

## Integrating IIF images into Digital Humanities databases: A step-by-step workflow proposal<sup>1</sup>

*Integración de imágenes IIF en bases de datos de Humanidades Digitales: una propuesta de flujo de trabajo paso a paso*

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### ABSTRACT

This article outlines a workflow for easily integrating high-resolution images into specialized databases. The proposed solution originates from the PARAHeB project, which focuses on studying the paratextual elements in medieval Hebrew biblical manuscripts. The workflow was designed to tackle challenges such as copyright restrictions and storage limitations related to high-resolution manuscript images. The central component of this solution is the seamless access to image fragments stored in external repositories thanks to the International Image Interoperability Framework (IIF), thereby eliminating the need for local storage.

The workflow incorporates tools like Canvas-Finder and the IIF Image Manipulation Tool, enabling users to easily generate and share image links. By following the FAIR principles, the workflow promotes the sustainability and broad usability of the data, providing a scalable model for image integration in Digital Humanities databases.

### KEYWORDS

Images, Manuscript, Linked Open Data, Storage, Standards.

### RESUMEN

Este artículo presenta un flujo de trabajo (*workflow*) que permite integrar fácilmente imágenes de alta resolución en bases de datos especializadas. La propuesta se origina en el proyecto PARAHeB, centrado en el estudio de elementos paratextuales en manuscritos bíblicos hebreos medievales. El *workflow* ha sido diseñado para abordar desafíos tales como restricciones de derechos de autor y limitaciones de almacenamiento relacionadas con imágenes de alta resolución. El componente central de esta solución es el acceso a fragmentos de imágenes almacenadas en repositorios externos gracias al uso del International Image Interoperability Framework (IIF), eliminando la necesidad de almacenamiento local. El *workflow* propuesto combina herramientas como CanvasFinder y IIF Image Manipulation Tool, que permiten generar y compartir fácilmente enlaces a imágenes. Al seguir los principios FAIR, el *workflow* promueve la sostenibilidad y usabilidad de los datos, ofreciendo un modelo escalable para la integración de imágenes en bases de datos de Humanidades Digitales.

### PALABRAS CLAVE

Imágenes, manuscrito, datos enlazados abiertos, almacenamiento, estándares.

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## 1. INTRODUCTION

Paratextuality, a concept originally theorized by Gérard Genette (1997), encompasses the complex relationship between a text and the supplementary elements that surround, frame, and extend it. In medieval manuscript studies, paratextuality refers in a broader sense to every part of a manuscript beyond the main text itself<sup>2</sup>. The analysis of paratextual elements has emerged as a crucial dimension in manuscript studies, offering invaluable insights into scribal practices, cultural contexts, and the transmission of knowledge across generations. Within this field, Hebrew biblical manuscripts stand out as particularly rich objects of study due to their elaborate paratextual apparatus.

Medieval Hebrew biblical codices frequently feature a well-structured and articulated system of marginal annotations known as Masora. These annotations appear predominantly in the intercolumnar space, as well as along the outer edges and top and bottom margins of each folio, alongside the biblical text, which is arranged in columns. In some cases, they may also be found at the end of individual biblical books or the main divisions of the Bible. Beyond Masora, certain manuscripts also feature other paratextual elements –glosses (*le'azim*), additions, biblical commentaries, corrections, titles, decorations, illuminations–, all of which coexist in the manuscript margins. All of these paratexts have traditionally been studied solely for their content, neglecting potential relationships between these elements and their combined impact on the reading experience.

The Understanding the Paratexts of the Hebrew Bible (PARAHeB) project undertakes a comprehensive study of such paratextual elements in Hebrew biblical manuscripts and is aimed at deepening our understanding of their role in shaping the reader's engagement with the biblical text<sup>3</sup>. This project pursues two main objectives: (1) to explore how the Masora interacts with the biblical text, focusing on annotation styles, visual emphasis, and the effect of its presence or absence on the reader's experience and understanding of the biblical text; and (2) to analyze the interplay between the Masora and other marginal paratexts, considering visual separation, hierarchical relationships, and their collective influence on the reading experience.

To achieve these objectives, it is essential not only to identify all of the paratextual elements in a manuscript but also to study each one in relation to its placement on the folio, its interaction with both the biblical text and other paratexts, and relevant codicological and palaeographical aspects. This in-depth approach requires a careful analysis of each paratext to fully understand its cognitive function and contribution to the manuscript's overall structure.

Given the extensive data involved in studying multiple paratextual elements across various manuscripts, it was evident from the outset that PARAHeB would benefit from the opportunities the Digital Humanities has to offer, since a database built for the unique needs of the research was

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<sup>2</sup> For a survey of the term in Manuscript studies see Andrist (2018).

<sup>3</sup> Accessible from: <https://paraheb.ilc.csic.es/>.

needed. This database would have to encompass all relevant aspects of paratextual study, as well as offer advanced search capabilities that extend beyond simple listings of paratexts. Crucially, it would also need to include images of the paratexts described in order to allow the scholars to have a complete scope of the study.

To address this need, we reviewed existing databases that focused on paratexts across various textual manuscript traditions. Apart from a few exceptions, we found that such projects typically do not integrate images of the paratexts within their descriptions. Some only included the URL of an external collection<sup>4</sup>, without providing direct access to the specific item, while others showcased images of entire folios on their websites, allowing the user to zoom in on specific areas<sup>5</sup>. Based on this analysis, we concluded that the PARAHeB database should display images of the paratexts directly alongside their descriptions. This approach would eliminate the need for users to search for items in the original sources or to arrange multiple windows on their screens in order to view such images together with the descriptions. At the same time, users should still have access to the original sources, which means that the project would have to face the challenge of interoperability, or the ability to operate together with other tools, easily exchanging data according to pre-established standards (Urra, 2024).

In particular, we were impressed by the system used by the GlossV.i.Be database<sup>6</sup>, which displays images of each paratext next to its description through pop-ups triggered when passing the cursor over the entry. This was the system we aimed to implement in our own database.

## 2. THE PROBLEM

Incorporating high-quality images of medieval manuscripts into a database presents several technical and legal challenges. Some of these challenges are internal to the project team, such as the technical expertise required to develop tools capable of storing and displaying media on a website and make use of the software already available; others depend on external factors, the latter being the hardest to overcome. Below, we outline several key issues that Digital Humanities projects commonly encounter, many of which we addressed in designing the PARAHeB database. These issues are both legal and technical in nature, and might be familiar to scholars engaged in other DH projects<sup>7</sup>.

### 2.1. Copyright

Currently, most libraries have digitized or are in the process of digitizing their physical collections, which allows all kinds of users to access materials that not so long ago were restricted to

<sup>4</sup> Such as the database *Paratexts of the Bible* or *The Database of Byzantine Book Epigrams (DBBE)*.

<sup>5</sup> For example, *Gloss Corpus* (Bauer, 2023).

<sup>6</sup> Accessible from: <https://gams.uni-graz.at/context:glossvibe>.

<sup>7</sup> References to the issues of limited funding and institutional restrictions on software deployment –discussed further below– can be found in del Río Riande & Alles Torrent (2022), in the context of digital philological editions.

scholars. Although, from a legal point of view, medieval manuscripts themselves are in the public domain, modern reproductions and digital images may be subject to copyright or other restrictions, which can limit their personal and commercial use, as well as options for downloading and local storage. Not all institutions provide usage licenses to the general public, and some may charge a fee. This could become a burden for research projects with limited funds, as covering such costs often depends on the availability of support from funding bodies.

## 2.2. Funding limitations

This is a well-known obstacle for Digital Humanities researchers and, along with the other restrictions outlined in this section, can delay or limit the scope of DH projects<sup>8</sup>. In searching for ways to incorporate images into the database, we explored some promising options, such as those offered by OCHRE Data Service<sup>9</sup>. However, most of the software available online required paid licenses, placing them beyond the financial reach of this project's budget.

## 2.3. Lack of a dedicated image server

High-resolution images are essential for analysing the intricate details of paratextual elements. However, these images often come in large file sizes, especially when stored in the TIFF format, which is the standard for medieval manuscript digitization. While TIFF files preserve crucial details, they also involve significant storage costs, which directly links this issue to a project's funding limitations. Additionally, issues related to digital storage include the need for specialized staff, infrastructure maintenance, backup servers, regular data refreshment, and even electricity costs. For long-term sustainability<sup>10</sup>, an ideal solution would be to store digital materials on an institutional server not subject to the temporal and financial constraints often faced by research projects<sup>11</sup>. In any case, each institution has its own constraints with regard to technical personnel, digital storage, and technological possibilities, and so institutional assistance cannot be taken for granted. For PAR-AHeB, we considered the option of creating a local image server using the open-source software Cantaloupe<sup>12</sup>. However, this plan was promptly discarded due to the impossibility of installing it –

<sup>8</sup> Bridget Almas, software architect and co-director of the Perseids Project, has commented on this problem in her article *Perseids: Experimenting with Infrastructure for Creating and Sharing Research Data in the Digital Humanities* (2017): "The technical hurdles to interoperability and sharing are usually much less difficult to overcome than those of social issues, funding, and governance. Even where there was a clear interest in interoperability and it was technically possible, we failed sometimes to implement or sustain an integration because doing so wasn't in the funded mandate of the partner project." The issue is also addressed by Fenlon (2020).

<sup>9</sup> OCHRE is an XML database system designed as "an online cultural and historical research environment" by the University of Chicago.

<sup>10</sup> In this case, we are dealing with temporal sustainability, even though there are other approaches to this aspect, such as the focus on environmental sustainability, which refers to how the resources used during a research project affect the environment (e.g., CO<sub>2</sub> emissions resulting from the electricity used by server centers).

<sup>11</sup> Arneil (2023) deals with this issue, among others common to DH projects, in his article "Planning for Sustainability: A Reality Check from the Development Team."

<sup>12</sup> Accessible from: <https://cantaloupe-project.github.io/>.

or, technically, any other related software— on the servers of the Center for Human and Social Sciences (CCHS)<sup>13</sup>, where the project is hosted, due to institutional directives.

#### 2.4. Access limitations to institutional servers for external researchers

Even when an institution has the technical and human resources to guarantee the long-term sustainability of a given project, bureaucratic limitations can still pose challenges. In the case of PARAHeB, the CCHS offers limited local storage to each project and restricts access exclusively to its own researchers. Consequently, the participation of external scholars in the project would be confined to a textual description of the paratexts, which would remain incomplete without the corresponding image. While assigning a CCHS researcher with server access to the role of media administrator could mitigate this issue, it would also significantly increase their workload, potentially detracting from their own research, especially given the large number of paratexts examined in the project. <https://dh-tech.github.io/awesome-digital-humanities/><https://dh-tech.github.io/awesome-digital-humanities/>

#### 2.5. Expiring open-source software

One possible solution to the funding limitations in projects like these is the use of free open-source software published online, such as that available on GitHub<sup>14</sup>, developed and maintained by online communities. However, the use of this technology requires some technical knowledge for its maintenance over time, since the original developers may eventually discontinue their work<sup>15</sup>. Consequently, DH projects that rely on this type of software may need to engage experts for maintenance and updates even after the project's official deadline, and this may not always be feasible. It is remarkable that, while the sustainability of open-source systems is a common concern, an assessment of its dimensions is still a pending task (Curto-Millet & Corsín Jiménez, 2022).

### 3. FINDING SOLUTIONS

Once we analysed the challenges the project would face, we decided that a viable solution was to incorporate images into the database while minimizing the use of technical resources. This methodological approach aligns with the work of the Minimal Computing working group, which fo-

<sup>13</sup> Accessible from: <https://www.cchs.csic.es/es>.

<sup>14</sup> Github is probably the most popular platform to host open-source software. Among its repositories, there are some dedicated to Digital Humanities such as "Awesome Digital Humanities (<https://dh-tech.github.io/awesome-digital-humanities/>), focused on DH Scholars, or "DHTech website" (<https://github.com/dh-tech/dh-tech.github.io>), for DH software developers, both created by DHTech.

<sup>15</sup> That would be the case of The Digital Resource and Database for Palaeography, Manuscript Studies and Diplomatic (DigiPal), a well-known project within the scope of the study of medieval manuscripts. Even though its software has been published as open-source, under the name of Archetype (2021), its last version was released on January 20, 2022. This means that it is up to the users to keep the code updated and ensure the security of their APIs. The last version released of Archetype can be consulted at <https://github.com/kcl-ddh/digipal/releases>.

cuses on “computing done under some set of significant constraints of hardware, software, education, network capacity, power, or other factors”<sup>16</sup>.

During the process of defining the database architecture and beginning our analysis of the manuscripts, we came across a valuable feature of the Chester Beatty Online Collections Viewer: the *Share Image Region* tool (Figure 1)<sup>17</sup>. This tool allows users to select a specific portion of the folio image and generate two types of links: one to the viewer page with a highlighted frame around the selected area; and another providing an IIIF (International Image Interoperability Framework)<sup>18</sup> image fragment<sup>19</sup>.

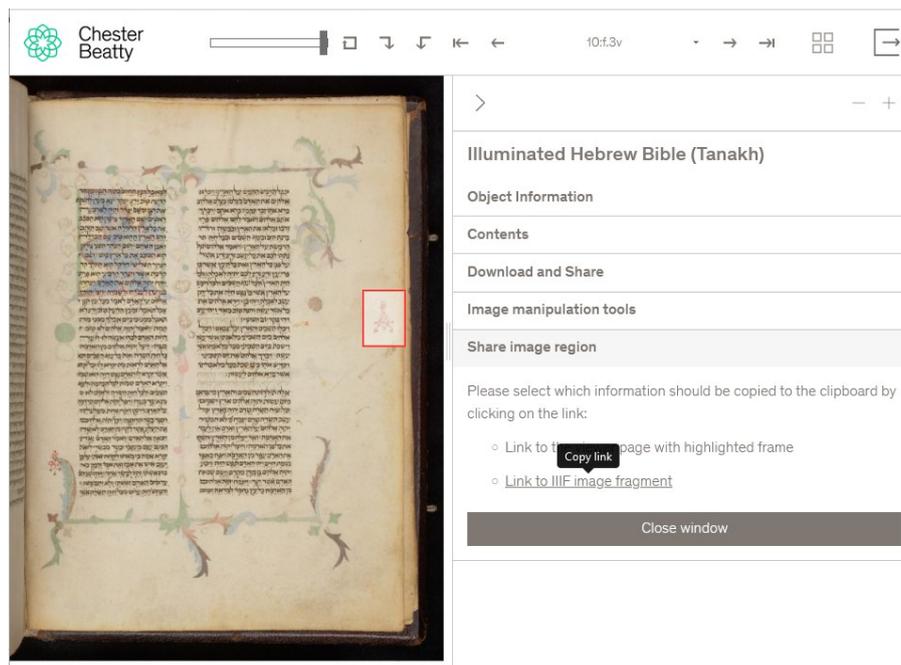


Figure 1. How to share IIIF image regions using the Chester Beatty Library's image viewer.  
Source: author's own work.

The option for sharing IIIF images fragments provided by the Chester Beatty Library proved to be the ideal solution to our challenges. It offers high-quality images without requiring local storage, as the links direct users to the library's own repository, allowing researchers to access high-definition images which improve their close reading practices (Rodighiero et al., 2023). What is more, the images at this collection are available under a CC BY-4.0 license, which allows free sharing without additional copyright costs. This means that researchers and the general public can use fragments of these high-quality manuscript scans as long as their copyrights are respected. The discovery of this tool marked a turning point in our project, as it allowed images to be added to the

<sup>16</sup> <https://go-dh.github.io/mincomp/about/>.

<sup>17</sup> Accessible from: <https://viewer.cbl.ie/viewer/index/>.

<sup>18</sup> IIIF is an initiative which aims to create a standard for the delivery of images and other audio-visual resources on the web, one that enables “portability across viewers, the ability to connect and unite materials across institutional boundaries.” This would be done by specifying “a RESTful web server that returns an image in response to a standard HTTP(S) request. The image request URI includes information such as region and size of the requested image.” More information at <https://iiif.io/get-started/how-iiif-works/>.

<sup>19</sup> Visit [https://viewer.cbl.ie/viewer/image/Heb\\_772/10/#xywh=3727,2365,356,424](https://viewer.cbl.ie/viewer/image/Heb_772/10/#xywh=3727,2365,356,424) to see an example.

database by simply pasting the URL generated into a designated field within each paratext entry, and using a few lines of JavaScript to display the image next to the item description. It is worth noting, however, that neither the IIIF standard nor the regional image-sharing system utilized by the Chester Beatty Digital Library are yet standard tools in digital repositories.

In this sense, although the initial research of PARAHeB focuses on the illuminated Hebrew Bible housed at the Chester Beatty Library (Heb 772), our research extends to manuscripts housed in other collections as well. While the Chester Beatty IIIF tool addressed our immediate issues, we needed to determine whether similar solutions could be implemented with digitized manuscripts from other institutions. The other manuscripts selected for the study were already available online and in open access, but we needed to know if they were in IIIF standard. Although there is no comprehensive catalogue of IIIF images currently available online, *Biblissima* (n.d.) (Observatory of Written Cultures, from Clay to Print) offers a prototype app which allow users to search for IIIF manuscript images across multiple institutional repositories<sup>20</sup>. Fortunately, all the manuscripts central to our research are available in this standard; otherwise, we would have needed to consider alternative solutions.

#### 4. THE WORKFLOW

A wide array of IIIF-based tools and resources can be found online, many of which are catalogued in *Awesome-IIIF*, a curated list compiled by members of the IIIF community<sup>21</sup> during online meetings referred to as *Community Calls*. To select the best tool for PARAHeB, we sought advice on the IIIF Community Slack channel<sup>22</sup>. In the *General* channel, we explained the functionality of the Chester Beatty tools –particularly how well they suited our needs– and requested guidance in finding a similar solution. We received responses from several users, including Glen Robson, the IIIF Technical Coordinator. He noted that, while this tool was new to him and he was unaware of an exact equivalent, to replicate its functionality would require two separate tools: one for generating a direct link to a specific page (or canvas) within a manuscript and another to crop that page. He recommended two existing online tools to accomplish this:

- For retrieving links to each canvas within a IIIF manifest, *CanvasFinder*, a free, open-access tool developed by Robson (2023) himself and listed in *Awesome-IIIF*. This tool provides users with a list of the folios within a manuscript and generates URLs that direct to each individual folio. This is especially useful in paratext research.
- For linking to specific regions of an image, the *IIIF Image Manipulation Tool*, developed by John B. Howard (n.d.), also open-access. This tool works in tandem with *CanvasFinder*

<sup>20</sup> Accessible from: <https://iiif.biblissima.fr/collections/>. Surprisingly, the Chester Beatty Digital Collection is not listed among these resources.

<sup>21</sup> IIIF offers a list of official communication channels at <https://iiif.io/community/>.

<sup>22</sup> Free access to the IIIF Slack channel can be requested by filling out a form at the IIIF Community website.

by taking the URL generated for a manuscript page and allowing users to select a specific area within the image, generating a unique URL that points directly to that selected area.

The combined use of these tools recreates a workflow for sharing specific image regions that closely resembles the system used by the Chester Beatty Digital Library, although alternative tools are also available. We found that similar results could be achieved with tools like the IIIF Cropping Tool, developed by Stoffer and O'Neill (n.d.) and used by the North Carolina State University Library<sup>23</sup>. However, we ultimately chose Howard's IIIF Image Manipulation Tool for its additional image manipulation features, such as its ability to convert the image colour profile, select its output format, and customize output size in order to fit user-specific needs. This workflow effectively addresses PARAHeB's requirements for incorporating images of the paratexts analysed, resolving the concerns outlined earlier in this article.

Below is a step-by-step guide for using this workflow:

- 1- *Check for IIIF images.* Verify that the repository you wish to use includes IIIF images –the Bibliissima app mentioned earlier can be useful for this step. If it does, open the page of the manuscript you are interested in.
- 2- *Locate the IIIF manifest (Figure 2).* Find the IIIF manifest for the manuscript (or document) containing the fragment you want to share. In this case, the manifest is located inside a dropdown menu, although its location can vary depending on the repository.

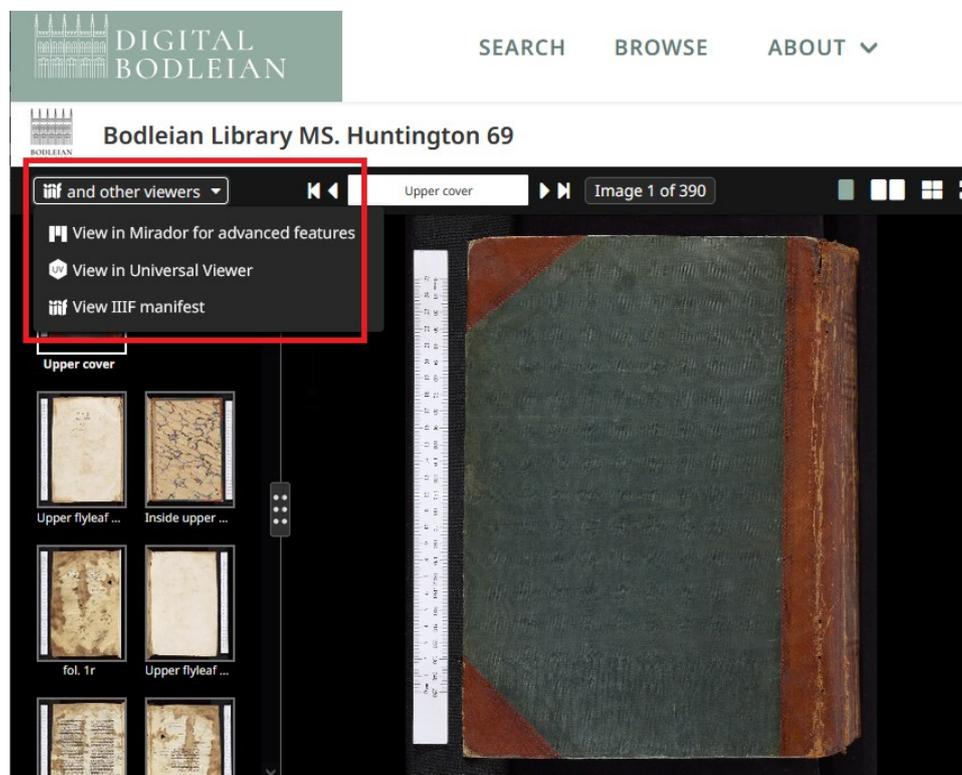


Figure 2. Find the IIIF manifest. Source: author's own work.

<sup>23</sup> Accessible from: <https://ncsu-libraries.github.io/iiif-crop-tool/>.

- 3- Find and copy the `@id` of the manuscript (Figure. 3). This identifier should resemble a URL with the extension `.json`.

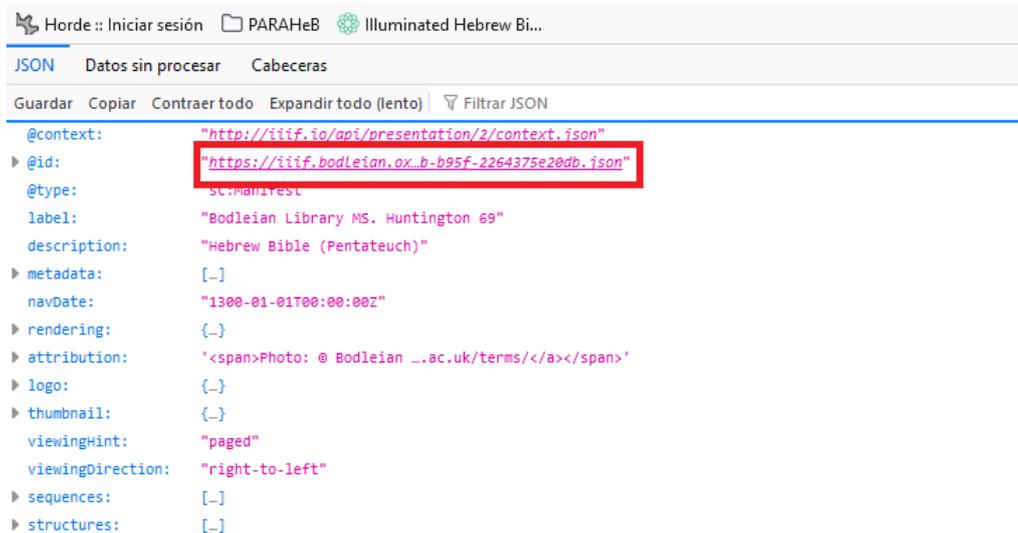


Figure 3. Copy the `@id` of the manifest. Source: author's own work.

- 4- Obtain the IIIF image URL (Figure 4). Use CanvasFinder (<https://glenrobson.github.io/CanvasFinder>) to locate the IIIF image for the specific page of the manuscript where the paratext is located.

## CanvasFinder

This tool allows you to paste a IIIF Manifest URL into the box below and it will show you all of the Canvases which are present in that manifest. You can then click the Copy Image URL button if you want to get a link you can use in the [Bodleian Manifest Editor](#).

If there are lots of canvases in the manifest you are using you can use the filter box to start typing the label of the canvas you are interested in.

Manifest URL:

You can find Manifests using the [IIIF Guide](#).

Figure 4. CanvasFinder. Source: author's own work.

- 5- Paste the `@id` link (Figure 5). Paste the `@id` link you obtained in step 2 into the "Manifest URL" field and click on "Load". Then, select the folio you wish to crop and copy its IIIF Image URL.

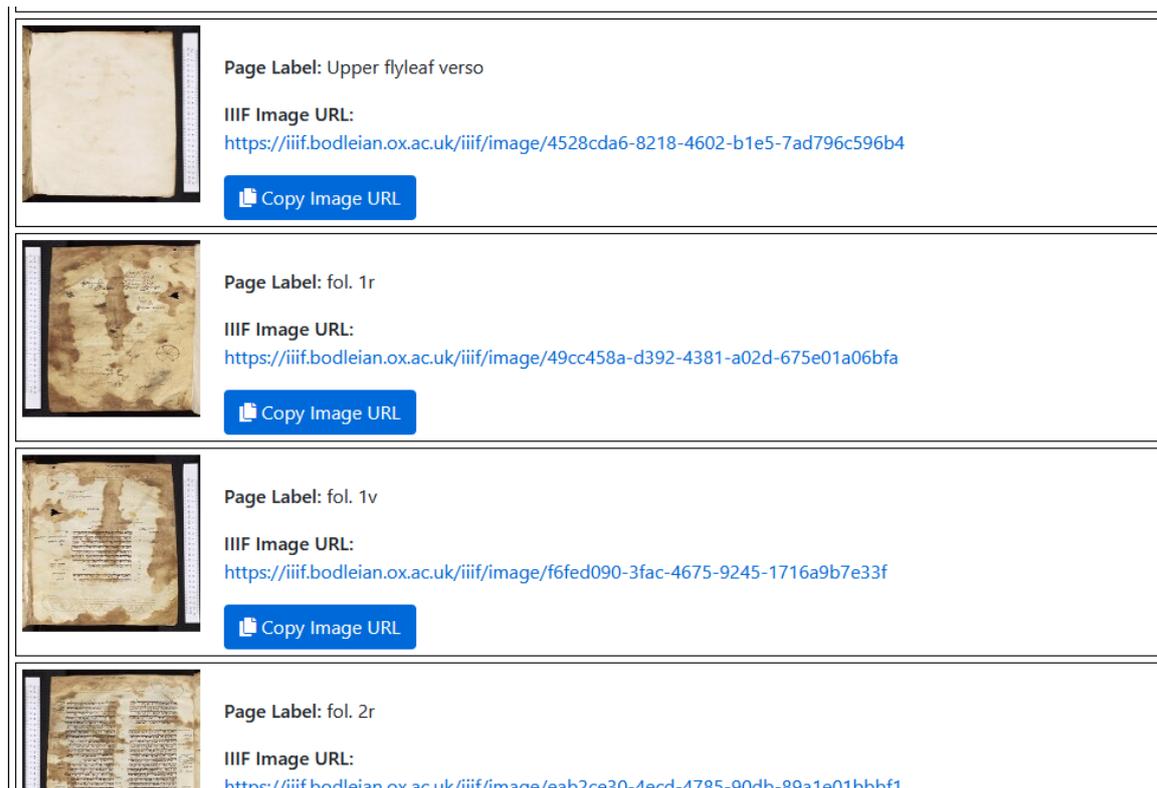


Figure 5. Find the IIIF Image URL to a specific folio. Source: author's own work.

6- Use the *IIIF Image Manipulation Tool*. To generate the specific URL for the fragment, paste the link you copied from the previous step at the end of this URL:

<https://jbhoward-dublin.github.io/IIIF-imageManipulation/index.html?imageID>.

The complete URL should look something like this: <https://jbhoward-dublin.github.io/IIIF-imageManipulation/index.html?imageID=https://iiif.bodleian.ox.ac.uk/iiif/image/49cc458a-d392-4381-a02d-675e01a06bfa>.

Paste this URL into your browser and press enter.

7- *Final step*: Select the image area (Figure 6). On the new webpage, select the area of the manuscript you wish to share. Choose any technical modifications you would like to apply or leave the predefined parameters as they are (see Figure 7). The link generated at the bottom of the refers to the specific area of the image and can be copied and pasted as needed.

## IIIF Image Manipulation Tool

### Crop and Re-size Images

Create custom images by cropping and re-sizing images for download or linking

Using the steps below, you can select all or a portion of an image, and either download it or create a persistent link to it.

#### 1: Select Image Area

Use the mouse (or a fingertip) to select all or a portion of an image in the Crop Box (or enter numbers in the coordinates boxes below).

 You can also [select the entire image](#).

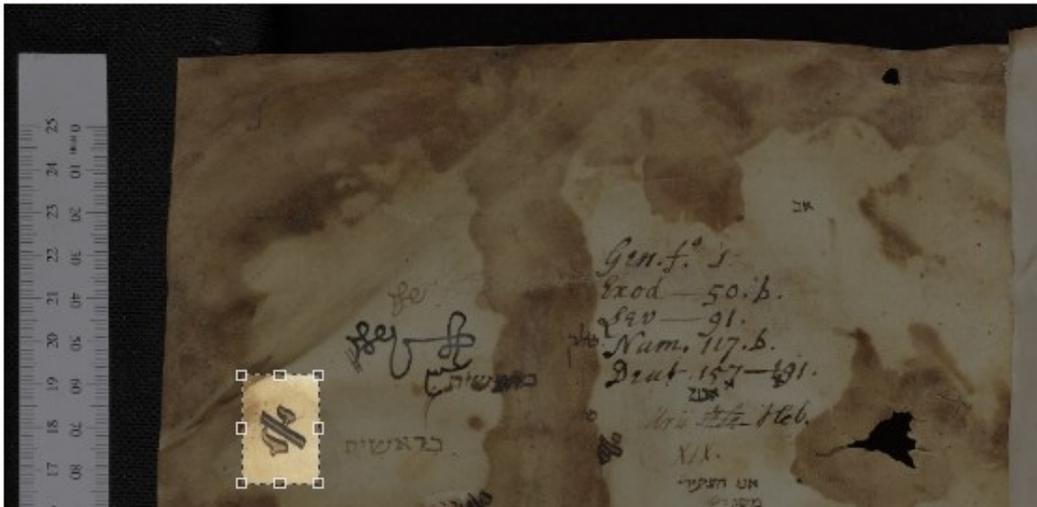


Figure 6. Select the desired area of the image. Source: author's own work.  
Source: author's own work.

#### 2: Select Image Size

Select output image width:  1280px  1024px  800px  400px  150px

create a square image

Tip: When downloading a full map sheet or very large image (width > 8000 pixels), select an output image value of 8000 or higher in the Other box. There is no need to add 'px' to the end of the integer.

#### 3: Select Image Options

Select output image format:  JPEG  PNG  WEBP

Select output image rotation:  0  90  180  270  mirror rotation

Select output image quality:  default  colour  bitonal

#### 4: Save or Link the image

Click on the 'Preview this image' button to open your image in a new window for download. Right click on the image to save to your computer.

[Preview this image](#)

[Download this image](#)

Or copy the URL below to create a persistent hyperlink to your custom image:

<https://iiif.bodleian.ox.ac.uk/iiif/image/49cc458a-d392-4381-a02d-675e01a06bfa/1273,1989,403,577/800,0/default.jpg>

Figure 7. Select how to share or save the image.  
Source: author's own work.

## 5. THE WORKFLOW IN USE: THE EXAMPLE OF PARAHEB

As previously explained, the project PARAHeB has, among its main objectives, the creation of a comprehensive database of biblical Hebrew paratexts. The visualization of these items is essential for their study, which makes the integration of images into the project a fundamental aspect.

The proposed workflow offers an efficient method for sharing specific areas of images digitized according to the IIIF standard. Within seconds, the system generates links that act as persistent identifiers, and that can be incorporated into a variety of academic works, presentations, websites and, as shown below, specialized databases.

This system can be used with any repository complying with the IIIF standard, for instance, the collections of the Bodleian Library. The generated links can be stored within a database; in this case, we have chosen a MongoDB database, where the image fragments are registered in a designated field named "image".

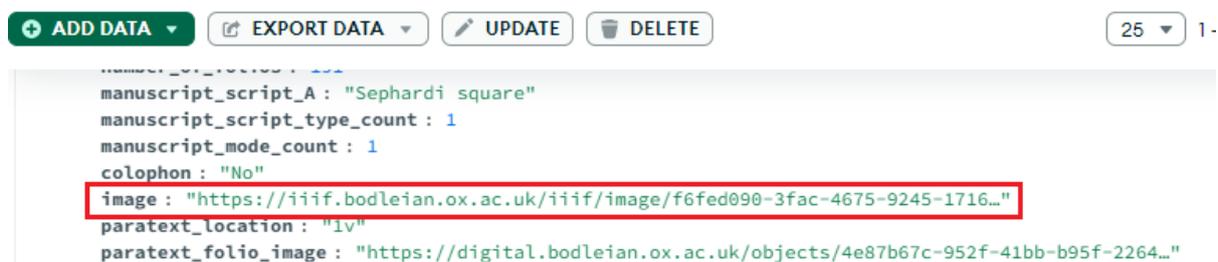


Figure 8. Structure of a record within the MongoDB database, using a link generated by the workflow.  
Source: author's own work.

The links were integrated into the website's interface using JavaScript, improving the user experience by easily displaying the paratexts images. The use of the links generated by the workflow allows the images to appear as pop-up elements when the user hovers the cursor over the unique identifier assigned to each paratext (ParaID).

ParaID ▲	Item shelfmark ▼	Paratext Transcription
10000 	MS HEB 772	ב
10001 	M	ג
10002 	M	בראש
10003 	M	ד
10004 	MS HEB 772	ד



Figure 9. Pop-up displaying the image of a paratext using a link Generated by the workflow. Source: author's own work.

This represents just one example of the potential uses of the workflow, adapted here to the needs of PARAHeB. However, it could be easily implemented in other Digital Humanities projects with similar needs, such as paleographic studies, iconographic analysis or digital editions.

## 6. BENEFITS OF THE WORKFLOW

As previously discussed, the development of a Digital Humanities project can be significantly impacted, both in the short and long term, by challenges such as the scarcity of resources and the difficulties of implementing personalized technical infrastructures. By using the proposed workflow, we believe that many DH projects could benefit from the following advantages:

- 1- *Adherence to international standards.* Engaging with a standards-compliant media framework increases the likelihood that resources will remain available over time compared to non-standard solutions (Arneil, 2023). This engagement also facilitates easier migration across different environments (The Center for Digital Research in the Humanities [CDRH], n.d.). Importantly, even if the tools used in this workflow become obsolete, the links generated will continue to function, retrieving fragments from the original repositories.
- 2- *User-friendly access without technical expertise.* Users can share image fragments by specifying the coordinates of the desired area within an existing URL, along with any additional parameters (Figure 9).

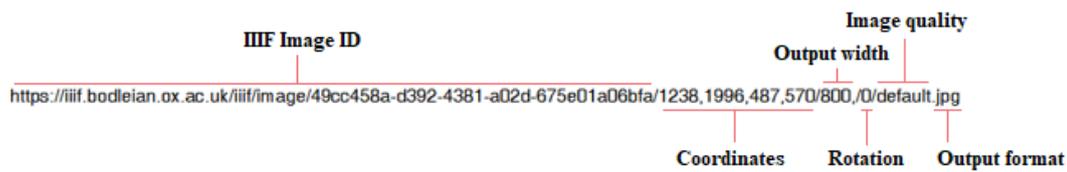


Figure 10. Description of the link generated by the workflow. Source: author's own work.

The URL could be created manually by specifying the coordinates into an existing URL, but this would require the user to have previous knowledge of IIF and image manipulation. This workflow enables users of all backgrounds –whether they are computer experts, humanities researchers new to digital technologies, or entry level students– to easily generate the necessary URLs.

- 3- *Cost-efficiency.* The workflow eliminates the need to purchase licensed software or pay fees for the tools described in this article, making it particularly beneficial for projects with limited funding.
- 4- *Long-term sustainability.* Images stored at exceptionally reliable institutions, such as national and university libraries, are likely to remain accessible for many years. Given that the availability of resources always affects the afterlives of projects (Cummings, 2023), the use of IIF images enhances their chances of surviving after the deadlines are met and funding has been used up.
- 5- *Environmental sustainability.* From an environmental point of view, the re-utilization of existing data contributes to a more sustainable research approach by reducing the need for new servers, which would contribute to global warming since these rely heavily on cooling systems to perform correctly (Monserrate, 2022). This approach also conserves time and resources, as disperse collections can lead to redundant information and added access complexity (Urrea, 2024).

Moreover, we believe that the use of this workflow contributes meaningfully to the implementation of FAIR principles in Digital Humanities projects. These principles aim for researchers to produce data that is Findable, Accessible, Interoperable, and Reusable, thereby optimizing its re-utilization. The proposed workflow aligns with these principles as follows:

- *Findability.* The workflow generates an inalterable URL for a specific area of the image in a particular repository, which ensure that users will be able to locate the item referred to even if the URL falls outside the context of the original DH project.
- *Accessibility.* The workflow relies on free-to-use tools that do not require advanced technical knowledge, enhancing accessibility for a broader audience.

- *Interoperability*. The URL generated makes the image widely compatible across various platforms and projects.
- *Reusability*. The link generated can be reused just as it is in other projects as well, as it provides enough metadata to be recognizable.

The workflow described is not only useful for Digital Humanities projects seeking to incorporate high-quality images into a database, but also suitable for any scenario in which high-resolution images need to be displayed, as the standard favours the TIFF format. It can, for instance, be used to illustrate an article, create a presentation for a conference, or support a classroom lecture, as long as the copyright requirements specified by the image owners are respected.

## 7. CONCLUSIONS

This article has outlined the strategy implemented by PARAHeB to overcome a common limitation in Digital Humanities initiatives: the incorporation of high-quality images when economic and technical resources are limited. The proposed solution, a workflow based on the use of IIIF, shows how the principles of interoperability and the reuse of digital resources can improve the research possibilities within the Humanities.

While the implementation of the workflow in PARAHeB illustrates the transforming potential of this methodology, it is fundamental to address its limitations. As previously noted, not every repository contains IIIF images –a notable example being the National Library of Spain– which limits the universal application of the workflow. Thus, there will still be a need to find alternative solutions for those researchers who do not have access to own servers or collections digitized in this standard.

On the other hand, the reuse of resources and interoperability that this workflow enhances, significantly contribute to the sustainability of digital projects. Nevertheless, as Cummings (2023) rightly affirms, “a centralized institutional image store may make sense, especially where the same set of images may be used for multiple projects, but it needs to be carefully incorporated into the site in a manner that prepares for graceful degradation of any linked resources”. This observation highlights the importance of planning in advance the future of locally stored resources.

The lack of institutional support for digital projects once the research phase is finished is, in general, a pending task in DH scholarship (Fenlon, 2020), and it seems that the use of shared resources might help the survival of smaller projects, since they reduce cost and can help organizations to be more efficient and adaptable (Eschenfelder et al., 2016).

It is also important to remember that, when using this workflow, it is mandatory to cite Robson (n.d.), Howard (n.d.), as well as this article, and to confirm image copyright details, duration, usage permissions, and any potential fees with the digital repositories.

In conclusion, we believe that this workflow proposal offers a viable means of improving the sustainability of Digital Humanities projects that lack technical or monetary resources, or whose technical expertise is limited, thanks to its ease of use. Even though it is limited to IIIF images, we can

foresee that, in the future, more institutions will join this standard, thanks to the popularization of the FAIR principles in digital projects.

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