

Toward Virtual Research Environment for Glagolitic Manuscript Studies

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Introduction

Pre-modern manuscripts are considered to be important witnesses of history of pre-modern Europe and as such present crucial sources for research in a number of disciplines, i. e. textual and literary studies, linguistics, history, culturology, etc. (Hyvönen, et al., 2020, Clemens, Graham, 2007). Although scattered in GLAM institutions throughout the world, nowadays those manuscripts are available to scholars through their digital reproductions. Heritage institutions have a long history of digitization of manuscripts and making their digital reproductions available online. Many libraries, such as the Bibliothèque nationale de France, the Vatican Library in Rome, and the British Library in London, have been actively digitizing their manuscript collections (Lied 2019, 15) and building digital libraries of manuscript material. Portals which aggregate specialized databases of old and rare books like CERL (Consortium of European Research Libraries) *Heritage of the Printed Book Database*¹ are also very important sources for manuscript research. But, besides having digital reproductions available online there are more and more projects which are strongly focused on supporting manuscript studies. Among those project it is worth to mention the Swiss project *e-codexes – Virtual Manuscript Library of Switzerland* and *Fragmentarium* who made a step forward and traced the path for using digital libraries of manuscripts and its fragments as an interdisciplinary cooperative research platform for scholars. *E-codexes* is dedicated on offering infrastructure for specialists who are performing research on Swiss manuscripts², while *Fragmentarium Digital Library* is a complementary research project specialized for mediaeval manuscript fragment

¹ CERL - Heritage of the Printed Book Database. Dostupno na: <https://kxp.k10plus.de/DB=1.77/DB=1.77/LNG=EN/?COOKIE=U999,K999,D1.77,E22f837aa-2,I0,B9994+++++,SY,QDEF,A,H12,,73,,76-78,,88-90,NGAST,R93.141.228.20,FN> (30.4.2022.)

² <https://www.e-codices.unifr.ch/en/about/history>

research, and as such it contains tools for gathering and describing fragments, as well as tools for tagging, linking and assembling fragments³. It is important to mention ENRICH's (European Networking Resources and Information Concerning Cultural Heritage)⁴ project, whose main result is a database *Manuscriptorium: Digital Library of Written Cultural Heritage*⁵, which provides access to distributed digital reproductions of written heritage held in European GLAM institutions, and whose goal is to build cooperative virtual environment for research of manuscripts and other historical sources. It can be concluded that decades of investments in digitization and building of digital libraries of medieval, early modern and other manuscripts and manuscripts' fragments has resulted in building a number of specialized digital libraries of manuscripts and its fragments, while the next phase of development of those digital libraries can be described as a phase of transformation of digital libraries into digital laboratories for interdisciplinary cooperative manuscript research. That shift can be described as a shift from digitization to datafication of manuscript studies, and is conducted mainly within Digital Humanities framework and through digital research infrastructures.

Manuscript studies are for a few last decades conducted by applying digital tools and digital methods, namely in the framework of Digital Humanities. The last decade is testifying particular advances in digital tools and platforms which are available for manuscript studies (Almas, et al., 2018). Besides digital reproductions availability, digital editions and text analysis, the focus in last decade is on building infrastructure for cooperative interdisciplinary research of manuscripts (designing and building virtual laboratories) and on using AI in the field of manuscript studies, in terms of datafication (big and smart data approach, data mining, data visualization, etc.), automatic optic recognition of signals (image, text). All that should be combined in virtual research infrastructures specialized for manuscript studies.

Croatian mediaeval culture is characterized by the use of three scripts: Latin, Glagolitic and Cyrillic. A significant part of Croatian corpus, crucial for research in history of language, literature, history and identity as a whole, is written on Glagolitic script. Therefore, there is a significant number of researchers whose main research interest is Croatian Glagolitism, or whose main research corpus is consisting of Glagolitic material. It is evident that the growing number of those researchers are using, or are intending to use digital tools and methods for research in Glagolitism. On the other hand, the interest in digitization of Glagolitic material

³ <https://fragmentarium.ms/pages/about/digital-laboratory>

⁴ European Networking Resources and Information Concerning Cultural Heritage (ENRICH) Project. Dostupno na: <https://digital.humanities.ox.ac.uk/project/enrich> (30.4.2022.)

⁵ Manuscriptorium. Dostupno na: <http://enrich.manuscriptorium.com/> (30.4.2022.)

held in Croatian GLAM institutions and abroad is growing and there is a number of digital libraries in which one can find digitized Glagolitic content. However, despite the growth of interest for digitization of Glagolitic primarily and secondary research sources, and despite the growing number of scholars who use digital tools and methods in their research in Glagolitic, there is currently no common digital infrastructure for research in Croatian Glagolitic.

In this paper, selected features of virtual research infrastructure for cooperative interdisciplinary research in Glagolitic will be proposed, with a focus on providing union platform for interdisciplinary research of Glagolitic manuscripts and its fragments. This study will (1) summarize the feedback of scholars in the field of Glagolitic obtained through survey on scholars' expectations from virtual research infrastructure for research in Glagolitic, (2) provide a "state of the art" report on available digital tools and methods in the research in Glagolitic manuscripts and its fragments, including the limitation of its use, and (3) outline draft of the selected features of virtual research infrastructure for cooperative interdisciplinary research in Glagolitic, namely research in Glagolitic manuscripts and its fragments.

Theoretical framework

Researchers in the field of manuscript studies nowadays use digital tools and methods in manuscript research. For that, they demand digital reproductions of manuscripts to be available online, as well as a digital infrastructure which would enable manuscript research in digital environment, namely in the framework of Digital Humanities. In addition to digital copies of manuscripts, users in such a digital environment expect other possibilities, such as searchable information, online reading rooms for scholars, online collaborative workshops where manuscripts are transcribed, translated, or edited, or they may serve as combined archives and connecting tools for scholars working on specific manuscript materials (Lied 2019, 15-16). Also, in addition to the availability of digital copies and a research environment, users expect other types of accessibility, for example the availability of transliterated text or links through semantic data enrichment, but also the possibility of accessing data (delivery of metadata from catalog of manuscripts, i.e. their availability in open access), access to tools for data mining, visualization, GIS applications, tagging options, etc. Digitization has certainly facilitated access to manuscripts, which we can now browse, comment on, catalogue and study, but it has also indicated the need for more complex options and possibilities when it comes to the availability of reproductions, data, tools and infrastructure. That availability can refer to a stable way to

store these digital surrogates, 'interoperability' that allows for easy communication between different repositories, manipulation of images side by side and so on (van Lit 2019, 100).

By researching manuscripts using digital methods and digital tools, researchers are nowadays able to pose and answer new research questions, shed new light on our understanding of manuscript culture and generate new knowledge by interpreting digital reproductions of manuscripts and digital data. However, it is important to stress the importance of the quality of digital reproductions and of metadata used for its description, which affects accessibility, but also research of manuscript material. Taking into account that the access to and availability of digital reproductions and semantically rich metadata of manuscripts and other research sources (watermarks, fragments, etc.) are crucial for manuscript research, this paper will examine the theoretical assumptions of manuscript studies in a digital environment. It will explore what a scholar is expecting to, what a scholar can and what should be able to access nowadays when it comes to manuscript studies in digital environment. Consequently, the results of this study will inform the design and building of virtual research environment for research in Glagolitic. Virtual research environment is defined as a „collaborative digital environments that facilitate the integration of information resources and tools to support a particular set of research activities” (Blanke and Hedges 2013). It is a comprehensive environment for collaboration which facilitates global sharing of research findings and expertise across organizational and operational boundaries and barriers. Through virtual research environment „scientists will be able to use their browsers to access data, software and processing resources that are managed by diverse systems” (Blanke et al., 2010).

Research aim, goal and methodology

The aim of this study is to review the state-of-the-art of Glagolitic manuscript studies and to foster the research of Croatian Glagolitic within Digital Humanities framework. The goal of the study is to identify and examine those features of digital infrastructures which would enable and potentiate the possibilities of interdisciplinary cooperative research of Croatian Glagolitic in digital environment. In result, the elements of virtual research environment for Croatian Glagolitic will be proposed. The study will be conducted in the framework of Digital Humanities and will use the methodologies of the survey and of the case study based on *GlaboLab portal and digital laboratory for collaborative research and promotion of the Croatian Glagolitic*.

In this study digital infrastructure is defined according to Atkins and denote the *collection of standards, software, digital content, and expertise that directly supports scholarly research* (Our Cultural Commonwealth). The elements of digital infrastructure which present the basis of this study are *collect, catalogue, transcribe/translate, identify, analyse/interpret and publish*, and correspond to the humanities research workflow as defined by Donald J. Waters (2022).

This study will (1) summarize the feedback of scholars in the field of Glagoliticism obtained through survey on scholars' expectations from virtual research infrastructure for research in Glagoliticism, (2) provide a "state of the art" report on available digital tools and methods in the research in Glagolitic manuscripts and its fragments, including the limitation of its use, and (3) outline draft of the selected features of virtual research infrastructure for cooperative interdisciplinary research in Glagoliticism, namely research in Glagolitic manuscripts and its fragments.

It is assumed that the results of the study will empower the Glagolitic manuscripts research in digital environment by identifying the features of virtual research environment crucial for research in Glagoliticism and connected with access to and availability of digital reproductions of manuscripts, metadata, research data, digital tools and other elements of digital infrastructure for research in digital environment. A comprehensive draft of those features will be provided.

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