Making Sense of Digital History

CHAPTER 2

The Long Road to 'Digital History'

History of Computer-Assisted Research of the Past in Finland since the 1960s

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> Kranzberg's First Law reads as follows: Technology is neither good nor bad; nor is it neutral.[1]

Historians have rarely been associated with the latest IT, or the other way around. In broad terms, the same applies to all IT, both old and new, and history research; they seem a world apart, unless one counts things such as pens and books. In their publications, most historians make it look like their use of information technologies is unbiased and unproblematic. However, Melvin Kranzberg, who was a veteran historian of technology, reminded us that technologies always come with consequences. With digital history, and the growing use of computational methods in historical research, this practice and performance of neutrality vis-à-vis technological tools, as well as the old stereotype, could be changing.

In reality, IT such as computers has been utilised in history research since the 1960s, as in most other walks of life. At that time, a few historians in the United States (and elsewhere) started to explore the usability of mainframe computers for their work.[2] In over 50 years, computer-assisted history research has evolved, or graduated, from the tests of a very few scholars into an emerging

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field of computational history, also called more broadly digital history research. Of course, one should inquire if those are phases and part of the same continuum or rather separate developments with no tangible influence from the former to the latter. In any case, this development seems to be something else than a straightforward progression.

This chapter focuses on the history of computer use by historians, drawing its evidence mostly from Finland, but with an emphasis on the researchers' transnational influences. To explore this evolution, this chapter asks: What have historians been doing professionally with computer technology, and when did that begin in Finland? What were their international influences in developing the use of computers in history research?

Here, 'computer technology' refers to the technological developments connected to computers and IT during the research period: in this case, its evolution from the relatively large mainframe computers to microcomputers, to internet and beyond. The focus in this chapter is on historical research, thus mostly excluding teaching history with the help of or via IT, as well as technological changes related to publishing.

Interviews and memoirs, various written documents, especially digitised history journals, and observations (since the late 1990s) are used in answering these questions.[3] With these materials, the chapter aims to examine this development from several different levels and viewpoints. These range from the individual scholar(s) to their collaboration and extend into libraries and archives, and institutional use and support of digital means to advance research in the field of history.

One important motivation behind these questions is to distance the researcher and readers from the present terminology concerning digital humanities and digital or computational history, which often seem to make studying their own development very confusing. Without these concepts, I hypothesise, we can better approach and understand historical events and trends on their own terms.

While research in historiography had tended to value and focus on the theoretical aspects of historical thinking and research, this chapter highlights the more practical side of carrying out historical research and thus contributes to a more balanced idea of how historians conduct their work. A better, increased understanding of the now mundane technologies and practices of historians is especially appropriate now that the discipline is facing yet another change towards an increasingly electronic and more digitised research process, with new and more powerful computational tools, which present challenges to historians themselves, but also to teaching and outreach to the public.[4]

Further, for the international discussion, this chapter serves as a reminder of and correction to the US-centric or Anglo-American view of history of computing-assisted history. This too was an international and transnational development.[5] In international comparison, the number of Finnish historians was fairly limited. After rapid growth in the 1960s, there were, in 1970, historical research units in six Finnish universities, employing a total of 32 professors.

Since then, the community grown to the extent that, in 2015, there were 56 history professorships in eight research units, but the profession has expanded greatly, especially when one counts all historians with doctoral education.[6] Nevertheless, from early on, this community of historians in Finland took part in most if not all transnational trends and developments in their field and adopted major new technologies used by historians in industrialised countries. In general, then, Finnish historians' experience of using computers can be thought of as rather representative of other Western countries. The few untypical aspects will be highlighted.

Computer Usage Starts in the Late 1960s

According to the digitised version of the *Historiallinen Aikakauskirja* (*Historical Journal*) in Finland, the word 'computer' (*tietokone*) was first mentioned on its pages in a book review in 1964.[7] One early Finnish historian to make use of computers, Pertti Huttunen, later wrote that he became interested in using computers during that same year, in 1964, while extending his studies and planning his doctoral dissertation in Rome, Italy. There, he first talked about such an option with a Finnish physicist and also visited a local computing centre.[8]

Following examples abroad, a small number of historians had started to familiarise themselves with mainframe computers in the mid-1960s. The first public discussion about computers by historians in Finland took place in the spring of 1967. At that time, the Historiallinen Yhdistys ry. (Historical Association), or younger generation of historians, had invited historians Kaarlo Wirilander and Pertti Huttunen, a well-known senior researcher and a doctoral candidate respectively, to talk about 'The historian and the computer'. At the meeting, an IT specialist from the Helsinki University's computing centre, Jorma Torppa, offered technical expertise.[9]

Before this seminar in Helsinki, historian Viljo Rasila had joined the first short, introductory course given by the new computing centre at Tampere University. The centre had installed its first computer in 1966. The following year, Rasila became the first historian in Finland to publish an article about using computers in the national *Historiallinen Aikakauskirja*. In it, he mentioned the work of Wirilander, Huttunen, the 'brick group' studying Roman brick stamps and his own as examples of history research involving computers in Finland. According to Rasila, this computer use by historians was just beginning.[10]

This use so far included collecting and inserting data into (punched) cards, which were meant for building databases (to create tables and to compile statistics) and performing calculations. Rasila himself was applying multivariable analysis, and specifically factor analysis, to weigh up the various reasons for the civil war in Finland. That same year (1967), Pertti Huttunen published an article outlining his ideas about how to use computers to study Roman social

history. His article was published as the first volume in the series *Studia Historica* from the young University of Oulu (founded in 1958) in northern Finland.[11]

The following year, Viljo Rasila was the first to publish a history book, a monograph where he applied computer-aided statistical methods to explore key themes in recent Finnish social history during the 1918 war. His main computational method, factor analysis, had been developed in the field of psychology. The book, *Kansalaissodan sosiaalinen tausta* (*Social background of the civil war*), appeared in 1968.

Heikki Waris, a professor and social historian at the University of Helsinki, reviewed the study for the *Historiallinen Aikakauskirja* and thanked Rasila especially for introducing new methods for historians to use.[12] In the same issue of the journal, however, Pertti Järvinen from the computing centre at Tampere University discussed Rasila's book and heavily criticised his choice of a statistical method. In his book's preface, Rasila acknowledged the computing centre and its 'mathematicians' who had helped him, but, importantly, Pertti Järvinen had not been involved in Rasila's project. Instead, Järvinen had taken an independent interest in this innovative approach to history and likely became the first computing professional to share his ideas in this journal.[13] All in all, Rasila's study accompanied many firsts simultaneously.

Issues of multidisciplinary soon impacted Pertti Huttunen. Based on an analysis by a colleague, it seems Huttunen's dissertation manuscript on Roman social history faced harsh criticism from a classical philologist in Helsinki, which led Huttunen to move his dissertation project to the University of Oulu.[14] For sure, such difficulties and change did not support finishing the study, but, importantly, they were not directly associated with the new, computerised method applied by Huttunen. He never returned to work in Helsinki, but forged a career in researching and lecturing (for instance, about the history of technology) in Oulu and in other universities.

Pertti Huttunen defended his doctoral dissertation and book *The social strata in the imperial city of Rome* in 1974. Arguably, Huttunen wrote the first Finnish doctoral dissertation in history to use computerised methods, although that same year (1974), Reino Kero also defended his doctoral dissertation of general history at the University of Turku, and he too had used a computerised method in his study on migration.[15]

Regarding the feedback surrounding his 1968 book, Viljo Rasila recalled in my interview with him that the method was widely noticed, but at that point in time it raised mostly confusion:

> The reception of the mathematical analysis was controversial. Researchers of economic and social history, Eino Jutikkala among them, welcomed it as opening new opportunities, but the school of historians following [Professor Pentti] Renvall and doing textual analysis ('*renvallilainen tekstianalyysiin nojaava koulukunta*') shunned it and doubted its usefulness.[16]

This ambiguity is relatively easy to understand when one considers the technological and data-processing options available at the time. Starting from mainframe computers and the programs available on them, computer technology for a long time worked mainly for quantitative research and did not really fit qualitative research designs. First and foremost, there was virtually no data to be processed in digital text formats. At this time, computers and the promise they represented undoubtedly encouraged historians (as well as social scientists before them) to carry out quantitative research, which grew more popular in universities during the 1970s. In certain history departments, this period left a relatively strong tradition of quantitative history research that has been more or less carried on ever since.

Nevertheless, it is important to note that historians had applied quantitative and computational methods in their research even before computers were available. In Finland, the breakthrough of these approaches occurred in the early 1960s, if not somewhat earlier.[17] In an interesting simultaneity to historians first learning about the use of computers, the first independent department of economic history in Finland, at the University of Helsinki, was established in 1966. Unlike the '"old" Finnish economic history' which was later seen as rather descriptive, the new economic history became characterised by 'systematic application of quantitative methods'.[18] From this perspective, embracing computers was not a beginning nor a revolution, but part of an evolutionary development in the scholarship of history. It was a step further, which later perhaps seems to us a bigger change than it actually was. However, this longer intellectual background of quantitative history, going back at least until the last decades of the 19th century, has been studied elsewhere.[19]

How did historians compare with social scientists in computer use? For instance, Kullervo Rainio, later Professor of Social Psychology at the University of Helsinki, visited Finland's first operational computer, an IBM 650, at a state-owned bank soon after the machine's inauguration in 1958. At that time, he took part in a visit arranged for the Suomen Psykologinen Seura (Psychological Association of Finland), and in 1960 he could learn using another computer in Helsinki with his complex mathematical calculations needed for simulating group behaviour in a computer program.[20]

In general, we can safely say that social science researchers started using computers well before historians.[21] In Tampere University, which until 1966 carried the name Yhteiskunnallinen korkeakoulu (College of Social Sciences), Viljo Rasila had for years been in the company of mostly social scientists and had become familiar with their statistical methods. This environment partly explains his early interest in and initiative to test and use a computer for scholarly work in history.

One could also surmise that Rasila was in a position to fully cooperate with social scientists at Tampere University, but that was not the case. When I interviewed him, he told me that there was a major political difference between himself (he was more conservative) and his colleagues who, for instance, in the

department of sociology, were politically quite left-wing. Despite the shared interest in using computers, this political dissimilarity caused them to maintain a working distance from each other.[22]

In this respect, Rasila was rather typical. For a long while in the 1970s too, I suspect, this was a more general pattern: when compared with social science departments, history departments were much more conservative, including politically. This points out, intriguingly, that many contextual, historical factors could have an effect on and limit the circulation and exchange of scientific and scholarly tools such as the use of computer programs.

Tellingly of this technological milieu and the options available, it was predominantly a few researchers in social and general history who first started making use of computers. In the 1960s and the 1970s, the group of active history researchers totalled a few hundred, so they all knew each other and knew what others were doing,[23] even if those using computers remained a tiny minority. Further, Viljo Rasila penned a textbook entitled *Tilastolliset menetelmät historiantutkimuksessa* (*Statistical methods in history research*, 1973, 2nd edition 1977), including examples of computer-assisted operations, and that book became widely known among the profession, and especially among history students.

In summation, during roughly the first decade of computer use by historians, they used IBM and other mainframe computers for statistics, saving collected data, evidence, storing and processing it, forming tables, and then carried out various kinds of calculations and statistical analysis.

Research Projects: The 1970s

The early 1970s saw a new phase in historians' use of computers when the technology was incorporated into research projects. Such projects were considered fashionable, and the reorganised Academy of Finland granted funds for up-to-date research projects in the field of history too. In 1971, for instance, Vilho Niitemaa, Professor of General History at the University of Turku, presented a newly funded project focusing on people who have emigrated from Finland to distant countries (known as *kaukosiirtolaiset* in Finnish). The project included what Niitemaa labelled the 'ADP department', or individuals working on data collecting and compiling statistics with automatic data-processing tools. To store data, they used punched cards. The first doctoral dissertation to emerge from this project was written by Reino Kero, who, as mentioned above, defended his thesis in 1974.[24]

Conducting research in organised projects had become more common in the sciences in postwar decades. In the leading history journal, *Historiallinen Aikakauskirja*, several Finnish researchers wrote about current historical research projects in Sweden from the late 1960s onwards, and these reports included a

few mentions of ADP systems which were either being tested or were already in use to store and handle information.[25]

Thus, historians continued to use computers for organising data and for statistical purposes in the 1970s, but, for them, making use of the 'computer' (as technology) had also become a tool for winning research funding. Using computers signalled taking part in advancing research with the latest ideas and technology, and being at the forefront of development.

Viljo Rasila's expertise in computers played a major role in encouraging a collaborative research project called *Muuttoliikeprojekti* (Migration Project), which focused on migration within Finland between 1850 and 1910, with a particular focus on industrialisation. That project was led by Professor of Finnish History, Pentti Virrankoski, from 1977. Virrankoski also directed one sub-project at the University of Turku while Rasila, now an appointed professor, led another research team at Tampere University, and Yrjö Kaukiainen a third team at the University of Helsinki. In this project, the workload for collecting data manually grew much larger than was anticipated. Still, the difficulties with the ADP programs and processing the data proved to be even more significant. Because of these surprises, the larger project ran out of funding in the early 1980s. Most of the human-collected and manually input data was never computerised.[26]

However, the sub-project team at Tampere constructed their database differently from that of the Turku team, and consequently the Tampere team and Rasila himself were able to use and process their materials with a computer, and publish research results. Importantly, the larger project had formed ties with the Swedish project already building a demographic database in the late 1970s, and they exchanged experiences in international seminars.[27] Surprisingly, there are hopes that this Tampere database could be used anew in the early 2020s, once again inspired by the Swedish example.[28]

In principle, such databases can have a very long lifespan. Nevertheless, the opposite seems to have been the rule, so that many Finnish projects collecting and processing data in history research have produced a very ephemeral legacy. Their datasets were left in archives with data formats that basically died out within a rather short period of time.

The international discussion concerning historians' use of computers was increasing from the late 1960s onwards. In that exchange, Finnish historians rarely contributed publications, although Viljo Rasila, at least, published two articles in international journals such as in the 1970 volume of *Economy and History*. Importantly, however, during the 1970s and continuing well into the 1980s, Finnish scholars had relatively dynamic transnational communications, especially with their Estonian colleagues from the Soviet Union who had pioneered using computers in history research. Juhan Kahk was one of several such Estonian colleagues who published studies (using both the Finnish and the English languages) also in Finnish history series.[29]

Microcomputers for Text Processing:
The New Typewriter (Plus)

The impact of the computer on historians' practice was not only as a calculator, but even more so as a word processor. Typewriters were already being advertised for historians in *Historiallinen Aikakauskirja* in 1916. It took time, however, before they began to be widely used by historians. And relatively soon afterwards, the latest products of the IT industry emerged: smaller computers that could be used as an advanced typewriter. The spread of personal computers (PCs) or microcomputers opened up new possibilities for historians in the early 1980s.[30]

In Finland, Jussi T. Lappalainen was the first person to write to historians about the possibility of using a computer to write texts. He had heard of such a novelty from his son Vesa, who studied mathematics. Lappalainen explained that he first thought of writing archival notes on a computer in place of using the long-used edge-notched cards (or edge-punched cards, *neulakortti*). Father and son then co-wrote a short article entitled 'Historical research without papers', which was published in *Historiallinen Aikakauskirja* in 1983. At the time, Jussi Lappalainen, who had previously worked at the University of Jyväskylä, was as Associate Professor of Finnish History at the University of Turku.[31] When the first, still quite expensive, microcomputer landed in the history department's office in Turku, his colleagues were afraid of using it. Lappalainen, however, was convinced about the device's potential and wrote another article entitled 'Making text on the screen', after which his colleagues began to telephone him to glean some clarification. As a former publishing editor, Lappalainen also persuaded the popular Finnish novelist Kalle Päätalo to migrate to using a computer for his work. The learning phase involved some text vanishing from the computer's memory (or from the writing software) and this made the angry author revert to the typewriter for a while.[32] Despite the new technology, then, the (anticipated) main use of these new machines was familiar; it was typing. Computers replaced typewriters, and most of the historians started using computers as not-yet-so-advanced typewriters. Yet, social science historians soon discovered ways in which the PC could do more.

In 1985, a new historical research project at the University of Helsinki started using a microcomputer to save and study materials. Project members examined the Finnish famine of the late 1860s (*1860-luvun suuret nälkävuodet*) based on the latest developments in social science history. In that project, they utilised either quantitative or qualitative methods (or both) on a variety of materials. For both types of method, they developed new best practices using software for building databases and for word processing, including one project-member, Kari Pitkänen, writing a concise guide book for fellow historians entitled *Historiantutkija ja mikrotietokone* (*The historian and the microcomputer*, 1987).[33]

Many preferred to wait and see, however. Several historians have confessed that they themselves hesitated and postponed adopting the novel PCs in the

mid-1980s, but by the beginning of the 1990s, nearly all had started to at least write with microcomputers.[34] A significant factor in this transition was the increased user-friendliness of PCs in the form of graphical user interfaces (in place of the command line interface). At the same time, PCs became cheaper and consequently more common. Soon after, the media started to excite people about a new information network: the internet. Considering the changes recently introduced by microcomputers, it is unsurprising that for many (older) historians the new online world of information networks remained for most of the 1990s quite distant.

Compared to older mainframe technology, microcomputers opened up a whole new spectrum of uses for historians to choose. Typing or text processing was by far the most widely adopted of these new uses and thus in many ways the most important one. But, in addition, on a PC one could also keep records and notes, and later draw maps and graphs, and take time to learn other new uses. Again, much of the development was gradual.[35]

Meanwhile, many other people were using microcomputers too. These included genealogists, who launched their own journal *Sukutietotekniikka* (*Computer technology for family research*) in 1984, and who worked together to insert data in digital formats, and later digitised parish registers and made them available online (HisKi). In some universities, linguists developed corpus linguistics and even historical linguistics. In the early 1980s, the Helsinki Corpus of English Texts was initiated. This ground-breaking digital text collection was completed and publicly distributed in 1991.[36] Quite a few historians became aware of these endeavours, but they remained distant to historical research.

Overseas, groups of historians established for themselves organisations such as the Association for History and Computing (AHC), which was proposed at a conference at the University of London in 1986. The AHC was dedicated to the use of computers in historical research and in 'promoting the use of computers in all types of historical study, both for teaching and research'.[37] Unlike their colleagues in many other countries, Finnish historians did not form a national association for history and computing, and to the best of our knowledge, they consequently took part to a very limited extent in this international discussion.

With every major change, quite a few historians at first postponed adopting the new technology. Who were these non-users of the (new) technology? Until well into the 1980s, they were those historians who were relying on textual analysis—basically, the majority of people in most history departments. They could use card files to make archival notes and to store their data, and other such manual or mechanical tools, and they used typewriters or perhaps had the department's typist transcribe their writings.

Gradually, for instance, cultural historians also switched their typewriters to PCs. Perhaps it took them a few more years, but it did happen, and soon, in the 1990s, it was only the most senior historians who did not change to writing on a computer, but hung on to the typewriter.

At the same time, Finnish researchers committed to the new cultural history avoided numbers and statistics, and in general quantitative methods. For instance, their colleagues in Italy and Germany more often used numbers and calculations to study microhistory. This avoidance can be regarded as a counter-reaction towards the general emphasis on quantitative methods such as statistical approaches in the 1970s. Instead, cultural historians studied textual evidence in the light of the then recent linguistic turn. Their emphasis was on using qualitative methods, especially 'close reading' of texts, as well as discussing and exploring narratives. Over time in the late 20th century, close reading became a leading (often the main or even only) method for legions of historians and other people studying texts, so much so that the literary historian and Professor Franco Moretti termed his new and different computer-assisted method 'distant reading'. Inspired by the Annales School of historians, he coined the term in 2000.[38] It has subsequently gained popularity as a response and complement to the dominance of close reading.

Enter the Internet: Anticipating a Digital Revolution?

In the early 1990s, the younger generation of historians discovered the internet, or networks of computers, that had been first built in the United States in the 1960s for military purposes and only came into wider, academic use by scientists during the 1980s. Furthermore, some historians soon took part in creating a new, virtual dimension to the world. In Finland, they first tested Gopher-based internet pages (before the html language) which were in use by 1994. At that time, the World Wide Web, or the Web, after being created at CERN, had begun its successful expansion as the information medium over the internet.

One of the early Finnish projects was the Electronic Centre for History Research in Finland. It first opened in late 1995.[39] The following year, it joined forces with other related projects, and these were transformed into a new national cooperation. Named as the Agricola network, this was a joint effort among historians in the universities, libraries and archives, and it was officially launched in 1996.[40]

The new Agricola site brought together people working with or interested in history, created new avenues of communication and enabled them to discuss their relevant issues in a very popular email list, H-verkko, nationally. They aimed to inform others and share news, as well as publish online. Importantly, one key component for the network builders consisted of educating historians and keeping them abreast of the internet's latest relevant developments. This included thinking ahead and writing about the possible futures of history research in the digital era: an anticipated digital revolution and what that might entail.[41] Further in connection to the Agricola network, a group of historians started to study IT history, especially in Finland, thus improving the shared understanding of living in a society in which computer technology was

gradually applied everywhere.[42] Out of the Agricola network's publishing activities grew *Ennen ja nyt* (*Then & Now*), in existence since May 2001, which was the first national, refereed online journal in history.[43]

To summarise, historians were now using computers and their networks for searching and gathering information, including data about archives, and they sometimes even accessed the actual sources that someone had downloaded to their pages. This could easily be achieved transnationally, and for quite some time it seemed national borders were becoming less and less important. The burgeoning virtual world and its sites first complemented and then slowly began to replace former foundations of historians' work such as library indexes, travel to archives and archive guides, followed by books, phone books, etc. In scholarly communications, electronic mail or email correspondence instead of postal letters proved triumphant in the 'internet age'.[44]

For the first time, historians were also becoming familiar with sources that were 'born digital', such as email letters and digital art, and discussed the future of electronic sources. Two extreme questions surrounded whether everything would be saved electronically (a burden for historians) or whether the new electronic sources (such as early www-pages) would be deleted or otherwise lost within a relatively short time, leaving future historians without important materials from the 1990s.[45] Thinking about it now, the latter seems closer to what has actually happened. Furthermore, the digital revolution that took place proved to be slower than expected and transformed into a digital evolution that eventually invaded every aspect of life during the 2000s and onwards.

In the 50-year period examined here, the contextual changes for historians have been significant, ranging from the expanding universities to the evolution of the Finnish society at large. The historical profession in Finland in the early 1960s consisted of perhaps fewer than 100 people active in conducting research. The number of history professors in Finland was 17 in 1960, and it grew to 32 in 1970 to approximately 46 in 2000 and to 10 more in 2015, while the number of research units (larger university departments) rose from five to eight in the same time period. However, the number of university-educated history researchers (PhD) and lower-level positions grew much more extensively, particularly from the late 1990s onwards. In addition to universities, there were historians carrying out research elsewhere, especially in a few major institutions such as archives and the National Library.[46]

Starting in the 1990s, the Finland-based multinational corporation Nokia, selling new mobile phones, led the country's high-tech investments and image, and Finland became a leader in many IT developments. This probably encouraged also technologically open-minded historians to explore the new possibilities that the novelties might offer. Meanwhile, especially since 2000, the profession has both specialised further and internationalised heavily, and historians have in general perhaps become less and less knowledgeable of their domestic colleagues compared with experts abroad. Historians in the universities have also confronted an ever heavier competition for (external) research

funding, which has contributed to their willingness to adopt new methods and ideas.

Digitising Sources and Offering Them Online

In many ways, digitisation of historical sources had its roots in microfilming similar materials. The state (national) archive in Finland started a project to microfilm documents in the late 1940s. It was the new general manager of the archive, Yrjö Nurmio, who led ground-breaking efforts to film important sources abroad, first in Sweden and West Germany, and thus made these archival collections that were considered relevant for Finnish historians easily available to researchers in Finland, on microfilm readers. Later in the 1950s and 1960s, Finns could also microfilm Soviet materials.[47]

During a longer period of time, a large collection of historical newspapers was microfilmed in Finland. Foreign newspaper collections could be purchased for use in Finnish libraries and universities. Microfilming and their use had then continued for about three decades when automatic data processing (ADP) started to become another option to store and access primary sources. While the history of microfilming might sound ancient and wholly irrelevant for historical researchers in the 2020s, this legacy is in fact a pertinent background to the digital newspaper collection.

The National Library at Helsinki had already established the Centre for Microfilming and Conservation in 1990, located in the small town of Mikkeli in Eastern Finland. They aimed to create a comprehensive microfilm collection of Finnish newspapers and journals. Meanwhile, the internet made its first breakthrough as a new and exciting channel to distribute information in digital formats in the early and mid-1990s.

Digitisation of cultural heritage began in Finland after the mid-1990s, with the Mikkeli centre playing a central role. From the perspective of newspaper collections, an essential turning point was the launching of the Nordic project Tiden in 1998. In the Finnish case, the digital collection of newspapers is for the most part based on microfilms, which means that both the quality of the microfilm and the quality of the original newspaper have an important impact on the accuracy of optical character recognition (OCR), which varies from decade to decade. After a busy few years, the National library was able to open the Historical Finnish newspaper archive online in 2001.[48]

The first collection of digitised newspapers already covered several decades of the 19th-century press. Historians could now carry out some of their historical research using digitised original materials, over the internet, via their own computers in their own offices.

Since its inauguration in 2001, this major online press archive has been constantly expanded and its user interface, such as search options, improved. These significant investments have made the National Library's DIGI Collection of

newspapers and periodicals published in Finland arguably the most used historical digital source material in 2018.[49] In fact this collection is so complete especially regarding the 19th-century newspapers that in many cases they are enough for answering the researcher's question/s. This has made some researchers critical and asking if not the research questions where chosen so that one is able to limit his/her study into consulting only the digital materials, relying on keyword searches, and applying the rather conventional qualitative methods.

Evolving Digital Humanities and Emerging 'Digital History'

Gradually, in the 2000s and the early 2010s, an increasing number of historians became aware of and familiar with the massive amount of digital texts from primary sources that were processed by memory institutions such as libraries and archives around the world into digital formats and made available online. In retrospect, suddenly, there was an abundance of material suitable for qualitative and quantitative analysis online. Anyone could perform simple yet comprehensive keyword searches in these vast collections. It was (and is) easy to forget that such searches might be anything but perfect (due to the low quality of OCR results) because the accuracy of the search process was very difficult to assess.

Most researchers rapidly realised that one could only perform 'close reading' on a tiny fraction of those online sources because even just skimming them all went beyond anyone's capabilities time-wise. This gradually led progressive historians to think about obtaining and/or creating more adequate, computer-assisted methods and the means to get the most out of this wealth of digital sources. Among these, one can count the above-mentioned literary historian Franco Moretti.

Meanwhile, computerised methods and software with a longer development history such as GIS came to be used by a few historians in Finland in the 2000s. They used GIS to place and study historical information on maps of various kinds. Compared to GIS, textual analysis with computational tools and the newly emerging 'big data' was still very much being invented and developed during the early 2000s. Nevertheless, researchers of AI had made important progress in cooperation with linguistics since the 1980s, and a research field called natural language processing (NLP) was advancing. Based on complex statistical mathematics and algorithms, this work promised new tools for analysing texts too. The first peer-reviewed journal article where the rather recent method of 'topic modelling' was applied for historical materials was published in 2006.[50]

In Finland, too, the early 2000s witnessed inventions in software turned into new digital tools that historians could use. For instance, in the late 1990s, a group of medievalists and the National Archives had built an electronic version of Finland's medieval sources (*medeltidsurkunder*), producing an online database called Diplomatarium Fennicum.[51] In the mid-2000s, Tuomas Heikkilä

joined forces with some IT specialists and together they started developing computational methods to group medieval texts. Their aim was to create a family tree, a stemma, based on the dis/similarity of those early scripts, in order to better study their origins as well as influences on each other.[52] Over the years, this new interdisciplinary cooperation has led to several international scholarly meetings called Studia Stemmatologica, as well as publications developing further stemmatological analyses.[53]

The availability of these digital materials combined with the introduction of new tools sparked many developments during the 2010s that are changing and will renew history research. Starting towards the middle of the decade, several national conferences and seminars have been organised to discuss such new research. The first two textbooks concerning historical research and digital methods were published in Swedish and Finnish, in 2014 and 2016, respectively.[54] In 2015, the major research funder for historians, the Academy of Finland, opened a call for projects to The Digital Humanities Academy Programme (2016–2019), which encouraged many to pay more attention to developments going on in this new research area. Some, but not quite all, of the outcomes of this wave of new research are presented in this book.

All this technological development and expectations for ever faster and wider analysis of the historians' 'big data' has also re-emphasised 'old' problems (stemming from the 1990s), such as the poor quality of OCR-processed digital texts. How can we overcome this obstacle to the use of these latest computational research methods? Challenges like this partly motivated some historians to plan the project Computational History and the Transformation of Public Discourse in Finland, 1640–1910, funded during 2016 to 2019, in which the low OCR accuracy in the digitised newspapers and periodicals was circumvented by basically using a method originally designed for bioinformatics—in this case, modified to recognise the reoccurrences of similar text passages systematically in several millions of pages of primary sources.[55]

These challenges are highlighting our need for developing novel ways of digital source criticism, but also for taking new, fresh perspectives on the digital evolution that surrounds us. An eye-opening example is offered by Johan Jarlbrink and Pelle Snickars, who studied the specific ways in which newspapers are transformed in the digitisation process, and concluded that in fact the massive digitisation has created large amounts of digital noise: 'that is millions of misinterpreted words generated by OCR, and millions of texts re-edited by the auto-segmentation tool', resulting in a new—and, moreover, unevenly distributed—layer being added to the shared cultural heritage.[56] This reinterpretation suggests and confirms, first, that we need to learn to live and come to terms with that digital noise and, second, that a totally new and so to speak born-digital (that is, generated by computer technology) demand for historians' tools in computer technology will be to reduce that digital noise.

Meanwhile, this emerging 'digital history' research has also been explored. In one inquiry, Finnish historians raised doubts about this new concept and/or identifying themselves with it. In other words, many responders expressed

uncertainty about whether or not they were digital historians and/or digital enough, meaning that, as of 2016, few historians saw themselves as digital historians.[57] Among the critical issues that were identified through the inquiry were the importance of creating better, up-to-date information channels of digital history resources and events, providing relevant education, skills and teaching by historians, and the need to help historians and IT specialists to meet and collaborate better and more systematically than before.

One can hypothesise that two camps of historians were formed in the late 20th century, distinguished by their use of computer technology. On the one hand, everybody was more or less taking advantage of text processing (working with text files and mainly writing), PCs in general and the internet, in various ways. On the other hand, there were those sub-fields that (had) also continued with quantitative methods, such as statistics, for a long time. But many historians concentrated mainly on text processing. It is important to note that the new methods of digital humanities, based among other things on developing NLP (technology), were more eagerly adopted, and embraced even, by those researchers who focused on processing texts. To be more precise, it was a fraction of those historians who embraced the latest methods and also appropriated the term 'digital history', while the social and economic historians adhered for a longer period to their seasoned ways in quantitative methods.

Further, these new ideas and the digital humanities scholarship have in Finland, as elsewhere, been brought together in new laboratories for humanistic research. By far the largest effort nationally in this field, the Helsinki Centre for Digital Humanities, or HELDIG, was established at the University of Helsinki in 2016. By 2020, HELDIG has evolved into a vibrant centre of teaching and research in digital humanities, including digital history. The centre's multidisciplinary research groups, led by Eero Hyvönen and Mikko Tolonen among others, have concentrated on semantic web and building linked open data portals, such as the Sampo series, intended also as historians' research tools, and on using large but overlooked collections of library metadata to quantitatively examine the evolution of book publishing and the press over hundreds of years, respectively. In addition, a group of Finnish historians has been actively involved in the association Digital Humanities in the Nordic Countries and its DHN conference series held annually since 2016. In 2018, HELDIG was one of the key organisers of the third DHN conference, this time arranged in Helsinki. The overarching theme of the conference was Open Science, which challenges current and future historians in yet other ways. Historians and other scholars involved in the field of digital humanities may expect all of this to further advance their digital research capabilities in the future.[58]

Conclusion

To better understand where the present digital and computational history has come from and its place in the historical discipline, this chapter has studied

the historians' use of computer technology, together with some associated technological influence in history research in the case of Finland. It is argued here that such an open and broad approach to these phenomena serves best to expose the complex and already quite extensive roots of the present-day digital history approaches.

Certainly, historical research has many layers of history with the digital, and this relationship continues to be formed in the mutual shaping of the research field, including its people and ways of doing things, technology and the society at large. Perhaps we can even say that the field of digital history today has not one but many histories, and its history remains open to a variety of interpretations.

On the one hand, it is difficult to exaggerate the changes that computer technology has brought to the work of historians (too) during the recent decades. Combined with other changes, the technological advances have positively enabled and enlarged historians' study options in unforeseen ways and scale, while they have also guided and reformed the research designs (see Table 2.1). On the other hand, it has been a long and circuitous route from computers being used for processing statistical data in the late 1960s (Viljo Rasila) and thereafter being used mostly by historians undertaking quantitative research, up until several technological advances and also disruptions (microcomputers, the internet and the World Wide Web, and related software), to the present day, where historians are able to perform their whole research process digitally, from planning to gathering materials, carrying out the analysis, including statistics (if any), writing their interpretation and then publishing the results online.

Nevertheless, it is evident that the use of IT was heavier in some sub-fields than in others, for many reasons. Those reasons range from theoretical underpinnings to copyright law, which has slowed both digitising and distributing certain primary sources from the 20th century.

From early on, divisions were created by different approaches to understanding history and consequently how the research was done. For a long time, starting from mainframe computers and the programs available on these, computer technology worked better for quantitative than qualitative research. That, in turn, might be one reason why the new 'digital history' was, albeit decades later, more eagerly welcomed by (some of the) historians analysing texts. This type of source had been the focus of their qualitative work for decades, and by the 2010s they needed new tools to handle the massive amounts of textual sources that organisations such as major libraries around the world had digitised and made available online during the last 15 to 20 years.

What remained the same during the 50 years in between was that the interpretations were made by the human mind of the historian. Unless perhaps those interpretations also changed while the technological environment and tools for making them were transformed? This is quite conceivable, which reminds us that we still know very little about the impact that computerisation has had on history as a field of study and its products from historical narratives to its theories of change and continuity. It is also time for the students of historiography and even philosophers of history to take a serious, deep look into the

Table 2.1: Milestones of computer use by Finnish historians.

1967	Two articles on using computers for scholarship: Viljo Rasila in *Historiallinen Aikakauskirja*; Pertti Huttunen on Roman social history.
1968	First monograph to use computer-aided statistical methods: Viljo Rasila, *Kansalaissodan sosiaalinen tausta* (*Social background of the civil war*).
1974	First two history PhDs using computerised methods: Pertti Huttunen and Reino Kero.
1970s	Computers in research projects: focused particularly on migration and mobility.
1983	First article (Lappalainen and Lappalainen) about PCs for historians' use.
1990	Centre for Microfilming and Conservation established in Mikkeli.
1996	The Electronic Centre for History Research in Finland (SHEK) for internet use and digitising sources begins (in the Mikkeli centre and elsewhere).
2001	Historical newspapers opened for research online and *Ennen ja Nyt* journal established online.
2014–2016	First two textbooks about digital history published in Finland.

Source: Author.

practical aspects of 'doing history',[59] where computer technology has become so central.

Whether embracing the new tools or shunning them, we should, however, remember what Melvin Kranzberg (a leading historian of technology) famously formulated as his first law. In our case, Kranzberg's rule, quoted as the epigraph to this chapter, means that we should take historians' thoughts and feelings about technology seriously. At times, they probably saw the computer technology as good, bad or both. More importantly, it reminds us that the computer has never been 'just a tool', and this is why we should collectively think more about using these changing products of IT developers and their bearing on our work.

Notes

[1] Kranzberg 1986: 545.
[2] Thomas 2004; see also Kahk 1984.
[3] Specifically, I have studied and observed the field of digital history from 2015 onwards in two research projects funded by the Kone Foundation.
[4] See also Kaiserfeld 1998; Jarlbrink 2015; Haapala, Jalava & Larsson 2017.
[5] See also Paju 2019. For the Anglo-American milestones, see Thomas 2004.
[6] Karonen 2019: esp. 19.
[7] Tirranen 1964: 225–234.

8   Huttunen 1992: 21, 28. This book by Huttunen includes republished articles and the ones relevant here were originally written in the late 1960s.

9   Historiallinen Yhdistys ry. 1966–1967. *Historiallinen Aikakauskirja* 1/1968, 89–90; Åberg 2010: passim.

10 Rasila 1967: 145; Viljo Rasila, interview on 17 May 2016. The 'brick group' (*tiiliryhmä*) was a coordinated research effort focused on studying Roman brick stamps and led by Jaakko Suolahti, Professor of General History at the University of Helsinki. See Bruun 1992: 133–134.

11 Huttunen 1967; Rasila 1967: 145. See also Rasila 1970.

12 Waris 1969: 73–74.

13 Järvinen 1969: 57–59; Rasila 1969a: 60–61; Pertti Järvinen, email letters, 26 October 2018.

14 Bruun 1992: esp. 135–136.

15 Huttunen 1974; Kero 1974.

16 Viljo Rasila, email letter 21 March 2016.

17 Tommila 1998: passim.

18 Mauranen 1988.

19 See Iggers 2012: 43–45 and passim; Hudson & Ishizu 2017: ch. 2.

20 Paju 2008; Rainio 2013.

21 See Heyck 2015.

22 Viljo Rasila, interview on 17 May 2016.

23 See, for instance, Strömberg 1998.

24 Niitemaa 1971; Reino Kero, email letter 6 June 2016. ADP stood for automatic data processing.

25 Lindberg & Sovio 1969: 134–142.

26 Virrankoski 1982: 23–28, passim. On manual work behind the digital, see Jarlbrink, Chapter 7, this volume.

27 Rasila 1982; Virrankoski 1982; Haapala 1986. See also Nygren, Foka & Buckland 2014.

28 Tampere Research Group for History of population, environments and social structures.

29 Rasila 1969b, 1970; Kahk 1973; Virrankoski 2013: passim. See also Kahk 1984; Paju 2019.

30 See, e.g., *Historiallinen Aikakauskirja* 5/1916, 73; Kirschenbaum 2016.

31 Neulakortit—jokamiehen reikäkorttijärjestelmä. (Kirjoittanut K.) *Tekniikan Maailma* 1/1955, 30; Lappalainen & Lappalainen 1983; Lappalainen, email letter 26 February 2016.

32 Lappalainen 1985; Lappalainen, email letter 26 February 2016.

33 Häkkinen et al. 1989.

34 Virrankoski 2013: esp. 314. See also Paju 2016.

35 Lappalainen, email letter 26 February 2016.

36 Rissanen & Tyrkkö 2013.

37 Denley & Hopkin 1987.

38 See Hackler & Kirsten 2016: 6. See also Kiiskinen 2010; Salmi 2011.

39 Onnela 1995.

[40] Kallio, Kari: Agricolasta Suomen historiaverkko Internetiin. *Digitoday*. Julkaistu 12.8.1996 15:41; Tapio Onnela, oral information 10 October 2018.

[41] See esp. Onnela 1998.

[42] See, for instance, Suominen 2000; Paju 2008.

[43] See Ennen ja Nyt 2001.

[44] See Paju 2016.

[45] Suominen & Sivula 2016: passim.

[46] Karonen 2019: esp. 19 and passim.

[47] Nurmio 1952; Nuorteva & Happonen 2016: passim. See also Jarlbrink 2015.

[48] Bremer-Laamanen 2006.

[49] See Kettunen, Pääkkonen & Koistinen 2016.

[50] Brauer & Fridlund 2013.

[51] See Diplomatarium Fennicum's history.

[52] Tuomas Heikkilä, interview on 15 August 2016. See Roos, Heikkilä & Myllymäki 2006.

[53] See Heikkilä & Roos 2016.

[54] Parland-von Essen & Nybergh 2014; Elo 2016. See also Guldi & Armitage 2015.

[55] See Vesanto et al. 2017.

[56] Jarlbrink & Snickars 2017.

[57] See Paju 2016.

[58] Hyvönen 2018; Matres, Oiva & Tolonen 2018; Tolonen et al. 2019. See also Mäkelä & Tolonen 2018.

[59] See also Paul 2011, who suggests the study of historians' 'doings'.

References

Interviews and correspondence (all by the author)

Pertti Järvinen, email letters, 26 October 2018.
Tuomas Heikkilä, interview, 15 August 2016.
Reino Kero, email letter, 6 June 2016.
Jussi T. Lappalainen, email letter, 26 February 2016.
Tapio Onnela, oral information, 10 October 2018.
Viljo Rasila, email letter, 21 March 2016; interview, 17 May 2016.

Journals

(Mostly from the National Library of Finland: https://digi.kansalliskirjasto.fi /aikakausi/)
Digitoday 1996
Historiallinen Aikakauskirja 1916, 1968
Tekniikan maailma 1955

Literature

Brauer, R., & Fridlund, M. (2013). Historicizing topic models: a distant reading of topic modeling texts within historical studies. In L. V. Nikiforova & N. V. Nikiforova (Eds.), *Cultural research in the context of digital humanities: proceedings of international conference 3–5 October 2013* (pp. 152–163). St. Petersburg.

Bremer-Laamanen, M. (2006). Connecting to the past—newspaper digitisation in the Nordic countries. *Journal of Digital Asset Management, 2*(3–4), 168–171.

Bruun, C. (1992). Nyt Rooman historia! *Historiallinen Aikakauskirja 90*(2), 129–143.

Denley, P., & Hopkin, D. (Eds.) (1987). *History and computing.* Manchester: Manchester University Press.

Diplomatarium Fennicum. *Tietoa hankkeesta.* Retrieved 3 October, 2018 from http://df.narc.fi/info/project

Elo, K. (Ed.) (2016). *Digitaalinen humanismi ja historiatieteet.* Turku: Turun historiallinen yhdistys.

Ennen ja Nyt. (2001). *Arkistot kuukauden mukaan: toukokuu 2001.* Retrieved 22 February, 2019 from http://www.ennenjanyt.net/2001/05/.

Guldi, J., & Armitage, D. (2015). *The history manifesto.* Cambridge: Cambridge University Press. 1st edn. 2014. Retrieved from http://historymanifesto .cambridge.org/

Haapala, P. (1986). *Tehtaan valossa: teollistuminen ja työväestön muodostuminen Tampereella 1820–1920.* Tampere and Helsinki: Osuuskunta Vastapaino and Suomen historiallinen seura.

Haapala, P., Jalava, M., & Larsson, S. (Eds.) (2017). *Making Nordic historiography: connections, tensions and methodology, 1850–1970.* New York, NY: Berghahn Books.

Hackler, R., & Kirsten, G. (2016). Distant reading, computational criticism, and social critique: an interview with Franco Moretti. *Le foucaldien, 2*(1), 7. DOI: http://doi.org/10.16995/lefou.22

Heikkilä, T., & Roos, T. (2016). Thematic section on Studia Stemmatologica. *Digital Scholarship in the Humanities, 31*(3), 520–522. DOI: https://doi .org/10.1093/llc/fqw038

Heyck, H. (2015). *Age of system: understanding the development of modern social science.* Baltimore, MD: Johns Hopkins University Press.

Hudson, P., & Ishizu, M. (2017). *History by numbers: an introduction to quantitative approaches.* 2nd edn. London: Bloomsbury.

Huttunen, P. (1967). Tietokoneet Rooman sosiaalihistorian tutkimuksessa (The computer in the study of Roman social history). *Studia Historica: Acta Societatis Historicae Ouluensis* (pp. 29–64). Tomus I. Oulu: Oulun historiaseura.

Huttunen, P. (1974). *The social strata in the imperial city of Rome: A quantitative study of the social representation in the epitaphs published in the Corpus inscriptionum Latinarum, volumen VI*. Oulu: University of Oulu.

Huttunen, P. (1992). *Työ—tekniikka—historian muutos: kirjoituksia työn ja tekniikan historiasta*. Oulu: Oulun historiaseura.

Hyvönen, E. (2018). *Semanttinen web: linkitetyn avoimen datan käsikirja* (Semantic web: handbook of linked open data). Helsinki: Gaudeamus.

Häkkinen, A., Ikonen, V., Pitkänen, K., & **Soikkanen, H.** (1989). *1860-luvun suuret nälkävuodet: tutkimus eri väestöryhmien mielialoista ja toimintamalleista. Loppuraportti*. Helsinki: Helsingin yliopisto.

Iggers, G. G. (2012). *Historiography in the twentieth century: from scientific objectivity to the postmodern challenge*. 2nd edn. Middletown, CT: Wesleyan University Press.

Jarlbrink, J., & **Snickars, P.** (2017). Cultural heritage as digital noise: nineteenth century newspapers in the digital archive. *Journal of Documentation, 73*(6), 122–1243.

Jarlbrink, J. (2015). Historievetenskapens mediehantering. In M. Hyvönen, P. Snickars & P. Vesterlund (Eds.). *Massmedieproblem: mediestudiets formering* (pp. 225–247). Lund: Mediehistoriskt arkiv 30, Lunds universitet.

Järvinen, P. (1969). Voidaanko historiaa tutkia tietokoneella? *Historiallinen Aikakauskirja 67*(1), 57–59.

Kahk, J. (1973). New possibilities of using computerized historical analysis in the study of peasant households. In *Turun Historiallinen Arkisto 28* (pp. 375–389). Turku: Turun Historiallinen Yhdistys.

Kahk, J. (1984). Quantitative historical research in Estonia: a case study in Soviet historiography. *Social Science History, 8*(2), 193–200.

Kaiserfeld, T. (1998) Historikerna och tekniken: om betydelse av tekniska hjälpmedel för historieforskningen. In M. Hedin & U. Larsson (Eds.). *Teknikens landskap: en teknikhistorisk antologi tillägnad Svante Lindqvist* (pp. 365–377). Stockholm: Atlantis.

Karonen, P. (2019) Historiantutkimuksen ja yhteiskunnan yli puolitoistavuosisatainen vuoropuhelu: resurssit, rakenteet ja tulokset. In P. Karonen (Ed.), *Tiede ja yhteiskunta: Suomen Historiallinen Seura ja historiantutkimus 1800-luvulta 2010-luvulle* (pp. 13–44). Helsinki: Suomalaisen Kirjallisuuden Seura.

Kero, R. (1974). *Migration from Finland to North America in the years between the United States Civil War and the First World War*. Turku: Institute for Migration.

Kettunen, K., Pääkkonen, T., & **Koistinen, M.** (2016). Kansalliskirjaston digitoitu historiallinen lehtiaineisto 1771–1910: sanatason laatu, kokoelmien käyttö ja laadun parantaminen. *Informaatiotutkimus 35*(3), 3–14.

Kiiskinen, H. (2010). Talous, käytänne ja kvantitatiivinen analyysi kulttuurihistoriallisesti suuntautuneessa tutkimuksessa. In H. Rantala &

S. Ollitervo (Eds.), *Kulttuurihistoriallinen katse* (pp. 80–97). Turku: k&h, Turun yliopisto.

Kirschenbaum, M. G. (2016). *Track changes: a literary history of word processing*. Cambridge, MA: Harvard University Press.

Kranzberg, M. (1986). Technology and history: 'Kranzberg's Laws'. *Technology and Culture, 27*(3), 544–560. DOI: https://doi.org/10.2307/3105385

Lappalainen, J. T. (1985). Tekstintekoa näytöllä. *Historiallinen Aikakauskirja*, *83*(4), 283–286.

Lappalainen, J. T., & **Lappalainen, V.** (1983). Historiantutkimusta ilman papereita. *Historiallinen Aikakauskirja, 81*(1), 75–78.

Lindberg. D., & **Sovio, P.** (1969). Katsaus Ruotsin tutkimusprojekteihin. *Historiallinen Aikakauskirja 67*(2), 134–142.

Matres, I., Oiva, M., & **Tolonen, M.** (2018). In between research cultures: the state of digital humanities in Finland. *Informaatiotutkimus, 37*(2), 37–61. DOI: https://doi.org/10.23978/inf.71160

Mauranen, T. (1988). Review of research in economic and social history in Finland in the 1970s and 1980s. *Scandinavian Economic History Review, 36*(3), 23–41. DOI: https://doi.org/10.1080/03585522.1988.10408125

Mäkelä, E., & **Tolonen, M.** (2018, 7–9 March) *DHN2018—an analysis of a digital humanities conference: Digital Humanities in the Nordic Countries 3rd Conference*. Proceedings of the Digital Humanities in the Nordic Countries 3rd Conference (pp. 1–9). Helsinki.

Niitemaa, V. (1971). Kaukosiirtolaishistorian tutkimusprojekti. *Historiallinen Aikakauskirja, 69*(2), 146–150.

Nuorteva, J., & **Happonen, P.** (2016). *Suomen Arkistolaitos 200 vuotta: Arkivverket i Finland 200 år*. Helsinki: Kansallisarkisto.

Nurmio, Y. (1952). Valtionarkiston toimesta ulkomailla suoritettavat mikrofilmaustyöt. *Historiallinen Aikakauskirja, 50*(4), 268–274.

Nygren, T., Foka, A., & **Buckland, P. I.** (2014). The status quo of digital humanities in Sweden: past, present and future of digital history. *H-Soz-Kult*. Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-88730

Onnela, T. (1995). Email to H-verkko email list: 'Suomalaisen historiantutkimuksen elektroninen keskus' 14 November 1995. Retrieved 12 November, 2018 from http://historia.utu.fi/h-verkko/arkisto/0137.html

Onnela, T. (1998). Historiantutkimus internetin ja digitaalisen kumouksen aikakaudella. *Agricolan Tietosanomat* 5/1998. Retrieved 1 September, 2016 from http://agricola.utu.fi/julkaisut/tietosanomat-1998-2005/numero5-98 /historiantutkimus.html

Paju, P. (2008). National projects and international users: Finland and early European computerization. *IEEE Annals of the History of Computing, 30*(4), 77–91.

Paju, P. (2016, 1 September). *Digitaalinen historiantutkimus: kyselytuloksia*. Report from the project Towards a Roadmap for Digital History in

Finland. Retrieved from https://digihistfinlandroadmapblog.wordpress.com/2016/09/01/raportti-kyselyvastauksista/

Paju, P. (2019, 6–8 March). International collaboration and Finland in the early years of computer-assisted history research: combining influences from Nordic and Soviet Baltic historians. In *Proceedings of the 4th Conference of the Association Digital Humanities in the Nordic Countries* (pp. 349–357). Copenhagen. CEUR Workshop Proceedings 2364.

Parland-von Essen, J., & **Nyberg, K.** (2014). *Historia i en digital värld*. Online book. Retrieved 10 September, 2018 from http://digihist.se/

Paul, H. (2011). Performing history: how historical scholarship is shaped by epistemic virtues. *History and Theory, 50*(1), 1=19. DOI: https://doi.org/10.1111/j.1468-2303.2011.00565.x

Rainio, K. (2013). Kuusitoista kilotavua—humanisti koodinmuuntimien ajassa. In *HY: Tietotekniikkapalvelut: 1960-luku*. Retrieved 28 June 2018 from http://www.helsinki.fi/atk/50v/1960-luku.html.

Rasila, V. (1967). Tietokone historiantutkimuksessa. *Historiallinen Aikakauskirja, 65*(2), 140–146.

Rasila, V. (1968). *Kansalaissodan sosiaalinen tausta*. Helsinki: Tammi.

Rasila, V. (1969a). Edellisen johdosta. *Historiallinen Aikakauskirja, 67*(1), 60–61.

Rasila, V. (1969b). The Finnish civil war and land lease problems. *Scandinavian Economic History Review, 17*(1), 115–135. DOI: https://doi.org/10.1080/03585522.1969.10407659

Rasila, V. (1970). The use of multivariable analysis in historical studies. *Economy and History, 13*(1), 24–53. DOI: https://doi.org/10.1080/00708852.1970.10418879

Rasila, V. (1982). Projektin hankkiman aineiston käyttömahdollisuudet. In *Muuttoliikkeiden ja sosiaalisen kehityksen väliset yhteydet Suomen teollistumisen alusta maan itsenäistymiseen* (pp. 42–60). Turku: Turun yliopiston historian laitos.

Rissanen, M., & **Tyrkkö, J.** (2013). The Helsinki corpus of English texts (HC). In A. Meurman-Solin & J. Tyrkkö (Eds.), *Principles and practices for the digital editing and annotation of diachronic data*. Studies in Variation, Contacts and Change in English 14. Helsinki: Varieng.

Roos, T., Heikkilä, T., & **Myllymäki, P.** (2006). A compression-based method for stemmatic analysis. In ECAI 2006: Proceedings of the 17th European Conference on Artificial Intelligence.

Salmi, H. (2011). Traditions of cultural history in Finland, 1900–2000. In J. Rogge (Ed.), *Cultural history in Europe: institutions—themes—perspectives* (pp. 45–62). Bielefelt: transcript Verlag.

Strömberg, J. (1998). Avhandlingarna. In P. Tommila (Ed.), *Historiantutkijan muotokuva* (pp. 55–80). Helsinki: Suomen historiallinen seura.

Suominen, J. (2000). *Sähköaivo sinuiksi, tietokone tutuksi: tietotekniikan kulttuurihistoriaa*. Jyväskylä: Jyväskylän yliopisto.

Suominen, J., & **Sivula, A.** (2016). Digisyntyisten ilmiöiden historiantutkimus. In K. Elo (Ed.), *Digitaalinen humanismi ja historiatieteet* (pp. 96–130). Turku: Turun Historiallinen Yhdistys.

Tampere Research Group for History of population, environments and social structures. Retrieved 19 December, 2018 from https://research.uta .fi/hopes-en/database/

Thomas, W. G. III (2004). Computing and the historical imagination. In S. Schreibman, R. Siemens & J. Unsworth (Eds.), *A companion to digital humanities* (pp. 56–68). Malden, MA: Blackwell.

Tirranen, H. (1964). Katsauksia: biologisia historianselityksiä. *Historiallinen Aikakauskirja 62*(3), 225–234.

Tolonen, M., Lahti, L., Roivainen, H., & **Marjanen, J.** (2019). A quantitative approach to book-printing in Sweden and Finland, 1640–1828. *Historical methods: a journal of quantitative and interdisciplinary history, 52*(1), 57–78. DOI: https://doi.org/10.1080/01615440.2018.1526657

Tommila, P. (Ed.) (1998). *Miten meistä tuli historian tohtoreita*. Helsinki: Suomen historiallinen seura.

Waris, H. (1969). Kansalaissodan taustatekijät. *Historiallinen Aikakauskirja, 67*(1), 73–74.

Vesanto, A., Nivala, A., Rantala, H., Salakoski, T., Salmi, H., & **Ginter, F.** (2017, 23–24 May). Applying BLAST to text reuse detection in Finnish newspapers and journals, 1771–1910. In Proceedings of the 21st Nordic Conference of Computational Linguistics. Gothenburg, Sweden (pp. 54–58). Linköping Electronic Conference Proceedings. Retrieved from http://www .ep.liu.se/ecp/133/010/ecp17133010.pdf

Virrankoski, P. (1982). Projektin historia. In *Muuttoliikkeiden ja sosiaalisen kehityksen väliset yhteydet suomen teollistumisen alusta maan itsenäistymiseen* (pp. 7–29). Turku: Turun yliopiston historian laitos.

Virrankoski, P. (2013). *Historian professori ja laulajapoika: kulttuurin kuvia suuren muutoksen ajalta*. Turku: Memnon-kirjat.

Åberg, V. (2010). *Lisää muistia! 50 vuotta tietotekniikkaa Helsingin yliopistossa*. Helsinki: Helsingin yliopiston tietotekniikkakeskus.