



Juha Henriksson

Time Machine in Finland

Music Archive Finland

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For the Reader

This report is based on the extensive Time Machine in Finland survey, which I have carried out part time for over a year, since April 2020. During the survey, I have examined the capabilities and materials, as well as wishes and needs of the Finnish Time Machine Organisation members. The aim of the survey has been to promote the networking of TMO members, as well as to promote new cooperation projects. As awareness of the materials and capabilities of domestic organisations grows, it is easier to form both national and international Time Machine projects.

The Time Machine organisation includes 38 Finnish organisations, of which 26 have been involved in the survey. They represent a diverse range of cultural heritage organisations, but the survey has also included higher education institutions and companies, as well as future user groups for Time Machine services.

Thanks to a comprehensive set of respondents, the survey promotes various types of projects related to Time Machine in Finland, but at the same time it provides a fairly broad and diverse picture of the state of digitalisation of cultural heritage in Finland.

I would like to thank all the involved organisations and their staff. Without their input and commitment, the survey would not have been possible. I am also very grateful to Lingsoft for offering to translate this book into English.

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In August 2021

Juha Henriksson

Time Machine

Time Machine¹ is a unique and broad project on a European and global scale, with the aim of developing innovative solutions to translate cultural heritage material stored in European archives, libraries, and museums, into digital format. Digital materials can be studied and visualised in new ways, for example by using text and character recognition, artificial intelligence, as well as 3D modelling.

The original action plan or roadmap² of the Time Machine initiative, which was prepared in 2019, will take place for a period of ten years from 2020 to 2030. The roadmap is divided into four basic pillars, the first of which has the aim to produce extensive digital cultural heritage materials that are consistent and standardised. The first pillar will, among other things, develop new digitisation methods, such as technologies based on X-ray techniques. Simultaneously, methods based on artificial intelligence are produced, which can be used to link and contextualise digital cultural heritage to promote research use. New long-term preservation methods for digital data will also be developed.

The second pillar focuses on the implementation of joint Time Machine services and creates the necessary infrastructure for the large-scale digitisation of cultural heritage, and the processing and simulation of data. The second pillar also includes the so-called Local Time Machine services.

The aim of the third pillar is to disseminate the results of the project extensively and diversely. Supporting research and education is central, but the results of Time Machine also serve libraries, archives and museums, creative industries, smart tourism, urban planning, as well as land use, and regional policy.

The fourth pillar of Time Machine, "innovation and information", serves the entire project. It aims to answer a wide range of practical questions related to the project: What legal questions and restrictions are involved in digital cultural heritage and how should legislation be developed? Where does the funding needed for Time Machine and related local projects come from? How to store data in a sustainable manner? How are experts and citizens informed about the project and its results?

Time Machine initiative competed for a billion Euro FET Flagship funding from the European Commission. In spring 2019, Time Machine succeeded to become one of the six finalists, among hundreds of projects, and received the best possible grade in the mid-evaluation of applications. However, the Commission decided not to finance any new FET Flagship projects. Since then, other EU funding channels have been sought for the Time Machine

¹ <https://www.timemachine.eu>

² <https://www.timemachine.eu/time-machine-roadmaps-mapping-the-future/>

initiative. At the moment, the aim is that the project could receive broader funding from 2024, at the latest.

Time Machine Organisation

To achieve the objectives of the Time Machine project, the Time Machine Organisation (TMO) was established in 2019. Already, nearly 700 organisations from across Europe have joined. The members include a large number of cultural heritage organisations, as well as universities and research institutes, but also private sector operators, such as IT companies.

TMO also includes associations and communities. If the member organisations of these communities are included, more than 14,000 organisations and over 100,000 professionals are directly or indirectly involved in Time Machine. In other words, it is a very extensive network, which provides new opportunities for cooperation and funding.

Finland has also been enthusiastically involved. In April 2021, TMO already includes 38 Finnish organisations or communities. Three of which are founding members: the National Archives of Finland, the National Library of Finland, and the University of Tampere.

- Aalto University
- Agricola – The Finnish Network for the Humanities
- Society of Finnish Archivists
- Citynomadi
- CSC – IT Centre for Science
- Disec
- Central Archives for Finnish Business Records, Elka
- Fabula Productions
- Helsinki City Museum
- Helsingin Sanomat Foundation
- University of Helsinki (HELDIG)
- History, Culture, and Arts Studies Archives
- The Association for Teachers of History and Social Studies in Finland
- South-Eastern Finland University of Applied Sciences Xamk
- Finnish Folk Music Institute
- National Archives of Finland
- National Library of Finland
- National Museum of Finland
- Open Knowledge Finland
- The People's Archives
- Lingsoft Group Inc.
- Mikael Agricola Society
- Mikkeli Development Miksei Ltd

- Music Archive Finland
- Paavo Nurmi Festival
- Postal Museum
- Sibeliusmuseum
- StageZero
- The Association of Cultural Heritage Education in Finland
- Finnish Museums Association
- Muisti Centre of War and Peace
- Finnish Literature Society
- Society of Swedish Literature in Finland
- Turku University of Applied Sciences
- Labour Archives
- University of Tampere
- University of Turku
- Finnish Broadcasting Company Yle Archives

The number of Finnish TMO organisations, especially in proportion to the population, is among the highest in Europe, with more members only in Germany, Italy, Spain, the Netherlands, Austria, and France.

The Finnish Time Machine ambassadors³ are Tomi Ahoranta (National Archives of Finland) and Juha Henriksson (Music Archive Finland). The tasks of the TMO ambassadors include communicating about the project, guiding new member organisations to membership, and meetings with stakeholders relevant to the project.

Action Plan for the Near Future

Time Machine Organisation has published an action plan for 2020–2021⁴. TMO is to invest in the development and provision of services, which bring added value to the members of the organisation. The focus areas are the development of Project Scouting Service and support for Local Time Machine projects. In addition, the Time Machine roadmap will be specified and developed into a more concrete direction by means of the Request for Comments procedure, which for its part will improve the possibilities for obtaining funding.

At the same time, the aim is to develop technologies for the implementation of the Time Machine project, which includes:

³ <https://www.timemachine.eu/ambassadors/>

⁴ https://www.timemachine.eu/wp-content/uploads/2020/09/TMO-Operational-Plan_2020-2021.pdf

- Data processing infrastructure consisting of a digital content processor and various simulation engines
- Digitisation infrastructure consisting of a Europe-wide network of digitisation centres
- Technology developed for Local Time Machine services (Data Graph, 4D Maps, Code Library, Project Repository)

TMO's immediate objective is also to monitor the development of funding opportunities in Horizon Europe, and other similar funding programmes. To this end, TMO will continue to lobby the EU Commission and politicians, and cooperate with other cultural heritage projects.

Request for Comments

The original Time Machine roadmap is extensive, but at the same time rather abstract. The Request for Comments process⁵ has been launched to specify more detailed content for Time Machine. It is based on the process used to develop the IETF RFC 791 protocol, which is adapted to the demands of Time Machine. The RFC process in Time Machine produces openly available publications with a unique identifier. They define rules, recommendations, and architecture options for different components of the Time Machine infrastructure.

Producing RFC documents is an open, collective process in which anyone can participate. TMO's member organisations will thus be able to influence what kind of entity will be built within the Time Machine framework. RFC documents cover not only the technical infrastructure of Time Machine, but also the standards and legal context associated with the project, as well as the general values and principles of the project.

Once approved by the RFC Editorial Committee, the draft RFC will be officially published as a peer-reviewed publication. Draft and publication documents are available in the GitHub RFC archive, where they can be commented.

It is important that Finnish TMO members actively participate in writing, editing, and/or reviewing the RFC documents⁶. This will ensure that the infrastructure of the Time Machine project considers issues, which are important for Finnish organisations.

⁵ <https://www.timemachine.eu/building-a-time-machine/requests-for-comments/>

⁶ <https://www.timemachine.eu/building-a-time-machine/requests-for-comments/participate-in-the-rfc-process/>

Local Time Machine Services

According to the current definition of TMO, Local Time Machines are the representation of the collected Big Data of the Past of a geographic place (GeoEntity), created by the sum of information provided by different projects and initiatives connected to this place⁷. In accordance with the new definition, a certain LTM is therefore not one specific project or service, but it consists of a set of materials or services related to the same location.

The Time Machine website contains a register where local LTM projects can be proposed⁸. Projects can be proposed by all TMO members who have – either ongoing or already completed – a project related to a specific location or a wider geographical area⁹. Even if a culturohistorical project is not directly related to a specific location, it can still be registered on the LTM site, in which case the address of the organisation's headquarters will be indicated.

The definition of Local Time Machine has changed from how LTM services were defined in 2019. However, nothing prevents a number of organisations from continuing to cooperatively provide a virtual presentation service of Vyborg, for example, but according to the policies of the Time Machine organisation, it is not possible to name such a service "Vyborg Time Machine", but rather to name it in a different manner.

Nevertheless, the LTM on Vyborg can also be built in a manner where different organisations register their own materials or services concerning Vyborg on the LTM website, in which case "Vyborg Time Machine" is an entity of these materials and services.

Project Scouting Service

The Time Machine Project Scouting Service¹⁰ supports TMO members in forming competitive project consortia and sending high-quality project proposals, in particular for various EU funding channels. Project Scouting Service also provides support for networking.

Project Scouting Services include:

- Information and advice on appropriate third-party funding arrangements
- Support for finding partners for project consortia
- Participation of the TMO central organisation in projects
- Advice and services for preparing project proposals

⁷ <https://www.timemachine.eu/ltms/>

⁸ <https://www.timemachine.eu/building-a-time-machine/propose-an-ltm-project/>

⁹ <https://www.timemachine.eu/building-a-time-machine/lrm-faq/>

¹⁰ <https://www.timemachine.eu/building-a-time-machine/project-scouting-service/>

The TMO Central Organisation can participate in projects in three ways: 1) TMO coordinates the project, 2) TMO participates in the project as a partner, or 3) TMO supports the project with a written recommendation. The Project Scouting Service also helps TMO members to form projects and obtain funding in which the TMO central organisation does not participate.

Survey

Finnish members include various types of organisations and communities, whose needs and capabilities vary greatly from the perspective of Time Machine. The purpose of this survey was to map out which systems and services, already available to Finnish members, could be brought under the Time Machine entity, to enable the services to receive international funding and/or foreign users. In addition, several new system development projects are underway in Finland, which may possibly be integrated into the Time Machine entity, allowing their funding base to be expanded.

Finnish members include 1) cultural heritage organisations which could enhance the digitisation of their materials and offer their data for use in new ways through Time Machine, 2) researchers and teachers who are future user groups of Time Machine, and 3) companies and IT sector operators that could assist in implementing local Time Machine services. The survey mapped the views of all these groups.

Objectives of the Survey

The following objectives were set for the survey:

Extension of the funding base for existing national services: Can national systems and services be integrated into the Time Machine entity, allowing them to apply for EU funding? The funding base for new system development projects could also be expanded with Time Machine funding.

Improved efficiency of the national research system: Significantly accelerating the digitisation of cultural heritage organisations' materials, and reducing costs. Processing materials, for example by linking, text recognition, and simulation. Developing technological solutions for the long-term preservation of digital materials.

Promoting interoperability: If national services and systems are integrated into the Time Machine entity, their interoperability will improve both at national and international level.

Promoting citizen science and science education: Providing cultural heritage materials in entirely new ways for the use of citizens, schoolchildren, students, and teachers, utilising visualisation, simulation, and 3D modelling.

Promoting open science: The EU-level cooperative development of legislation and ethical principles governing the opening of data.

Developing relations between science and society: The results of Time Machine promote the activities of authorities and companies, such as smart tourism, urban and land use planning, as well as the entertainment and creative media industry.

Strengthening cooperation networks: The Time Machine Organisation already has 38 Finnish members representing cultural heritage organisations, communities, and private sector actors, in a versatile manner. The survey will intensify cooperation between them.

Implementation of the Survey

The survey was implemented by sending a questionnaire to Finnish TMO members. Written responses were complemented by video interviews in spring, summer, and autumn 2020. Finally, the results of the questionnaire responses and video discussions were supplemented on the basis of written material. A total of 26 organisations participated in the survey.

The following issues were examined in the questionnaire and discussions:

- What systems already exist? Can these be brought into the Time Machine entity? What could be built on them in the Time Machine framework?
- What plans do Finnish TMO members have considering new systems and information services, that could be placed under the Time Machine umbrella?
- What materials could Finnish GLAM organisations have for this purpose?
- What are the wishes of future end users? How could Time Machine promote research and education, for example?
- What are the capabilities of higher education institutions and companies in terms of technical implementation?

The questionnaire is attached to this report.

Results

Society of Finnish Archivists

The Society of Finnish Archivists¹¹ creates and maintains contacts between individuals operating in the archive sector, as well as promotes knowledge and scientific research in the field. The society organises meetings and seminars on topical issues in the archive sector, takes a stand on key issues in the field, as well as maintains contacts with Finnish and international organisations.

The Society of Finnish Archivists can support the Time Machine project, for example by promoting the project both among its members and more broadly. The society may assist in organising Time Machine events, for instance, as the society has existing networks and experience in organising events. The Society of Finnish Archivists can also highlight the perspectives of different user groups when developing Time Machine.

The Society of Finnish Archivists has supported the Time Machine survey financially.

Local Time Machine

Local Time Machine services could be built, for example, in connection with historical castles. Suomenlinna, a UNESCO World Heritage Site, could serve as a pilot. Suomenlinna has a connection to a wide range of archive and museum materials – from the construction stage to the present day. Oral history has been collected from Suomenlinna, and there have been prison camps during the Civil War, for instance. For example, the Helsinki City Museum has a lot of material from Suomenlinna, and it has previously implemented an online exhibition on Helsinki in the 1700s and the construction of Suomenlinna.

From Suomenlinna the project could proceed to other historical castles in Finland. 3D-modelled buildings and historical documents could be combined, for example, with films shot in castles, which also present environments that may already be lost. The archive of the University of Helsinki has an archive of the Turku Academy, which contains a lot of impressive material and interesting personal archives. Could the fragments of the National Library, which include, for example, a lot of medieval liturgic music, provide a soundscape for LTM services? The fragments are also very impressive.

If only one national LTM service is implemented, it cannot be too tied to a specific location, in order for it to serve the entire Finland. Would it be possible to implement a mobile

¹¹ <http://arkistoyhdistys.fi/index.php/the-society-of-finnish-archivists/>. Interviewees Juha Hannikainen, Marja Piironen-Honkanen, and Johanna Mieta, 12 May 2020.

service that allows you to visit virtually different parts of Finland? And would it be possible to cooperate with Heureka?

Citynomadi

Citynomadi¹² is a company established in 2009 that visualises interactivity and various data on a map. Customers include several artistic and cultural heritage actors. Citynomadi is strongly internationally networked.

The OpenStreetMap service provided by Citynomadi is global and multilingual. Interfaces are used to combine different types of information, open data, IoT feeds, and feedback, as well as crowdsourced information. The Nomadi application¹³ implemented by Citynomadi is available in app stores.

Map-based Services

A large number of cultural heritage tours based on the Nomadi application have been carried out. The various types of routes¹⁴ include Eastern Lapland, Turku Cathedral, Old Rauma, and Seurasaari. The service provided by Citynomadi also includes the "Community" side, where you can make different sets of themes without a separate agreement. For example, village activists create content that can be used to navigate the village roads and familiarise oneself with them.

The Avoimet Kylät ("Open Villages") day is an annual online event¹⁵. A village can publish various digital content, such as videos and photographs, village history, outdoor trails, and its hiking destinations. Villages and municipalities publish the produced digital material on their own channels on the day of the event, and the links to the channels are collected on the event map. Citynomadi also has foreign customers. For example, a Beethoven walk¹⁶ for the Haus der Musik Museum in Vienna.

A part of the map services produced by Citynomadi, have been based on the utilisation of open interfaces with regard to data, so that the material connected to a specific location is not predetermined. For example, an event map was created for the Turku Capital of Culture 2011, in which other events in Turku were sought, with an algorithm from the interface provided by Heldig, and linked to events in the Capital of Culture.

¹² <https://www.citynomadi.com/?uiLang=en>. Interviewee Merja Taipaleenmäki, 13 May 2020.

¹³ <https://app.citynomadi.com>

¹⁴ <https://www.citynomadi.com/route>

¹⁵ <https://avoimetkylat.fi>

¹⁶ <https://www.citynomadi.com/route/e6ecf5d99b4e6175ded98ba70e24b03a>

Urban Planning

Citynomadi has had a few urban planning projects. A two-step study was carried out with the Department of Geography at the University of Turku, which first asked about different development options in the area on the map. In the second phase, videos of the response options were created that modelled the area and brought the ideas to the context. Tampere, in turn, modelled seniors' and immigrants' views on the attractiveness and safety of the urban environment on a map basis.

In 2020, an international idea competition was organised for the development of the surroundings of Turku Castle and the western shore of the Aurajoki river mouth¹⁷. The competition area and its destinations were accessible through the Linnanniemi map in the Citynomadi route service.

Development Ideas

Technology could be developed with a third party to analyse the information on the map with the help of artificial intelligence, enabling users to make smart, context-sensitive searches of the extensive data. Crowdsourcing can also be developed. How could map data be enriched not only with the material of cultural heritage organisations but also with citizens' own materials?

In smart tourism, map applications can help guide people more evenly across the city, and find everyday life, in order to avoid all tourists visiting only a few of the most well-known sites or walking along the same nature trail. This would also enable the areas around the city to become vibrant and companies to receive new customers from tourists.

Central Archives for Finnish Business Records, Elka

The purpose of the activities of the Central Archives for Finnish Business Records¹⁸ (Elka) is to safeguard the preservation of history and tradition concerning Finnish business life. The material in Elka is intended to be utilised by researchers from various disciplines and other persons in need of the information. For this purpose, Elka collects, processes, and makes available documentation and other material produced in the activities of companies, private individuals, associations, and societies, such as drawings, maps, photographs, as well as various sound and image recordings.

¹⁷ <https://www.turku.fi/en/linnanniemi>

¹⁸ <https://www.elka.fi/index.php/fi/>. Interviewee Jarmo Luoma-aho, 9 June 2020.

Materials and Digitisation

Elka has approximately 30 shelf kilometres of material, mainly since the mid-1800s. Materials older than 100 years can be published in terms of data protection. The newer material may contain restrictions due to copyright or data protection.

The description requires a lot of human resources, which has thus far limited the amount of digitised material. Materials are described and digital materials are managed in Disec Oy's Yksa service. Elka has tested a Disec-implemented application that would directly import metadata and digital objects from Microsoft SharePoint to Yksa, automatically.

There are currently about 26 TB of digital material. A significant part of these are sound recordings and videos, that were digitised at the turn of the 2010s with the Ministry of Education and Culture's project funding. Photographs have also been digitised for a long time. Until now, digitisation has been carried out largely either through project funding or for a specific purpose, such as a research project. Digitisation is carried out for approximately 1 person-year, but in addition to retrospective digitisation, this also includes digitisation related to customer service, publications, and image orders. A digitisation plan has been drawn up for the digitisation of the materials, on the basis of which digitisation will be implemented more systematically in the future.

Design Archive and 3D Modelling

The Design Archive¹⁹ is a national special archive of Finnish design, located in connection with Elka. The purpose of the Design Archive is to collect and permanently store documents and objects related to Finnish design, and to provide everyone interested in design with an opportunity to study the materials. The objective of the archive is to promote research in design, accessibility, and the preservation of cultural heritage.

3D models²⁰ have been drawn up based on the materials of the Design Archive and Elka. Drawings, photographs, and physical objects have been used for their implementation. The 3D models have been implemented in cooperation with South-Eastern Finland University of Applied Sciences Xamk, during two different projects in 2011 and 2013.

Online Exhibitions

Elka's "Aikakone"²¹ ("Time Machine") is aimed at the general public. The website is like a showcase for Elka materials, and it contains images, videos, advertisements, drawings,

¹⁹ <https://www.elka.fi/designarkisto/index.php/en/>

²⁰ <https://www.elka.fi/designarkisto/index.php/fi/aineistot/aineistojen-3d-mallit>

²¹ <https://www.elka.fi/aikakone/>

documents, and other material from different decades. Elka also has its own channel on YouTube²², and it is active in social media.

The Varkaus Museums' and Elka's Laivadata Service²³ ("Ship Data Service") provides the archives of the Varkaus Shipyard as open data for everyone to access and use freely. Combining data from two different types of memory organisations enables as comprehensive an overview of the topic as possible.

So far, three online exhibitions²⁴ have been carried out on the materials of the Design Archive, which operates in connection with Elka: "Design is thinking", "Industrial Designers", and "Success Stories of Design".

Memoriaali

Elka is involved in a joint project aimed at developing the Memoriaali online service²⁵. The project maps the existing operating models, systems, tools, and technical environments developed for the reception and enrichment of digital data, as well as tests their suitability as a platform for Memoriaali. The end result is an online service package that is independent regarding material and operators.

As one part of Memoraali, a model for the reception of Elka's electronic material is being piloted. The information received in the Memoriaali service is altered into an archived format, metadata related to the content is added, the information is packaged in an archived package if necessary, and validity and correctness checks are carried out.

In addition to Elka, the Memoriaali project also includes Mikkeli Development Miksei Ltd, Muisti Centre of War and Peace, and South-Eastern Finland University of Applied Sciences Xamk, which are all members of the Time Machine Organisation.

Development Opportunities

Until now, the description of the materials has been the bottleneck of digitisation. Identifying handwritten text and automated metadata generation could help enhance digitisation. From the perspective of Elka, the utilisation of X-ray technology in the digitisation of old documents, is extremely interesting.

²² <https://www.youtube.com/user/Elkatoyou>

²³ <https://www.laivadata.fi>

²⁴ <https://www.elka.fi/designarkisto/index.php/en/material/web-exhibitions>

²⁵ <https://www.elka.fi/index.php/fi/palvelut/memoriaali-hanke>

In the future, researchers could be offered a service that would not require them to physically be present in the research hall; instead, archives could be collected and digitised on behalf of Elka, and tools for analysing them is provided.

Cooperation with Yksa organisations would be promoted if the interoperability of archive and description systems could be improved through Time Machine.

The Association for Teachers of History and Social Studies in Finland (HYOL)

The Association for Teachers of History and Social Studies²⁶ does not have the resources to carry out development work on Time Machine -related issues, but it can inform a large number of history and social studies teachers who, in turn, can disseminate information to schoolchildren and students, especially in upper secondary and secondary schools. HYOL has more than 20 local associations around Finland and a total of approximately 1,300 members.

Supporting Education

The teaching of history has changed in recent decades. Source criticism and the use of materials are practised early. The digital materials of archives and museums provide opportunities for the utilisation of original sources. At the same time, digital materials protect the original material, which may be fragile. Therefore, digital materials give schoolchildren and students access to material that has previously been protected from use.

The technology used in teaching does not necessarily need to be based on the latest AR/VR/3D technology to attract the interest of schoolchildren. Schools often do not have the right equipment to utilise the latest software technology. Occasionally, even surprisingly small things, such as turning black and white images into coloured, may be enough to attract the students' interest.

Mobile access to education applications developed in Time Machine is an absolute requirement, as there are often no computers or tablets available on behalf of the school, so students use their own mobile phones.

²⁶ <https://www.hyol.fi/en/english/>. Interviewee Kirsi Ruhanen, 17 August 2020.

About Local Time Machine

Local Time Machine should not only present great men. It is important that the history of ordinary adults and children, as well as different minorities is also shown. Additionally, all material should be available in several languages.

The perspective of ordinary people is important to be considered even in the planning work of a possible Local Time Machine. For example, Suomenlinna or Vyborg Castle are interesting sites, but LTM could also be built around a croft in Kerimäki. For example, how has life in a particular family or village community changed during history? When the aim is to stimulate historical empathy in young people, it is often started with a matter personally related to each pupil, such as the history of their own locality or family.

In addition to site-specificness, certain thematic entities could be considered. For example, the history of diseases and medicine is an interesting perspective, which is made particularly topical by the global coronavirus pandemic.

South-Eastern Finland University of Applied Sciences XAMK

Digitalia

Digitalia²⁷ is a joint research and development centre for digital information management at Xamk University of Applied Sciences²⁸, the University of Helsinki, and the National Library of Finland. Digitalia develops, for example, automatic file conversions, content analysis, text recognition, image enhancement, anonymisation, and visualisation of data in game-like 3D environments.

Digitalia handles various types of material, such as digitised text documents, photographs, videos, and historical press material, as well as e-mails and social media data. In Digitalia, even long-term preservation is developed and tested, for example by conducting migration research and promoting the transfer of digital data from outdated platforms and media to new systems. The aim is also to improve the usability and quality of digital historical material.

Digitalia's partners include archives, libraries, research organisations, educational institutions, companies, and organisations. Digitalia works closely with information management and electronic archiving training, and organises a summer school of digital information annually.

²⁷ <https://www.xamk.fi/en/rdi/digitalia-research-center-digital-information-management/>

²⁸ <https://www.xamk.fi/en/frontpage/> Interviewees Noora Talsi, Anssi Jääskeläinen, and Miia Kosonen, 25 May 2020.

Data Processing

Digitalia solutions can be used to convert office formats, image files, and e-mails to archived file formats with metadata. For e-mails, data can also be converted into a format that enables visual network diagrams from discussion networks.

Digitalia has developed an open-source OCR workflow to process both individual image files and entire folders at a time. When requested, one PDF document or Hocr / AltoXML document containing OCR data is generated from the contents of the folder. The activities are still partly under development, and partly fully completed.

OpenCV and AI-based methods have been tested with the National Archives of Finland, to identify blank, handwritten, and machine written pages of texts, as well as text pages containing both. This pilot has been completed, and as a result the pages containing data were separated from the blanks with approximately 99% accuracy.

Competence Development

Digitalia organises seminars and webinars, and produces open and practical guidance material, such as *Digiopas* ("Digital Guide")²⁹ and *Tiedolla johtamisen käsikirja* ("Information Management Handbook")³⁰. Digitalia's activities also cover the special features of online cultural heritage material, recovery, and management, excluding legal issues.

King's Road Renaissance

King's Road Renaissance³¹ is a two-year international project, in which attractions and service networks around the historic King's Road from Helsinki to St. Petersburg are compiled on a new interactive digital platform, where they can be explored using VR/AR technology. The platform serves companies and sites operating along the King's Road, for which it is a visibility and an important marketing channel. The project also provides tools for improving international cooperation around the King's Road theme and for enhancing cooperation between companies and cultural sites along the route, as well as between authorities and societies.

Memoriaali

Xamk is involved in the Memoriaali project³², which is also described in the sections on Elka (page 15) and Muisti (page 47). Xamk works as a technical expert and implementer in the

²⁹ <https://digitalia.xamk.fi/digiopas>

³⁰ <https://digitalia.xamk.fi/tijo>

³¹ <https://www.xamk.fi/en/research-and-development/kingsroad/>

³² <https://www.xamk.fi/tutkimus-ja-kehitys/memoriaali/>

project. The aim is to create a single shared Memoriaali solution, and then creating separate online services for Muisti and Elka, which are distinguished between content and appearance. The information received in the Memoriaali-Core is altered into an archived format, metadata related to the content is added, the information is packaged in an archived package if necessary, and validity and correctness checks are carried out.

Separate tools are also integrated into Memoriaali-Core to analyse and convert external data storage media content to archive format, extract and further process files received in various package formats into file formats suitable for the storage service, as well as package the received data in archive packages that conform to the OAIS model. Xamk students will be utilised in the development of Memoriaali, in the form of traineeships and theses.

Virtual Museum

Digitalia pilots a Virtual Museum³³ that is dynamic, interactive, and immersive. The solution is based on the Unity gaming engine. The Virtual Museum pilot has cooperated with the Design Archive, which operates in connection with the Central Archives for Finnish Business Records. The museum environment is completely dynamic: For every visit, the entire museum building with its floors, walls, ceilings, windows, materials, lightings, and objects will be rebuilt. The museum visitor can also adjust the museum space to suit their preferences. In virtual mode, both the actual 3D models and images from which the museum creates 3D models, can be presented. Object-related metadata displayed to users can be retrieved directly from the Yksa system or entered into a text file describing museum objects. Downloading metadata from Finna service is under development.

Development Ideas

The OCR development work in the framework of Time Machine, would help to process the content of digitised documents and other materials containing text, into a more easily accessible format. Time Machine could also offer opportunities for testing and introducing the virtual museum concept more broadly at both national and international level. At Xamk, digital cultural heritage can be linked to tourism development projects, as well as to urban architecture and planning.

National Archives of Finland

The National Archives of Finland³⁴ is responsible for the preservation of the national documentary cultural heritage. It promotes information management based on artificial intelligence and the renewing methods of science, as well as open access to document

³³ <https://read.xamk.fi/2020/digitaalinen-talous/digitalia-luo-dynaamista-virtuaalimuseota/>

³⁴ <https://arkisto.fi/en/frontpage>. Interviewees Tomi Ahoranta and Maria Kallio, 11 June 2020.

information, together with its customers. The business area covers the entire Finland. The National Archives of Finland receives documents handed over by the authorities, and acquires and stores other data relevant to society and research.

The National Archive of Finland is a founding member of Time Machine Organisation.

Materials

The National Archives of Finland possesses over 200 shelf kilometres of material, most of which are official data, such as documents of central government, ministries, and central agencies, as well as courts of appeal, or documents of district and local authorities. A large number of microfilm duplicates of documents from other archives have also been obtained in the National Archives of Finland. The majority of the most used materials and microfilms have been digitised. From the beginning of 2021, official data will mainly be received in digital format.

The archives of municipalities that have remained behind the border as a result of wars, materials from Lutheran parishes, along with archives of several individuals, families, organisations, associations, and businesses are also stored in the National Archives of Finland.

Material stored in the National Archives can be retrieved using the Astia online service (in Finnish)³⁵. The Astia service can also be used to access public digital material, and to apply for access rights to restricted material. To use all the features of the Astia online service, an electronic identification is required. It is also possible to search for material and view public digital material without identification. In this case, personal archives and family archives containing documents younger than 100 years are not included in the search for data protection reasons.

The extensive and versatile materials of the National Archives of Finland are excellent material from the perspective of various national or international development projects related to Time Machine.

Digitisation of Materials

In the mass digitisation³⁶ of the National Archives of Finland, the archived paper documents of the state authorities are digitised, for them to be available in digital format. The aim is to centralise the digitisation of approximately 135 shelf kilometres of archived documents, making the task internationally unique, in terms of its scope and objective in the archive

³⁵ <https://astia.narc.fi/astiaUi/>

³⁶ <https://arkisto.fi/massadigitointi>

sector. In 2019, before the transition to the production phase, the National Archives implemented a mass digitisation pilot³⁷.

Mass digitisation aims at a fully electronic operating environment, which

- promotes better availability and usability of document information
- enables the renewal of information management processes and methods
- releases government agencies from paper archives, thus speeding up their transition to a fully electronic operating environment
- saves preservation costs for archives in agencies and in the National Archives.

The paper documents will be destroyed after digitisation, and in order to enable this, the National Archives has defined the requirements³⁸ for digitisation aiming at destruction.

The National Archives of Finland has accumulated experience and expertise in the mass digitisation process of extensive data and its management, as well as the development of the process by means of artificial intelligence. This competence is significant even in international terms, which promotes opportunities to participate in joint international mass digitisation projects.

Retrospective digitisation³⁹ of National Archives data has also been implemented in cooperation with research projects, in which case the research project has acquired funding for digitising the data. Retrospective digitisation has also been carried out in cooperation with the FamilySearch community.

Recognition of Handwritten Text

The National Archives of Finland was involved in the READ project⁴⁰, funded under Horizon 2020 programme, which ended in summer 2019. The other partners of the project (13) mainly came from Central Europe (Austria, Germany) and England. The majority of the project partners were research institutes and universities. The project developed the Transkribus research platform, which enables automated recognition of handwritten text (HTR). The maintenance and development of the Transkribus platform will be continued by the European Cooperative Society READ COOP SCE⁴¹. The National Archives of Finland is one of the founding members of the cooperative.

³⁷ <https://arkisto.fi/fi/viranomaisille/massadigitointi/masadigitoinnin-pilotti>

³⁸ <https://arkisto.fi/uploads/Viranomaisille/Määräykset%20ja%20ohjeet/Kansallisarkiston%20vaatimukset%20havittamiseen%20tahtaavaan%20digitointiin.pdf>

³⁹ <https://arkisto.fi/fi/aineistot/digitoinnin-eteneminen>

⁴⁰ <https://makingamodernarchive.blogspot.com>

⁴¹ <https://readcoop.eu>

The first large set of HTR-identified National Archives' data is the Finnish Court Records Search online service⁴² launched in November 2020, where it is possible to browse and search for 19th century's renovated court records, which are one of the largest collections of the National Archives. The documents stored in the online service are minutes of reports for the years 1809–1870, and deal with legal notices, land ownerships, guardianship matters, and marriage contracts.

National Digitisation Centre project

In spring 2021, a study project will be carried out under the leadership of Mikkeli City Development Miksei, which will produce information to support decision-making concerning the establishment of a national digitisation centre, and examine the prerequisites for the establishment and operation of a digitisation centre in Mikkeli. Additionally, the report will provide basic information on the possibilities and alternatives for the implementation of the digitisation centre. The report is related to the city of Mikkeli's strategic development platform Memory Campus, a centre of expertise and service for the archive and library sector.

Other Developments

From the perspective of the National Archives of Finland, the development of automatic content analysis is crucial, in order to identify, for example, journal numbers, document identifiers, and diary information, in connection with mass digitisation. In terms of development work, active cooperation with other Nordic national archives is carried out.

The National Archives has participated in the international Book CT project, the purpose of which is to develop X-ray computed tomography scan technology⁴³ for the digitisation of documents. Attempts have been made to obtain EU funding for the project. If the project is implemented, the materials of the National Archives of Finland could be digitised using X-ray technology, while simultaneously testing the functionality of the technology and the process.

Thus far, photographs have been digitised relatively little in the National Archives of Finland. A process for the digitisation and management of larger photographic entities is being developed, and this could benefit from automated object recognition. The technology could also be applied to old map materials, of which there are several millions in the National Archives.

⁴² <https://tuomiokirjat.narc.fi/en>

⁴³ <https://youtu.be/q67HOVpLub0>

Local Time Machine

The materials of the National Archives of Finland can be used to produce a wide range of Local Time Machine services, as the National Archives' area of operation covers the entire Finland. Suomenlinna is a potential Local Time Machine site, and there are plenty of material related to it in the National Archives. In May 2021, for example, an extensive exhibition⁴⁴ showcasing Suomenlinna from the 1700s to the 2020s, will open at the National Archives and the Suomenlinna Centre, where the original material related to Viapori-Suomenlinna's history will be presented.

National Library of Finland

The National Library of Finland⁴⁵ is responsible for preserving, describing, and making available the national publication heritage, as part of the augmentation of its unique collections. The National Library of Finland also serves as the national service and development unit for the library sector. The National Library of Finland strives to comply with the FAIR principles⁴⁶ in the development of its services, and to promote the interoperability of the systems and materials of the GLAM organisations.

Digitisation

The publications of Finnish newspapers, as well as other materials, are digitised in the National Library of Finland, annually, according to the digitisation programme. The focus of digitisation is currently on the newspapers of the 1940s and in their own book collections. The annual volume of their own digitisation activities is nearly two million pages.

The Mikkeli office⁴⁷ has a wide and versatile range of manual level, book elevator, pass-through, and microfilm scanners. Scannable materials include newspapers, magazines, books, leaflets, roll films, and maps. Well-preserved books can be scanned almost automatically using the 4DigitalBook robot scanner⁴⁸, which produces up to thousands of pages per day.

⁴⁴ <https://www.epressi.com/tiedotteet/kulttuuri-ja-taide/suomenlinnan-historiaa-kolmen-valtakunnan-linnoituksena-juhlistetaan-laajalla-nayttelylla.html>

⁴⁵ <https://www.kansalliskirjasto.fi/en>. Interviewees Mikko Lappalainen, Erkki Tolonen, Maria Virtanen, Osma Suominen, Minna Kaukonen, Liisa Savolainen, Johanna Lilja, and Liisa Näpärä, 18 June 2020. Interviewees Mikko Lappalainen, Johanna Lilja, Kristiina Hormia-Poutanen, Erkki Tolonen, and Minna Kaukonen, 6 October 2020.

⁴⁶ <https://www.go-fair.org/fair-principles/>

⁴⁷ <https://www.kansalliskirjasto.fi/fi/uutiset/kansalliskirjaston-digitointi-ja-konservointikeskus-on-nyt-mikkelin-toimipiste>

⁴⁸ <http://www.4digitalbooks.com/index.php>

The post-processing of material scanned in Mikkeli, is done with a docWorks system⁴⁹, specifically designed for mass digitisation. In the context of post-processing, the cropping of pages, straightening of text sections, automated recognition of images and text sections, and text recognition (OCR) are carried out. As an end product, a set of files is created that contain all the files required for publication and long-term preservation of the work or magazine, including metadata. The long-term preservation standard is METS.

Sound recording digitisation is carried out in three studios in Mikkeli. The system supplier is NOA. The formats that can be digitised include CDs, Compact Cassettes, Micro and Mini Cassettes, Reel-to-Reel Tapes, Vinyl Discs, Minidisc discs, and DAT's. The covers of the discs and cassettes have their own scanner.

The digitisation of the National Library of Finland materials has also been implemented using a partnership model with newspaper and media houses, foundations, and Kopiosto.

Digi.kansalliskirjasto.fi

Digi.kansalliskirjasto.fi is a digital content presentation system that contains magazine, book, and small print material produced by the National Library of Finland, as well as the option for presenting notes and maps. All written material of the National Library of Finland is stored in a METS/ALTO format, suitable for long-term preservation, and preserved, at a point, at CSC. The digital sound recording material is available online in the Raita ("Track") database⁵⁰. Copyrighted materials are available in Varia (legal deposit working stations).

Press material until 1939, is currently freely available to everyone, newspapers in Swedish until 1949, as well as certain more recent materials are available, depending on copyrights and license agreements. In addition to the working stations at legal deposit libraries, magazines and literature can be used in most universities and certain universities of applied sciences, for research purposes under the Tutkain project⁵¹ contract, by logging in using the HAKA authentication system of higher education institutions.

Other Material Services

The National Library of Finland maintains publication archive services based on open source DSpace Software⁵², for approximately 50 Finnish public sector organisations. Publication archives include scientific publications, theses, and official publications, to name a few.

⁴⁹ <https://content-conversion.com/software/docworks/>

⁵⁰ <https://www.doria.fi/handle/10024/66373>

⁵¹ <https://www.kansalliskirjasto.fi/en/projects/tutkain-2020-2022>

⁵² <https://duraspace.org/dspace/>

The National Library's own digitised data has been stored in three DSpace-based data services. The materials of the National Library of Finland, published in Doria⁵³, contain more than 10,000 digitised books, 8,000 small prints, 1,600 maps, 800 manuscripts, and nearly 500 sound recordings (Raita). The Fragmenta Membranea⁵⁴ contains a collection of medieval text fragments of the National Library, approximately 9,300 parchment leaflets, described and digitised from approximately 1,500 medieval books. Fenno-Ugrica⁵⁵ consists of 20 different languages of monographs and newspapers, and has published over 1,100 monographs, over 20,000 magazine issues, and approximately 1,500 pages of manuscripts.

Development of Description

In cooperation with other national expert groups of description, the National Library of Finland and the National Description Standard Development Group⁵⁶ introduce the international library sector standards, which guide description, in Finland. A Description Standard Development Group, consisting of representatives of various library sectors, participates in the translation of standards, and their communication with the National Library's Cataloguing Standard Service. The group also responds to international requests for comments on standards in Finland, and forwards the development proposals of the partners to international development networks.

In addition, the group serves as a descriptive standard competence sharing forum for libraries and other cultural heritage organisations. For descriptive standards, the group's steering responsibility covers the RDA description instructions, ISBD rules, the International Cataloguing Principles, and the LRM conceptual reference model and its derivatives. The RDA description instructions are also used in archives and museums for describing actors.

Finna

Finna⁵⁷ is a versatile service package that offers cultural and scientific materials broadly to everyone. Finna is a joint service of cultural heritage organisations and includes more than 400 museums, libraries, and archives. The core of Finna's data resources is its index, which contains information on over 16 million archive, library, and museum material. In addition to the materials, services related to the organisations' materials have been integrated in Finna.

Finna services provide the Time Machine entity with an opportunity to build collaboration with several organisations at once. This cooperation includes, in particular, usability work,

⁵³ <https://www.doria.fi/>

⁵⁴ <https://fragmenta.kansalliskirjasto.fi>

⁵⁵ <https://fennougrica.kansalliskirjasto.fi/>

⁵⁶ <https://www.kiwi.fi/pages/viewpage.action?pageId=50170398>

⁵⁷ <https://www.finna.fi/?lng=en-gb>. Interviewees Susanna Eklund and Erkki Tolonen, 2 September 2020.

where the opinions of the users of organisations' materials is brought up, the discovery of materials is enhanced, and their use facilitated. In addition, the materials' joint information assets, which have been enriched and normalised, provide opportunities for building a variety of services.

By Finna, descriptions have been harmonised and interfaces developed for various GLAM sector systems. These interfaces could be utilised and further developed, in order to import the metadata of Finnish organisations into different Local Time Machine services, to avoid each organisation having to build its own interface for LTM services.

According to the Finna Services vision 2025⁵⁸, Finna creates solutions for learning and research, and offers ways to combine information into new entities. Furthermore, Finna offers smart ways to find information, and personalises information retrieval, in a secure way. Finna also aims to support IIIF and 3D materials. All of these objectives could be promoted by the development work carried out under the Time Machine project. Further development of the Finna Classroom, links to open learning materials, and development in supporting lifelong learning, could also provide a framework for Time Machine cooperation.

The Time Machine project focuses on new ways of making materials available, such as 3D and virtual applications. Cooperation with Time Machine could bring new ways for Finna to make materials available, that cannot be implemented within the frames of normal funding of Finna. The Finna Street Search and sustainable development solutions that serve Finna, could be promoted through Time Machine cooperation, as well. Similarly, technologies developed within the Time Machine framework could offer new opportunities for processing Finna's extensive data resources, for example through artificial intelligence.

Open Interfaces and Linked Data

Finna has a harvesting interface (OAI-PMH), which enables the harvesting and processing of the entire content of the Finna index as a mass. Also several other information systems in the National Library of Finland (e.g. Digi, Doria, Finto, and Melinda) offer material dumps and/or open interfaces, through which data can be accessed. A comprehensive and accurate list of open data and interfaces can be found in the National Library's data catalogue⁵⁹, which is developed especially from the perspective of the needs of researchers.

The National Library of Finland possesses extensive knowledge of the theory and standards of linked data. For example, the National Library of Finland is involved in an international

⁵⁸ <https://www.doria.fi/handle/10024/177027>

⁵⁹ <http://data.nationallibrary.fi>

ShareVDE project, that builds a joint linked data infrastructure⁶⁰ for libraries, which could possibly be expanded and further developed within the framework of Time Machine.

The Linked Fennica is a dataset and online service, based on linked data formed by the Finnish National Bibliography Fennica, that has converted the original record-based bibliographic data into a network format (Knowledge Graph) consisting of interlinked entities.

Ontologies

Finto⁶¹ is a service promoting the interoperability and use of linked data, and developing glossaries and ontologies, as well as software that enables their use. Finto ontologies, such as the General Finnish Ontology YSO, and the ontologies of specialised fields linked to it, create a network of machine-readable data that can be utilised in extracting information from the materials.

Finto ontologies combine concepts and data content from different fields, and act as a link when developing interoperable and multidisciplinary services. Often multilingual, Finto ontologies enable information retrieval across language boundaries in various search systems. Finto ontologies are already widely utilised in the GLAM sector and, for example, in public administration agencies.

Skosmos⁶² is a publication platform for linked data glossaries and ontologies, developed in the Finto service. Skosmos enables open and machine-readable publication of Knowledge Organisation Systems, in such a way that the contents are easily linked and utilised, regardless of sector-specific formats. Skosmos is utilised by several international organisations, research projects, and universities.

Finto's ontologies could be further developed, for example, through various event and actor ontologies. These ontologies and the solutions for automated description by the National Library of Finland, could, in the future, be utilised to automatically extract extremely rich data content, that users could complement. By increasing the multilingualism of ontologies, the materials of different language areas could be made more widely available, and the construction of services across language boundaries would be facilitated.

⁶⁰ <https://www.share-vde.org>

⁶¹ <https://finto.fi/en/>

⁶² <http://skosmos.org>

Automated Document Description

Annif⁶³ is an automated document description tool based on language technology and various machine learning models. Its purpose is to enable automated indexing and classification of materials. Annif will be taught with existing text material, based on which it will also learn to recognise keywords or categories from new material. Annif is multilingual, and is not bound to a specific glossary, but can be adapted to different types of classification tasks by selecting appropriate algorithms and pre-processing methods.

Annif has been utilised in the Finto AI service⁶⁴, which provides an automated document description service, especially meant for Finnish document describers. With Finto AI, automated document description, in accordance with the YSO, can be executed in three different languages (Finnish, Swedish, English). Annif is an open-source software that has been utilised worldwide.

Automated subject indexing has also been developed in cooperation with CSC, as part of the High Performance Digitisation project⁶⁵, which is described in more detail in the CSC chapter on page 59. Annif software serves as an automated subject indexing and classification tool in the annotation pipeline developed in the HPD project.

In the framework of Time Machine, Finto AI and automated description services could be further developed to perform, for instance, bibliographic descriptions, in addition to document descriptions. In the same context, image recognition and automated description would also be an interesting development direction.

The NewsEye project⁶⁶ builds tools for the processing of historical newspaper material by means of machine learning. Among other things, the project develops text recognition, article extraction, name extraction, and topic modelling, and creates a personal digital research assistant. The project results may be maintained by the READ cooperative⁶⁷, which also provides related services (e.g. improving text recognition and extracting articles).

Research Services

In its Digital Open Memory project (DAM)⁶⁸, the National Library of Finland develops its data-related research services⁶⁹. The aim is to increase the role of the National Library of

⁶³ <https://annif.org>

⁶⁴ <https://ai.finto.fi/?locale=en>

⁶⁵ <https://www.digime.fi/2020/09/29/high-performance-digitisation-hankkeella-vauhtia-digitaalisten-aineistojen-kuvailuun/>

⁶⁶ <https://www.newseye.eu>

⁶⁷ <https://readcoop.eu>

⁶⁸ <https://www.kansalliskirjasto.fi/en/projects/digital-open-memory>

⁶⁹ <https://blogs.helsinki.fi/thinkopen/kansalliskirjasto-dam-hanke/>

Finland from the service provider to an interactive partner in research. Based on the results of the project, it will be specified in more detail, which data services the National Library of Finland will continue to provide as its own basic service, and which will be provided through other channels, such as the Language Bank of Finland or the FIN-CLARIAH infrastructure, which is under construction. Key questions will be the enriched data produced in the study and its integration into existing services, especially as part of the digi.kansalliskirjasto.fi service.

Various research projects have developed, for example, the automatic classification of images in historical newspapers, the extracting of names from materials, and text recognition, as well as published a large number of related articles. Development work related to name recognition has also been carried out on the basis of the FINER of the FIN-Clarin consortium⁷⁰, which is based on the NER software⁷¹, originally developed in Stanford.

The functionalities developed on the basis of the study have been brought to the digi.kansalliskirjasto.fi service, and the related teaching materials have been published as open data⁷². In addition, related instructions, and examples of how to process files in the ALTO format have been published⁷³. Raw data packages are available from newspaper and magazine materials, and these can be downloaded through the National Library of Finland's Data Catalogue or the open data website⁷⁴ of the digi.kansalliskirjasto.fi service. A pilot self-service tool⁷⁵ has been created for researchers to download data packages.

Europeana

Time Machine project and Europeana have a cooperation agreement⁷⁶. The National Library of Finland acts as the national aggregator⁷⁷ of Europeana, and transmits material from Finnish archives, libraries, and museums to Europeana. For this purpose, the National Library of Finland maintains the Formula service. The National Library of Finland and the organisation using the Formula signed an agreement on the delivery of metadata to Europeana. The National Library of Finland, in turn, has entered into a Data Exchange Agreement with Europeana. The data descriptions of the materials are converted from the original format to Europeana Data Model (EDM) metadata. The Formula service currently supports conversions from LIDO, EAD, MARC, and Dublin Core formats.

⁷⁰ <https://www.kielipankki.fi/organization/>

⁷¹ <https://nlp.stanford.edu/software/CRF-NER.html>

⁷² https://digi.kansalliskirjasto.fi/opendata?set_language=en

⁷³ <https://github.com/NatLibFi/digitalia-notebook>

⁷⁴ <https://digi.kansalliskirjasto.fi/opendata/submit>

⁷⁵ <https://natlibfidigi.gitlab.io/gitbook/>

⁷⁶ <https://pro.europeana.eu/post/europeana-and-time-machine-join-forces-for-a-partnership-promoting-the-future-of-european-cultural-heritage>

⁷⁷ <https://www.digime.fi/en/availability/europeana/>

National Museum of Finland

The National Museum of Finland⁷⁸ operates as part of the Finnish Heritage Agency⁷⁹, under the Ministry of Education and Culture. The activities of the National Museum of Finland are regulated by law. The National Museum has Finland's largest and oldest culturohistorical collections. They contain approximately 550,000 objects, which are the responsibility of the museum's collection and research unit and the Collection Centre. The objects describe Finland's history, folk culture, the culture of Finno-Ugric peoples, and world cultures on different continents. The National Museum of Finland also documents modern culture in Finland. The National Museum of Finland operates in a total of ten sites, and the museum's collections are also displayed in other museums.

The collections of the National Museum of Finland are systematically and actively accumulated. The museum's task is to record the history and reality of all citizens, their memories and objects – regardless of gender, religion, ethnic background, or sexual orientation. The National Museum's strategy is to make collections accessible to the public in a more multichannel way, by utilising new technologies, and developing new operating methods, as well as by promoting the mobility of collections. The aim is to engage in collection work and preservation in interaction with different audiences, by involving the audience in new forms of operation and on various online platforms.

Digital Collection Website

A Digital Collection section⁸⁰ has been opened on the website of the National Museum of Finland, to present already digitised materials curated by theme, together with information and stories related to the objects. In the first phase, the site has about 200 items opened with CC licenses for the most open use possible. The site covers five themes: faces, transition rites, clothing, animals, and the sea. The site also offers entertaining elements, for instance, puzzles can be built from objects and they can be coloured.

In the future, theme content will be produced both curated by researchers and according to the wishes of the audiences. In addition to the themes, the website contains a separate section for the objects displayed at the National Museum of Finland exhibitions. At the moment, the website contains articles from the National Museum's updated permanent exhibitions: Prehistory, Otherland, and Story of Finland.

⁷⁸ <https://www.kansallismuseo.fi/en/>. Interwee Leena Furu-Kallio, 3 June 2020.

⁷⁹ <https://www.museovirasto.fi/en/>

⁸⁰ <https://www.kansallismuseo.fi/en/digitaalinen-kokoelma-1-1>

MuseumPlus

The collection management system of the National Museum of Finland is called MuseumPlus, which contains information on the description of objects and related attachments, such as image and PDF files. The system also contains, for example, information on the conservation of the objects. The Finnish Heritage Agency utilises the same system to manage its picture collections and archaeological collections.

MuseumPlus serves as a customer interface (with limited user rights) at the premises of the Finnish Heritage Agency. Finna and the Finna views, of the National Museum of Finland and of other units of the Finnish Heritage Agency, act as public customer interface.

3D Digitisation Project

In 2018–2019, the Finnish Heritage Agency had a 3D digitisation project funded by the Ministry of Education and Culture. The project was divided into three work packages, the first of which improved the interoperability and usability of digital archaeological cultural heritage by producing and publishing consistent glossaries and concepts. The description of archaeological cultural heritage will become more consistent by using the glossaries produced in the work package, regardless of the operator. The second work package planned how cultural heritage information, such as objects and images, can be automatically transferred from the Finnish Heritage Agency's MuseumPlus collection management system to the Digital Preservation Service for Cultural Heritage (DPS). A tool called Passari was developed for transferring file packages.

The third work package designed and implemented the entire process of 3D digitisation from the selection of topics to the publication. The pilot project examined what types of objects are suitable for 3D digitisation, how the 3D digitisation process is, what skills, equipment, and software are needed, as well as how 3D models can be published online to everyone. The piloting created sufficient knowledge of 3D model production processes, and their necessity and possibilities, for the Finnish Heritage Agency and for the field in general.

The Finnish Heritage Agency has opened a selection of 3D models online in the Sketchfab service⁸¹. In cooperation with the National Library of Finland and other museums, the Finnish Heritage Agency develops solutions for publishing 3D models in Finna.

⁸¹ <https://sketchfab.com/Museovirasto>

Mass Digitisation

A mass digitisation development project is currently under way at the Finnish Heritage Agency, the purpose of which is to get the collections from the Finnish Heritage Agency increasingly online for everyone to see, experience, explore, or reuse.

The Finnish Heritage Agency has been digitising materials since the 1990s, yet only a small proportion of the collections have been digitised thus far. Digitising collections requires a lot of expertise and manual work. In particular, describing and entering files into the system has taken a lot of time. The purpose of the mass digitisation project is to better integrate hardware and software, in order to automate a part of the phases of the digitisation process.

In the future, the mass digitisation methods developed in the project can be utilised nationally, and they can be applied in cooperation across Europe. After the project has been completed, the instructions for mass digitisation will be published in the avoindata.fi ("open data") service. The technical documentation for long-term preservation, or the Passari service, has already been published openly in the GitHub service.

At the National Museum of Finland, digitisation is developed and coordinated as part of the activities of the Finnish Heritage Agency. In the future, it would be a good idea to find out how the mass digitisation of the National Museum of Finland and the Finnish Heritage Agency could be made more efficient, with the new digitisation methods and technologies developed in the Time Machine project. Potential development of text and object recognition through Time Machine, automatic annotation, could promote the automatic formation and enrichment of metadata at the National Museum of Finland and the Finnish Heritage Agency. Additionally, the extensive and versatile materials of the National Museum of Finland and the Finnish Heritage Agency offer excellent test material for testing new methods and technologies.

Long-term Preservation

Alongside the mass digitisation project, the long-term preservation of cultural heritage has been developed as a separate work package. Currently, the systems of the Finnish Heritage Agency contain versatile information on archaeological cultural heritage and built cultural environments, which include, for example, reports, text and image materials, and their metadata. In the future, the data will be increased with archaeological 3D data.

The aim was to implement a technical solution that is as automated as possible, and that will be used to transfer cultural environment information to the Digital Preservation Service for Cultural Heritage (DPS). In 2019, the Finnish Heritage Agency produced a solution called Passari alongside the collection management system MuseumPlus. Passari will

automatically package and transfer image and object collection materials to long-term preservation.

At the end of the project, all outputs of the work package, such as standard specifications, data model, and programme code, are openly available online and can be utilised and further developed by other organisations.

Local Time Machine

The mission of the National Museum of Finland and the Finnish Heritage Agency is to serve the entire Finland. From their perspective, it would be important that the Local Time Machine services (LTM) developed in Finland, would be distributed in a sufficiently diverse manner across Finland. The National Museum of Finland and the Finnish Heritage Agency have materials that provide opportunities for various local LTM services. The materials of the National Museum could also be used to build links between LTM services located in different parts of Finland, for example from the perspective of certain themes, dates, or persons.

In addition to national projects, the National Museum of Finland and the Finnish Heritage Agency are also interested in international projects, which utilise the materials of the National Museum and the Finnish Heritage Agency, as well as develop their production and further provision.

The People's Archives

Digital Materials

The People's Archives⁸² does not systematically digitise documents, as there is currently no system for the storage and distribution of digitised material to customers online. Sound recordings have been digitised in a project-like manner for rescue purposes. If necessary, the digitised documents and recordings are manually transferred to the client terminals.

The digital files, produced in the so-called instant digital project and in the joint projects of Private Archives Association, are stored in the Disec⁸³ service. They will later be transferred to the Digital Preservation Service for Cultural Heritage. A part of the digitised material is stored on the People's Archives' own online data storage or external hard disks.

⁸² <https://www.kansanarkisto.fi/in-english/>. Marita Jalkanen and Pia Pursiainen, 5 June 2020.

⁸³ <https://disec.fi/in-english/>

The People's Archives are included in the AHAA service⁸⁴ for documents, and in the arjenhistoria.fi ("history of daily life") service⁸⁵ for images and posters, which is a joint e-portal of the Finnish Labour Museum Werstas, the Labour Archives, the People's Archives, the Museum of Technology, the Electricity Museum Elektra, the Helsinki University Museum, the Päivälehti Museum, the Finnish Emigrant Museum, and the Gold Museum. It contains extensive collections of objects and photographs related to the themes of working life, industry, technology, science, history of higher education, the labour movement, and social history. For the time being, arjenhistoria.fi contains only a small proportion of the collections of the organisations. During spring 2021, the production base of arjenhistoria.fi will be renewed from eKuva to Collecte⁸⁶.

The digitised photographs of the People's Archives are also available through Finna. Some are marked with a watermark for copyright reasons. The aim is to switch to CC licenses as widely as possible.

Development Needs

The sharing of digitisation experiences and good practices would be needed in the People's Archives. A system for the reception, processing, storage, and use of digital material would also be needed. In this respect, an AADA service ("Digital Material Management of Archives") has been initially planned with SKS and the Music Archive Finland.

Local Time Machine

Local Time Machine, covering the entire Finland, may be too extensive, as people's identity is often tied to a regionally restricted location, such as a region or a city. For example, the People's Archives contain materials related to Vyborg, such as photographs and oral history. In 2018, an exhibition was produced in cooperation with the Lenin Museum of Vyborg, which was displayed in both Vyborg and Finland.

Finnish Folk Music Institute

Finnish Folk Music Institute⁸⁷, which operates in the Folk Art Centre in Kaustinen, promotes folk music and folk dance in Finland. Its main tasks include research, preservation, archiving, information and publication activities, education and museum activities, and

⁸⁴ <https://arkisto.fi/ahaa-palvelu>

⁸⁵ <http://www.arjenhistoria.fi>

⁸⁶ <https://collecte.pics/blogi/>

⁸⁷ <https://kansanmusiikki-instituutti.fi/en/>. Interviewee Outi Valo, 3 November 2020.

cultural policy influencing. Finnish Folk Music Institute is an accredited expert organisation in the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage.

Materials and Databases

The archive of the Finnish Folk Music Institute⁸⁸ is the largest Finnish archive specialising in folk music and folk dance. The collection includes approximately 5,600 hours of sound recordings, 1,500 hours of AV recordings, 30,000 photos, and 100,000 newspaper clippings. The collections of the Finnish Folk Music Institute reference library include approximately 5,000 volumes, and over 2,700 audio discs, as well as a wide variety of magazines in the field.

The reference data of the archive's digitised sound recordings, audio publications, book and note collections, digital and digitised photographs, and the data of the musical instrument collection of the Museum of Traditional Folk Instruments have been stored in the Kansan ääni ja kuva ("people's voice and image") database⁸⁹. Access to the database requires a username and password that can be obtained by fulfilling the Terms of Use Agreement. The digitisation of the archive collections is still ongoing.

Kaustinen Folk Fiddling Tradition

The Ministry of Education and Culture has proposed the Kaustinen folk fiddling tradition⁹⁰ to UNESCO's Intangible Cultural Heritage list. The proposal was prepared by the Finnish Heritage Agency in cooperation with the communities practising the tradition. As a local tradition, the Kaustinen folk fiddling is strong and vibrant. Material related to the tradition has been stored not only in the Finnish Folk Music Institute, but also in the Tampere Folklife Archives, the SKS archives, and the Vaasa Provincial Archives.

The intangible and tangible cultural heritage associated with the Kaustinen folk fiddling, could provide a good basis for a Local Time Machine service.

Pelimanni 8bit

Pelimanni 8bit⁹¹ is a fantasy game implemented according to the style of classical game consoles. The game is based on folk stories and violin music. The Pelimanni 8bit game, published by the Finnish Folk Music Institute, was implemented by Jimmy Träskelin, and it is based on the 8-bit partiture of Antti Janka-Murros. The game can be downloaded from Apple and Google app stores.

⁸⁸ <https://kansanmusiikki-instituutti.fi/en/arkisto-ja-kirjasto/>

⁸⁹ <http://kaustinen.collecte.fi/admin/login.php?page=%2Fadmin%2Findex.php%3F>

⁹⁰ <https://kaustislainenviulunsoitto.wordpress.com>

⁹¹ <http://www.pelimanni8bit.fi>

Genius Loci

Based on the materials of the Finnish Folk Music Institute, the Genius Loci service has implemented a "Village Route of Chiming Stones"⁹². The Genius Loci project package⁹³ combines research and development in humanist and social sciences, as well as ICT development work. The tangible and intangible cultural heritage placed on the Geni Loci website, offers residents and visitors sites for independent adventure and tourism, in historic Central Ostrobothnia.

Genius loci ("site spirit") is enriched by historical sites, facts, legends, and stories, as well as content rich route packages. The project has produced nearly 900 site reports and 10 cultural heritage routes from the historical Central Ostrobothnia. The three-language website (Finnish, Swedish, English), and its contents and IT solutions, have been built by a working group of the Kokkola University Consortium Chydenius. Local home region teams have also been actively involved in route planning.

Other Development Projects

The Finnish Museum of Traditional Folk Instruments⁹⁴ is currently testing a virtual joint play with Folk Music Band Tallari (virtual glasses), and Pelimannin Penkki (the instruments to be played are Finnish zither and harmonium, and the playing instruction videos implemented for them).

In connection with villages in the Kaustinen area, virtual walks have been initially planned, in which historical data, such as archive recordings and photographs, could be combined with the map. Currently, the idea is being piloted as a poster board, which has been implemented at the Folk Art Museum, which contains audio samples from eight different sites.

In connection with her doctoral dissertation, Outi Valo has added the location coordinates and utilised the OpenStreetMap application, for the Tampere Folklife Archives. The contents of the Digital archive of Finnish Folk Tunes⁹⁵ at the University of Jyväskylä, have also been presented map based. This material could provide opportunities for building Local Time Machine services.

⁹²

https://geniusloci.chydenius.fi/index.php?option=com_content&view=article&id=356&Itemid=551&lang=en

⁹³ <https://geniusloci.chydenius.fi/index.php?lang=en>

⁹⁴ <https://kansanmusiikki-instituutti.fi/en/suomen-kansansoitinmuseo/>

⁹⁵ http://esavelmat.jyu.fi/index_en.html

The archives of the Finnish Folk Music Institute contain interesting materials for various LTM services, such as those from the Skolt Sámi region.

Lingsoft

Lingsoft⁹⁶ has developed its own language management tools, as well as terminology and subject word solutions based on language structure analysis. Lingsoft technologies can, for example, be utilised to produce various accessibility services. Named items can be automatically identified and subject indexed using ready-made ontologies. Lingsoft solutions are based on a Two-Level Morphology (TWOL) model, enabling the introduction of new languages. Currently, Lingsoft offers basic text recognition in several languages, as well as speech recognition in Finnish, Swedish, and Norwegian (Bokmål).

Lingsoft has cooperated widely with various cultural heritage materials and organisations. For example, the book recommendations of Ellibs, belonging to the same concern, are based on Lingsoft technology. In addition, Lingsoft has participated in national ontology projects. The NameSampo⁹⁷, in the company's internal use, is based on prototypes utilising semantic technology, published by the Aalto University SeCo group. The Semantic Computing Research Group (SeCo) was established at the University of Helsinki, in 2002. Today, the research group is part of the Aalto University Department of Computer Science. The group's research focuses on semantic technologies, such as Semantic Web, open linked data, and smart web services, whose application areas include cultural heritage, digital humanities, health, law, biology, administration, marketing, and learning.

Lingsoft is one of the largest language service companies in the world⁹⁸. It has provided Finnish language translation services to the European Commission for nearly 20 years. Within the framework of the four-year contracts concluded in summer 2020, Lingsoft will submit the Finnish and Swedish translations of the European Commission documents until spring 2024. Since 2018, Lingsoft has also been responsible for the provision of summaries on EU regulations, to the Publications Office of the EU, in all official languages.

Accessibility

Lingsoft's Speech Recognition service⁹⁹ is based on a structural analysis of Finnish language, combined with versatile language models, which can also be tailored to recognise the special terminology of limited professional languages. Lingsoft's solution is speaker independent and does not need to be trained separately. The solution can be integrated

⁹⁶ <https://www.lingsoft.fi/en>. Interviewees Ossi Tuusvuori and Mervi Koivulahti, 17 June 2020.

⁹⁷ <https://seco.cs.aalto.fi/projects/nimisampo/>

⁹⁸ <https://www.nimdzi.com/nimdzi-100-top-lsp/>

⁹⁹ <https://www.lingsoft.fi/en/solutions/speech-recognition>

with other systems through interfaces. Speech recognition can be performed in real time, but the service also recognises existing audio files. For the Finnish Broadcasting Company (YLE) and Sweden's Television Stock Company (SVT), for example, speech recognition-based subtitling has been utilised for video material.

Lingsoft's speech recognition service can be utilised to promote the accessibility of cultural heritage materials¹⁰⁰. Video subtitles and podcasts' text equivalents in Finnish, Swedish, and English are created in cooperation between humans and machines. In 2018, Lingsoft has even developed a solution based on Lingsoft's language technology, together with the Digital and Population Data Services Agency, to enhance the linguistic accessibility of the Suomi.fi Finnish Service Catalogue¹⁰¹.

MeMAD

In 2018–2020, Lingsoft participated in the EU research project MeMAD¹⁰², which sought methods for utilising artificial intelligence in the media sector, for example, in describing, translating, and subtitling video material. In the project, Lingsoft focused especially on the further development of speech recognition in Finnish and Swedish, speaker recognition, and the subject indexing of the material. The MeMAD project is described in more detail in the Finnish Broadcasting Company (Yle) chapter on page 72.

Local Time Machine

Lingsoft activities are not site or language-specific, therefore the technologies it develops can be utilised in various national Local Time Machine projects. One possible LTM target could be the "4Castles", i.e. Finland's medieval castles (Turku Castle, Häme Castle, Olavinlinna Castle, and Vyborg Castle).

Additionally, Lingsoft is interested in LTM projects aimed at various user groups, such as learning environments produced for schools, or the production of memories for the elderly in a multi-sensory manner. These could utilise the accessibility services offered by Lingsoft.

Local Time Machine could join the ontology based – Finna, Europeana, and Digital Humanities – "Suomi-pediaAR" platform, for existing digitised materials, which would include dynamically developing customised applications such as Transkribus, Speech Service, machine translation and semantic analysis, 3D and 360-degree digitisation and, for

¹⁰⁰ <https://www.lingsoft.fi/en/services/subtitling>

¹⁰¹ <https://dvv.fi/-/automaattisesti-parempi-suomi-fi-lingsoft-ja-vaestorekisterikeskus-parantavat-kiellellista-saavutettavuutta-kieliteknologian-avul-1>

¹⁰² <https://memad.eu/>

example, AR, VR, XR, and Gamification. Users could add content according to a certain protocol, including crowdsourcing.

Other Development Ideas

Cooperation within the Time Machine project will be facilitated by the fact that all Lingsoft digital services have been implemented as interfaces, thus they can easily be integrated with new or existing services. Lingsoft has long-standing expertise, and could add value to various international projects, that develop different Natural Language Processing technologies, such as text analysis, ontologies, speech recognition, speech production and enrichment, as well as automatic translation.

Navigation based on natural language could be utilised in the virtualisation of museums. For example, a virtual twin could be created from the original museum room, where speech is used to navigate, and which can be enriched, for example, by image and sound.

Music Archive Finland

Music Archive Finland¹⁰³ is a national central archive that preserves material related to Finnish music, with the exception of art music and folk music. Music Archive Finland is an association and non-profit private archive. It serves researchers, as well as other people interested in the history of Finnish popular music.

Music Archive Finland collects, stores, and makes available especially unique material. There are approximately 1,200 shelf metres of material. The collections are comprised of some 450 personal and community archives, which consist of materials such as recordings, videos, photos, interviews, notes, manuscripts, music magazines, contracts, and letters handed over by music authors, researchers, journalists, enthusiasts, as well as music communities.

Digital Materials

Music Archive Finland is a digitisation expert, whose specialist area is analogue recordings, such as open reel tapes, C cassettes, and video tapes. Digital recordings such as Minidisc discs, DATs, and MiniDV videos are also transferred to the Music Archive Finland's digital long-term preservation system.

In the early 2000s, Music Archive Finland was already involved in the digitalisation and information management project for scientific audio archives. Even internationally

¹⁰³ <https://musiikkiarkisto.fi/music-archive-finland.php>

speaking, Music Archive Finland is an expert in digitisation. It also participated in the TAPE (Training for Audio-visual Preservation in Europe) project¹⁰⁴ 2004–2008.

Music Archive Finland currently contains approximately 50 TB of digital material. Most of them are recordings or video recordings. Digital materials are stored in the Music Archive Finland's own long-term preservation system on RAID hard drives and LTO tapes. The materials will be transferred to the Digital Preservation Service for Cultural Heritage in the near future.

As a rule, Music Archive Finland does not own copyrights to its materials. Exceptions include interview materials and a small proportion of photographs.

Databases

Music Archive Finland currently deploys four databases. Since 1998, sound recordings, videos, printed notes, and note manuscripts have been described in the libraries' joint databases, first in Viola and, since 2020, in Melinda¹⁰⁵. The description data will be harvested from Melinda to Finna.

The other archive material will be described in the AHAA service¹⁰⁶, offered by the National Archives of Finland, which was introduced in autumn 2019. Currently, archive lists are described in the AHAA service. In the future, the description data stored in the AHAA service will also be displayed in Finna.

The general collection of Music Archive Finland includes a reference library, a collection of music magazines, and an interview collection, and these are listed in the Skaala database¹⁰⁷, which is available through the Music Archive Finland website.

In 2020, a widely used database of the Finnish National Sound Archive, which covers all Finnish recordings between 1901–1999, was transferred to the Music Archive Finland server with search functions and discography data. In addition to performers, songwriters, composers, and arrangers, pseudonyms and, for example, recordings made in a specific year can be retrieved from the Fenno database¹⁰⁸.

¹⁰⁴ <http://www.tape-online.net>

¹⁰⁵

https://melinda.kansalliskirjasto.fi/F/KPC31KUVL1DKIQ9ICI26YULHLFF25PTNATVQ9L9CRS43BGUC-TX-01384?func=option-update-lng&file_name=find-b&F2=pc-latin&P_CON_LNG=ENG&local_base=fin01_opac

¹⁰⁶ <https://arkisto.fi/ahaa-palvelu>

¹⁰⁷ <https://skaala.musiikkiarkisto.fi/kokoelmat-arkistot/>

¹⁰⁸ <https://fenno.musiikkiarkisto.fi/>

Open Access

Music Archive Finland has its own Open Access publishing activity¹⁰⁹. A few research materials have been opened in table format in the Open Data service¹¹⁰. Digital books have been published on the OA website of the Music Archive Finland. Interviews and video recordings, such as seminar presentations, have been published on the Music Archive Finland YouTube channel¹¹¹. The publishing of photographs in Wikimedia Commons is planned to start in the near future.

AADA

The Music Archive Finland is involved in the AADA project (Digital Material Management of Archives), the aim of which is to implement a joint service that meets the demands related to the management of digital materials in private archives. AADA would include functions for receiving and processing digital material, as well as for managing user copies, and making them available for long-term preservation.

AADA would be seamlessly linked to existing joint services for availability and preservation (e.g. AHAA, Finna, and Digital Preservation Service for Cultural Heritage). In addition, other existing or emerging services such as SAPA, Researcher Hall Finna, and the Memoriaali project, will be considered in the design of AADA. The AADA service follows the overall architecture of the cultural heritage sector, and the archive sector's own reference architecture.

Open Knowledge Finland

Open Knowledge Finland¹¹² and its OpenGLAM group¹¹³ represent open solutions in the cultural heritage field. The OpenGLAM group works in cooperation with Wikimedia Finland¹¹⁴. The objective is to promote the utilisation of open projects, in the sharing of cultural heritage and public participation. These include Wikimedia Foundation's Wikipedia, Wikidata¹¹⁵, and Wikimedia Commons¹¹⁶, as well as OpenStreetMap¹¹⁷.

¹⁰⁹ <https://musiikkiarkisto.fi/oa/>

¹¹⁰ https://www.avoindata.fi/data/en_GB/organization/musiikkiarkisto

¹¹¹ <https://www.youtube.com/channel/UCaTFnLfimy0rzt8p44n70bA>

¹¹² <https://www.okf.fi/fi/>. Interviewee Susanna Änäs, 8 December 2020.

¹¹³ <https://avoinglam.okf.fi>

¹¹⁴ <http://wikimedia.fi>

¹¹⁵ https://www.wikidata.org/wiki/Wikidata:Main_Page

¹¹⁶ https://commons.wikimedia.org/wiki/Main_Page

¹¹⁷ <https://www.openstreetmap.org>

OpenGLAM also promotes the utilisation of open digital environments and licenses, such as Creative Commons¹¹⁸.

OpenGLAM supports memory organisations in their transition to the utilisation of open digital environments and licenses. It aims to influence the consideration of open cultural heritage in legislation. OpenGLAM implements projects, campaigns, and events, which promote the publication, discovery, reuse, and enrichment of open cultural material. It strives to promote the creation of an open and equal public debate and history writing.

OpenGLAM also supports cultural and linguistic diversity, by working to revive under-represented languages, and to ensure responsible sharing of Traditional Knowledge, as well as by cooperating with various language communities. For example, Wikimedia Finland works with the Sámi communities, and influences the operating preconditions of small language communities, in international information networks. Wikipedia in Inari Sámi¹¹⁹ is an initiative of the language community itself.

The aim of the OpenGLAM Group is to participate in the development of Traditional Knowledge (TK) labels¹²⁰ that identify and clarify community-specific rules. Traditional Knowledge may include, for example, holy and/or ceremonial material, or gender-restricted material. The TK Label specifications are intended to be customised by the communities themselves, and enable indigenous peoples to determine the availability and future use of their own traditions.

Wikidata is a project of the Wikimedia Foundation, that responds to the needs of the cultural heritage field, for example by enabling the linking of collection data to other open cultural heritage materials, through authority tags. Furthermore, Wikidata provides a stable platform for preserving and processing data through community care. Wikimedia Commons offers similar possibilities for media files. However, utilising linked data and linking it to the data of cultural heritage organisations, is still just in the beginning at Wikimedia Commons¹²¹.

Creative Commons Search¹²² collects open media files from cultural heritage organisations into its index (CC Catalog). It enables centralised access to open media materials. Although, OpenGLAM does not directly represent the MyData organisation¹²³, it still wants to promote MyData thinking to share cultural heritage and related privacy issues.

¹¹⁸ <https://creativecommons.org/>

¹¹⁹ <https://smn.wikipedia.org/wiki/Ovdâsijđo>

¹²⁰ <https://localcontexts.org/labels/traditional-knowledge-labels/>

¹²¹ https://commons.wikimedia.org/wiki/Commons:Structured_data

¹²² <https://search.creativecommons.org>

¹²³ <https://mydata.org>

Wikidocumentaries

Wikidocumentaries¹²⁴ is a demo wiki for a "small" history, where you can gather history traces and turn them into stories. Wikidocumentaries combines open platform information (Wikidata), with data managed by cultural heritage organisations (Finna, Wikimedia Commons, Flickr, Creative Commons Search, Europeana). Wikidocumentaries also provides tools for improving content. Currently, articles can be translated between different languages using the Content Translation tool¹²⁵. Subject indexing and image location with Wikidata are under development. Wikidocumentaries has been launched as an Open Knowledge project, and it will continue as an open-source community project.

Development Ideas

The OpenGLAM Group is interested in developing legislation in transforming areas (e.g. artificial intelligence), and monitoring regulation together with Creative Commons and other international networks of open data. The Time Machine project could contribute to enhancing international cooperation in this area. The Time Machine network could also promote the large-scale deployment and development of Creative Commons licenses, and Rights Statements¹²⁶, as well as MyData, in systems.

The OpenGLAM work has gained valuable experience in crowdsourcing and producing information on open platforms, which could serve the Time Machine project. Models for participation have been tested in Wikimedia projects (e.g. Wiki Loves Monuments¹²⁷), or in the hackathons¹²⁸ of open cultural heritage. The OpenGLAM Group also plans to promote experimental and educational activities of cultural heritage organisations under the heading 'GLAM Lab'. Centralised GLAM Lab activities could also enable smaller institutions to remain involved in the development of digitalisation.

The Time Machine project could promote multilingualism using, for example, Wikimedia technologies. The Sámi community is Europe's only indigenous community; therefore it plays a key role in studying the models of sharing Traditional Knowledge, in the digital world. The OpenGLAM group is planning to launch a joint project with the National Library of Finland, to support the Sámi languages of Finland.

¹²⁴ <https://wikidocumentaries-demo.wmflabs.org>

¹²⁵ https://www.mediawiki.org/wiki/Content_translation

¹²⁶ <https://rightsstatements.org/en/>

¹²⁷ <http://wlm.wikimedia.fi/en/about-the-contest/>

¹²⁸ See for example <https://summit.creativecommons.org/hack4openglam-dashboard/#/>

Päivälehti Archives and Museum

Materials

In the Päivälehti Archives¹²⁹, the materials have been described and preserved in the Yksa service¹³⁰, offered by Disec. Since spring 2020, older digitised material with no restrictions on use has been published in Yksa. In the future, the Yksa materials will also be available in Finna.

An internal magazine and image database of Sanoma is also used, which contains a large number of materials that are not publicly available. These include an abundance of photographs and AV materials. The majority of the digitisation of archive material has been outsourced, but photographs are also digitised independently.

The collections of the Päivälehti Museum¹³¹ are stored in the Collecte system¹³², through which they have been published in Finna. The museum collections are digitised independently, and described, in accordance with the instructions of Collecte and Finna.

With regard to the digitisation of museum collections, participation in the joint project of 3D digitisation¹³³ has been made, which includes the Postal Museum, Forum Marinum, Päivälehti Museum, Finnish Railway Museum, Mobilia, and the Museum of Technology. Each museum has described and modelled museum objects for education and exhibition use, as well as produced applications for their 3D models. 3D modelled materials can be used in teaching, research, and recreational activities. The finished 3D material has also been productised as sales products for museum shops. The 3D models have been published in the Sketchfab service¹³⁴, and will later be published in Finna.

Development Needs

More extensive cooperation would be needed from the perspective of the technical solutions of digitalisation and the processing of digital material. One of the possibilities highlighted was that Time Machine cooperation could also be participated as a broader group, through Collecte or Yksa, for example.

¹²⁹ <https://www.paivalehdenarkisto.fi/in-english/>. Interviewees Johanna Mieto and Janne Ridanpää, 26 August 2020.

¹³⁰ <https://disec.fi/in-english/>

¹³¹ <https://www.paivalehdenmuseo.fi/en/>. Interviewee Saila Linnahalme, 26 August 2020.

¹³² <https://collecte.pics/blogi/about/>

¹³³ <https://trafiikki.fi/best-practices-and-practices-for-3d-storage-of-museum-objects/>

¹³⁴ <https://sketchfab.com>

New technical solutions for the processing of digital material could, for example, offer opportunities for automatic anonymisation of the materials, in which case materials that are currently limited to demonstration or use could also be made available.

Supporting Research and Education

Promoting research and education is a key aspect. The Päivälehti Archives and Museum's asset is its diverse customer base. Archive materials are utilised especially by researchers, while the museum has various customer groups, perhaps the most important of which are schoolchildren. What creative new ways, such as games, could be used to highlight cultural heritage and attract new customers? It would be important to involve future end users in the planning of Time Machine.

Local Time Machine

In implementing Local Time Machine, the goal must be sufficiently ambitious. A thematic or location-specific approach could help users better understand, how many organisations can have fragmented material, related to a specific theme or location. A perspective related to a certain group of users, such as schoolchildren, could also be a meaningful starting point. For the Päivälehti Archives and Museum, themes related to media, or printing, and newspaper history are interesting.

Muisti Centre of War and Peace

The Muisti Centre of War and Peace¹³⁵, which opens in spring 2021, is a science centre that in its interactive exhibitions depicts war to promote peace. The Muisti Centre of War and Peace Ltd, public utility company is responsible for the operative activities of Muisti, with its areas of responsibility the marketing and development of the Centre's services, the implementation of exhibitions describing the phenomena and impacts of war and peace, as well as the provision of the Centre's services (learning materials, events, shop, and conference services).

Virtual Combat Experience

The virtual combat experience¹³⁶ offered by Muisti, is an internationally unique service, in which a visitor to the exhibition can use the virtual experience to get to the front line of the battles. The aim is to create a war experience that is as realistic as possible, in order for a present-day guest, living in peace, to identify with what the soldier who fought in the front

¹³⁵ <https://www.muisti.org/?lang=en>. Interviewees Olli-Pekka Leskinen and Pia Puntanen, 20 August 2020.

¹³⁶ <https://www.muisti.org/muistin-vuosi-2020/>

line could have felt. The virtual combat experience is implemented by Teatime Research. First, based on research, a world of February 1940 will be created.

Stories

In the Stories section¹³⁷, the visitor can choose one person in whose shoes he or she walks through the war. There are six stories to be selected from, at the opening exhibition, but more stories are aimed to be produced every year. At the end of 2021, the exhibition section will be supplemented by a game section, in which the exhibition visitors themselves can influence how the story progresses.

Noheva Content Management System

Noheva¹³⁸ is a dedicated content management system at Muisti, that allows staff to manage exhibitions. Noheva also presents the contents of Muisti exhibitions in various digital forms. Noheva works on all digital devices in Muisti (e.g. monitors and projectors), that inform the visitor about the human being in the war.

RFID tags can provide individual experiences based on visitors' preferences and choices. Data collection based on RFID tags, provides valuable information for the development of future exhibitions, but the visitor also receives the collected data for themselves if they so wish. It allows him/her to see what solutions and choices he/she has made, for example in terms of game content, and to compare his/her solutions with the experiences and choices of other visitors.

Before starting the Noheva development, Muisti tested more than 30 software available on the market but was not able to find one suitable for their needs. Noheva has been developed together with GoFore and Metatavu. The Museums of the city of Mikkeli are part of the project, and the system will also work in the premises of the Headquarters Museum.

Memoriaali

Muisti participates in the developing of the Memoriaali online service¹³⁹, together with Mikkeli Development Miksei, the Central Archives for Finnish Business Records, and South-Eastern Finland University of Applied Sciences Xamk. All participants in the Memoriaali project are members of the Time Machine Organisation.

¹³⁷ <https://yle.fi/uutiset/3-11470096>

¹³⁸ <https://www.muisti.org/noheva-mahdollistaa-muistin-nayttelyt/>

¹³⁹ <https://www.muisti.org/memoriaali/>

From the point of view of Muisti, Memoriaali enables crowdsourcing of archive material and data related to war history. The aim is to bring citizens' private war material alongside public and official material. Memoriaali collects, distributes, and preserves material related to war history in a digital archive. The first development phase of Memoriaali, began at the beginning of October 2020, and ends at the end of 2021. So far, development has focused on Memoriaali's key functionalities, such as file downloads and search functions.

Learning Plan

Muisti produces learning materials¹⁴⁰ on the themes of war and peace, for schools and educational institutions. The aim is to encourage students to reflect on issues related to war, peace, and humanity, as well as to guide them to critical thinking. In its learning materials and exhibition pedagogy, Muisti relies on national curricula. At present, the learning plan in the form of article collection is divided into two sections, the first of which deals with the themes of war, peace, and remembrance, and the second with learning, learners, and science centres. In the future, material on each new exhibition site will be attached to the learning plan.

Finnish Literature Society

The Finnish Literature Society (SKS)¹⁴¹ is a scientific club and a non-profit association, that collects and preserves Finnish culture and cultural heritage. SKS has an archive and a library, in addition to which it is the largest humanist publisher of openly available science books, in Finland. The collections of the SKS archive contain material in the fields of tradition and modern culture, as well as of literature and cultural history. The SKS library is a specialised scientific library open to everyone, the key areas of which are cultural research and literature research. SKS has a lot of content expertise, but also long-term experience in developing digital infrastructures for cultural heritage organisations (e.g. AHAA, Finna, and Finto).

Digital Materials

Avoin Kalevala¹⁴² ("open Kalevala") contains two parts, the first of which includes the poems 1–15 of Kalevala (New Kalevala), which appeared in 1849, and Lönnrot's forewords for the New and Old Kalevala (1835). The second part contains the poems 16–50 of Kalevala from 1849. All poems and forewords of Kalevala can be read as an image of a printed book, transcripts of text, and fax images of a manuscript.

¹⁴⁰ <https://www.muisti.org/opettajalle/>

¹⁴¹ <https://www.finlit.fi/en>. Interviewees Heli Kautonen, Outi Hupaniittu, Kirsi Keravuori, and Maria Niku, 8 June 2020.

¹⁴² <http://kalevala.finlit.fi>

Almost all traditional Kalevala poetry, stored in archives and found in written sources, was published in the volumes of the Suomen Kansan Vanhat Runot (SKVR) ("Old Poems of the Finnish People") work. SKVR has been digitised in its entirety. The database, which is freely available, contains the entire SKVR, nearly 90,000 poems. The database also includes the SKVR poetry directory.

The SKVR database¹⁴³ relates to a broader project by the SKS, to provide large data sets available for research in a digitised form. In addition to the SKVR publication, the unprinted Kalevala-length poetry material of the Folk Poetry Archive has been digitised, and is available in the archive facilities of the SKS. Runosong recordings have been notated and transcribed in the runosong project.

In Estonia, some Estonian poetry texts have been digitised with the support of SKS. There is an open database of poetry texts¹⁴⁴, which is largely similar in structure to the SKS database. Kalevala and folk poetry materials offer opportunities for international cooperation in other respects, as well, for example, these materials can be combined with similar international materials or services.

SKS has also published Aleksis Kivi's *Heath Cobblers*, of the critical editions of Kivi, as a digital edition¹⁴⁵. In addition to critical editions, an extensive electronic material on Kivi's writings, the Aleksis Kivi corpus (SKS), has been edited by the SKS, and is available in the Language Bank of Finland¹⁴⁶. SKS has also published the correspondence¹⁴⁷ of Elias Lönnrot in digital format. The web service includes letter faxes and transcripts, which have been complemented with annotations.

The SKS website contains links¹⁴⁸ to catalogues and directories of SKS material, as well as to data bases and other online sources relevant to cultural research and research in Finnish literature. Furthermore, information packages¹⁴⁹ have been compiled on the SKS website, for example in relation to Elias Lönnrot, J. L. Runeberg, and Juhani Aho.

¹⁴³ <https://skvr.fi/>

¹⁴⁴ <http://www.folklore.ee/regilaul/andmebaas/?ln=en>

¹⁴⁵ <http://elias.finlit.fi/nummisuutarit/>

¹⁴⁶ <https://korp.csc.fi/>

¹⁴⁷ <http://lonnrot.finlit.fi/omeka/>

¹⁴⁸ <https://www.finlit.fi/en/archive-and-library-services/collections-and-information-sources/online-information-sources>

¹⁴⁹ <https://www.finlit.fi/en/find-it-web/information-packs>

Personal Histories

In addition to the actual National Biography, the National Biography of Finland website¹⁵⁰ contains databases on economic influencers, generals, and admirals, as well as in the Finnish clergy 1800–1920. There are nearly 6,500 biography articles in the National Biography of Finland, and the collection is continuously updated and complemented.

The National Biography of Finland form the core material in Biografiasampo¹⁵¹, which enables the research of Finnish biographies, individuals, and groups of individuals, using methods of digital humanities. The National Biography of Finland and other databases, a total of approximately 13,000 biographies, have been enriched with other external materials. The system was developed by Aalto University's Semantic Computing Research Group and the Helsinki Centre for Digital Humanities (HELDIG) of the University of Helsinki. In the Biografiasampo, a set of data analytical application views for data combination, visualisation, and various analyses, have been developed on top of the linked data. In fact, the system is unique in its diversity in the world.

Codices Fennici

Codices Fennici¹⁵² is a research and digitisation project for Finland's medieval and 1500s manuscripts, which maps and lists all Finnish and Finnish-related pre-1600s codices, using modern manuscript research methods. Manuscripts collected from various countries have been digitised and published with descriptive data, in a virtual library open to everyone. The material has also been published in Europeana.

Codices Fennici provides opportunities for both national and international cooperation. In Finland, the key partners for the materials of the medieval and new beginning, are the National Library of Finland (Fragmenta Membranea¹⁵³) and the National Archive of Finland (Diplomatarium Fennicum¹⁵⁴). Latin, German, and Swedish codices open up opportunities for international cooperation, as well.

Development Ideas

The old SKS card catalogues can be transferred to digital format more efficiently, by developing automatic text recognition. One pilot material is the extensive oral history

¹⁵⁰ <https://kansallisbiografia.fi/english>

¹⁵¹ <https://biografiasampo.fi/>

¹⁵² <https://www.finlit.fi/fi/tutkimus/tutkimushankkeet/codices-fennici#.YH14qi06psM>

¹⁵³ <https://www.kansalliskirjasto.fi/en/collections/fragmenta-membranea-collection>

¹⁵⁴ <http://df.narc.fi/>

material collected by J. K. Harju, which has been copied into a card catalogue, and classified by tradition¹⁵⁵.

The automated compilation and/or enrichment of the metadata of books could be done, for example, on the basis of the title leaf information, as the information on the card catalogues of older materials, in particular, may be extremely limited. The development of (semi)automated quality control of metadata, would also be important for the SKS.

The materials related to Kalevala could be used to build a semantic Kalevala, which would, for example, include open Kalevala and the letters and spells of Elias Lönnrot, in XML format. The broadside ballad material of the SKS could also offer opportunities for international cooperation projects, as the time span of the broadside ballad material is long, and it crosses media boundaries: it combines written and oral cultural tradition with performance and music.

Local Time Machine

SKS contains materials for a wide range of Local Time Machine services. The SKS archive contains materials related to Vyborg and Suomenlinna, for instance. Additionally, Sápmi could be an interesting LTM site, if the Sámi archive and Giellavealgut were also included. Several topical themes such as tolerance, minorities, the relationship with nature, and climate change, could be addressed in the context of the Sápmi LTM.

Finnish Museums Association

The Finnish Museums Association¹⁵⁶ is a central organisation of the museum sector, with over 200 community members. They maintain over 400 museum sites, over 300 of which are professional museums. Museum sites include cultural history museums, art museums, and science centres. The Finnish Museums Association is an interest representative of the museum sector, representing museums in common questions in the field, and serving as a cooperation network for museums. The activities of the Association are divided into interest representation and communications services, education and development services, as well as support services.

¹⁵⁵ <https://www.finlit.fi/fi/arkisto/perinteen-ja-nykykulttuurin-arkistoaineistot/tekstiaineistot/paaluettelo/johan-knut-harju>

¹⁵⁶ <https://museoliitto.fi/en.php>. Interviewees Sampsa Heinonen, Pauliina Kinanen, Laura Kokki, Kimmo Levä, and Janne Tielinen, 12 June 2020.

Digitalisation of the Museum Sector

Digitalisation in the museum sector can be divided into five stages, each of which could benefit from Time Machine cooperation: 1) extensive digitisation of the museum collections, 2) management of digital material, 3) making digital material available, 4) interaction of materials with users, and 5) new applications and ways of using the materials.

Museum digitalisation has progressed to the longest extent in Finland, with regard to the digitisation of materials. Currently, approximately 28% of object collections and 72% of art works have been digitised. Yet, a mere 15% of photograph collections have been digitised together with, for example, approximately 3% of natural history exhibitions. Although, the materials have been digitised reasonably, especially in the case of art works and objects, there is still a great need to improve the efficiency of digitisation.

In other areas of digitalisation in museums, the development has been much slower. For example, the description of materials is easily forming as a bottleneck of digitalisation, and the availability of data in digital format is limited. For example, only 6% of objects and 11% of art works are available in digital form. To date, the major problem has been that digitisation has not been granted long-term funding, and the other stages of digitalisation have been financed even less.

Digital Material Management

For digital material management, the Finnish Museums Association offers Kookos collection management service¹⁵⁷. Kookos is a comprehensive solution that includes three areas: 1) MuseumPlus collection management system, 2) a secure server space for storing digital data, and 3) an on-call helpdesk and annual training.

Digimuseo.fi

Digitalisation of the museum sector is greatly promoted by the Digimuseo.fi service platform¹⁵⁸, which strives to develop and promote museum activities, cooperation between museums, and the digital recording and availability of cultural heritage. Digimuseo.fi brings the contents and services of museums to consumers, in a new and inspiring way, regardless of time and place, but at the same time it offers the museums technology and related services, for efficient operation in a digital operating environment.

The pilot version of the Digimuseo.fi platform was opened to the public in May 2020. At the moment, there are exhibitions produced by the finalists of the Museum of the Year 2020, i.e. the Pharmacy Museum and the Qwensel House, Helinä Rautavaara Museum, and

¹⁵⁷ <https://www.museoliitto.fi/kookos>

¹⁵⁸ <https://digimuseo.fi/en/>

the Finnish Museum of Agriculture Sarka, as well as the 360 model of the Presidential Palace, and the gems of the John Nurminen Foundation collection¹⁵⁹.

The aim is to gradually increase the number of exhibitions in the Digimuseo.fi service. The service uses two different technologies, 360° virtual demonstrations and WebAR technology. In the latter, the museum space is created in a virtual manner, after which exhibitions can be created, and museum collection materials, images, sound, and videos can be utilised. Digital Museum services are available on your smartphone, tablet, and computer.

A museum employee can guide a group, with access to the digital museum, in virtual rooms. This type of interactive implementation is unique at the European level, and therefore, it provides opportunities for international cooperation, such as development projects related to Time Machine. The virtual museum space also expands the audience base and creates new business models.

The partners of the Digimuseo.fi platform include Arilyn, Buena, Cisco, Giosg, Insite Finland, and Preacom. The Digital Museum is maintained by Yhteinen Perintö Oy, owned by FMA Creations and the John Nurminen Foundation.

CREMA and Creative School

The Finnish Museums Association is a partner of the CREative MAKing for Lifelong Learning (CREMA) project¹⁶⁰, funded through the Erasmus+ programme. The 3-year project was launched in autumn 2019. The aim of CREMA is to develop and inspire creative activities in adult learning between museums and maker communities. The project brings together methods and recommendations for utilising cultural heritage materials and museum collections, in an innovative and new manner. One objective is to create guidelines for working with various target groups. The CREMA project involves 7 European partners.

The Finnish Museums Association is also a partner in the Creative School project¹⁶¹, funded by the Erasmus+ programme. This 3-year project was also launched in autumn 2019. Its objective is to develop learning modules utilising cultural heritage, targeted at children, and tailored to the use of teachers, and thus promote children's self-directed learning, together with critical and creative thinking. The Creative School project involves 9 European partners.

¹⁵⁹ <https://digimuseo.fi/en/>

¹⁶⁰ <https://www.cremaproject.eu>

¹⁶¹ <https://www.creative-school.eu>

Society of Swedish Literature in Finland

Materials and Services

The Society of Swedish Literature in Finland¹⁶² (SLS) has opened its data with a CC-BY licence in Finna. In the future, these could even be utilised in Time Machine. SLS materials contain many handwritten documents, together with other materials, such as photos and music. The archive also contains dialect samples with spatial data on where the sample has been collected. Therefore, it would be possible to attach them to the map application. SLS even has history related to Swedish geographical names, which could be combined with other material that has been provided with geographic information.

For the identification of handwritten text, SLS has utilised the Transkribus programme¹⁶³. Regarding this, two different models have been developed, one for identifying the handwriting of Zachris Topelius, and the other for Albert Edelfelt. These models can be freely distributed to other organisations.

As for Local Time Machine, SLS has interesting materials from, for example, coastal areas, Helsinki University blocks, the old city centre, and Vyborg.

Transaction-based metadata has been collected from Edelfelt's letters¹⁶⁴: to whom did Edelfelt sent letters, as well as information about the recipients. Another project has modelled the correspondence of Topelius, and people's connections with each other¹⁶⁵. To define these connections, collaboration in the development of the national Finto ontology is essential.

Development Views

SLS has used Filemaker software as both a digital materials management system and a description tool. The system is being renewed, and consequently, various materials management systems have been tested during 2020. Some AI modelling programmes, such as Google's Vision AI software, have also been initially tested, even though there are few objects in SLS materials.

The digitisation of handwritten materials is a key bottleneck. In this respect, there would be a great need for potential mass digitisation technologies to be developed in the Time Machine project. In addition, it would be important to link automated descriptions and

¹⁶² <https://www.sls.fi/en>. Interviewees Niklas Liljestränd, Johan Pyy, and Karola Söderman, 4 June 2020.

¹⁶³ <https://readcoop.eu/transkribus/?sc=Transkribus>

¹⁶⁴ <https://edelfelt.sls.fi>

¹⁶⁵ <https://topelius-m.sls.fi/#/home>

linked data to the digitisation process. At the moment, it is difficult to outsource the digitisation of handwritten material, as it requires an understanding of the material itself, which few service providers have.

SLS's key customer groups are researchers and teachers at school and university level. The third important user group is opinion leaders and decision-makers. Simulations executed via Time Machine, could support research, teaching, and decision-making.

University of Tampere Faculty of Social Sciences

The Faculty of Social Sciences¹⁶⁶ at the University of Tampere is a founding member of the Time Machine Organisation.

The University of Tampere has numerous separate Digital Material Infrastructures (DI), that have emerged at different times. Extensive digital materials have been utilised and preserved in, for example, health science, which is part of the Faculty of Social Sciences (health, ageing, and lifestyle-related materials, such as The Social Insurance Institution of Finland [Kela], Statistics Finland, and S Group materials). For the administration and development of these, the faculty has established the Tampere Enterprise for Research Data Excellence (TERDE), under which the Folklife Archives¹⁶⁷ is also located.

In Social Sciences, extensive materials are also comprised of EU panel surveys, the data of which is preserved and available in the Finnish Social Science Data Archive¹⁶⁸ (FSD), which is the national infrastructure for long-term preservation at the University of Tampere.

Folklife Archives

The Folklife Archives serves as its own entity in the Faculty of Social Sciences. The Sound Archive has more than 20,000 hours of sound recordings and consists of two collections: Erkki Alakönni's A-K collection, and the general collection which constantly growing, most of which originate from field work trips. The Photograph Archive collections contain approximately 200,000 photographs, which are mostly stored in negatives. The oldest glass plate negatives are from the late 19th century.

The Collection of Manuscripts consists of private individuals' documents, minutes of various associations, and responses to tradition inquiries, as well as approximately 60,000 wartime letters and postcards. The manuscript archive also includes collections of notes, a

¹⁶⁶ <https://www.tuni.fi/en/about-us/faculty-social-sciences>. Interviewee Pertti Haapala, 14 May 2020.

¹⁶⁷ <https://sites.tuni.fi/kansanperinne/folklife-archives/>

¹⁶⁸ <https://www.fsd.tuni.fi/en/>

collection of old audio discs, and a significant collection of instruments, which is mostly available at the Museum of Traditional Folk Instruments in Kaustinen.

Most of the Folklife Archives materials (recordings, photographs, letters) have been digitised and are available to researchers. The materials are used especially by researchers and students of history.

Past Projects

Already in the 1990s, a CD-ROM "Time Machine of Finnish History" was made, but it was never published. However, the light version of it¹⁶⁹ is available HTML encoded online. In the 1990s, the students and Tampere museums together implemented the online service 'Koskesta voimaa'¹⁷⁰ ("rapid power").

A general list of Finnish inhabitants¹⁷¹ (SAY) has been produced in cooperation with the National Archives of Finland. It is a collection of materials to which data on rural houses and their residents have been collected using the crown's accounting documents as a source. SAY contains data mainly from Western Finland and, at its broadest, covers the period from 1539 to 1809.

Translocalis Database

The Translocalis database is a digital history project of the Centre of Excellence in the History of Experiences (HEX), the purpose of which is to create a digital database of Finnish reader letters published in the magazines of the 19th century, which transmit local experiences. In the 19th century, letters from readers have been written from local communities across Finland, but also in the name of regions and different parts of the country, as well as from abroad. Letters are collected using the Digital Materials service¹⁷² of the National Library of Finland.

Each local reader letter is collected separately in the database, in order for them to be examined in both qualitative and quantitative terms. The aim is also to combine the old article directory collected by hand in the turn of the 20th century with a new database, in a way that the old information serves the new. The database is initially built for research use, where it serves as a multifaceted source of experience history. Later, the Translocalis database will be published electronically online, which will make it useful for history enthusiasts, as well.

¹⁶⁹ <http://agricolaverkko.fi/vintti/julkaisut/historiakone>

¹⁷⁰ <http://www.history.tampere.fi/main.htm>

¹⁷¹ http://wiki.narc.fi/portti/index.php/Suomen_asutuksen_yleisluettelo

¹⁷² https://digi.kansalliskirjasto.fi/etusivu?set_language=en

Other Research Projects

The University of Tampere has several research projects using digitised material. For example, in the project "Digital History and Handwritten Sources: Digitisation, Machine-Reading, and Historical Analysis of Wartime Letters"¹⁷³ (DIGIKÄKI) a digital research using handwritten texts from ordinary people is carried out. The material has been a collection of wartime letters from the Folklife Archives, which contains some 60,000 letters from Finland during the Second World War. The digitised letters are converted into digital text using the Transkribus programme, and a metadata base is formed. The letters will then be analysed using new methods of digital humanities research.

The STASKO project¹⁷⁴ built, refined, and analysed large database materials related to the history of the Second World War in Finland. The materials are used to study the social and cultural history of the war in a way that, in addition to numerical data, the experience and emotional history of people, who have experienced the war, can also be captured. The new information thus generated will also be utilised in the planning of general upper secondary education and museum presentations. STASKO operates under the Research Centre COMET¹⁷⁵, in the Faculty of Information Technology and Communication Sciences.

Trivium¹⁷⁶ is a multidisciplinary research centre of the Faculty of Social Sciences, whose main task is to compile and promote research on societal change and long continuum from antique to the beginning of the new era. In addition to historians, the Centre's researchers include philologists, philosophers, and literature scientists.

Supporting Education

With digital materials, the learning situation is different from that of traditional reading. The basic studies of museology train professionals for the museum sector. The subject of history has had good research relationships with the Vapriikki Museum¹⁷⁷. The perspectives of the digitalisation of museums are emphasised in museology studies. Dozens of joint online courses have also been produced within the framework of "Agricola – The Finnish Network for the Humanities", which is an administrative project of the University of Tampere and the University of Turku.

¹⁷³ <https://www.tuni.fi/en/research/digikaki-digital-history-and-handwritten-sources>

¹⁷⁴ <https://www.tuni.fi/en/research/stasko-large-databases-studying-history-war-experiences>

¹⁷⁵ <https://research.tuni.fi/comet-en/>

¹⁷⁶ <https://www.tuni.fi/en/research/trivium-tampere-centre-classical-medieval-and-early-modern-studies>

¹⁷⁷ <https://www.vapriikki.fi/en/>

Development Needs

The mass digitisation of materials has been limited by the lack of resources and efficient equipment. In recent years, the situation has improved through cooperation with the National Archives of Finland. Nevertheless, there would be a great demand for new digitisation technologies and methods to be developed through the Time Machine project, which would allow, for example, more systematic digitisation of old population data.

IT Centre for Science CSC

CSC – IT Centre for Science¹⁷⁸ is a non-profit special task enterprise, owned by the state and higher education institutions, and managed by the Ministry of Education and Culture. CSC develops, integrates, and provides IT services, and plays an important role in the steering and development of education, science, and cultural policy of the Ministry of Education and Culture. CSC's main customers are the Ministry of Education and Culture and its industry organisations, universities and universities of applied sciences, research institutes, and public administration.

Data Centre Environment

CSC offers a versatile data management and computing environment¹⁷⁹, which is interesting for the Time Machine project. Puhti¹⁸⁰, for instance, is a general-purpose supercluster, suitable for a wide variety of use cases, ranging from interactive data analysis to medium simulations. A wide range of scientific software has been installed in Puhti. Puhti's AI section Puhti-AI is specifically aimed at artificial intelligence research and AI applications. In 2021, a dedicated AI section, Mahti-AI, will also be opened on the Mahti supercomputer, to complement the popular Puhti-AI.

Datacenter CSC Kajaani¹⁸¹ is Finland's national data computing and data management environment. LUMI¹⁸² of the EuroHPC project, will also be located in Kajaani, and it will be one of the world's most renowned scientific computing instruments during its 2021–2026 life cycle. The capacity of LUMI, and other CSC computational infrastructure, could potentially be offered, for example, for the Time Machine framework-related development of new object recognition methods and machine learning, which requires a lot of computing capacity.

¹⁷⁸ <https://www.csc.fi/en/home>. Interviewees Aleksi Kallio (10 June 2020) and Kimmo Koivunen (16 December 2020).

¹⁷⁹ <https://www.csc.fi/moderni-datakeskusymparisto>

¹⁸⁰ https://research.csc.fi/-/puhti?pk_vid=f557c1f35f696d6e1618556290dbc364

¹⁸¹ <https://www.csc.fi/csc-datakeskus-kajaanissa>

¹⁸² <https://www.lumi-supercomputer.eu/eurohpcju/>

Automated Description

The High Performance Digitisation project¹⁸³ of CSC, the National Library of Finland, and the National Archives of Finland, concluded at the end of 2020, and was intended to create a service for memory organisations to facilitate the processing of material. The project developed a smart annotation pipeline for semi-automatic annotation (i.e. adding metadata) and enrichment of archived materials, such as newspapers, books, and documents.

The artificial intelligence annotation pipeline was implemented in CSC's supercomputer environment, from which it can be offered as a service to memory organisations, or duplicated into a memory organisational environment. The Annif software¹⁸⁴, developed in the National Library of Finland, serves as the tool for automated subject indexing and classification in the pipeline.

Restricted Materials

The Resource Entitlement Management System (REMS)¹⁸⁵ offered by CSC, is an electronic tool for managing access to research material and resources. REMS circulates the electronically made application for a user licence for approval to the owner of the material or his or her representative. In addition, REMS will produce the necessary reports on the applications and the access licenses granted. REMS has been developed to manage the access rights to biomedical materials, as part of the ELIXIR project¹⁸⁶, hosted by CSC for Finland. The REMS tool is also used in other branches of science.

Digital Preservation Service for Cultural Heritage (DPS)

The Digital Preservation Service for Cultural Heritage (DPS) maintained by CSC, guarantees the long-term preservation of key national digital material resources in libraries, archives, and museums. Digital cultural heritage material refers to both digitised cultural heritage material, as well as material originally produced in digital form. The Digital Preservation Service for Cultural Heritage is primarily offered to organisations responsible for the preservation of intellectual and material cultural heritage, operating in the administrative branch of the Ministry of Education and Culture. By the end of 2020, over 1 PB of organisations' cultural heritage material¹⁸⁷ has already been approved for storage in the DPS.

¹⁸³ <https://www.digime.fi/2020/09/29/high-performance-digitisation-hankkeella-vauhtia-digitaalisten-aineistojen-kuvailuun/>

¹⁸⁴ <https://annif.org>

¹⁸⁵ <https://www.csc.fi/rem-s-kayttovaltuuksien-hallintajarjestelma>

¹⁸⁶ <https://elixir-europe.org>

¹⁸⁷ <https://www.digitalpreservation.fi/laaturaportit/2020>

Expertise related to long-term preservation has been developed in cooperation with organisations using the Digital Preservation Service for Cultural Heritage. For example, in 2021, CSC published a requirement specification for logical level preservation¹⁸⁸, the aim of which is to identify the requirements related to logical preservation, describe the tasks and obligations associated with it: both for DPS and for the organisation that utilises them. Similarly, in cooperation with organisations utilising the DPS, file formats and their required technical metadata have been defined, in which the national long-term preservation services preserve and receive materials¹⁸⁹. In addition, material packaging¹⁹⁰ and DPS interfaces¹⁹¹ have been defined. The specifications are updated annually together with the organisations.

The Digital Preservation Service for Cultural Heritage is intended for Finnish organisations, and is offered to organisations, in accordance with the decisions of the Ministry of Education and Culture. Thus, a broader discussion on the provision of the service to foreign Time Machine actors should take place, while considering the impacts of expanding the funding base. However, the technological development work related to long-term preservation, as well as the sharing and strengthening of competence, offer many possibilities for international cooperation within the framework of the Time Machine project. CSC already has international cooperation related to long-term preservation. It is represented in the development of the key METS standard¹⁹² in DPS activities, and is part of the Open Preservation Foundation (OPF)¹⁹³, which maintains validation tools (veraPDF, JHOVE, jplyzer, and fido), for instance. CSC has also become a member of the Digital Preservation Coalition (DPC)¹⁹⁴, which will increase dialogue with international long-term preservation actors, and thus contribute to strengthening CSC's ability to act as a high-quality national Digital Preservation Service provider in Finland.

Turku University of Applied Sciences

Turku University of Applied Sciences¹⁹⁵ has an Information and Communications Technology (ICT) field of education¹⁹⁶, that includes a study path in gaming and interactive technologies. The studies combine creativity, software-technical competence, digital

¹⁸⁸ <https://www.digitalpreservation.fi/documents/looginensailyttaminen>

¹⁸⁹ <https://www.digitalpreservation.fi/specifications/fileformats>

¹⁹⁰ <https://www.digitalpreservation.fi/specifications/metadata>

¹⁹¹ <https://www.digitalpreservation.fi/specifications/interfaces>

¹⁹² <https://www.loc.gov/standards/mets/mets-board.html>

¹⁹³ <https://openpreservation.org>

¹⁹⁴ <https://www.dpconline.org>

¹⁹⁵ <https://www.turkuamk.fi/fi/>. Interviewee Mika Luimula, 15 May 2020.

¹⁹⁶ <https://www.turkuamk.fi/fi/tutkinnot-ja-opiskelu/tutkinnot/Tietojaviestintatekniikka/>

media, and project work. Application areas include entertainment and serious games, and interactive user interfaces. Most of the studies are implemented in English.

Turku University of Applied Sciences has focused on the application of gaming technologies in sectors other than purely entertainment. Students still have the opportunity to become entertainment gaming entrepreneurs, but the actual research development projects are usually outside the entertainment game industry.

Projects

Since 2009, Turku University of Applied Sciences has had a joint Turku Game Lab¹⁹⁷ with the University of Turku. Turku Game Lab offers services in gaming education and development, by utilising the latest technological development. The aim is to promote research and the preconditions of industry in the field, as well as to improve user experiences.

The research group led by Mika Luimula, "Futuristic Interactive Technologies"¹⁹⁸, strives for extensive utilisation of interactive technologies in various sectors. The research group works in close interaction and cooperation with business life. Innovative, interactive technology solutions are implemented, for example, in the fields of technology industry, well-being, education, and tourism, in cooperation with experts from various sectors. In the centre are activities related to gamification, serious games, game-based simulations, augmented reality, and virtual environments.

Since 2013, there have been tourism sector projects. For example, the cooperation with the Turku Museum Centre has resulted into an augmented-reality utilising application¹⁹⁹ for the Turku Castle, and fair games for the Turku Fair Centre. The cooperation with Lingsoft has produced applications located in the Turku city centre. Together with the Paavo Nurmi Games, Suunto, and other collaborative partners, augmented reality applications related to mobility and fitness have been developed.

Finnish-Estonian "Lights On!" joint project highlighted tourist destinations of significant culturohistorical interest, by means of new technology. The project developed a mobile application²⁰⁰, through which eight ruins of the castle in the Baltic Sea area can be accessed

¹⁹⁷ <https://www.turkugamelab.fi>

¹⁹⁸ <https://www.turkuamk.fi/fi/tutkimus-kehitys-ja-innovaatiot/tutkimusryhmat/tulevaisuuden-interaktiiviset-teknologiat/>

¹⁹⁹ <https://www.turku.fi/blogit/turun-linnan-blogi/turun-linna-virtuaalisesti-lisatty-todellisuutta-ja-tietoa>

²⁰⁰ <https://www.turkugamelab.fi/lightson/>

through an augmented reality guidance application. The mobile application was awarded in the Finnish Game Awards 2019 (in the Best Applied Games category)²⁰¹.

The University of Applied Sciences has also developed an augmented reality platform and mobile application, which could be offered to teachers, for example. Through the platform and application, the teacher would be able to build places in the terrain and determine the types of tasks, or media content, associated with them, for example by using augmented reality. In the past, an application has usually been created for each purpose separately, but platform-thinking opens up entirely new opportunities, also for international cooperation.

Development Opportunities

Turku University of Applied Sciences has cooperated with Lingsoft. Multilingualism provides countless opportunities for international cooperation. Furthermore, development work in the semantic web sector would enhance the utilisation of European cultural heritage. As far as Turku Castle is concerned, there have been discussions with Swedish operators on potential cooperation projects related to Katariina Jagellonica.

FIT Turku Competence Center

In March 2021, the facilities of the Turku University of Applied Sciences introduced a FIT Turku (Futuristic Interactive Technologies) Competence Center²⁰², which is a joint open research environment for companies, research institutes, and the public sector. With the help of digitalisation, FIT Turku aims to meet the diverse challenges posed by the future. It provides virtual training and experience solutions, as well as services for the development, usability, and assessment of impact of virtual reality and augmented reality applications.

FIT Turku also includes a virtual training centre, where competence can be tested and practised using virtual training applications. Turku University of Applied Sciences has built a number of virtual training applications related to shipping, fire safety, logistics, transport, and health care.

²⁰¹ <https://www.turkuamk.fi/fi/ajankohtaista/2137/vuoden-2018-hyotypeli-turku-game-labin-jahumakin-lights/>

²⁰² <https://www.turkuamk.fi/fi/tyoelamapalvelut/palvelut/futuristic-interactive-technologies-fit-turku/>

University of Turku

Digital materials and their processing

The University of Turku²⁰³ has a great number of digital materials that could be used in various Time Machine -related projects. For example, the School of Languages and Translation Studies (SLT) has nationally and internationally unique language materials. The Digilang project²⁰⁴, which is funded by the University, will develop the school's digital materials during 2018–2021. Their usability will be enhanced, and their visibility and accessibility will be promoted, by compiling them in a portal²⁰⁵ that will be functional even after the funding period. Digilang includes the following sub-projects: Satakuntalaisuus puheessa (“Satakunta's speech”) corpus, the regional and social variation of Finnish language corpus (Prosovar), finnougic corpus, academic Finnish corpus, Universal Parsebanks corpus, and LOG corpus.

History, culture, and arts studies archives are rich in materials. The archives are a TMO member, and therefore discussed as a separate entity on page 68.

In 2019–2020, an education, research, and information project²⁰⁶ for 3D digitisation of archaeological materials, was implemented as a joint project between the University of Turku Department of Archaeology, the Turku Museum Centre, and the Aboa Vetus & Ars Nova Museum, with the support of the Ministry of Education and Culture. The project examined the 3D digitisation process of archaeological discoveries, as well as the related topical equipment, software, and methods. The aim was to map 3D digitisation solutions best suited for various archaeological object types and users, and thus introduce 3D digitisation as a natural part of archaeological research. During the project, archaeological discoveries from the collections of museums and the department were 3D-digitised.

The University of Turku was also involved in the project “Computational History and the Transformation of Public Discourse in Finland 1640–1910 (COMHIS)”, which studied public debate in historical newspapers, as well as Finnish information production as part of European development²⁰⁷. The four-year project was attended by the Centre for Preservation and Digitisation of the National Library of Finland, the University of Helsinki Faculty of Arts, and the Departments of Cultural History and Information Technology of the University of Turku. The project analysed how language boundaries, elite culture, and

²⁰³ <https://www.utu.fi/en>. Interviewees Hannu Salmi (7 October 2020) and Erkki Sutinen (24 August 2020 and 1 October 2020).

²⁰⁴ <https://sites.utu.fi/hiiskuttua/digilang-kehittaa-kieliaineistoja-ja-kokoaa-ne-portaaliin-rahoitusta-myonnettiin-yli-puoli-miljoonaa-vuosille-2018-2021/>

²⁰⁵ <https://digilang.utu.fi>

²⁰⁶ <https://blogit.utu.fi/ark3d/>

²⁰⁷ <https://www.utu.fi/en/university/faculty-of-humanities/cultural-history/research>

popular discussion, as well as the reuse of texts and channels for publication interacted. The results of the project have been published as an open database currently on CSC's server. This project, like other similar projects, involves long-term preservation. For example, the discovered reproduction chains can be preserved in the Data Archive, but how do you keep the database and its search properties alive?

A few data sets have not yet been opened at all, as a method of opening them is yet to be found (for example, conceptual historical harvesting of Finnish and Swedish newspaper material). The international project studied the movements of concepts and news across borders utilising the algorithm developed at the University of Utrecht. In computational terms, Finnish newspapers were examined to find all words corresponding to a specific "seed word", that appear in the same semantic environments. The method is so heavy in computational terms, that a server that is efficient enough to open the results, is yet to be found.

Time Machine could become a framework that would compile and bring continuity to the current project-specific approach. In Finland and elsewhere in Europe, an enormous amount of digital material and services are produced, which will work for a while, but which will soon be forgotten or left without long-term maintenance. Professor Hannu Salmi noticed this personally, when writing his recent book *What is Digital History?*, for which he explored an extensive amount of old digital services. They included a great deal of services that have stopped at some point: either they still partly work or not at all. Time Machine could help manage the current project-specific world.

Future Projects and Ideas

A project has been launched in the field of the history of audiovisual culture, involving a group led by Mikko Kurimo from Aalto University's Department of Signal Processing, and a group led by Jorma Laaksonen from Data Science. The aim is to apply object recognition, image recognition, and speech recognition to all Finnish cinema material from the 1910s to the beginning of the 2000s. In the early stages, 250 digital-format films from KAVI have been tested.

The project could provide opportunities for international cooperation as, for example, metadata of the Internet Movie Database is openly available. However, copyright matters pose a major challenge. In particular, newer materials involve a large number of production companies, which means that it may be difficult to obtain research permits. On the plus side, copyrights with older materials are easier to manage. In Finland, KAVI is the right holder for the older documentary materials.

Cooperation with "living memory" type network projects, such as the Yle Archives, would also open up new opportunities. By enriching metadata, several matters could be found in

the material that have not been detected earlier (for example, in which films the first mobile devices were seen at European level).

Realised AR/VR Projects

The University of Turku has been involved in several virtual and augmented reality projects. For example, the joint Futuristic History research project²⁰⁸ of the university and VTT Technical Research Centre of Finland, developed technology for augmented reality for the use of museums and historical tourist destinations, and studied business models suitable for them. As part of the project, an adventure application located in the museum blocks of the Turku Luostarinmäki was implemented.

The MIRACLE project²⁰⁹ has studied the application of mixed reality to cultural tourism and learning outside the classroom. In addition to the University of Turku, the project has included research units from the universities of Helsinki and Tampere and VTT, as well as approximately twenty companies and public actors. The project has developed, for example, a Wordsmith application, which takes you to events in the 16th century in the Turku Cathedral, as well as a Transformations of the Knights' Hall application, which describes the history of the Häme Castle.

"Turku goes 1812"²¹⁰ is a historical 3D environment of several simultaneous users, which is experienced through VR glasses. Participants can navigate in the virtual world, together with other visitors, and discuss the historical urban environment. Turku goes 1812 is based on the modelling of the Turku Great Square and its surroundings, at the beginning of the 19th century.

In his doctoral dissertation, *Digital lies or historical knowledge?*²¹¹ (2019), Lauri Viinikkala studied the potential of mixed reality technology, as a tool for speaking about the past. The study showed that visual and hearing perceptions, together with other sensory perceptions can convey historical information and explain how things may have appeared or sounds in the past. Thus, presentations combining material remains of the past and digital effects can provide more information about the past than traditional written works.

In her doctoral dissertation on hypercontextual games, Carolina Islas Sedano developed a method for small communities and companies, to design and implement mobile games from their own starting points. The Pielinen Museum developed a story-based LieksaMyst mobile game²¹², which combines the physical environment and virtual reality. The game can be further developed by the museum's own employees. Islas Sedano has also been

²⁰⁸ <https://tt.utu.fi/ar/research/futuristic-history/>

²⁰⁹ <https://tt.utu.fi/ar/research/miracle/>

²¹⁰ https://www.turku.fi/uutinen/2019-06-13_virtuaalinen-vanha-turku-koettavissa-turun-linnassa

²¹¹ <https://www.utupub.fi/handle/10024/146572>

²¹² <https://yle.fi/uutiset/3-7381922>

involved in developing TekGame²¹³ and TekGuide, for the Technology Museum. Islas Cedano has an IT company Ubium²¹⁴.

Local Time Machine Services

Turku and the Turku region have long been cooperating on spatial data. On the university's side, cooperation has been derived from the Department of Geography, but the city of Turku has also been active. For example, Turku has a lot of information obtained in archaeological excavations. Combining it with spatial data would provide several opportunities. Likewise, there is a lot of digitised material about the city's old history, from the black book of the Cathedral to the reliquaries.

There are various projects in the Turku region, but the challenge is keeping the applications they produce, available in the long term, and how to develop them further. Time Machine could provide a framework, within which various projects and applications dealing with Turku, could be brought together, and offered continuity.

In December 2020, a cooperation agreement has been signed to launch the Culture Campus Turku cooperation²¹⁵. The agreement was signed by the city of Turku, the University of Turku, Åbo Akademi, Turku University of Applied Sciences, Humak University of Applied Sciences, Turku Music Education, and Turku Science Park. City of Culture Turku cooperation can also enhance cooperation between local actors, regarding potential Turku Time Machine, and provide new opportunities for funding it.

Remote Presence

The Remote Presence technology²¹⁶ has been developed at the Department of Future Technologies at the University of Turku, and under Professor Erkki Sutinen's guidance at the University's Future Tech Lab at Windhoek, Namibia. Remote Presence is based on a 20–30 video cameras' image to build a composite model, that allows you to be digitally present in another location. The Remote Presence technology offers entirely new perspectives on how to be present in another place and in another time. While Virtual Reality and 3D modelling have been built beforehand, Remote Presence also enables real-time remote presence.

²¹³ <http://tekgame.tekniikanmuseo.fi/site/index.php?lang=en>

²¹⁴ <http://www.ubium.net/site/index.php>

²¹⁵ <https://www.utu.fi/en/news/press-release/culture-campus-turku-to-become-a-new-platform-for-developing-culture-sector>

²¹⁶ <https://ftlab.utu.fi/projects/remote-presence>

The Remote Presence technology has been tested with schoolchildren²¹⁷ from the Turku Pääskyvuori and Bangladesh Dhaka schools, as well as with students at the University of Turku and Namibia Windhoek. A mobile unit, which can be moved to the desired location, is under development. The aim is to support experiential presence in another location. At the same time, an effort will be made to construct the required technology to be "invisible" to users.

Remote Presence also enables, among other things, an experience of combining film making and viewing. This can be done in cooperation with a well-known Namibian filmmaker and Director of the Namibian Film Commission, Joel Haikali (Joe Vision Production²¹⁸), who has extensive African and European film contacts.

Namibia's Future Tech Lab is interesting not only for the development of new technology, but also as a meeting place for Finnish and African science and culture. The activities of the unit involve, for example, intercultural contractual matters, which have been worked on with the Faculty of Law, at the University of Turku. Furthermore, the theme provides opportunities for international cooperation with, for example, the University of Amsterdam and Harvard.

The University of Cape Town has developed the Indegenious Knowledge System between Europeans and Africans. For example, residents of a herero village know their houses and objects, but they do not know how to model them in 3D. How can villagers communicate their knowledge to international 3D designers? And how do they get hold of the developed models, in order for them to assess the outcome?

University of Turku History, Culture, and Arts Studies Archives

Organisation, Preservation, and Digitisation Project

In 2018, began a project of organising, preserving, and digitising the materials in the History, Culture, and Arts Studies Archives²¹⁹ at the University of Turku, and it will last until the end of 2023. The aim of the project is to improve the findability, accessibility, and research use of material, as well as the long-term preservation of electronic material. The aim is to digitise all the original materials in the archives. Materials will not be disposed of after digitisation.

²¹⁷ <https://www.utu.fi/fi/ajankohtaista/uutinen/virtuaalista-oppimista-ja-pallonheittoa-turusta-bangladeshiin>

²¹⁸ <https://www.joe-vision.com>

²¹⁹ <https://www.utu.fi/fi/yliopisto/humanistinen-tiedekunta/hkt-arkisto>. Interviewees Kirsi Hänninen and Heli Syrjälä, 18 May 2020.

The collections of the History, Culture, and Arts Studies Archives include photographs, manuscripts, maps, and audio tapes, as well as interview transcripts. The archives contain a wide range of data from reel tapes to VHS cassettes, and from Minidiscs to survey responses. A part of the archives has already been digitised in the early 2000s (for example, the Talvadas corpus, which has accumulated from the 1960s to present day, as recordings, transcriptions, notes, and photographs).

Additionally, the archives contain a large number of urban research materials from, for example, Western Finland. In addition, there are a number of survey materials, that are frequently used, and will be digitised without delay, immediately after the AV materials. Before digitisation, the materials are mapped and catalogued.

In connection with the project, the aim is to obtain an archive information system, which works for both archives and customers, as well as secure material preservation and storage solutions. Experiences and operating methods accumulated from the digital project may be shared further. The History, Culture, and Arts Studies Archives have expertise in the formation, organisation, long-term preservation, and sharing of qualitative human sciences research material.

The materials of the archives are often restricted only to research, education, and museum use, based on agreements or data protection. The material contains a large number of personal data, including material containing special categories of personal data (sensitive data). Thus, it is not possible to open the data on a large scale.

Supporting Education

Kirsi Hänninen, who is responsible for the History, Culture, and Arts Studies Archives, coordinates and instructs joint master's studies in the Records and Archives Management²²⁰ of the University of Turku and Åbo Akademi. Students and researchers could be recruited to thesis, research, and other projects related to Time Machine. Would the Time Machine network even provide opportunities for (virtual) student, teacher, and researcher exchanges?

The connection between the archives and university education can bring bidirectionality to Time Machine. For example, on the one hand, archaeological research produces archive materials that can be utilised in Time Machine, but on the other hand, the materials presented through Time Machine can be utilised in future archaeology teaching.

²²⁰ <https://www.utu.fi/fi/yliopisto/humanistinen-tiedekunta/arkistoalan-ja-asiakirjahallinnan-maisteriopinnot>

Development Opportunities

Would it be possible to build an input platform through which, for example, students could produce content for Time Machine, as a thesis (for example, examining small archive material, entering data, and connecting it to a larger entity)? The work could also include 3D modelling, if easy tools are provided for it. Utilising text recognition in connection with mass digitisation of materials, could significantly facilitate the production and processing of metadata. The University of Turku has participated in the READ project²²¹.

The History, Culture, and Arts Studies Archives also contain archaeological image data. In 2019–2020, an education, research, and information project for 3D digitisation of archaeological materials, was implemented as a joint project between the University of Turku Department of Archaeology, the Turku Museum Centre, and the Aboa Vetus & Ars Nova Museum. The aim was to map 3D digitisation solutions best suited for various archaeological object types and users, and thus introduce 3D digitisation as a natural part of archaeological research. During the project, archaeological discoveries from the collections of museums and the department were 3D-digitised. The 3D digitisations produced were aimed at the use of scientific research and museum work, i.e. the visualisation of archaeological discoveries to the general public.

Ajan Koneet (“Machines of Time”) Collective²²² operates in the field of science and art, in the area of the Tuorla Observatory. Artefacts and archive material created through astronomical research are used to examine and interpret the essence of time. Among other things, the project interviewed the Tuorla community, and listed the museum objects, that describe the history of astronomy in Finland and Turku. There are astronomical measuring points around Turku, and a city trail has been designed around them, with art located in these sites. Through the Tuorla community, there are contacts with Estonia, the Nordic countries, and European observatories and the departments of astronomy.

The city of Salo has a smart city project in cooperation with Lounea and the University of Turku Department of Future Technologies. The aim of the project is to produce researched information on human-centred smart city planning, the cyber security of smart city solutions, and the transfer of information required by a smart city. The project also implements capstone projects on smart cities, in student groups. Based on the research results, concrete development and solution proposals will be presented to Salo.

Local Time Machine

The History, Culture, and Arts Studies Archives could produce stories of its material, such as buildings, railways, and events, within the limits set by its agreements and the Data

²²¹ <https://readcoop.eu>

²²² <https://blogit.utu.fi/ajankoneet/>

Protection Act. For example, how was a wedding party attended in the early 20th century? Photographs may also contain material to be published in Time Machine (for example, Turku community garden photographs collected by the Department of Museology). The archives also contain, for example, maps, construction drawings, village drawings, and industrial area drawings. A few wooden house blocks have been documented in an incredibly detailed manner in free-form field work.

Labour Archives

Digitisation, Description, and Deployment

In the Labour Archives²²³, the digitisation of extensive document material is mainly outsourced, but, when necessary, documents have also been digitised on a small scale, by the archives themselves. Archive materials are described, and electronic materials are stored in the Yksa service²²⁴, provided by Disec. Additionally, the long-term preservation services for digital materials are also purchased from Disec. Yksa's latest version will offer an interface for exporting descriptive information to Finna.

The Labour Archives have digitised photographs and posters by themselves. Recordings have also been digitised, mainly oral history recordings or conference recordings. The Labour Archives also contain interview videos. Photographs and posters are described in the Collecte system²²⁵, from which they are available to customers via arjenhistoria.fi²²⁶ ("the history of daily life") and Finna services.

The Labour Archives have produced learning materials²²⁷ for schools and other interested parties, both independently, as well as in cooperation with the People's Archives and the Finnish Labour Museum Werstas. The aim is to provide an opportunity to easily examine archive materials, and to utilise them, for example, in history teaching. The production of learning materials was related to the extensive Museum of Liberty project²²⁸. The Labour Archives materials can be used to produce teaching material in the future, as well.

Development Needs

The broad opening of data sets is restricted by data protection, as the data contains a great deal of personal data, as well as special categories of personal data (sensitive data). The

223 <https://www.tyark.fi>. Interviewees Petri Tanskanen and Petri Marjeta, 19 August 2020.

224 <https://disec.fi/in-english/>

225 <https://collecte.pics/blogi/about/>

226 <http://www.arjenhistoria.fi>

227 <http://www.tyovaenliike.fi/kouluille/oppimateriaaleja/>

228 <http://www.werstas.fi/event/vapauden-museo/>

opening of data could be significantly promoted if personal data could be automatically identified. The Labour Archives has monitored the READ project²²⁹, but for the time being no identification of handwritten text in connection with digitisation has been done.

As a rule, the material is not described in more detail in connection with the digitisation, but the description is based on the description of the analogue material already carried out earlier. The spatial data of photographs is described in more detail, but the spatial data of documents is mainly described at the level of the records creator. The automated compilation of keywords and spatial data would be of great benefit to the findability of the material.

Thus far, only a small percentage of the material has been digitised. From the point of view of the Labour Archives, it would be of greatly beneficial, if the mass digitisation of photographs and documents could be enhanced through technological development within the framework of Time Machine.

Local Time Machine

The Labour Archives serve the entire Finland, therefore, from its point of view, it would be important to present a national perspective in the development of the Local Time Machine services. Then again, the Labour Archives contain material for various Local Time Machine services, based on a specific location or theme. The materials contained in the Labour Archives highlight the history of ordinary people, popular movements, and association activities, making them well complement the data on authorities or notable persons in other archives.

The Labour Archives contain oral history data and photographs concerning Suomenlinna prison camp. In cooperation with the People's Archives, an exhibition on the year of 1918 in Suomenlinna was organised, in connection with the Suomenlinna tourist information and the HSL waiting room.

Finnish Broadcasting Company Yle Archives

Digital Materials

The Finnish Broadcasting Company Yle²³⁰ has strong expertise in the digitisation of AV material, as recordings, videos, and film material have been digitised for over a decade. The Yle Archives contain a wide variety of digital material, but access rights are often

²²⁹ <https://readcoop.eu>

²³⁰ <https://yle.fi>. Interviewees Tuomas Nolvi and Elina Selkälä, 29 May 2020.

restricted. A part of the material is not licensed at all, and a part can only be used in Yle's own activities. More extensive opening of the materials always requires clarification and negotiations with authors.

Up to date, only a small percentage of the material has been opened. The material is divided into four types:

- Digitised old film material for which Yle owns all the rights. Of these, over 200 clips have been published in Vimeo²³¹.
- Photos have been published in Flickr²³², but Wikimedia Commons²³³ will be used in the future. There are over 200 published photos, which is only a small part of Yle's photo collection.
- Sound effects to which Yle owns full rights. These can be used, for example, to produce various soundscapes. Sound effects have been published in Freesound²³⁴.
- A part of the metadata in the archive databases has also been opened pilot based.

Projects

Methods for Managing Audiovisual (MeMAD)²³⁵ is an EU-funded three-year project, in which Aalto University, University of Helsinki, Lingsoft, Limecraft, University of Surrey, EURECOM, and INA have been involved, in addition to Yle. The project developed methods to automatically produce a text description of video events and speech. The artificial intelligence system can be taught to improve its results by comparing the descriptions produced by the method and by people. The method is able to combine both speech and image content when making a description, and it produces text directly in the desired language. One teaching material used in the project, was video archive materials from Yle.

The automated description of audiovisual content significantly promotes the processing of large video collections, for example in media companies, and enables the recycling and application of previously produced material for new purposes. In addition, text descriptions and searches based on them, facilitate the findability and accessibility of the material, especially for people with poor hearing and vision. MeMAD ended at the end of 2020. The Time Machine network could provide an opportunity to continue the MeMAD development and share the project results.

EUScreen²³⁶ is a website that provides free access to European television cultural heritage, through videos, articles, pictures, and audio. Material has been obtained from European

²³¹ <https://vimeo.com/ylearkisto>

²³² <https://www.flickr.com/photos/ylearkisto/>

²³³ [https://commons.wikimedia.org/wiki/Category:Finnish Broadcasting Company Yle Archives](https://commons.wikimedia.org/wiki/Category:Finnish_Broadcasting_Company_Yle_Archives)

²³⁴ <https://freesound.org/people/YleArkisto/>

²³⁵ <https://memad.eu>

²³⁶ <https://www.euscreen.org>

audiovisual archives and television companies. EUscreen is in contact with Europeana. EUscreen harmonises the heterogeneous collections in Europe, and encourages different user groups to explore cultural and television history. For Time Machine, a functional connection to EUscreen can bring added value, and help reduce duplication.

Local Time Machine

Yle Archives contain a wide range of material for Finnish Time Machine projects, focusing on different locations, theme entities, or user groups. A part of the material is easier to access, but negotiations often need to be conducted to obtain the necessary rights. Yle Archives contain, for example, topical and news films on a variety of themes. There is a great deal of materials available on public figures, politics, and the entertainment world, among others. Yle's own history and technology have also been comprehensively documented.

One example of the expertise of Yle with regard to Time Machine projects, is an interactive online article based on 3D modelling, from Puotinharju shopping centre Puhos²³⁷. The entity enabled navigation through the three-dimensional Puhos, using arrow keys or the touch screen, and at the same time, it was possible to hear interesting stories told by people working in the shopping centre. Puhos' interactive 3D model was implemented in cooperation with Aalto University, and the video content was produced by the Svenska Yle Spotlight.

Utilising Time Machine Results

Time Machine could offer new opportunities for creative operators and journalists. How could materials be presented in a new and creative way? When examining the content offered by Time Machine, from the perspective of media companies and journalism, what kind of confluence does it give to cultural history, the past, and perhaps the present? While Yle could offer digital content to Time Machine, it could also utilise the digital material produced in the project, in its own activities.

Regulatory Development

The Time Machine organisation could collaborate to develop the regulation of digital cultural heritage, for example in the field of data protection and copyright. It would be important to be able to influence regulation in such a way, that archive materials could be opened up more extensively than before – while respecting copyrights.

²³⁷ <https://yle.fi/uutiset/3-9891171>

Mikael Agricola Society

Important stakeholders, such as the Finnish National Agency for Education, the Church of Finland, the National Archives of Finland, and universities, are represented in the Board of the Mikael Agricola Society²³⁸ established in 2006. In connection with the 2007 anniversary²³⁹ of Agricola and after that, a large number of Agricola thematic publications of various disciplines have been produced, especially by SKS and the University of Turku, in addition to Simo Heininen's "Mikael Agricola – elämä ja teokset" ("life and works") biography, published by Edita. A part of the publications were popular, while others were more scientific. The diverse contents of the Finnish National Agency for Education²⁴⁰ and Yle²⁴¹, also present the lifework and era of Agricola in a multifaceted manner, for example, the three-part history document series "Agricolan jalanjäljillä" ("following Agricola's footprints")²⁴². Cooperation with museums, for example, has also been active. The experts of the society have contributed to the implementation of the contents. Since 2008, the Agricola Society has managed projects and materials, produced in connection with the anniversary year, and has strived to develop them further.

Databases, Events, and Services

The Syntax Archive of the University of Turku contains the scientific edits of Mikael Agricola's works, and a morphosyntactic database²⁴³, developed in cooperation with the Institute for the Languages of Finland, in 2004–2007. The database contains a corpus of old written Finnish, with almost 40,000 sentences, over 80,000 clauses, and over 400,000 words, containing all the Finnish-language parts of Mikael Agricola's nine works. The database is morphologically and syntactically annotated.

In 2017, the Reformation anniversary year, the "Agricolan ajan Turku" ("Agricola's Age Turku") application²⁴⁴ presented the 16th century Turku, and sites related to Mikael Agricola's life, in authentic historical places. The application has been available for Android and iOS platforms. The application includes 1) a map view of Turku centre, in which different places and events can be embedded, 2) a target menu, where the user can read text clips related to the sites, and view 3D models of objects related to the history of the sites, 3) a topical view of current and Agricola-related events and news, and 4) a glossary view, consisting of a vocabulary on Agricola, a timeline, and a quiz. The implementation

²³⁸ <https://www.mikaelagricolaseura.fi>. Interviewees Kalle Järvelä, Erkki Sutinen, and Ossi Tuusvuori, 24 August 2020.

²³⁹ <https://agricola.utu.fi/mikael/agricola2007/translations/english/index.html>

²⁴⁰ <https://www.oph.fi/fi/koulutus-ja-tutkinnot/mikael-agricolan-elama-ja-tyo>

²⁴¹ <https://yle.fi/aihe/artikkeli/2013/02/07/mikael-agricolan-paiva-94>

²⁴² <https://areena.yle.fi/1-3932665>

²⁴³ <http://urn.fi/urn:nbn:fi:lb-20140730170>

²⁴⁴ <https://www.lingsoft.fi/news/agricolan-ajan-turku-sovellus-tuo-reformaatioajan-turun-kaikkien-ulottuville>

serving tourism and phenomenon-based learning, for example, has involved Turku GameLab, Plush POP soft, and Lingsoft. The application is designed in a way, that its content may be changed in the future, without modifying the application itself. Furthermore, the development has considered the fact that support for languages other than Finnish, can be added, with little effort.

The Agricola Society has regularly participated in the Turku Book and Food Fair, by producing programmes, as well as in its department. In 2007, as part of the anniversary year of Agricola 2007, the Agricola-themed Turku Menu competition was organised in cooperation with Turun Keittiömestarit ("Turku chefs"), the society has also organised Agricola-themed food culture events, and, in addition, the Agricola beer²⁴⁵ was launched in cooperation with Laitilan Wirvoitusjuomatehdas. The lessons and advice provided by Agricola, regarding herbs, for instance, have been extracted from his Kalendarium and published on, for example, the Mikael Agricola Society Facebook²⁴⁶.

Starting in 2019, Mikael Agricola Society also has a project aimed at reviving and developing "the Seven Churches Tour"²⁴⁷, known as Finland's oldest tourist route, by utilising modern technology. The tour, which was launched by the Southwest Finland Tourist Association in 1938, introduces you to the churches of Askainen, Lemu, Masku, Merimasku, Nousiainen, Naantali, and Raisio. In the project, the Seven Churches Tour is taken into electronic form. The project will increase public interest in the route, and may be useful in school teaching, for example. The project will be promoted through a grant from the Southwest Finland Regional Fund of the Finnish Cultural Foundation. In spring 2021, the society also applied for funding from the Ministry of Education and Culture for its development project for cultural tourism, "Aikamatkalla Agricolan ajan Suomeen" ("Time travel to Finland in the Agricola era")

In 2020, a lecture series, "Retkiä Agricolan maailmaan" ("Trips to Agricola's world") was implemented together with the National Archives of Finland and Aboa Vetus. The lectures have been recorded on video.

Future Plans

Text recognition, and AI-based processing of recognised text, offer new possibilities for examining old handwritten documents from the Agricola era. How, for example, will the old language be brought into the form of the current language understandably? A project has been under way, with the University of Helsinki Almanac Office, in which Agricola's old calendar would be brought to the present time, through a mobile application or an

²⁴⁵ <https://laitilan.com/2016/11/laitilan-uutuus-kunnioittaa-suomea-ja-suomen-kirjakielen-isaa/>

²⁴⁶ <https://www.facebook.com/mikaelagricolaseura>

²⁴⁷ <https://turunseutusanomat.fi/2019/11/seitseman-kirkon-reittia-heratellaan-eloon/>

application platform. The society has cooperated closely with the city of Turku, and the Turku and Kaarina Parish Union.

The Remote Presence technology, developed at the University of Turku, offers opportunities for new digital experiences. The technology is described in more detail on page 67, in connection with the University of Turku. Mikael Agricola Society has been interested in how to bring memorability into the new technology. For example, how could remote communion and remote sacraments be implemented? The original Reformation in the 16th century was based on printing technology. What would be Reformation X.0 based on interactive digital technology?

In the teaching series of Agricola's school years, the career of Agricola could be followed, for example, until 1528, when he left Vyborg, to become a secretary of the Turku Bishop. The school years of Agricola could also be linked to the 800th anniversary of Turku, in 2029.

Agricola's material related to plants and food heritage, could be utilised more widely, with the help of modern technology. A physical event, related to the medieval food culture, has also been planned as a cooperation project, but the implementation has been shifted due to the pandemic situation. In relation to old folk tradition and food culture, even European cooperation could be possible.

Mikael Agricola Society can bring together researchers and experts from various fields. Correspondingly, research results can be simplified from the society's side, and brought up in various environments. For example, the society has considered, how Martti Rautanen, Mikael Agricola, and Aleksis Kivi could meet in digital space. Martti Rautanen arrived in Namibia in 1870, the same year as the book *Seven Brothers* was published. He became a multidisciplinary researcher and language structure developer, who spoke 11 languages and translated the Bible. One possibility would be to make an interactive film of Rautanen, in which case various digital material could be included. The Nakambale museum²⁴⁸ in Namibia, is one of the few museums presenting Finnish cultural heritage. Professor Erkki Sutinen, a member of the Mikael Agricola Society's board of directors, leads the remote campus of the University of Turku, at the University of Windhoek.

Local Time Machine

The Mikael Agricola Society has been involved in the archaeological research project of the ruins of the Old Cathedral of Vyborg, which has been carried forward together with the Russian Academy of Sciences, and the Vyborgsky District, and the Department of Museum Services, under the leadership of Aleksanteri Saksa. The purpose of the project is to study

²⁴⁸ <https://www.info-namibia.com/activities-and-places-of-interest/north-central/nakambale-museum>

a church built in the Middle Ages, by means of archaeology and construction research. Viipuri was a school city for Agricola for ten years (1518–1528), and the Turku Bishop, who was returning from Moscow and Novgorod, with the peace delegation sent by Kustaa Vaasa, was buried in the Vyborg Cathedral, in 1557. Considering Vyborg Local Time Machine, there is plenty of material that could be accessed through the networks of the Mikael Agricola Society. Yle, which was one of the partners of the Agricola anniversary year, would also have a lot of audiovisual material on Vyborg. Together with the Vyborgsky District Administration, the society was responsible for the re-establishment of Mikael Agricola's monument in Vyborg, in June 2009.

Conclusions

In the following are proposals on how to proceed with the Time Machine project in Finland. The proposals are based not only on discussions with organisations during the survey, but also on the Time Machine Action Plan²⁴⁹, and the services²⁵⁰ offered by Time Machine Organisation²⁵¹ to its members. More specific proposals, for developing the digitalisation of cultural heritage in TMO member organisations, are described in the "Results" chapter, for each organisation.

Influencing the Content of the Time Machine Project

Participation in the Time Machine **Request for Comments process**²⁵² provides the most direct way to influence the content of the project. It would be desirable, for the most possible number of Finnish organisations to participate in producing RFC documents in one way or another: as writers, editors, or reviewers. Organisation experts can directly register for the RFC process, using the form²⁵³ on the Time Machine website. In practice, it could make sense for Finnish people involved in the RFC process, to network with each other, allowing them to coordinate their participation, and offer peer support to each other.

The content of the Time Machine project can also be influenced **by participating in seminars and events organised by the project**, such as the annual Time Machine conference. Finland was strongly represented in the virtual conference held at the end of 2020. Mikko Lappalainen from the National Library of Finland, and Pertti Haapala from the University of Tampere, talked about their own organisations, during the opening session of the conference²⁵⁴²⁵⁵. In addition, Juha Henriksson presented the Time Machine in Finland report, at the final session of the second conference day²⁵⁶²⁵⁷. As a new operating method, there are the Time Machine Academies events²⁵⁸, launched in spring 2021.

²⁴⁹ <https://www.timemachine.eu/tmo-operational-plan/>

²⁵⁰ <https://www.timemachine.eu/building-a-time-machine/>

²⁵¹ <https://www.timemachine.eu/time-machine-organisation/>

²⁵² <https://www.timemachine.eu/building-a-time-machine/requests-for-comments/>

²⁵³ <https://www.timemachine.eu/building-a-time-machine/requests-for-comments/participate-in-the-rfc-process/>

²⁵⁴ <https://youtu.be/Mdv68IZxIIA>

²⁵⁵ <https://www.timemachine.eu/tm2020-poster-wall/>

²⁵⁶ <https://youtu.be/S3kwna6IAF8>

²⁵⁷ https://www.timemachine.eu/wp-content/uploads/2020/12/TM2020_Session-III_presentation.pdf

²⁵⁸ <https://www.timemachine.eu/time-machine-academies/>

The views and wishes of Finnish organisations, can also be brought to the attention of the TMO central organisation, through **the Finnish Time Machine ambassadors**²⁵⁹ Tomi Ahoranta (National Archives of Finland) and Juha Henriksson (Music Archive Finland).

Development of National Infrastructure

The Time Machine project and the development of technology and operating methods within its framework, may provide opportunities for developing national digital cultural heritage infrastructures. **Finna**, used by the majority of Finnish libraries, archives, and museums, plays a key role here.

Cooperation with Time Machine could help achieve the goals of Finna services vision 2025²⁶⁰. According to the vision, Finna creates solutions for learning and research, combines information into new entities, and offers intelligent and personalised ways to retrieve information. Development work carried out in the Time Machine framework, can help Finna to provide material to use, in new ways. The Finna Street Search and sustainable development solutions that serve Finna, could be promoted through Time Machine cooperation, as well. Then, Finna's interfaces can be utilised and further developed, in order to import metadata from Finnish organisations, into various Local Time Machine services.

Another key national infrastructure is **the Digital Preservation Service for Cultural Heritage (DPS)**, which already does international cooperation. Cooperation with Time Machine would increasingly strengthen the international networking of the DPS. Furthermore, development work within the TMO framework, could even provide the DPS with new technologies, for the long-term preservation of digital cultural heritage.

An important part of the Time Machine action plan is the **enhancement of mass digitisation**, by developing new technologies and new procedures. In Finland, large-scale digitisation has been carried out especially by large national actors, such as the National Archives of Finland, the National Library of Finland, and the Finnish Heritage Agency. For example, the development of digitisation technology based on X-ray technology, within the Time Machine framework, could enhance the digitisation of old fragile documents and books. In the designing of the new national digitisation centre planned for Mikkeli Memory Campus, cooperation with the Time Machine project could also prove productive.

The development of digitisation technology and methods within Time Machine, also serves the digitisation projects of smaller Finnish GLAM organisations, as new equipment and procedures may significantly reduce the costs of digitisation and the amount of human labour needed.

²⁵⁹ <https://www.timemachine.eu/ambassadors/>

²⁶⁰ <https://www.doria.fi/handle/10024/177027>

The ontologies of the **Finto service**²⁶¹, that promote interoperability and the use of linked data, could be further developed within the framework of the Time Machine project, for example through various event and operator ontologies. By increasing the multilingualism of ontologies, the materials of different language areas could be made more widely available, and the construction of services across language boundaries would be facilitated.

Local Time Machine Services

According to the survey, Finnish TMO member organisations have several completed or planned digital cultural heritage projects, involving data harvesting or visualisation of data. These projects can be proposed to the **Local Time Machine register**²⁶², which would increase their visibility. Projects related to a specific location, form the Local Time Machine entity for the location. Thus, for example, all of the projects located in Turku and listed in the register, would jointly create the Turku Time Machine. If the projects harvesting data or visualising data, are not directly related to a specific location or area, they can still be entered in the LTM register, in which case the address of the organisation's head office is recorded as the location.

During the survey, several interesting proposals for targets for national Time Machine services came up, that could be implemented by several Finnish TMO members combining their expertise, materials, and resources. Many discussions highlighted **Suomenlinna**, which is one of Finland's seven World Heritage Sites, and has a long history since 1747, as part of Sweden, Russia, and independent Finland. TMO members' collections contain a number of versatile materials related to Suomenlinna, some of which have already been utilised in various exhibitions²⁶³. Some virtual content²⁶⁴ has already been produced from Suomenlinna, and these could be complemented by a potential Time Machine project.

In addition to Suomenlinna, other old castles, such as **Turku Castle**, **Häme Castle**, and **Olavinlinna Castle**, were also mentioned in the discussions for the survey. Turku Castle could be an interesting target in this respect, as there are several members of the Time Machine organisation in Turku, with international and diverse expertise and interesting materials (History, Culture, and Arts Studies Archives, Mikael Agricola Society, Paavo Nurmi Festival, Sibeliusmuseum, Turku University of Applied Sciences, and the University of Turku). The Culture Campus Turku agreement²⁶⁵, signed in December 2020, could be useful in terms of the joint project on Turku Castle.

²⁶¹ <https://finto.fi/en/>

²⁶² <https://www.timemachine.eu/building-a-time-machine/propose-an-ltm-project/>

²⁶³ An example <https://arkisto.fi/news/2782/61/Suomenlinnan-historiaa-kolmen-valtakunnan-linnoituksena-juhlitetaan-laajalla-nayttelylla/d,ajankohtaista>

²⁶⁴ <https://www.suomenlinna.fi/en/>

²⁶⁵ <https://www.utu.fi/en/news/press-release/culture-campus-turku-to-become-a-new-platform-for-developing-culture-sector>

Vyborg was also brought up in several discussions, as a possible target for cooperation. Material related to Vyborg is available in several Finnish archives. A Time Machine project on Vyborg, could bring to life the historic city, that has been partly destroyed. In addition, a virtual approach would significantly promote the availability of cultural heritage related to Vyborg. Considering the Time Machine project on Vyborg, cooperation should be carried out with Tampere University of Applied Sciences, which has implemented a Virtual Vyborg²⁶⁶, that is, 3D modelling of Vyborg as it was in September 1939.

A topical target for possible cooperation between Finnish TMO members, could also be the **Kaustinen Folk Fiddling Tradition**²⁶⁷, which has been proposed for UNESCO's Representative List of the Intangible Cultural Heritage of Humanity. Material related to the tradition has been stored, for instance, in the Finnish Folk Music Institute, the Tampere Folklife Archives, the SKS archives, and the Vaasa Provincial Archives.

A Time Machine project related to the **Sápmi country** would be of international significance. The Sámi community is Europe's only indigenous community; therefore it plays a key role in studying the models of sharing Traditional Knowledge, in the digital world. There are materials related to the Sápmi country in several TMO member organisations, and the Sámi Archives²⁶⁸, which operates in the Sámi Cultural Centre Sajos²⁶⁹, is part of the National Archives of Finland. Several topical themes such as tolerance, minorities, the relationship with nature, and climate change, could be addressed in the context of the Sápmi project.

Participation in International Time Machine Projects

Finland has a broad expertise and experience in various projects and technologies related to digital cultural heritage. For example, the capacity of the **LUMI supercomputer**²⁷⁰ of the EuroHPC project located in the CSC Kajaani data centre, and other CSC computational infrastructure, could be offered for the development of new object recognition methods and machine learning, in international Time Machine projects.

Finnish TMO members have strong expertise in **VR and AR technologies**, which provides good preconditions, not only for the implementation of national LTM services, but for international cooperation, as well. There have been several interesting projects in the Turku region, for instance. Turku Game Lab²⁷¹, the joint venture of the University of Turku

²⁶⁶ <http://www.virtuaaliviipuri.tamk.fi/fi>

²⁶⁷ <https://kaustislainenviulunsoitto.wordpress.com>

²⁶⁸ <https://arkisto.fi/samiarchives>

²⁶⁹ <https://www.sajos.fi/frontpage/>

²⁷⁰ <https://www.lumi-supercomputer.eu/eurohpcju/>

²⁷¹ <https://www.turkugamelab.fi>

and Turku University of Applied Sciences, has been operational since 2009. Turku University of Applied Sciences has developed a platform and a mobile application for augmented reality, that allows the user to build places in the terrain and determine the types of tasks, or media content, associated with them, for example, by using the augmented reality. In March 2021, a FIT Turku (Futuristic Interactive Technologies) Competence Centre²⁷² was opened at the facilities of Turku University of Applied Sciences.

The **Digimuseo.fi** digital museum platform²⁷³ has introduced the contents and services of museums to consumers in a new and inspiring way. Digimuseo.fi type of interactive implementation is unique at the European level, and therefore, it provides opportunities for development projects related to Time Machine. Expertise and technology related to the virtualisation of museums have also been developed in, for example, Digitalia, and Lingsoft is interested in developing the use of natural language when navigating in the virtual museum.

The **Remote Presence technology**²⁷⁴ developed at the Department of Future Technologies at the University of Turku, and its Future Tech Lab operating at Windhoek in Namibia, offers entirely new perspectives on how to be present in another location and time. Remote Presence also enables real-time remote presence. In its progressiveness, Remote Presence offers several opportunities for international cooperation, even in the framework of the Time Machine project.

Map-based applications have been developed especially by Citynomadi, which has already been internationally active. The extensive Genius Loci project entity²⁷⁵ also includes an interesting combination of locality, humanities and social science research, as well as ICT development. A current project, combining place and virtuality, is the King's Road Renaissance²⁷⁶, within which the attractions and service networks by the historical King's Road will be compiled on a new interactive digital platform, where they can be explored using VR/AR technology.

Description often forms the bottleneck of the digitalisation of cultural heritage. In Finland, several interesting, **automated description projects** are under way, which could offer opportunities for international Time Machine cooperation. The National Library's automated document description tool Annif²⁷⁷, is already multilingual and is not tied to a

²⁷² <https://www.turkuamk.fi/fi/tyoelamapalvelut/palvelut/futuristic-interactive-technologies-fit-turku/>

²⁷³ <https://digimuseo.fi/en/>

²⁷⁴ <https://ftlab.utu.fi/projects/remote-presence>

²⁷⁵ <https://geniusloci.chydenius.fi/index.php?lang=en>

²⁷⁶ <https://www.xamk.fi/en/research-and-development/kingsroad/>

²⁷⁷ <https://annif.org>

specific vocabulary. Annif software has been used in the High Performance Digitisation project²⁷⁸, as an automated subject indexing and classification tool.

Lingsoft has a great deal of expertise that could add value to various international projects, which develop Natural Language Processing technologies. The Time Machine network could also provide an opportunity to further develop the methods produced in the Methods for Managing Audiovisual (MeMAD)²⁷⁹ project, to automate the description of video material.

In addition to the Biografiasampo²⁸⁰ mentioned on page 51, the Semantic Computing Research Group (SeCo)²⁸¹ has published several other **digital humanities "Samos"** for use of researchers and the general public.

- CultureSampo²⁸²: Finnish culture on the semantic web
- TravelSampo²⁸³: Mobile cultural tourism service
- Kirjasampo²⁸⁴ ("BookSampo"): Finnish fiction on the semantic web
- WarSampo²⁸⁵: Winter and Continuation War on the semantic web
- AcademySampo²⁸⁶: Finnish academic people 1640–1899
- NameSampo²⁸⁷: Workbench for onomastics researcher
- WarVictimSampo²⁸⁸ 1914–1922

Sampo services offer many opportunities from the perspective of Finnish Time Machine activities – both internationally, and in terms of LTM projects. In addition to the aforementioned, a FindSampo (archaeology and citizen science), LawSampo (semantic Finlex of the Ministry of Justice), and ParliamentSampo (parliamentary data) are under development. The methodological basis for the Samos, is the Sampo model, based on the technologies of the semantic web and the idea of linked data, and the Sampo UI programming framework, for the implementation of the user interfaces.

Furthermore, it may be possible to participate in international Time Machine projects, by offering them materials, that can be used to test the technology and services developed in

²⁷⁸ <https://www.digime.fi/2020/09/29/high-performance-digitisation-hankkeella-vauhtia-digitaalisten-aineistojen-kuvailuun/>

²⁷⁹ <https://memad.eu>

²⁸⁰ <https://biografiasampo.fi>

²⁸¹ <https://seco.cs.aalto.fi>

²⁸² <http://www.kulttuurisampo.fi/?lang=en>

²⁸³ <https://seco.cs.aalto.fi/applications/travelsampo/>

²⁸⁴ <http://www.kirjasampo.fi>

²⁸⁵ <https://www.sotasampo.fi/en/>

²⁸⁶ <https://akatemiesampo.fi/en/>

²⁸⁷ <https://nimisampo.fi/en/>

²⁸⁸ <https://sotasurmat.narc.fi/en/>

the projects. Extremely extensive cultural heritage materials are available especially with large national operators, such as the National Library of Finland, the National Archives of Finland, and the National Museum of Finland, but interesting and versatile digital materials are also available with other Finnish TMO member organisations. These materials are described in more detail for each organisation in the "Results" chapter.

Appendix: Questionnaire

Not all questions need to be answered – just answer those that are relevant to your organisation.

Answers may be preliminary. In any case, a video discussion will be held with all Finnish TMO members on the basis of these questions. One to four people can participate in the discussion on your behalf.

Questions:

1. What systems or services do you already have that could be brought into the Time Machine entity?
 - 1.1. Data (e.g. digitisation, data modelling, long-term preservation)
 - 1.2. Data processing (e.g. object and text recognition, AI, visualisation, Super Computing)
 - 1.3. Theory (e.g. related subjects, such as Digital Humanities)
- 1.4. What new could be built on the before-mentioned systems within the Time Machine framework?
- 1.5. How can the before-mentioned systems and services be utilised to create joint TMO services, i.e. a part of the TMO infrastructure?
2. What plans do you have for entirely new systems and information services, that could be integrated into the Time Machine entity, and thus be covered by e.g. EU funding?
 - 2.1. Data (e.g. digitisation, data modelling, long-term preservation)
 - 2.2. Data processing (e.g. object and text recognition, AI, visualisation, Super Computing)
 - 2.3. Theory (e.g. related subjects, such as Digital Humanities)
3. What kind of thoughts do you have about a potential Finnish Local Time Machine (LTM)?
 - 3.1. A joint Time Machine for the entire Finland?
 - 3.2. Location-bound LTM?
 - 3.3. LTM based on a specific theme entity?
 - 3.4. LTM targeted at a specific user group?
 - 3.5. Something else?
4. What could you offer for the designing/implementation of the Finnish Local Time Machine?
 - 4.1. Materials
 - 4.2. Services and IT systems
 - 4.3. Expertise
 - 4.4. Something else?

5. What are your wishes from the perspective of future Time Machine users?
 - 5.1. Promoting research
 - 5.2. Promoting education
 - 5.3. Promoting the activities of GLAM organisations
 - 5.4. Something else (e.g. creative industry, urban planning, smart tourism)
6. What are your wishes regarding the TMO research?
7. What kind of cooperation would you prefer with other Finnish TMO members?
8. What else do you want to bring up?