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# **Kodikologie und Paläographie im digitalen Zeitalter**

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## **Codicology and Palaeography in the Digital Age**

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# Manuscriptorium Digital Library and ENRICH Project: Means for Dealing with Digital Codicology and Palaeography

Zdeněk Uhlíř, Adolf Knoll

## Abstract

Codicology and palaeography in the digital age can be developed both through adapting existing methods and using information and communication technologies. This can be achieved e.g. by projects focusing on the integration of individual resources under a single user interface. This is the aim of the Manuscriptorium digital library as well as the ENRICH project. The integration is based on the centralisation of metadata from various resources and on the distributed storage of data, mainly digital images. This is implemented through a distributed complex digital document, containing the so-called identification record and more data types. The construction of the integrated Manuscriptorium digital library within the ENRICH project is being done in four basic ways: automatically, or semi-automatically respectively manually, and those both online and offline. This has made it possible to amass more than 5,000 documents. For Manuscriptorium, a search is important, which allows information to be gathered through special fields and the differences in graphics to be harmonised. The aim of the ENRICH project is also the creation of tools for the compilation of virtual collections and documents. In its method of integrating resources, the Manuscriptorium endeavours to be an instrument of codicological and palaeographic research.

## Zusammenfassung

Kodikologie und Paläographie können sich im digitalen Zeitalter durch die Veränderung bestehender Methoden und durch die Nutzung von Informations- und Kommunikationstechniken weiterentwickeln. Diese Entwicklung kann beispielsweise durch Projekte befördert werden, die auf die Integration einzelner Ressourcen in ein gemeinsames Nutzerinterface abzielen. Dies ist das Ziel sowohl der Digitalen Bibliothek von Manuscriptorium als auch des ENRICH Projektes. Die Integration basiert dabei auf der Zentralisierung der beschreibenden Metadaten aus verschiedenen Sammlungen und auf der verteilten Datenhaltung der eigentlichen Daten, d.h. digitaler Bilder. Erreicht wird dies durch ein verteiltes komplexes Datendokument, welches einen sogenannten Identifizierungsdatensatz und weitere Datentypen enthält. Der Aufbau der integrierten

Digitalen Bibliothek Manuscriptorium im Rahmen des ENRICH Projektes geschieht auf vier Wegen: automatisch oder halbautomatisch bzw. händisch, und zwar beides entweder on- oder offline. So war es möglich, mehr als 5.000 Dokumente zusammenzuführen. Für Manuscriptorium ist eine Suche, die es ermöglicht, Information aufgrund von Spezialfeldern zu finden, ebenso wichtig wie der Versuch, die Unterschiede in der Darstellung zu harmonisieren. Ein Ziel des ENRICH Projekts ist die Entwicklung von Tools zur Zusammenstellung von virtuellen Sammlungen und Dokumenten. Durch diese Ressourcenintegration stellt Manuscriptorium ein Instrument für kodikologische und paläographische Forschung dar.

## 1 Introduction

Since the 1990s, people have been talking about the *third, i.e. information, wave* (Tofler), an *information and knowledge society*, and about the *digital economy*. Since the eve of the millennium, they have also been discussing *digital history* and/or *digital philology*, or digital research in general.

Hence, we can speak about *digital codicology* and/or *palaeography*, or about other historical auxiliary sciences (*historische Hilfswissenschaften*) in particular. In the digital age, codicology and palaeography can be developed in two directions: 1) by continuing to adapt the traditional methodologies that have been developed since the 16th century and 2) by updating information and communication technologies as an opportunity for an innovation of the methodology. Both directions can evolve from the resources that provide access to our written cultural heritage, especially to manuscript books and earlier administrative materials. This can be best achieved by special projects, which concerns not only specific-focus projects (dealing e.g. with watermarks, book covers, scripts, scribes), but also projects focused on the integration of particular resources into a uniform interface.

The development of codicological and palaeographic methodologies in the digital age is the main aim of the Manuscriptorium and ENRICH projects.

## 2 The Manuscriptorium and ENRICH

Both the Manuscriptorium and ENRICH<sup>1</sup> projects plan to become a component part of the European Digital Library for the specific cultural heritage consisting of manuscripts,

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<sup>1</sup> The technical partners of ENRICH are as follows: AiP Beroun Ltd., Beroun, Czech Republic; Oxford University Computing Services, Oxford, United Kingdom; Media Integration and Communication Centre, Florence, Italy; Institute of Mathematics and Informatics, Vilnius, Lithuania; SYSTRAN S.A., Paris, France; Computer Science for the Humanities, Cologne, Germany; Poznan Supercomputing and Networking Center, Poznan, Poland.

incunabula, early printed books, historical archival materials, maps etc. that would be easily accessible and searchable using various sophisticated approaches as well as multilingual search and ontologies. When saying ‘a *European* digital library’, we do not mean a single digital library used all over Europe but such a resource that integrates and provides real European content. As a general goal, the Manuscriptorium and ENRICH projects want to accumulate a critical mass of the digitised manuscripts deposited in the memory institutions in European countries or of European origin. In other words, the Manuscriptorium and ENRICH projects aspire to be fundamental sources for manuscript study on a global scale. Accordingly, there are three main goals to be achieved in three steps.

## 2.1 Integration of Resources

The integration of resources is not simple—precisely on the contrary, it is a very complex task. As the first step, it supposes the accumulation of metadata, i.e. not merely descriptive metadata, that is manuscript catalogue records, but also other kinds of metadata, especially structural metadata, representing the physical structure of the original document (mostly a book-codex), as well as the creation of a compound digital document (the so-called virtual book). As the second step, it assumes the accumulation of data, i.e. usually digital images of manuscripts but also full electronic texts (editions of historical documents) and also electronic representations of music notation or even audio or video files. The identification of documents (both physical manuscripts and their digital copies) is substantial, because it enables any orientation and navigation within the whole digital library and any kind of heuristics within the manuscript collections represented in the digital library. The heart of the Manuscriptorium system is therefore the database of identification records. In other words, every digital copy of a manuscript and/or any full text needs a descriptive record; on the other hand, there may be descriptive records without any digital images and/or full text. Furthermore, one physical item may have multiple descriptive records within the Manuscriptorium system although only one of them is and can be an identification record, because it supports the search utility within the digital library. Consequently, an identification record is in correlation to both the original document and its digital copy such that there is only one original document, one digital copy and one identification record. Multiplex descriptive records referring to one physical item can be both language variants and/or alternate records, i.e. these records may be translations of the same record or created from the points of view of different research interests (e.g. palaeography, codicology, heraldry, literary history, art history, musicology, history of theology and/or philosophy, history of science, etc.). However, as long as the identification record is just one of them, it is an unambiguous record (perhaps better put as *ein-eindeutig* in German or *jedno-jednoznačný* in Czech).

The identification record and the database of identification records enable the preparation of a compound digital document, i.e. the creation of a virtual book. Since the Manuscriptorium system was launched in 2003, compound digital documents (virtual books) have been created according to the XML-based standard called MASTER+, which is an extension of the MASTER developed in 1999–2001 by a consortium led by the De Monfort University Leicester, in which also the National Library of the Czech Republic participated. In the course of the ENRICH project in 2007–2009, the chapter on the manuscript description and the TEI P5 schema for ENRICH was defined, therefore any document in conformance with the ENRICH schema is also a TEI-conformant document and can be used by any TEI-aware software. This is very important, because when the ENRICH project comes to an end, the Manuscriptorium system will be widely interoperable and that interoperability is a significant step towards the easy integration of new resources.

Interoperability is naturally essential for imports/uploads and/or exports/downloads of metadata/data. However, it is not only a means for building centralised resources but also the basic condition for creating distributed resources—and work within the virtual distributed digital environment is what the Manuscriptorium is all about. A distributed compound digital document in general means that its parts are distributed anywhere throughout cyberspace. A distributed compound digital document as it is understood for the Manuscriptorium's purposes means in particular that the metadata part is centralised in the database of the identification records of the Manuscriptorium. On the other hand, the data remains at the server of the content partner. That is why not only the descriptive but also the structural metadata are of equal importance; the creation of the distributed compound digital document is impossible without the structural metadata, which mark the subordinated items (usually pages) of the appropriate physical document (usually codex), thus enabling the creation of a virtual book and its browsing as well as searching (when using so-called *applied foliation/pagination* as the labelling/names for individual files). This is of course not enough, because the necessary condition for the successful integration of documents distributed in cyberspace is that the data referred to by hyperlinks from the centralised structural metadata resource must be stored in a stable and persistent repository with perpetual and unmistakable names. It is a *conditio sine qua non* for the creation of any operating distributed resource.

Thus, the persistent addressing is a fundamental issue. The question may be whether persistent identification is possible when understood absolutely, i.e. regardless of a concrete resource and/or information system. On the other hand, such an absolutely understood question (i.e. the question of a universal persistence) has little sense—if any—for the practical process of building a digital manuscript library, although it has a deep meaning in theory. Thus, only a question of a relative (system-related) persistence, i.e. the solution of persistent addressing and identification regarding the Manuscriptorium

system, is connected with a topic that concerns digital palaeography and codicology. The way of creating persistent identification within the Manuscriptorium is quite simple, consisting of:

- The identification of the owner of the physical object (that relates to the appropriate digital object, of course), the identification of the physical object (shelf mark, call number etc.);
- The identification of a part of the physical object (typically a page, but also an open book, i.e. the back page of a preceding leaf and the front page of the next leaf altogether);
- The identification of the quality level of the images (e.g. gallery thumbnail, preview, normal size, black and white optimisation, etc.).

Such a kind of persistent addressing makes it possible both to ascertain and find an individual digital object (i.e. page) as well as to create an appropriate sequence of objects (i.e. sequence of images of the appropriate quality level) or complete the whole compound digital document independently of its centralised or distributed form. Thus, the use of consistently and logically created names for individual digital objects (files, not just documents) is crucial.

So as to ensure the smooth operation and progress of the Manuscriptorium system, still another condition regarding metadata is necessary. The Manuscriptorium has numerous partners, both current and potential, most of whom do not create their metadata solely for the Manuscriptorium system but for various, even divergent, goals and purposes, therefore using diverse metadata standards.

For the partners' results, i.e. data outputs, to be integrated, into the Manuscriptorium internal format (at present this is still MASTER+, but in the near future within the ENRICH implementation of TEI P5 we will use `enrich.dtd`, and `enrich.xsd` and the ENRICH Relax NG Scheme), metadata mapping and metadata conversion are needed. It is not an obsessive idea to transform heterogeneity into homogeneity but a practical effort to harmonise different metadata formats for the purpose of indexing them, which is the basis for efficient, if not for any, search. A digital library without efficient search (with no search or with mere browsing utilities) is not advisable for scholars or any other refined use.

On the basis of a deeper analysis of the particular content resources available within the frame of ENRICH, there are four typical ways of cooperation in integrating resources and in creating distributed compound digital documents:

1. The M-Tool (creating structural and descriptive metadata for individual documents): the M-Tool is an application serving the partners of the Manuscriptorium who create new metadata for existing image data. It enables the creation of descriptive and structural metadata and consequently also compound digital documents. The M-Tool currently exists as a stand-alone application and is going to be created

in an online version. It is now (end of April 2009) being tested. In its online version, it has been adapted to the new demands in the area of produced structural and descriptive metadata and to the usage of UTF-8.

2. The offline automated generation of structural metadata and connector for existing descriptive metadata: this method is similar to the previous one and suitable for partners who have a greater number of catalogue records which justify the creation of connectors. The use of a connector will make it possible to connect with the partner's source of primary information directly and will not necessitate the creation of duplicate descriptive metadata using the M-Tool. The M-Tool will be used to create structural metadata and descriptions in identification records, with the detailed description being processed by the connector. In the Manuscriptorium, it is possible to supply the outputs of the M-Tool with these brief descriptions through identifiers. These identifiers enable the document to be joined with the descriptive information processed by the connector, which is going to be optimised and adapted to the properties of input metadata to provide, where possible, zero-loss conversions.
3. The offline connector (converting the existing structural and descriptive metadata content offline): this is a tool enabling the conversion of the existing input metadata of compound digital documents depending on the needs of the Manuscriptorium system. It is part of the input interface of this system and is constructed in such a way that it cannot overreach the managing system of a partner. This approach makes it possible to separate the data production and management from the data presentation as well as optimise both of these tasks. It also ensures that it is not necessary to modify the existing processes at the workplaces of individual content partners. The most important parts of the connector are the conversion routines for transferring descriptive and structural metadata. This is suitable for partners who manage existing structural and descriptive metadata for such a number of documents that justifies the creation of the connector.
4. The online connector (converting the existing structural and descriptive metadata content using the OAI-PMH interface): it is similar to the offline connector but uses OAI-PMH for communication. At present, all the partners which have the OAI interface implemented will contribute with a relevant amount of documents justifying the creation of connectors.

In the course of its activity (since 2003), the Manuscriptorium team has developed a network of almost 50 Czech partners and more than 40 foreign partners. Some of them are quite small memory institutions (libraries, archives, museums etc.), yet others are the biggest and the most eminent players in manuscript digitisation (e.g. the National Library of the Czech Republic and the Czech national digitisation programme *Memoriae mundi series Bohemica*, the University Library Wrocław in Poland, the National and



University Library of Iceland and the Arne Magnusson Institute in Reykjavík in Iceland, the University of Cologne and the University Library Heidelberg in Germany, the Central National Library Florence in Italy, the National Library of Serbia, the National Library of Romania, the National Library of Spain etc.). In addition, the Manuscriptorium team and the partners from the ENRICH consortium negotiate with other important partners (e.g. the National Library of Austria, the National Library of Belarus, the State Library in Moscow and the Monastery Library at Sergiev Posad in Russia, the Badische Landesbibliothek Karlsruhe in Germany etc.).

At present (the end of April 2009), the Manuscriptorium digital library includes:

- 185,719 descriptive catalogue records for manuscripts, incunabula, early printed books, historical maps etc.;
- 5,133 compound digital documents (digital copies of manuscripts, incunabula, early printed books, historical maps etc.);
- Almost 1,500,000 individual images (typically pages of manuscripts, incunabula, early printed books), usually in five quality levels (gallery thumbnail, preview, low, normal/excellent, black and white optimisation);
- 350 compound digital documents containing full texts (transcriptions and/or editions of original historical documents).

## 2.2 Sophisticated Search

On the whole, search is the most important access method for the end user. Browsing is not enough, although several institutions that provide digitised manuscripts offer only this possibility of orientation and navigation within the resource. The possibility of search reduced to the mere library and shelf mark or call number is also unsatisfactory. Search applicable in any large digital library has to be based on more sophisticated prerequisites that use indexing, exact phrases, model sentences etc. Consequently, both a full text search and a search according to selected individual fields/elements should be implemented including the possibilities of a simple, combined and expert search with filters. The question is which fields/elements should be indexed for searching. Such a question is not trivial, because there are many differing aspects to consider. The following possibilities are implemented in the Manuscriptorium: as default it is search by Settlement and Repository and as optional it is by Country, Shelf Mark, Alternative Name, Title, Author, Place of Origin, Date of Origin, Name, Date, Rubric, Incipit, Explicit, Colophon, Responsibility, Responsibility-Name, Scribe, Additions, Origin, Provenance, Bibliography, Printer (the Manuscriptorium digital library provides incunabula and early printed books as well) or Music Notation. Of course, another selection of fields/elements could be discussed; however, the existing one is sufficient according to the feedback of our end users.

When integrating resources, there is yet another challenge for the Manuscriptorium digital library as an aggregator: discrepancies in manuscript descriptions. Because of heterogeneity of standards and of the different levels/depth of manuscript descriptions, the accessible data for machine processing are not homogeneous. The simplest case of data heterogeneity is restricted to alternative mark-up syntax because of the use of different elements for the same information. To solve such discrepancies, a recommendation/best practice for the TEI P5 manuscript module (i.e. TEI P5 schema for ENRICH) has already been created and will be tested in the course of the ENRICH project. On the other hand, there are more difficult tasks to be solved. Different formats are usually based on different data models, which are often based on different conceptual frameworks, because they are intended for different goals and purposes. Of course, it is quite possible to convert various formats into the uniform internal format of Manuscriptorium but sometimes with a loss of information and sometimes without any loss of information, however with little correlation to the other data or metadata in terms of their content. Naturally, the loss of information concerns not the loss of the actual text but only the loss of the deep text structure of the descriptive record. On the other hand, the conversion of text into such indistinct fields/elements as <p> or <note> is not very helpful, because it entails the loss of definite meaning, which is so necessary for search. Thus, searching according to the selected fields/elements can sometimes make very little sense, and this challenge is not easy to answer. A methodology other than the mere automatic conversion of data formats into a uniform internal format would have to be used for a successful solution. Such a methodology must first be discovered and then tested before it can be applied.

Moreover, there are further challenges. In the past stages of language evolution, language systems not only in Latin but especially in vernacular languages lacked any conception of strict prescriptions, i.e. languages in the past used neither a prescriptive grammar nor a normative orthography. However, the usual description of manuscripts is based on the use of *rubrics*, *incipits*, *explicitis*, *colophons*, etc.—in other words, it is based on quotations from historical texts using their original wording. Consequently, no standard text search (based on the idea of strict prescriptions) can be implemented effectively and successfully. Thus, applying such a technique and methodology as tolerance (variations of one character written differently or erroneously) is not sufficient for a digital library dealing with manuscripts. A more sophisticated technique and methodology like e.g. graphical variants (for texts without normative orthography) must be used for the search in a digital library dealing with manuscripts to be effective and successful. A list of graphical variants, i.e. equivalents, for appropriate languages must be created and implemented into the search system of a digital manuscript library. At present, graphical variants for Latin, Czech and German have been implemented within the Manuscriptorium search system. As for graphic variants, they are represented for each language in a relatively independent module; future extensions are possible.

Another challenge is multilingualism. It can be understood in three ways. Firstly, it is a simple localisation of the user interface in various languages. It will be created during 2009 in the context of the TEI P5 transformation of the Manuscriptorium system (the user interface is currently localised only in Czech and English). Although such a kind of multilingualism is comfortable for users, it is not advisable for scholarly or any other refined use, because it has no relation to deeper search possibilities. Secondly, multilingualism is a translation of both individual descriptive records and a list of search results from one specific language into any other. It can be of great importance if an individual user does not know the language of the manuscript record; however, it is not advisable for scholarly or any other refined use because that use is based on a knowledge of the document language which is mirrored in the descriptive record. On the other hand, the ability of the Manuscriptorium information system to translate descriptive records as well as search results is a necessary precondition for a more sophisticated implementation of multilingualism, if such an ability will be developed within the ENRICH project. Thirdly, such a multilingualism that is appropriate for scholarly and any other refined use is the multilingual search, i.e. it is enough to submit a query in one particular language and the search works also for any other language. It is an extremely complex issue for every digital library and especially for a digital manuscript library because of the use of various historical phases of individual vernacular languages. Although it cannot be implemented into the Manuscriptorium system in the foreseeable future, it is a long-term goal for the Manuscriptorium team.

Last but not least, ontologies present a challenge. No matter what most librarians and information scientists think, the methodology of the ontologies is not a simple information retrieval language. It is rather a semantic networking of texts respectively fulltexts (as which the manuscript descriptive record can also be understood). The European VICODI project (VISual CONTEXTualization of DIGital content) was led by the Latvian company RIDemo in 2002–2004 and, with the participation of the National Library of the Czech Republic, it elaborated an ontological system for history using concept flavours (abstract notion, event, individual, location, object, organisation), social group roles (i.e. abstract ideas like person, role and symbol) and time intervals on the one hand and instances (a specific specimen of the abstract concept) on the other. Thus, firstly a flavour is connected with the appropriate role and time interval, i.e. a concrete concept-instance is created, and secondly several flavours are connected into the appropriate semantic net, i.e. a concrete context is created. For a digital manuscript library's practical use, the concept instances are mostly personal and/or place names. On the other hand, the implementation of the VICODI ontologies into the Manuscriptorium search system is very difficult, forcing the work on implementation to be done step by step. Firstly, we wish to use ontologies for the translation of descriptive records and search results (words that should not be translated). This step should be implemented during the progress of the ENRICH project. Secondly, an analysis of the implementation

of ontologies must be elaborated, which will come after ENRICH if sufficient funding is raised. Thirdly, the implementation of VICODI ontologies into the Manuscriptorium search system depends on the results of the previous analysis.

### 2.3 Virtual Collections and Virtual Documents

Not only do information and communication technologies enable the overlapping of space and time by sharing different collections held at different places worldwide in a uniform user interface, but they also make it possible to approach the manuscripts and manuscript collections virtually. They allow for the representation of what has no actual existence but what existed either in the past or exists only at an abstract level. Thus, the reconstruction of dispersed historical libraries, the reconstruction of an activity of an individual scriptorium, the reconstruction of a work of an individual scribe, a palaeographic anthology etc. can be accomplished. It is fundamental that all these and other possible reconstructions be accomplished not by accumulating descriptive records, which would be no difference in comparison with the printed environment, but that it be achieved by collecting digital documents, which is very important as against the method not using information and communication technologies. Some virtual collections, e.g. collections of manuscripts, incunabula, early printed books etc., meet typical end-user requirements and as such should be created beforehand, *a priori*. On the other hand, some virtual collections should be created not only *a posteriori* but also for specific purposes and individual tasks. Furthermore, also virtual documents should be created *a posteriori* for specific purposes and individual tasks.

Consequently, personalised research tools for creating virtual documents and virtual collections will be developed in the ENRICH project. A virtual collection can be either static or dynamic. A static virtual collection is a simple selection of documents from those in the Manuscriptorium database at the moment, which requires manual work. A dynamic virtual collection is a selection of documents from the documents in the Manuscriptorium database at that moment or that will be there in future. Such a collection is not based on manual work but on a personalised permanent query that is activated after every update of the Manuscriptorium database, so that the dynamic virtual collection is continuously growing. Especially this kind of virtual collection could be applied well for scholarly and any other refined use, because it enables permanent heuristics. It is very important that static and dynamic virtual collections can be both used individually by their creators and shared with other end users in accord with their creators' consent. On the other hand, a virtual document is a selection of parts of the documents from all the documents currently in the Manuscriptorium database, i.e. manual work is needed for the creation of the virtual document. Practically, it means that a virtual document is a collection of pages or leaves that come from various

documents, i.e. manuscripts and/or books. It is thus a specific heuristic tool, whose desirability and efficiency should be proved in the near future.

### 3 Conclusion

The Manuscriptorium Digital Library uses the ENRICH project to accelerate its development in becoming an important tool for codicological and palaeographic research. The integration of various resources from many European countries as well as the development of tools that would enable the processing of distributed compound digital documents and/or scholarly work with manuscripts are the main advantage of the Manuscriptorium when compared with other similar resources.

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