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RECOMMENDATIONS ON THE IMPLEMENTATION OF IIIF

ARMA - The Art of Reading in Middle Ages - Milestone 3

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Management Summary

The project *The Art of Reading in the Middle Ages* (ARMA) shows how medieval reading culture evolved and became a fundamental aspect of European culture. The project did so by contributing and updating over 60.000 digitised medieval manuscripts, early printed books, coins and other objects from seven cultural heritage institutions across Europe to Europeana.

The International Image Interoperability Framework (IIIF) is an important protocol to share and use digitised images in high quality, but is not yet widely implemented across cultural heritage institutions in Europe. For this reason, the ARMA project paid special attention to the implementation and use of this protocol with all the partners, including Europeana.

This report, *Recommendations on the implementation of IIIF*, presents the lessons learned of the ARMA partners while working with the IIIF protocol. These lessons are turned into recommendations to other cultural heritage institutions, as the ARMA partners strongly believe in the potential of IIIF to improve the sharing and using of digitised collections among institutions and portals such as Europeana.

The report opens with a short factual description of what IIIF is and what it can do (Chapter 1).

Next, it describes the usefulness of the IIIF protocol and tools for working with digitised medieval collections, and we will give some examples of portals and other web services that use IIIF to provide access to digitised medieval objects (Chapter 2).

In Chapter 3 each ARMA partner describes its experiences of working with IIIF during the ARMA project, and if applicable also its motivations to work with IIIF if the partner already had an operational IIIF infrastructure prior to the start of the project.

Chapter 4 then presents the lessons learned and recommendations. The chapter opens with a generic recommendation why the ARMA partners consider IIIF to be a valuable tool for digital cultural heritage. Next, the recommendations are split into three sections: a) Recommendations to institutions that already have an operational IIIF infrastructure in place and that want to extend and optimise their use of IIIF; b) Recommendations to institutions that do not yet make use of IIIF; c) Recommendations to Europeana.

The report closes with some references and links for further reading.

Introduction

This report is the result of the collaborative efforts by the consortium partners of the project *The Art of Reading in the Middle Ages* (ARMA) concerning the International Image Interoperability Framework (IIIF). This work is part of Activity 2 of the ARMA project ("Ingesting content to Europeana"). The partners in the ARMA project chose to work with this framework, as it increases interoperability and usability of digital cultural heritage objects without compromising their responsibilities for curation and digital object management. As one of the main goals of ARMA is to enrich Europeana by bringing together various collections and object types that explain and illustrate reading culture in the Middle Ages, especially in an educational context, IIIF was considered an excellent tool to use in the project.

Also, as the implementation of IIIF across the cultural heritage domain is still gradually increasing, the ARMA project provided a good opportunity to explore, implement and promote the IIIF tools with the partners and other parties. Some of the ARMA partners already had extensive experience with IIIF, others were completely new to it. Europeana was already using IIIF, but only for a small number of specific collections. In collaboration with the content providers in ARMA, Europeana could extend its use of IIIF to digitised medieval manuscripts and other objects.

Each partner was responsible for the creation and availability of the IIIF manifests that accompany their digitised objects and metadata records. They took care of it either by themselves or with the help from other ARMA partners or a third party (e.g. a national aggregator). All objects that were digitised during the ARMA project had to be accompanied by a IIIF manifest. For objects that the partners had already digitised prior to the project start and that were now also submitted to Europeana as part of the ARMA collection, it was optional to also provide them with IIIF manifests.

During the ARMA project, various opportunities were provided to work jointly and individually on the implementation of IIIF. Leiden University Libraries, which already had an operational IIIF infrastructure, took the lead in this task. Three online meetings dedicated to IIIF were held in March and May 2021 and March 2022. In addition to these meetings, special sessions addressing IIIF were held at the ARMA consortium meeting in September 2021, the ARMA web conference in February 2022 and the ARMA Conference in June 2022.

This report is a formal milestone of the ARMA project. Chapter 1 provides a generic overview of what IIIF is and what it can do. Chapter 2 describes the relevance of IIIF for digitised medieval manuscripts and other objects related to *The Art of Reading in the Middle Ages*. Chapter 3 documents the experiences of all individual project partners while working with IIIF. Chapter 4 concludes this report by sharing the lessons learned and providing recommendations to other cultural heritage institutions and consortia that are considering to enrich or optimise their digital services with the tools that make use of the IIIF protocol.

Erik-Jan Dros & Marco de Niet
*(Leiden University Libraries, on behalf of the ARMA consortium)*

Chapter 1: What is IIIF?

1.1 The protocol

The International Image Interoperability Framework (IIIF) is an open source protocol with which cultural heritage institutions can deliver, share and show their digitised items (esp. images and videos) in a high resolution and in a standardised way. This standardisation makes it easier for users to use and compare digitised items from various institutions in a high resolution. Moreover, it gives the institutions the possibility to develop and implement services based on shared technologies and tools (such as image viewers and annotation tools). With IIIF the data and metadata of digital objects stay on the server of the institution that curates that content. This not only ensures that the institution keeps control over what is shared with other institutions, it also takes away the need to distribute digital objects via hard disks or similar if an institution wants to contribute content to a specific portal or other type of digital platform.

1.2 Management and development of IIIF

IIIF was developed in 2011 by seven research libraries and has been operational since 2012. It is supported by the IIIF Consortium, containing 63 cultural heritage institutions as members, and the IIIF community, a network of developers and users, who maintain and improve the protocol. Within the community there are a number of working groups active, which focus on specific aspects of IIIF. In addition, there is a discussion list. Conferences, symposia and developer days are organised regularly.
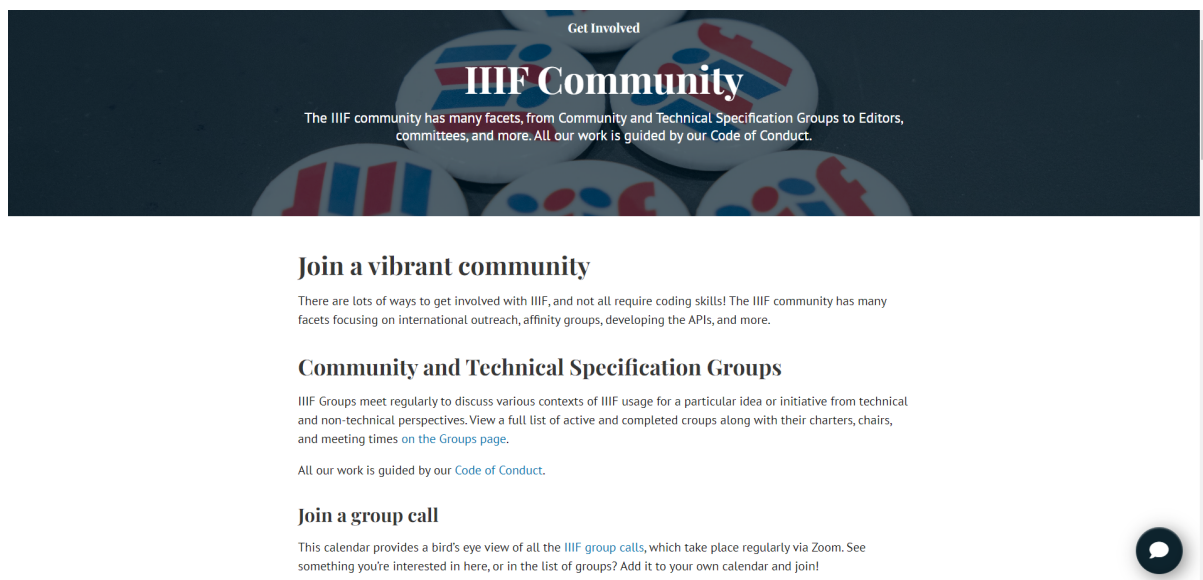
Display of the IIIF Community starting page.

Most of the technologies used for IIIF and the standards on which IIIF is based are available in open source. This, in combination with the fact that the IIIF protocol is maintained and

developed by a whole community, instead of one institution or company, increases the sustainability of the protocol.

For more information on the activities of the IIIF community see: https://iiif.io/community/

1.3   The APIs

The IIIF framework consists of several *Application Programming Interfaces* (APIs). These APIs make connections between different computer programs, providing the interoperability of images and image viewers. Within the IIIF-community six APIs are formulated: Image API, Presentation API, Authentication API, Change Discovery API, Content Search API, and Content State API.

1.3.1   Image API

The Image API provides the wanted image in a IIIF-viewer and enables the viewing of the image without downloading the full file. In addition, the user can adjust the specifics of the digital object, such as height, width, size, quality, colour and format, via the Image API. In this way, it is no longer necessary for users to download and duplicate a complete copy of the digital object and edit it themselves on their own PC.

1.3.2   Presentation API

The Presentation API is used to present the metadata of the digital object in the IIIF viewer. This also concerns the order in which the images are displayed, in case a digital object consists of multiple images.

The Presentation API uses a data model named Shared Canvas. The basic component of this data model is the canvas on which content can be shown. In the case of manuscripts and books, content will normally be one page or an opening. However, a canvas can also contain multiple images, as in the case of separately digitised fragments of the same page. Canvases can be combined in a sequence (for instance a book); multiple sequences form a manifest; which can be combined into a collection. On every level it is possible to add descriptions that apply to the corresponding level.

For the API it is necessary to deliver metadata about the digital object via a IIIF manifest, a document in which the metadata of the object is recorded for display purposes. Structural metadata is needed for complex objects, such as medieval manuscripts, to be able to display the pages in the proper order. It is recommended to include content related metadata in the manifest, to accompany the display of the object, but there is no prescription about the format of this metadata.

1.3.3   Authentication API

The Authentication API describes the processes that can be followed in cases where access to a digital object is restricted (for instance due to copyright). In that case, the API guides the user to an external access control system and may provide an image of lower quality.

1.3.4   Change Discovery API

The IIIF Change Discovery API provides information about changes to IIIF content resources and the location of those resources to harvest, which enables clients to discover and exploit IIIF resources. Through this API other systems can filter on items that have changed recently, which speeds up the synchronisation between the providing institution and other systems.

1.3.5   Content Search API

The Content Search API gives building blocks for creating search systems for finding relevant content available through the manifests, including annotations. While manifests can contain extensive descriptions, including full text transcriptions, the API provides the possibility to search for certain terms and additionally filter by the type and creation time of annotations.

1.3.6   Content State API

The Content State API provides possibilities to share a particular view of a IIIF presentation. For instance, when a user has opened multiple IIIF Manifests, the Content State API makes it possible to share this collection at once with another user, regardless whether they use the same viewer.

For a further introduction on IIIF APIs see: https://iiif.io/api/

1.4   IIIF viewers and other tools

Due to the standardised and interoperable nature of IIIF, there are a number of viewers and tools available. Currently, the two most used viewers are the Mirador Viewer and the Universal Viewer.[1] Mirador is an Open-source viewing platform, in which it is possible to open multiple objects next to each other and compare and annotate them. The Universal Viewer has less functionalities, but in contrast to Mirador it can also display other kinds of media apart from IIIF (such as PDF). In addition, the Universal Viewer makes it easier to share a specific page or part of an object, since changes that are made in the viewer are processed immediately in the URL. When sharing this URL, another user gets exactly the same image. In contrast, the URL in Mirador is fixed and will give the full (or first) image of an object.[2]

All IIIF viewers need the IIIF manifest to get access to the images in the original digital repository. In practice, this means that regardless through which institution a IIIF viewer is opened, all digital objects with a IIIF manifest can be shown in the viewer. This makes it very easy to change between different objects and, in case of using for instance the Mirador viewer, to view two objects at the same time in the same viewer.

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[1] See https://iiif.io/get-started/iiif-viewers/.
[2] See for the differences between Mirador and the Universal Viewer the Viewer Matrix: https://iiif.io/api/cookbook/recipe/matrix/.

 Most content hosting institutions provide the IIIF manifest by showing the IIIF logo in their repository. This logo can be dragged into the viewer, which opens the IIIF manifest right away.

For a further introduction on IIIF viewers see: https://iiif.io/guides/using_iiif_resources/

Chapter 2: IIIF and digitised medieval manuscripts

2.1   Advantages of IIIF

As already touched upon in the previous chapter, IIIF offers some major advantages in comparison to the traditional setup of digital repositories. In such a setup, repositories usually have their own viewer in which only those objects can be seen that the hosting institution can provide from that specific repository. In case the institution wants to provide access to digital objects from other institutions, the images have to be sent and uploaded into that repository or they can be accessed via the sharing of links to the other repositories. Simultaneous viewing of multiple objects from multiple collections is usually not an option that is provided. In case a user wants to customise the image, he/she has to download it.

The IIIF viewer uses the IIIF manifest to directly connect with the digital repository of the providing institution. This has a number of great advantages:

- Since the digital files no longer have to be sent back and forth between repositories, it is no longer necessary for institutions to store and manage digital files (which can be complex objects) originating from other institutions.

- If digital objects are shared between institutions, this is usually done using low resolution copies of the digital objects. By sharing IIIF manifests instead of the objects themselves, all parties can access and use the larger, high-resolution files, making it possible for the user to zoom in on small details.

- The user can view all objects with a IIIF manifest in one IIIF viewer. This means that the user does not have to switch viewers (and interfaces) to see and compare different items. In the case of some viewers, such as Mirador, it is even possible to view multiple items at once in the viewer. So using a IIIF viewer makes it much easier to bring together objects from different repositories.

- The user can customise and share (parts of) the image directly in/via the viewer, without having to download the file first. Not only is this a lot easier for the user, also the connection with the original stays intact. For instance, when a user has zoomed in on a detail and has shared this detail, it is also possible for the second user to zoom out again. IIIF also offers the user to make, save and share annotations to the object. In other words, the user is much more in charge than in traditional digital repositories.

Although these advantages apply to all kinds of cultural heritage objects, we would like to point out that IIIF can be especially helpful in the study of medieval manuscripts. Medieval manuscripts are characterised and therefore identified by similarities and differences in their scripts and their textual, pictorial and physical components. As IIIF makes it easier to share high-resolution images and, therefore, gives the possibility to zoom in deeply on details that can be compared with each other, IIIF is an invaluable tool for scholars that study these cultural objects. Also, throughout the centuries many manuscripts have been taken apart, after which the individual parts ended up in various places throughout the world. IIIF provides an ideal digital way to bring these parts back together. This is certainly the case

when only fragments of a codex survived.[3] In the same way (although on a larger scale) medieval libraries and collections can be virtually brought together, as for instance has been done with the Library of Federico da Montefeltro by the Vatican Libraries.[4]

2.2   Some examples and best practices

In recent years much has been experimented with the possibilities of IIIF and medieval manuscripts. We have gathered some examples and best practices, which, in our view, are the best demonstrations of what is possible in this field

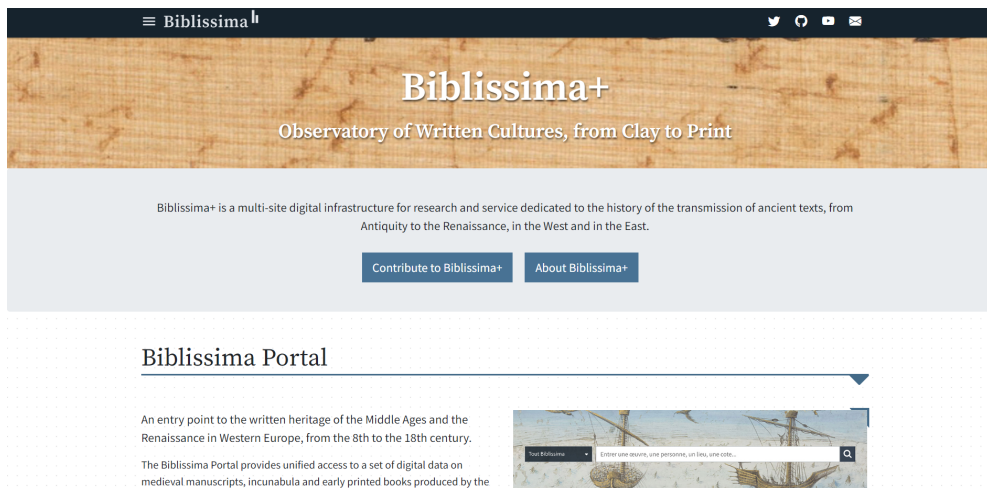### 2.2.1   E-codices – Virtual Manuscript Library of Switzerland

Accesses all medieval and a selection of modern manuscripts held by Swiss institutions by means of a virtual library. Digital facsimiles are linked with scholarly descriptions.

https://e-codices.unifr.ch/en

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[3] For instance at Fragmentarium: https://fragmentarium.ms/
[4] https://spotlight.vatlib.it/humanist-library. See also 2.2.5.
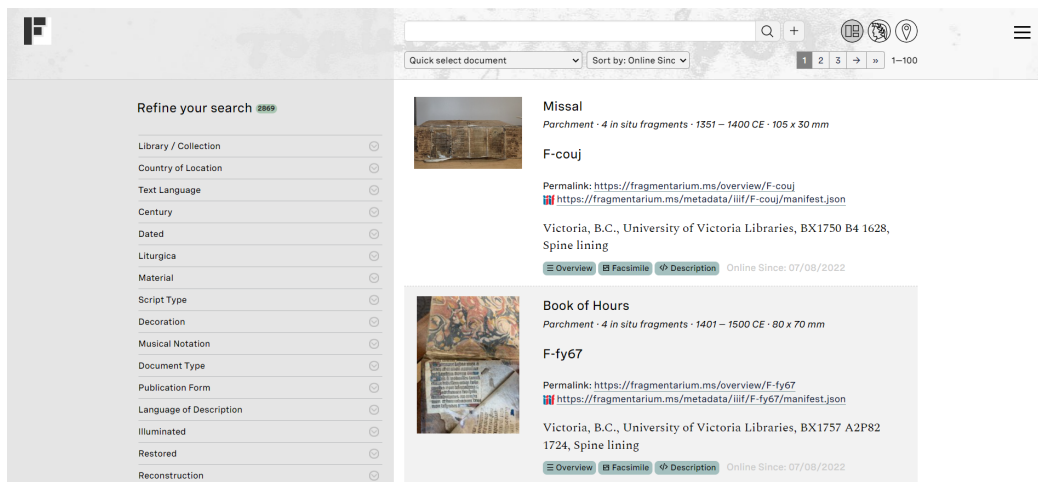
2.2.2 Biblissima Portal

This portal provides unified access to a set of digital data on medieval manuscripts, incunabula and early printed books produced in Western Europe, from the 8th to the 18th century, and held by various institutions.

https://portail.biblissima.fr/

2.2.3 Fragmentarium

Platform for publishing images of medieval manuscript fragments, allowing them to catalogue, describe, transcribe, assemble and re-use them.
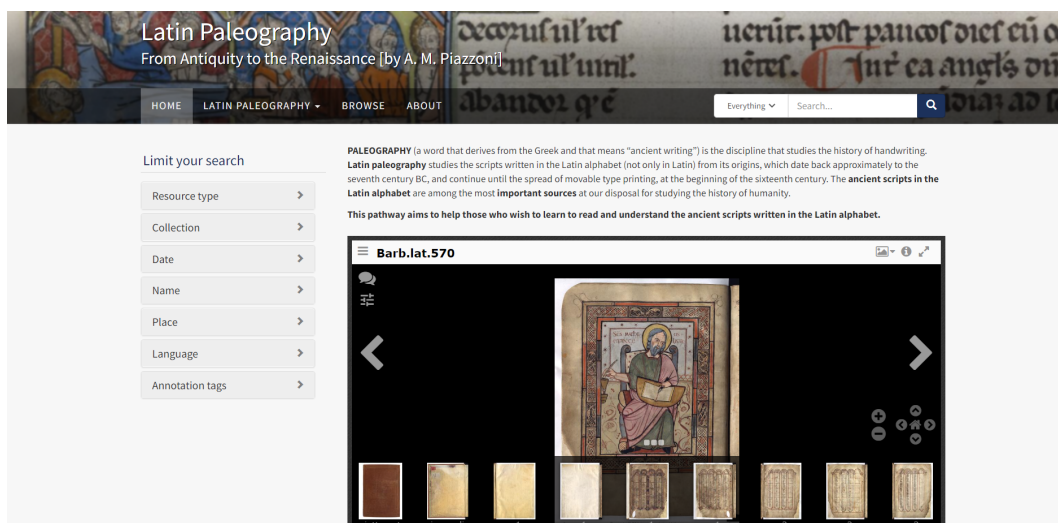
https://fragmentarium.ms/

2.2.4 France et Angleterre: manuscrits médiévaux entre 700 et 1200

Repository with digital facsimiles of 800 medieval manuscripts held by the Bibliothèque national de France and the British Library. The content can be accessed via themes, authors, places and centuries.

https://manuscrits-france-angleterre.org/polonsky/en/

2.2.5 DigVatLib

Introduction to Latin and Greek paleography in 20 + 11 illustrated chapters with IIIF annotations of manuscripts from the Vatican collections.

https://spotlight.vatlib.it/latin-paleography - https://spotlight.vatlib.it/greek-paleography

The Library of a 'Humanist Prince': Federico da Montefeltro. A collection of manuscripts from the Vatican collections, presented with IIIF annotations.

https://spotlight.vatlib.it/humanist-library

2.2.6 Digital manuscripts in the classroom
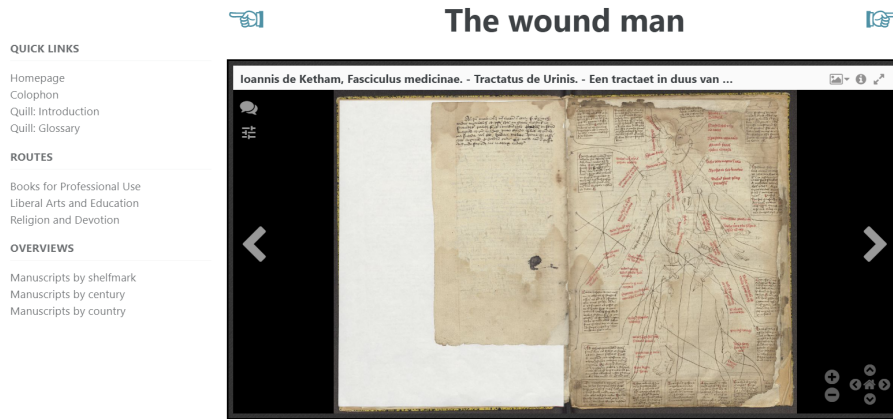
BPL 1905 (Southern Netherlands?, Netherlands, 1400-1600): Johannes de Ketham, *Fasciculus Medicinae* (Medical Treatises), paper, 15 fols., c.290 x 170 mm, , various lines.

This little manuscript contains parts of the *Fasciculus medicinae*; a compilation of six medieval medical treatises. Even though only two manuscripts with this compilation ever existed, the

An educational resource with a selected set of mostly medieval digitised manuscripts from Leiden University Libraries, organised in thematic routes and assignments for students.
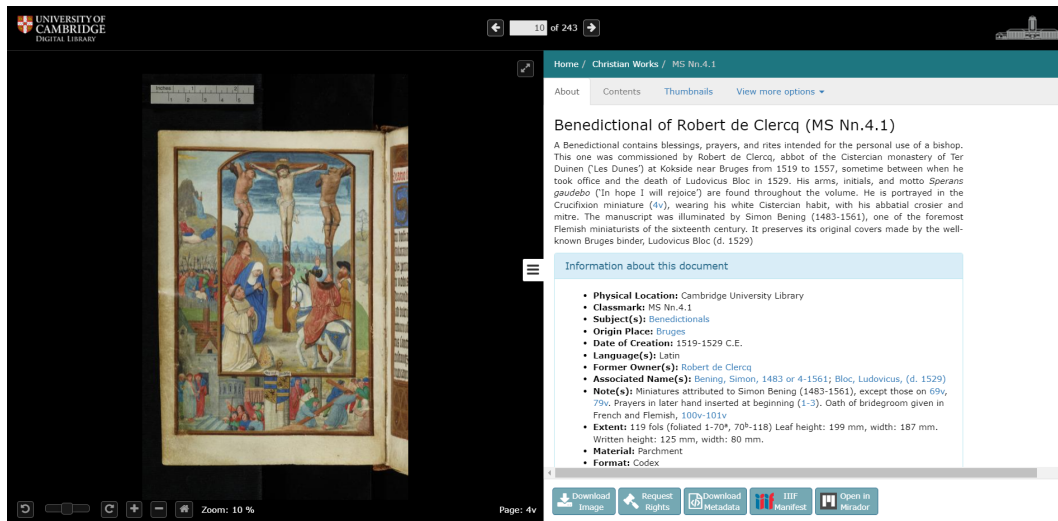
https://digmanclass.universiteitleiden.nl

2.2.7 Mouse and manuscript

Another educational website created at Leiden University. This website presents more than 50 lessons in codicology (the study of handwritten documents or codices) and palaeography from the Muslim world. The lessons will guide the user through the ways books were made and used there before the printing press, by investigating the traces left by producers, owners and readers of manuscripts.

https://mouse.digitalscholarship.nl

2.2.8 Cambridge Digital Library

Not a project, and not limited to manuscripts, but a good example of customisation of the Universal Viewer. See for example:
https://cudl.lib.cam.ac.uk/view/MS-NN-00004-00001/10. It has a user-friendly layout, a useful set of functionalities, and is overall a good example of presentation of manifest metadata.

Chapter 3: IIIF in the ARMA project

3.1 IIIF at the ARMA Content Partners

3.1.1 Bibliothèque national de France
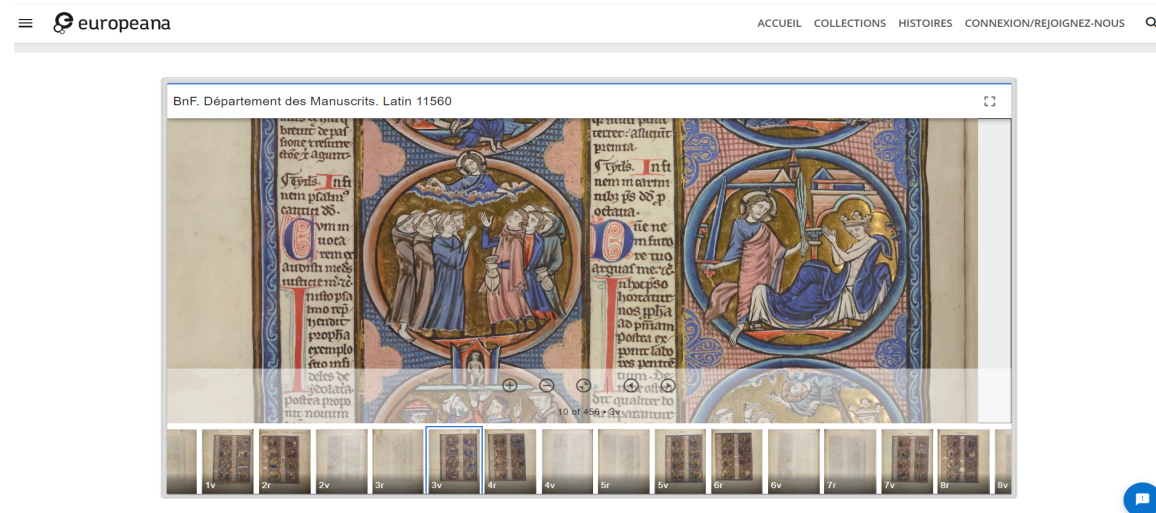
BnF, Département des Manuscrits, <u>Latin 11560</u>

As of 2000, BNF started digitising medieval manuscripts for joint portals like *<u>Europeana Regia</u>* or the *<u>Roman de la Rose Digital Library</u>*. Transfer and interoperability of images and metadata soon appeared to be an issue, leading the BNF to adopt international standards such as SharedCanvas and IIIF – BNF became a founding member of the IIIF consortium in 2015.

The first versions of IIIF APIs were integrated into <u>Gallica</u>, BNF's digital library, in 2015. Although the volume of BNF's digital collection and the necessity to treat the collection as a whole with a coherent approach have slowed down the adoption of the IIIF protocol in BNF's digital ecosystem, IIIF projects involving medieval manuscripts have been led at a smaller scale:

- The Biblissima project (2013-2021), an observatory of the written heritage from the Middle Ages, focused on the interoperability of resources coming from different data providers. It allowed for the experimentation, development and implementation of IIIF technologies. BNF was one of its founding partners.

- The France-Angleterre project, led in partnership with the British Library with manuscripts from the 700-1200 period, allowed for the integration of the IIIF Mirador viewer. The project included scientific cataloguing activities and helped using the description of the digitised documents, available on the catalogues and the OAI/PMH server, in order to map the metadata for the IIIF manifests.

The Mirador 2 viewer has been integrated into the Gallica interface since 2021. A new release of the IIIF APIs is planned for 2022, and will include:

- Multilinguality

- More flexibility in the display of the different elements on the consulting interface (f.i, horizontal or vertical display)

- The possibility to customise the viewer (Mirador 3)

- A protected mode (for the consultation of documents under copyright)

- Separated server access for Gallica display and external IIIF access (improving performance of both)

The revision of the Mandragore database for medieval illuminations, planned for 2022, will heavily use IIIF technologies, and in particular annotation, in order to allow for a precise description of parts of the images (i.e., different illuminations within the same page).

ARMA manuscripts, like all documents online on Gallica, are available via the IIIF API – full resolution, manifests built on the metadata available on the OAI servers (allowing for the EDM conversion).

3.1.2 Hunt Museum
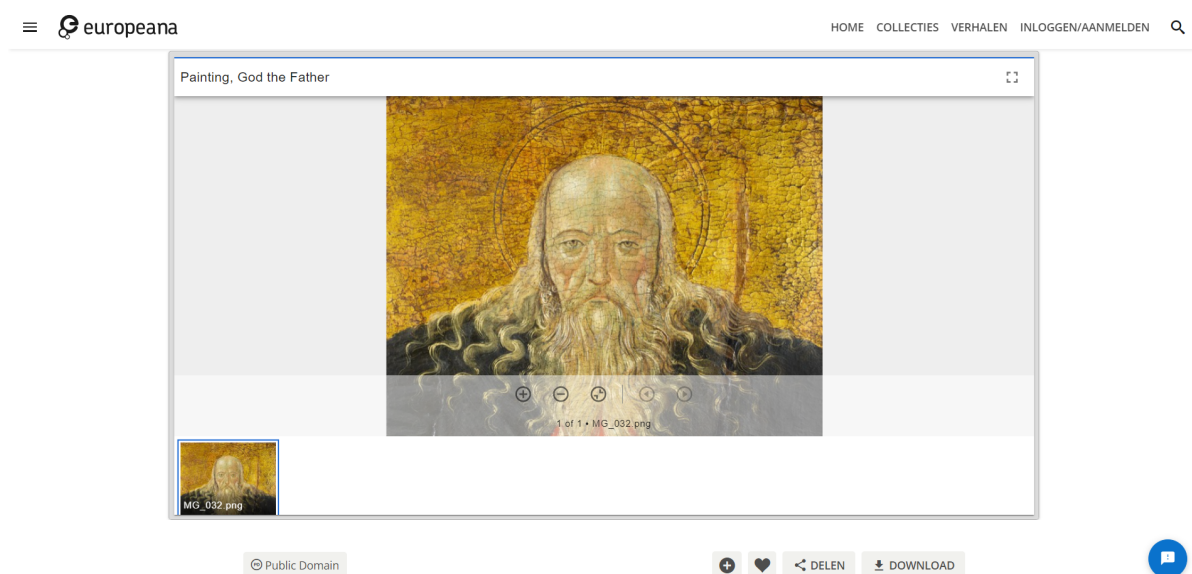
Hunt Museum, Painting, God the Father

Prior to commencing the ARMA project, The Hunt Museum had not published any of its collections with IIIF manifests. As a relatively small museum, we did not have the technical capabilities in house to create IIIF manifests or the ability to have a IIIF server capable of processing the manifests. However, the museum is dedicated to digital cultural heritage and sharing heritage in an interoperable form and IIIF affords us an opportunity to unlock the possibilities for sharing and research.

Two medieval manuscript fragments were digitised under the ARMA project and were added to the aforementioned *Fragmentarium.* This publication provided us with IIIF manifests for these fragments. These were then used to curate a digital display to accompany a physical exhibition/display of the fragments within the museum, promoting the ARMA project. A IIIF

annotation tool called Exhibit was used, illustrating the curatorial and educational possibilities of IIIF for museum use.

The ARMA project was particularly beneficial as it offered us the opportunity to learn from other project partners who have expertise on IIIF. The consortium meetings have helped us to understand the technical specifications and processes for IIIF but also the usability of the tools in the project and beyond. In its basic form IIIF enables deep-zoom which is useful for paintings or panels which make up a sizable proportion of the Hunt Collection. The benefit of IIIF for the Hunt as a museum and cultural institution is in its interoperability, ability to share and the tools and viewers which can be used.

Ideally, we would like to add IIIF functionality to our Explore (search the collection) section of our website but would be restricted by technical capabilities and server space for the 3,000 objects in our collection. However, we plan to be involved in the National Digital Strategy for Ireland, and the inclusion of a IIIF server in this strategy.

The Hunt Museum will publish its collection to Europeana via the national aggregator Digital Repository Ireland (DRI). The DRI publishes all objects with a IIIF manifests, therefore the full collection of 2D objects from the Hunt will be published with IIIF manifests in Europeana.

3.1.3 Manuscriptorium

First experience with IIIF in Manuscriptorium dates to 2016 when we implemented the IIIF Image API closely followed by the IIIF Presentation API. The motivation for the implementation was to achieve a greater impact when disseminating the digitised content.

Since its beginnings Manuscriptorium has operated as a domain aggregator and thus the implementation provided the benefits of IIIF for all the aggregated documents and Manuscriptorium served (and still serves) as an *intermediate provider* of IIIF features for the non-IIIF enabled repositories. Later on, as the utilisation of IIIF among partners' image repositories spreads, we implemented the support of the two IIIF APIs into the processes of content *ingestion* so that we can ease our content aggregation tasks. Currently we provide IIIF enabled access to more than 150.000 fully digitised documents (manuscripts, early printed books, maps etc.).
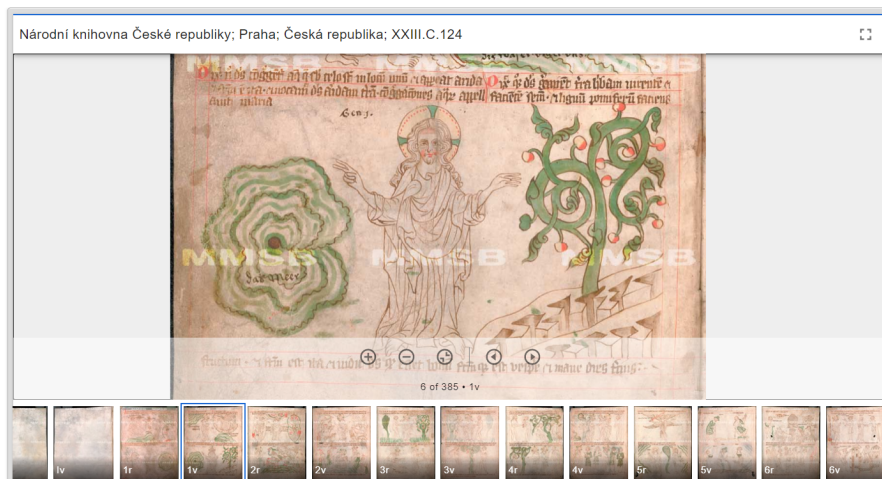
National Library of the Czech Republic, <u>XXIII.C.124</u>

In order to enable IIIF features for aggregated contents, we had to customise the available tools recommended by the IIIF community (Loris Image Server) to match our specific needs. Since then, the implementation of IIIF develops constantly. In Manuscriptorium we do not rely only on the commonly available SW readers (e.g. Mirador) but we develop our own medieval manuscript reader that allows not only to conveniently browse the content but also to create new information (mark parts of the images, crop images, annotate areas in the images etc.) and one of the most exciting new IIIF related development tasks focuses enabling IIIF for user-created contents (including user-created IIIF collections and user-created annotations within original IIIF manifests).

In 2022 we focused on migration to new versions of the IIIF Image and Presentation APIs (3.x) and we began to study possible implementation of IIIF Change Discovery and IIIF Content Search APIs.

3.1.4 Narodna in univerzitetna knjižnica

The National and University Library (NUK) will provide publications within the ARMA project as follows:

- 60 publications will be provided with IIIF support via Manuscriptorium.

- more than 450 publications will be enriched with new metadata, and via the Slovenian National Aggregator updated on Europeana. For those publications we have focused on changing literal values using Linked open data (LOD) from Wikidata.

Most of the work, apart from the digitisation itself, represents changing / updating the metadata. Finding certain metadata for old publications was also a challenge. Last but not least - creating metadata with support for the pagination of the publications, which will help the IIIF service, also takes time.

Currently, NUK has not yet implemented the IIIF service. During ARMA the IIIF services of Manuscriptorium have been used. Because of the usefulness of the IIIF service, we will implement this service ourselves in the near future, especially to support user experiences with old publications / manuscripts.
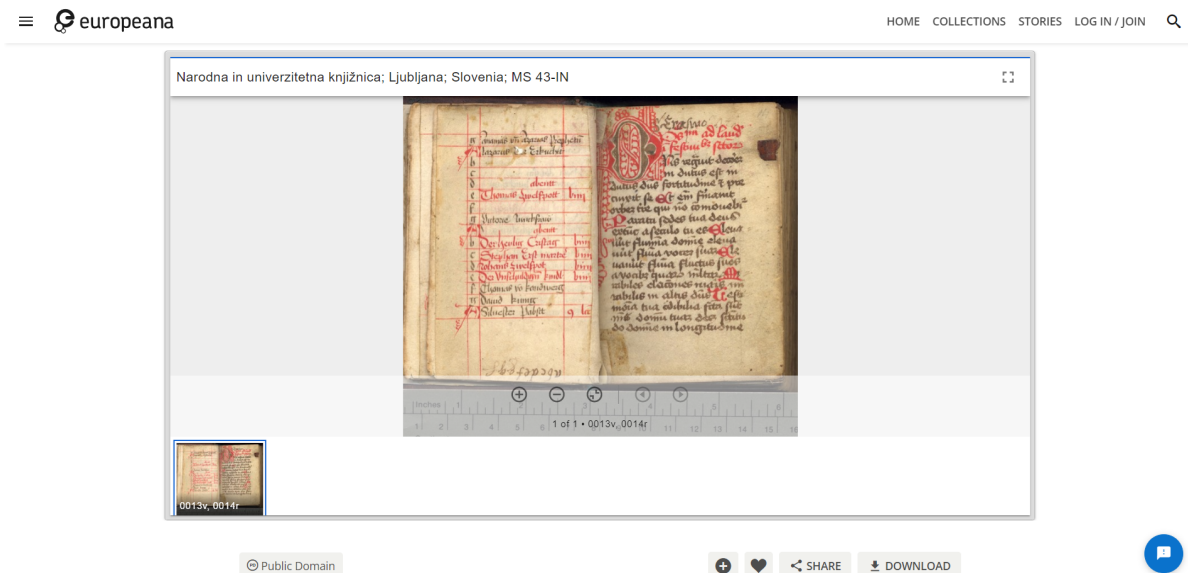
National and University Library, <u>MS 43-IN</u>

3.1.5 Public Library Bruges

Prior to the ARMA project, Bruges Public Library started implementing IIIF as part of the project Mmmonk. The project started in March 2019 and will end in November 2022. The aim of the project is threefold: to provide digital access to the ca. 820 medieval manuscripts of the abbeys of Ten Duinen, Ter Doest, Saint Peter and Saint Bavo, to aggregate the IIIF-compliant images and metadata on a contextualised platform, and to facilitate the uptake of IIIF by end users by creating user friendly tools and by offering hands-on workshops and tutorials.

Bruges Public Library uses the IIIF services of Ghent University Library, a frontrunner in terms of digital dissemination of heritage objects and one of the pioneers in the development of IIIF. At the end of the Mmmonk project, about 600 books at Bruges Public Library will also be IIIF-compliant.

In order to encourage the uptake of IIIF by end users that are not tech savvy, we wanted to make a shift from the IIIF-expert gaze to an user-orientated approach. We conducted interviews with a broad range of users and formulated a couple of conclusions that helped us define priorities in the developing stage of the Mmmonk project. The findings of this research gather around a couple of main issues, e.g. the impracticality of combining various offline, IIIF-compliant and non-IIIF-compliant materials in research; the "scary" technical jargon (e.g. 'manifests' and 'json'); the absence of IIIF-infrastructure at the user's institution; the lack of insight into the possibilities beyond basic functionalities (e.g. zoom); fear of investing too much time for too little profit, or of link rot. We defined a couple of recommendations, among

others: provide basic non-technical education on the reuse of IIIF-data; provide rich metadata; invest in SEO as Google remains the main entry point for searches.

We used the findings of the research to define four main development activities, to be executed by using minimal computing techniques and building on open source code: 1) a platform with catalogue offering search, filter and browse options based on IIIF metadata aggregation.[5] 2) an improved version of the Exhibit guided viewing tool, allowing the inclusion of YouTube videos.[6] 3) a proof-of-concept on multilayered presentation of annotations. 4) IIIF workshops and tutorials for educators.

At the ARMA conference at Ljubljana on 22 June 2022, we presented an adapted version of the workshop for educators. Bruges Public Library will publish its collection to Europeana via the aggregator Manuscriptorium. The metadata in the manifests of Bruges Public Library is as rich as the metadata in the catalogue records, therefore it was decided to harvest the metadata from the manifests directly. Note that this is a special case: as in general the recommendation is to keep away from using IIIF presentation information as a proxy for "real", structured metadata.[7]
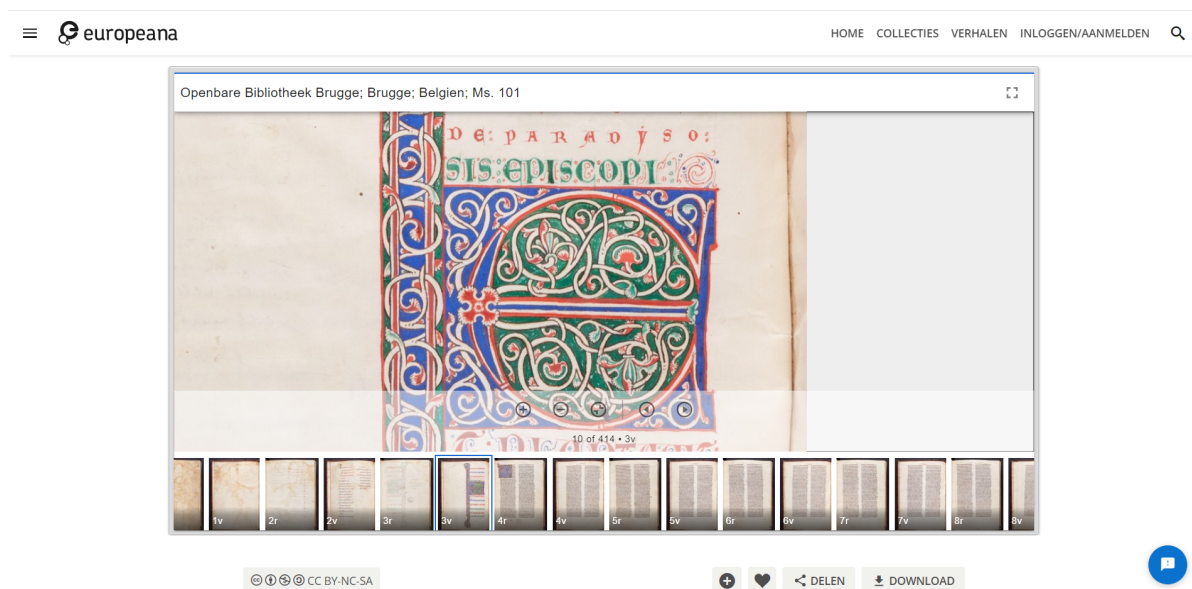
Public Library Bruges, ms. 101

3.1.6 Staatsbibliothek zu Berlin (SBB)

The SBB provides IIIF-compliant images and metadata within a number of central portals, websites and services:

- Digital Collections of Staatsbibliothek zu Berlin: Digital copies of books, manuscripts and other media that are held physically by the SBB. Currently 195.328 works in total.

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[5] The Project website will evolve into a platform on 1 November 2022. See https://mmmonk.be/en/aboutmmmonk/

[6] See for this free online tool https://mmmonk.vercel.app/.

[7] See also https://iiif.io/api/cookbook/recipe/0029-metadata-anywhere/.

- <u>SBB Lab</u>: SBB's data service: data for free download - demos to experiment with.

- <u>ZEFYS</u>: The newspaper information system of the Berlin State Library.

- <u>CrossAsia</u>: Access to specialised information from the entire spectrum of humanities and social sciences from and about Asia.

- <u>E.T.A. Hoffmann Portal</u>: Portal of E.T.A. Hoffmann-related material.

Altogether these services have 24 million images available (numbers steadily growing), 1.3 petabytes of storage are used, the systems serve up to multiple 100k requests a day.

How do we do this (infrastructure and tech stack)?

Core element of SBB's technical infrastructure is the "Next Generation Content Server (NGCS)".

- This server handles all related IIIF based requests and also the delivery of more content variants (ZIP, PDF, OCR and METS/MODS).

- It implements the IIIF Image API 2.1 and some parts of the IIIF Presentation API 2.1. An upgrade to support and be compliant to API version 3.0 is planned.

ARMA & SBB: IIIF and post-secondary educational resources

Cultural Heritage Objects (CHOs) in IIIF offer high quality images that can be used in different educational contexts. Access to IIIF quality manuscripts and other CHOs allows for very detailed viewing of medieval objects from almost anywhere in the world. IIIF is used in various ways for post-secondary educational resources in the ARMA project. We are focusing especially on multiple functions of IIIF advanced viewers.

IIIF advanced viewers (such as Mirador) can serve:

- as a tool to read texts (from manuscript pages)

- as a tool to compare manuscripts

- as a tool to explore manuscripts

- as a provider of metadata and information referring to medieval manuscripts.

In order to make it easier for students to deal with IIIF, IIIF advanced viewers are integrated in different ways into the learning scenarios for post-secondary education. On the one hand, a video from Leiden University Libraries (*How to use IIIF Advanced Viewer*) offers students the opportunity to familiarise themselves with the basic functionalities of IIIF advanced viewers on their own. On the other hand, IIIF advanced viewers are used by both lecturers and students in the classroom. Based on an introduction by the lecturer to the basic functionality of IIIF advanced viewer, the students should independently explore IIIF manuscripts in small groups. The focus is not only on the high-quality scans, but also on the metadata provided by IIIF. Advanced IIIF viewers (such as Mirador) have the functionality to display part of the metadata via an info button. Both students and lecturers can find important basic information about the manuscript there.

3.1.7 Leiden University Libraries
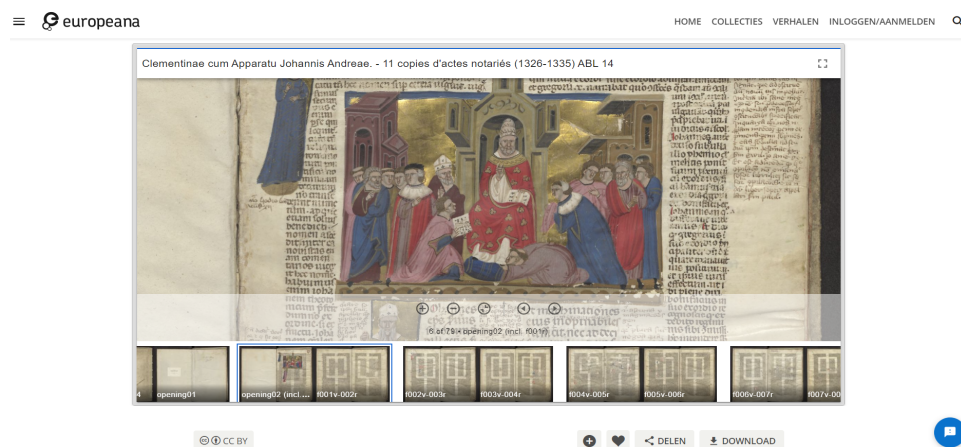
Leiden University Libraries, <u>ABL 14</u>

Leiden University Libraries (UBL) is also a founding member of the IIIF consortium and the Director of Leiden University Libraries is currently a member of the IIIF <u>Executive Committee</u>. UBL's IIIF infrastructure is operational since the summer of 2020, a few months before the start of the ARMA project. UBL's Digital Collections service currently provides ca. 200.000 digital objects that are accompanied by a IIIF manifest, including all digitised medieval manuscripts. UBL uses the Mirador viewer for accessing objects in its Digital Collections service, and Omeka software for creating digital exhibitions with IIIF.[8] Its medieval manuscripts are also made available via IIIF in the Biblissima portal, and together with the Humanities faculty of Leiden University, UBL created the IIIF-based educational website <u>Mouse and Manuscript</u>, a collection of interactive lessons on codicology and oriental manuscripts.

As UBL's IIIF infrastructure was operational only a few months before the start of the ARMA project, and as UBL's collections were underrepresented in Europeana, ARMA provided a good opportunity to set up a procedure for the delivery of selected records to the Dutch national aggregator (<u>Dutch Collections for Europe</u>), for transformation of UBL's MARC21 records to EDM. Unfortunately it turned out that this was not a straightforward process. Some challenges that we ran into:

- UBL uses the dual record system: a digitised object gets a new record, alongside the original record of the physical item. UBL tried to use the digital records, which for instance include Handles as permalinks, to create EDM records. However, as these records are less rich in descriptive metadata than the records of the physical object, we made the decision to use the record of the physical object as the basis for the EDM records instead.

- As a consequence, the permalinks to the digitised item needed to be added directly into the records of the physical objects to be able to use them easily in the transformation to EDM.

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[8] See for instance <u>the exhibition about the prints collection of Peter Chabot</u>.

- Some broken links were generated by the transformation because of unknown identifiers for the individual images. This problem occurred whenever there was more than one scan of an object. With the help of a script we harvested candidate images that we thought would be suitable to use as thumbnails for these cases.

- Initially, our IIIF servers were not capable of handling the media processing process that Europeana runs in the ingestion workflow. We solved this by making some changes to the servers and by limiting the size of the image requested from the server. This was easy to do with the help of the IIIF Image API URI syntax and applied to the links in edm:object and edm:isShownBy. An important requirement here was that the limitation that we set should not negatively affect the content tier calculation.

- For compound objects (for example a manuscript consisting of multiple parts), with each its own manifest but only one bibliographic record, only the first part can be shown in the IIIF viewer on the Europeana portal. We have not found a solution to this yet that does not involve making separate bibliographical records for each part.

The ARMA project helped UBL to streamline processes that support interoperability and harvesting in the context of IIIF. The next step will be to use IIIF for digitised maps, including georeferencing. UBL is currently participating in a project to help define IIIF specifications for such use. Furthermore we are investigating the possibilities of offering annotation facilities via IIIF on a broader scale than we are currently doing in some pilot projects.

3.2   IIIF at Europeana

3.2.1   Implementation of IIIF in Europeana

Europeana is one of the founding members of the IIIF Consortium and since 2015, when the IIIF Consortium was formed, EF has adopted and implemented IIIF at several levels: in the submission of metadata to Europeana; for improving the user experience in its portal; and to foster the re-use of cultural heritage data. During the ARMA project over 60.000 objects have been delivered with IIIF resources, around 30.000 of these objects are new to Europeana. Manifests have been created by Europeana for items that were delivered without, with the exception of 46 3D objects, delivered by the Hunt Museum.

Submission of IIIF manifests

The first level of IIIF support in Europeana relates to the Europeana Data Model (EDM). EDM allows data providers and aggregators to deliver to Europeana their IIIF resources. The IIIF to EDM Profile was first made available in 2016 along with the Guidelines for submitting IIIF resources for objects in EDM. The profile allows for explicit representation of IIIF resources for cultural objects. They are represented as web resources, similarly to other kinds of digital objects, and include a link to a manifest that a IIIF viewer can use for display.
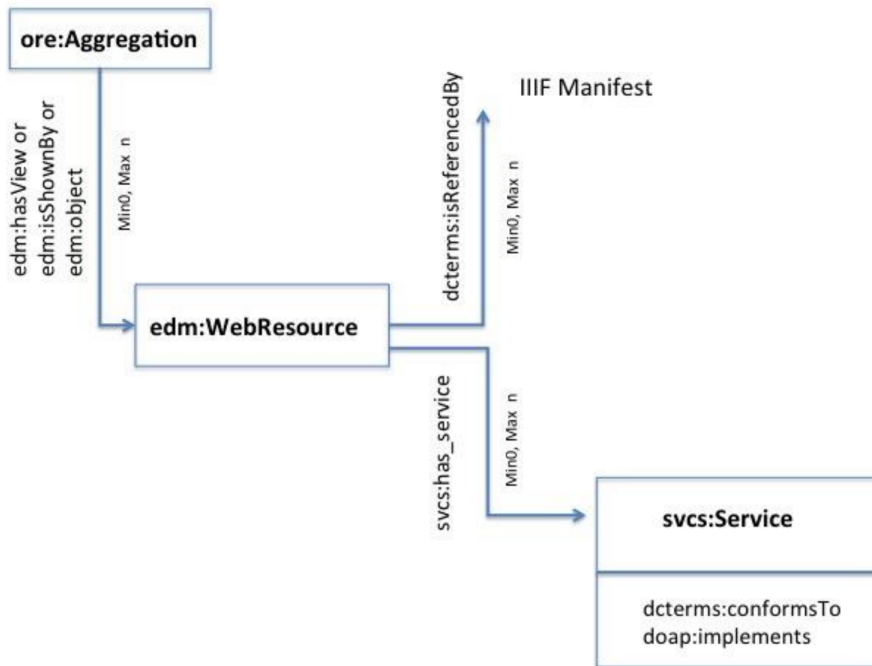
Overview of the model from the IIIF to EDM Profile

In parallel to the definition of the IIIF to EDM Profile, EF has implemented a IIIF viewer in its portal, achieving a clear improvement of the user experience while interacting with image-based digital objects in the portal. Upon the migration to the new Europeana portal in April 2020, EF has decided to adopt Mirador (v3.0.0) for the display of IIIF v2 manifests with custom plugins to handle display and search in full-text content. The view is configured for one window to be consistent with the user experience offered for other kinds of resources.
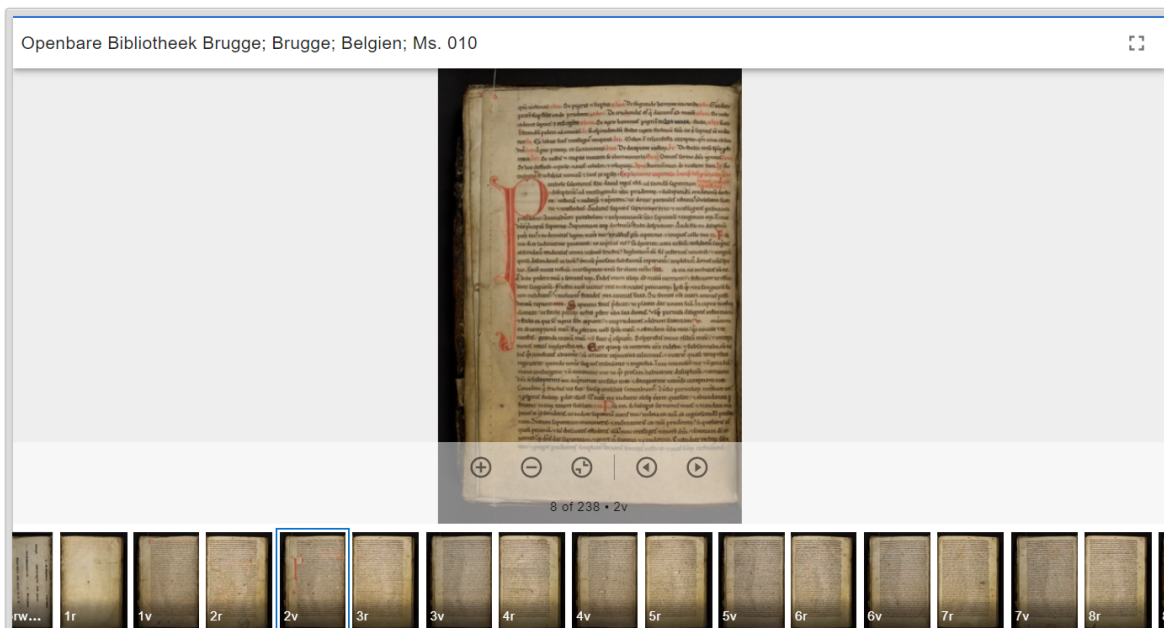
Display of provider manifest on the Europeana portal using the Mirador IIIF Viewer.

Manifests generated by Europeana

As part of the development of the Europeana Newspapers Collection in 2018, EF has expanded for the first time its offer to go beyond receiving IIIF manifests from data providers into generating IIIF manifests out of the EDM metadata that is delivered by data providers. This was essential for the Newspapers Collection as a significant portion of the image resources were accessible via the IIIF Image API and had to be made available via manifests so that a IIIF viewer used by the Europeana portal could display them. Since then, it is possible to obtain a Europeana manifest for any item that is publicly available in Europeana using the Europeana IIIF Manifest API. More recently, the main Europeana Record API has started to provide links to Europeana manifests whenever a provider has not indicated a manifest. This allows data consumers to more easily discover and use Europeana items in IIIF enabled tools and services.

Display of an item using a IIIF Viewer of Europeana generated manifest.

IIIF and Fulltext

Also as part of the development of the Europeana Newspapers Collection, work was done to support fulltext as part of the IIIF offering. This was essential so that fulltext could be displayed (as annotations) overlaid on Newspaper pages. For this development, a new EDM profile was designed "EDM Full-Text profile" which describes how full-text can be represented in a way that is compliant with IIIF, and paved the way for the development of the Europeana IIIF Fulltext API. This included both the support for the display of full-text, as well as the search on the content of a Newspaper across the whole Newspapers Collection.
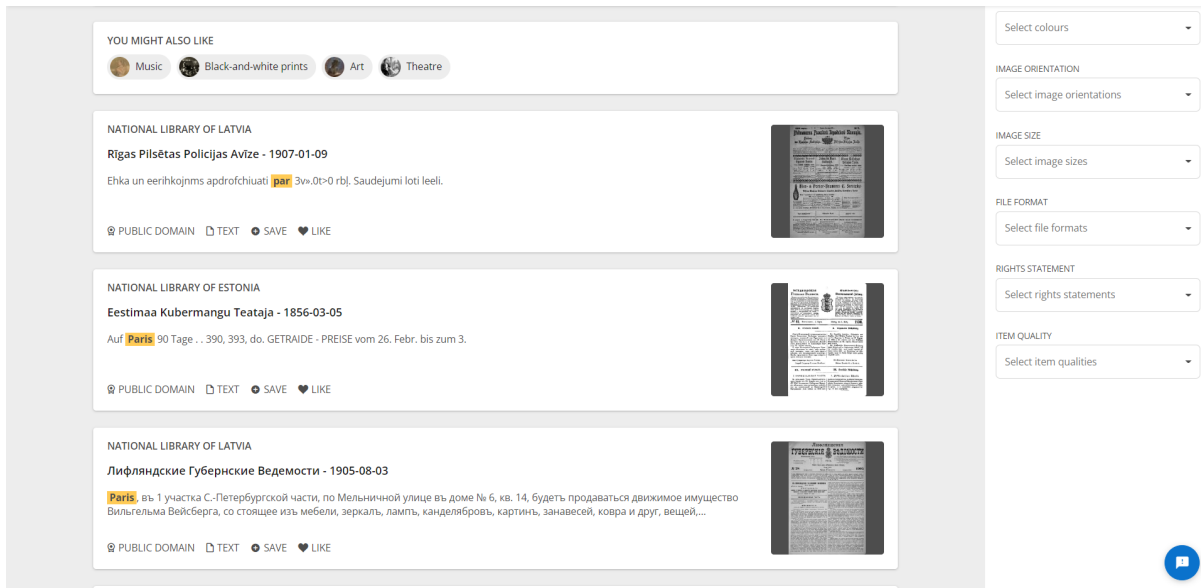
Display of full-text content search on the Europeana Newspapers Collection

In a second phase of development and driven by the users of this Collection, EF developed the IIIF Content Search API allowing users to search on the content of a single Newspapers item.
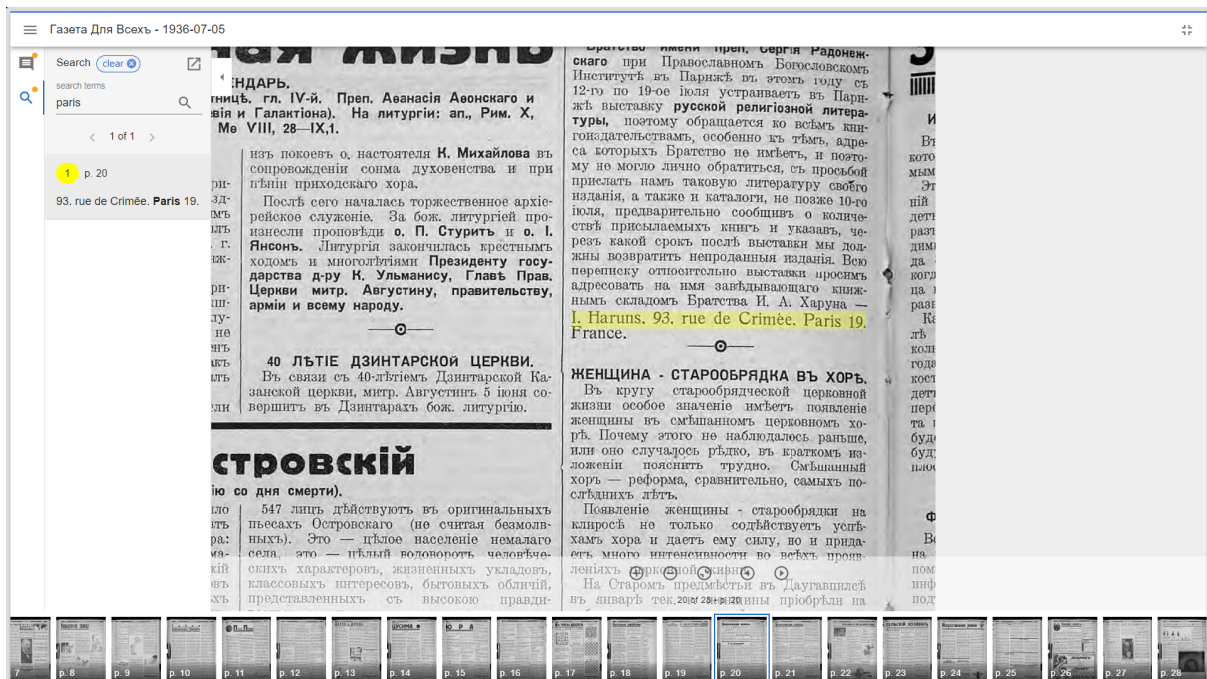
Search on the full-text content of a single Newspaper Item.

Europeana adoption of IIIF v3

Following the earlier developments on IIIF and driven by the Europeana Media GS Project, EF embarked on the development of the IIIF v3 with the interest of making available in the Europeana portal, a media player that can display a wide range of different media formats as well as display subtitles for audio and video resources. This was critical as IIIF v2 was

limited to image resources and recently v3 had been published with support for A/V materials. Together with the implementation of v3, also the fulltext support was expanded to cover audio transcriptions (ie. captions or subtitles) for both audio and video resources, allowing the Europeana Core Service Platform to use the same full text infrastructure for this kind of content.

Playout of a IIIF AV manifest using the Europeana Media Player.

This made it so that Europeana could offer both v2 and v3 manifests for all items that are available in Europeana.

What comes next for Europeana?

Europeana has investigated the use of the IIIF APIs as a mechanism for metadata harvesting (Freire et al., 2018). The successful application of IIIF for this purpose would allow data providers to re-use their IIIF implementations to deliver metadata to Europeana, therefore they would not need to implement the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). The success of these investigations have led Europeana to cooperate with the IIIF community in the specification of the IIIF Change Discovery API. This IIIF API has reached version 1.0 in 2020, and Europeana has provided a reference implementation of a metadata harvester based on it. Currently, this API is not implemented in Metis, the ingestion system of Europeana, since its implementation is pending an expression of interest by Europeana data providers to deliver metadata to Europeana using this protocol.

Another area where IIIF may play a role in Europeana is 3D content, for which Europeana is currently engaged in improving interoperability. The IIIF community is also active in this area. The IIIF 3D Community Group was formed in 2021, and is currently at the early stages of exploring possibilities for viewing, search, discovery, and annotating 3D data, and of

collecting and documenting use cases for interoperability of 3D data. Also, a <u>IIIF 3D Technical Specification Group</u> was installed to add 3D capabilities into IIIF. Although it is not sure yet if the IIIF community will achieve stable specifications for interoperability of 3D data via IIIF, EF is following the results from this community group.

3.2.2 Promotion of IIIF in the sector

One of the earliest initiatives from Europeana in promoting IIIF in the cultural heritage sector was the EuropeanaTech task force <u>Preparing Europeana for IIIF involvement</u>. The task force provided recommendations on the general use and handling of IIIF technologies within the Europeana ecosystem, and also led to the establishment of the <u>IIIF & Europeana Working Group</u> that is currently active. The working group aims to increase the uptake and understanding of IIIF in both the <u>EuropeanaTech</u> and <u>Aggregator Forum</u> communities, and it focuses its efforts on:

- Creating standardised training workshops materials for content partner usage as well as Train the Trainer activities

- Share examples of IIIF implementations

- Translate existing IIIF training materials

- Develop a communication strategy on IIIF usage for the Europeana Network

The IIIF & Europeana Working Group has run numerous online and in person events to enable participants to understand what is required to implement the IIIF standards and this will continue during the upcoming year.

Chapter 4: Recommendations

The ARMA project has learned that the advantages of IIIF for cultural institutions are in its interoperability, in its ability to share without duplication and in the tools and viewers which support a rich user experience. By using IIIF tools, we were able to achieve a greater usability and impact when disseminating the digitised content, which in our case are medieval manuscripts and other objects related to reading culture in the Middle Ages. In this final chapter, we share our lessons learned of working with IIIF and turn these into recommendations. First we provide some generic recommendations to promote IIIF as an important instrument for cultural heritage institutions in their digital transformation. After that we share our recommendations with institutions that may improve their current IIIF services and with institutions that are considering to start using IIIF. The chapter closes with recommendations to Europeana about options to extend their use of and support for IIIF.

4.1   Recommendations to all CHI's with medieval objects/collections

Based on the experiences in the ARMA project, we recommend Cultural Heritage Institutions to seriously look at the options that IIIF can bring to their digital services, as IIIF has a number of great advantages in comparison to more traditional ways of sharing and presenting digital cultural heritage objects. We have three main perspectives on this:

User perspective: Useful & user friendly

IIIF supports rich functionalities, such as the possibility to display, edit and share images in high-resolution. IIIF enables efficient zooming functionality, and there is no need to wait until a high resolution file is downloaded first. Also, the user can, depending on viewer functionality, easily annotate, customise and share the images with others.

Some IIIF viewers, such as Mirador, give the possibility to view (and compare) multiple objects side to side. Therefore, IIIF is an ideal way for a user to create virtual reconstructions of former collections or bring back various parts of a manuscript that are kept by different institutions.

IIIF puts users at the steering wheel, without losing connection with the original digital image. A user of a service that is based on IIIF can make use of IIIF functionality without having extensive knowledge of the protocol or the tools it supports. More advanced users that have an understanding of the options that IIIF provides, can make use of customisation possibilities, both as part of the functionality of IIIF viewers, or even with URL-manipulation.

Institutional perspective: Versatile / multifunctional

The fact that IIIF works with open standards and open source makes it a versatile standard. It supports for instance multilingual use and can display various kinds of metadata. As discussed above, a number of viewers have been developed, which gives the possibility to choose a viewer that works best for a certain type of collection, material or institution.

In addition, various supporting tools are being developed to enhance the possibilities of using IIIF, such as tools for making web exhibitions[9] or to integrate IIIF in educational resources.

Community perspective: Reliable / future proof:

IIIF works with open standards and open source software. IIIF tools are usually developed under open licences, and there is a whole community engaged with improving and extending IIIF specifications and functionality. At the same time, there is also a (growing) Consortium of over 60 cultural heritage institutions that guide and direct the development.

In practice, this means that IIIF is constantly evolving: work is in progress to support AV, location based and 3D materials, policy is developed to integrate user-generated content and metadata standards are being discussed.

The continuously improving and extending of IIIF by various communities and the Consortium makes the standard reliable and future proof.

4.2 Recommendations to institutions with IIIF facilities

If your institution already uses IIIF in its digital infrastructure, you may want to look at our lessons learned that may help you to improve or expand your implementation of IIIF. Our main lessons learned are:

Include rich metadata in your IIIF manifests

We learned that it is to be preferred that the IIIF manifest of a specific cultural heritage object should ideally include as much (references to) metadata as possible. Medieval manuscripts are research intensive objects, resulting in extensive metadata records. Incorporating this rich metadata in your manifest contributes to a rich experience in viewing and using the digital object, regardless of the website where the user accesses your IIIF manifest.

The metadata in a IIIF manifest may originate from the original catalogue or collection registration system, but you can also build your manifests on the metadata available on your OAI server. This can be convenient as it allows for easy conversion to data models used by harvesting services based on OAI-PMH, for instance Europeana, which requires conversion of the metadata to EDM. However, there is no proper standardisation of the metadata labels and values in IIIF manifests, so one can put any label in the list in contrast to the original bibliographic records. It is recommended to use the 'See also'-property' in the manifest to link to the original bibliographic records in institutional systems or other descriptions if further processing of the metadata in the manifest is needed. In this way you can have the best of both worlds.

Even though IIIF may not offer all the possibilities that, for instance, your own catalogue interface offers, we consider it good practice to offer to the end users metadata that is as rich as possible. Creating rich metadata, including for instance the pagination of the publications

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[9] See for instance <u>Exhibit</u> and <u>Omeka</u>. For an overview of tools that support IIIF, check out <u>https://iiif.io/get-started/tools/</u>.

that help IIIF services, will take time, but it enlarges the usefulness of your digital objects. In the case of medieval manuscripts be also aware that the metadata may be updated more frequently than with other types of objects. So the metadata in the manifests may need frequent updating as well. Some aggregators may do this on-the-fly, others may need to be informed about this.

Multilingual issues

A specific aspect of metadata is the language in which they are written. It is possible to indicate the language of the metadata per section in IIIF, which makes it also possible to present the metadata in various languages. Many IIIF-viewers also already offer the possibility to show the metadata in one particular language.

The Public Library of Bruges, one of the ARMA partners, uses Linked Open Data to present various sections of the metadata in as many languages as possible. It is possible to refer to these LOD via a IIIF manifest. There is however a dilemma here. On the one hand, one wants the metadata to be as readable as possible for the end user while viewing an object, so it may be best to add the labels directly into the manifest instead of linking to them. But in that way you lose the understanding that it is a linked data source. So the ideal solution is to do both: include rich multilingual metadata in the manifest, and link to the structured metadata via the seeAlso property in the manifest, which is useful for machine readability.

Annotations

A very useful functionality of IIIF, especially in research and educational settings, is the option to add user generated annotations, transliterations and transcriptions to (sections of) digitised cultural heritage objects. We didn't implement this functionality in the ARMA project due to time constraints, but this is a feature that the ARMA partners are currently exploring in other projects and services. There are already quite a few tools and platforms available to let users add annotations to digital objects via IIIF, such as Madoc, FromThePage and Simple Annotation Server. In addition, Europeana supports fulltext as part of the IIIF offering (see 3.2.1).

An issue for institutions to pay attention to when starting to support annotations via IIIF is how to manage these annotations. To prevent and react to abuse, such as spam, copyright infringement and (other) illegal content, it is necessary to set terms and conditions for creating annotations. In addition, it might be useful to have authentication and authorisation of users who can make annotations.

Another issue is how to link to the annotation from the manifest. At the moment, the IIIF community is also looking into ways how annotations that have been made in a decentralised way can best be linked to the manifest, so that institutions, for instance, know when their digital objects have been annotated.

Media processing

Another lesson we learned during the ARMA project was that you may run into issues on the IIIF server during the media processing step in the Europeana ingestion workflow. It turned out that the server(s) cannot always handle the media processing process and this may lead to many records with incorrect tier calculations or not be published on the Europeana portal.

A workaround for this can be to (slightly) limit the size of the image requested from the server with the use of the <u>IIIF link syntax</u>. Next to this, solutions of improving the setup of the server and the response might help to optimise this step in the ingestion workflow.

Provide basic, non-technical information to users

IIIF offers a lot of functionalities, but to ensure that users are drawn towards it and actually make use of these functionalities, it is recommended to inform your users on a basic level about working with IIIF and on the reuse of IIIF data, e.g. via an instructional video. This information should be as non-technical as possible, as too much technical jargon might have the opposite result.

4.3   Recommendations to institutions without IIIF facilities

If you work at an institution that curates cultural heritage objects, and that manages an online service that provides access to digitised collection items, we recommend that you look into the options to start using IIIF and invest in a IIIF infrastructure. IIIF is a tool that increases the quality of both the usability and the digital collection management.

We advise to start with the IIIF Image API, Presentation API and a IIIF supporting viewer, in the context of small projects, focusing on specific collections or specific aspects, and build it up from there. Connect with partner institutions and the IIIF community, there are no big thresholds to share knowledge on IIIF.

As for the choice of a viewer, you can choose to use the IIIF viewer as an add-on viewer with extra functionality supported by the IIIF manifests. Use the IIIF logo to link from the standard view in the metadata record to the advanced view using IIIF[10]. You can also start using IIIF viewers as a basic tool, without making use of the IIIF manifests, and build it from there.

If it is not feasible or doable to invest in your own IIIF infrastructure and tools, here are a few recommendations from ARMA partners who are in the same situation:

- Connect with a domain, thematic or national aggregator that supports IIIF and let them take care of the harvesting of your digital collections with the inclusion of IIIF manifests.

- If your main aggregator does not support IIIF yet, encourage them to connect with the IIIF community and promote with them the implementation of IIIF tools to improve their services to content providers such as yourself.

- Take good care of the quality of your own metadata, regarding both the content and the structure of the physical object that is described by the metadata. The better the metadata, the richer the user experience, as the metadata in the IIIF manifest is essential for presentation of and navigation through the digital object.

- There are also some commercial IIIF providers that you can hire to help you with, for instance, the creation of IIIF manifests.

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[10] If you are interested in UX-aspects of IIIF, please visit the website of the IIIF Discovery for Humans Community Group at <u>https://iiif.io/community/groups/D4H/</u>.

4.4   Recommendations to Europeana

As described above, Europeana has shown active involvement with the promotion and use of IIIF from its beginning. With the processing of the ARMA collections, medieval manuscripts are now also a collection in Europeana that can be accessed via IIIF. Now the uptake of IIIF in the cultural heritage sector is widening, we call upon the Europeana Foundation to take the following recommendations emerging from the ARMA project under consideration.

Continue strong support for IIIF

Europeana has shown leadership by early adopting the IIIF protocol and services, and contributing to the development of IIIF by actively participating in IIIF Community Groups and setting up task forces and working groups that focus on improving the use of IIIF. The ARMA consortium considers IIIF as an important tool in the digital transformation of cultural heritage institutions, as it contributes to an improved usability and a leaner management of shared digital collections. Therefore, Europeana is encouraged to continue and expand their support for IIIF, by:

- Including more collections and objects that are accompanied by IIIF manifests

- Working jointly with the Europeana Aggregator Forum to make IIIF a standard element in the aggregation of digital heritage collections

- Explicitly and visibly supporting and participating in IIIF related task forces and working groups, both in and outside the context of the Europeana Initiative, that help widen the functionalities of IIIF, e.g. for audiovisual and 3D collections and in the context of georeferencing

- Take a leading role in reviewing the role and structure of metadata in IIIF-manifests

Improve the use of IIIF in the Europeana Portal

Although Europeana already uses the Mirador viewer, which supports IIIF, it can only be used for basic presentation functions. It would be good if the presentation of IIIF objects in the Europeana portal will be improved along the following lines:

- Add the IIIF logo in the presentation of the objects.

- Allow for the side to side comparison of multiple digital objects

- Allow for customization of the viewing of a digital object in Europeana (e.g. adjustment of brightness)

- Make sure that every image of compound objects in Europeana can be identified individually, not just the first or landing page, so one can, for example, refer to a specific page of a medieval manuscript from a blog or educational website (this can be achieved by implementing the IIIF Content State API).

- Use IIIF not only in the collections portal, but also in the blogs, galleries and exhibitions on the Europeana website

- Apply a search filter to quickly identify IIIF-images in Europeana

- Enable the use of user created contents (e.g. annotations or transcriptions in digital objects, or user-created IIIF collections)

References

Throughout the report we have added various relevant references and links. In this section we have gathered a selection of references for further reading, which give general introductions to the themes that were central in this report.

References related to the ARMA project

The ARMA project is a Europeana Generic Service project and it is co-financed by the Connecting Europe Facility of the European Union. More information can be found via the project page on Europeana Pro:

> https://pro.europeana.eu/project/the-art-of-reading-in-the-middle-ages-arma
> (accessed 22-07-2022)

Apart from delivering and updating over 60.000 digital objects to Europeana, the project partners have also made a number of educational resources, an exhibition and many blogs and galleries. In addition to this report on IIIF, the project has resulted in a report on using digitised medieval objects in education and a document with EDM specifications for medieval manuscripts. The output of the project can be found on the project website:

> https://www.medieval-reads.eu (accessed on 22-07-2022)

The easiest way to find medieval digitised items and editorials about the Middle Ages in Europeana is via the feature page *Middle Ages*. This includes the exhibition, blogs and educational resources that were made as part of the ARMA project

> https://www.europeana.eu/en/middle-ages (accessed on 22-07-2022)

References related to Europeana

Europeana provides access to digital European cultural heritage materials. Via the platform you can find millions of digitised and digital items from institutions across Europe, among which the 60.000 objects that have been ingested and updated during the ARMA project:

> https://www.europeana.eu/en (accessed on 22-07-2022)

Europeana has a IIIF working group, which is closely connected to the IIIF community. The membership of the working group is open for everyone interested. Activities of the working group are coördinated by the Europeana IIIF coordination group. For more information on the activities of this working group:

> https://pro.europeana.eu/project/iiif-europeana-working-group (accessed on
> 22-07-2022)

General information on the use of IIIF by Europeana can be found here:

> https://pro.europeana.eu/page/iiif (accessed on 22-07-2022)

Information on the latest developments of IIIF on Europeana can be found here:

> https://europeana.atlassian.net/wiki/spaces/RD/pages/30671045/IIIF+work+at+Europeana (accessed on 22-07-2022)

At the Europeana conference of 2020 a presentation was given on the possibilities of using IIIF in education. The recording of this presentation can be found here:

https://pro.europeana.eu/event/teaching-and-learning-with-iiif (accessed on 22-07-2022)

In 2018, staff of Europeana and data providers published an article on case studies on implementing different possibilities of and with IIIF in Europeana:

N. Freire, G. Robson, J. B. Howard , H. Manguinhas, A. Isaac, (2018), 'Cultural heritage metadata aggregation using web technologies: IIIF, Sitemaps and Schema.org', International Journal on Digital Libraries. Springer Berlin Heidelberg. DOI: 10.1007/s00799-018-0259-5 (accessed on 22-07-2022)

References related to IIIF

General information about IIIF can be found via:

www.iiif.io (accessed on 22-07-2022)

Opportunities and possibilities of using IIIF in studying medieval manuscripts are discussed in this blogpost:

https://blalbrit.github.io/2015/07/14/fellow-travelers-the-canterbury-tales-and-iiif (accessed on 22-07-2022)

Yearly a IIIF conference is organised. The last conference took place on 6-8 June 2022 in Cambridge (MA). These sessions of this conference have been recorded and can be viewed:

https://iiif.io/event/2022/cambridge/schedule/#conference-presentations (accessed on 22-07-2022)

A good introduction to IIIF is this training, made as part of the Europeana Aggregator training on IIIF:

https://training.iiif.io/europeana/index.html (accessed on 22-07-2022)

Part of the above mentioned training is this video on the Presentation API:

https://www.youtube.com/watch?v=98z9YNFiUqU&t=1s (accessed on 22-07-2022)

Leiden University Libraries made a instructional video on using the Mirador Viewer:

https://www.youtube.com/watch?v=LanU4zB-P5M (accessed on 22-07-2022)