque, 182, in which Bisagni (2018) identified five previously undiscovered glosses in Old Breton. This same compilation, though a distinct version, also appears in the twelfth-century manuscript, Reims, Bibliothèque Municipale, 395. My work involves a critical edition and detailed philological and palaeographical analysis of this work, uncovering what it and its manuscripts can tell us about early medieval Breton exegetical activity and the routes of transmission that products of the Breton literati took both into and out of Brittany.

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[29] Snijders (2018); <https://computus.lat/> (05/2022).
[30] <https://ircabritt.nuigalway.ie/> (05/2022).
[31] Manuscripts at the centre of the project are: Angers, Bibliothèque Municipale, MS 476; Laon, Bibliothèque Municipale, MS 422; Orléans, Médiathèque, MS 182; Paris, BnF, Lat. 6400B and Paris, BnF, Lat. 7418A.
[32] Bisagni (2013-2014, 2017, 2021a, 2021b).

From the outset, a foundational element of IrCaBriTT's Project design was a comprehensive database of manuscripts with Breton connections. This element of the project has been successfully realised in the Descriptive Handlist of Breton Manuscripts, c. AD 780-1100 (DHBM), composed by Bisagni with contributions by myself and constructed by Mr David Kelly[33]. Far beyond presenting simply a catalogue of existing manuscripts, this online resource offers a critical and up-to-date survey of manuscripts with both known and disproven Breton connections and the scholarship pertaining to them. The digital nature of the catalogue is integral to the DHBM's capacity to incorporate new findings as they emerge. The DHBM is foundational to the specific goals of all three of the "IrCaBriTT" Project components, but also provides an unparalleled resource for future research in the field of medieval Breton latinity and intellectual culture. Although both Harrison and I are aiming to produce conventional critical editions of the source material, there was a drive to find a way to the value of the palaeographical evidence. Following the investigations made during EMDH, it was decided that the best way to disseminate this was using EVT, which would allow us to present the manuscript images with a palaeographically annotated transcription. As part of his own work, Bisagni is using Cytoscape to work on a network of computistical manuscripts that captures both the textual and codicological connections between Breton computistical manuscripts and their analogues.

4. Challenges and Responses

During both the EMDH and wider conversations, it has become clear that there are several obstacles facing the full realisation of what DH has to offer medieval, and other humanities researchers. Some of these still stem from a view of DH purely as an auxiliary science or a means of dissemination. While databases, websites, and visualisation can indeed be excellent methods of disseminating research, they have the potential to catalyse a dramatic transformation of research practices. In order for this to be able to take place, however, the infrastructure must be present to facilitate it and for the most part this is not the case. Elements of this infrastructure that researchers have highlighted as obstacles include not having suitably specialised technical staff available within institutions or indeed the ability to budget for digital specialists of one type or another in funding applications. The success of IrCaBriTT's digital aspects is due in many ways to collaborations with colleagues both in NUIG and beyond, but they would not have been achievable without the collaboration of David Kelly, the Digital Humanities Manager of the Moore Institute at NUIG[34].

Any kind of permanent DH staffing is relatively rare while also being integral to the success and expansion of DH work in all fields, and of course as work in DH grows, so do the staffing requirements. In tangent with this is the long-standing concern that researchers have regarding the maintenance and hence sustainability of their projects, which as Kelly (2022) pointed out in a recent conference contribution is a concern shared by those working on the technical side of these projects. While making the datasets available through open access archives is good practice where possible, often the specific web interface comprises a significant aspect

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[33] <https://ircabritt.nuigalway.ie/handlist/> (05/2022). The data is stored in a relational, MySQL database. The web application was built using the Laravel PHP Framework (<https://laravel.com/>, 05/2022). Data visualisation on the site is implemented using Leaflet (<https://leafletjs.com/>, 05/2022) for the map and HighCharts (<https://www.highcharts.com/>, 05/2022) for the bar charts. Data from the database can be downloaded as a .csv or .xml file or by accessing the data via a JSON API.

[34] <http://www.davidkelly.ie/> (05/2022).

of the project's value. If new DH research is aiming to be cutting edge, to constitute a step change in field, then the results of this labour cannot be viewed as fundamentally temporary, potentially with a shelf-life as short as that of the project funding. Alongside this permanence must come recognition: as more DH projects become less auxiliary and about dissemination and more the principal component and about publication, processes for acknowledgement and peer-review must follow. Some of the biggest advances being made in the field of DH involve the organisational and network connections being established among DH researchers within and beyond specific fields. Outstanding examples of this are the Digital Research Infrastructure for the Arts and Humanities (DARIAH-EU), for which Dr. Orla Murphy at UCC is the national coordinator, the UK-Ireland Digital Humanities Network, and of course the RIA's Digital Repository of Ireland (DRI)[35]. These organisations, networks, and projects offer the means for greater strengths in support and communication among DH researchers, which in turn will hopefully lead to the systemic changes that need to come about to fully support the future of their work.

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[35] <https://www.dariah.eu/> (05/2022); <https://dhnetwork.org/> (05/2022), see for example outputs such as Gambell, Gooding, Hughes (2021); <https://www.dri.ie/> (05/2022).

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