# SCIENTIFIC REFERENCE MODEL – DEFINING STANDARDS, METHODOLOGY AND IMPLEMENTATION OF SERIOUS 3D MODELS IN ARCHAEOLOGY, ART AND ARCHITECTURAL HISTORY

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**ABSTRACT:**

In object-oriented historical research the need to combine hypotheses and textual arguments with the critical analysis based on sources – such as floor plans, sections, perspectives, and photographs – has considerably benefited from the developments in Digital Humanities (Münster, 2022). The use of digital 3D models has overcome many limitations inherent to two-dimensional records. Since the early 1990s hypothetical 3D reconstructions have therefore increasingly become routine research tools and essential means of representation capable of offering new methods of investigation, enabling new insights into the object-related research. In terms of a holistic approach to the analysis and case studies, i.e. the enhanced ability to examine and explore (Favro, 2012) serious challenges remain regarding documentation, interoperability and long-term access to 3D-based research outputs.
In this context, numerous initiatives and research projects have emerged with the common objective of systematising and rationalising the various problems identified by scholars. Such projects still tend to remain isolated, lacking a significant impact on the community of potential users. 3D research outputs are not widely applicable, due to the complex prototypes of the software architecture, difficult to apply in a broad sense. Furthermore, the 'old' problems still exist, i.e. the traditional approaches - which do not consider a 3D model as a scholarly result, but only an investigative tool - and the reluctance to share these results and the associated procedures. Therefore, an attempt is being made to define the development and evaluation of an applicable methodology for the hypothetical 3D historical reconstruction, based on a shared theoretical approach.
The working method presented here reflects many years of engagement with source-based hypothetical 3D reconstruction of no longer extant or unrealised architecture for teaching and research. Our focus is therefore on a low-threshold, application-oriented method of the **Scientific Reference Model** (SRM) as a **documented and published basic model**. The structured SRM represents an important working and knowledge state, which clarifies the essential information about the object, its components, its credibility or extent of hypothesis and copyright. Such SRM is made available for further research, edits and refinement, as well as further derivatives (special applications). Thus SRM represents a findable referential result of a scholarly investigation of a material object that physically no longer exists.

## 1. INTRODUCTION

Since their earliest and sporadic applications, dating back to the 1980s, 'virtual reconstructions' have assumed an increasing role in academic research in numerous disciplinary fields, and especially in architecture and archaeology (Reilly, 1990). Therefore, an ever-increasing body of research uses source-based 'hypothetical 3D reconstruction' of physically non-existing objects as a now well-established — or even indispensable — tool and object of scholarly investigation and its vital output. Such practices still show significant theoretical problems and unresolved challenges related to documenting the procedures, decision-making processes and methods applied, as well as the resulting outcomes based on shared practices. The well-known guidelines (London Charter, 2006; Sevilla Principles, 2017) unfortunately have no recognisable impact, as the community does not agree on standards. Ready and easy to use infrastructures for publication and reusability of the 3D models that would convey the knowledge behind the geometry and visualisation are also missing.
On a par with more established products of scholarly research, the 3D models resulting from the hypothetical 3D reconstruction should not only respect traditional epistemological standards, but also offer a shared basis for further applications in edutainment, first and foremost for further subject studies and elaboration of scholarly hypotheses whenever new data and new evidence become available. And for this, academically authenticated 'serious 3D models' should be characterised and qualified according to shared standards that can assure methodological transparency, interoperability and long-term accessibility, taking advantage of upcoming and promising technologies and scientific infrastructures under development (Kuroczyński, 2017).

Some recent initiatives (DFG Network, 2018) and ongoing research projects (CoVHer, 2021) aim to systematise and rationalise a number of issues identified by the academic community, such as the definition, structure, classification, and characterisation of 3D models resulting from hypothetical 3D reconstruction.
All the hypothetical 3D reconstructions involve heterogeneous sources, interpretative and creative data processing, but not all of them require the same levels of inferences. Although generally identified as 'virtual and/or digital reconstructions', there are profound differences between computer models in question. For example, if the 'reality-based' models are digital models obtained through quasi-automatic procedures starting from raw data acquired from physical sources (point clouds and/or meshes), the

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‘source-based’ model are digital models that, in some cases alongside the raw data, collect and contain historical information of a textual and graphic nature and documentary resources.
The **Critical Digital Model** (CDM) (Apollonio et al., 2021) falls within the category of source-based models, aiming to accurately define a transmissible methodology for constructing, viewing and evaluating 3D models of unbuilt or no longer extant architecture, in particular to recreate its original appearance, as complete and as close to the original design as possible, based on a comparative study of all the available primary and secondary sources.

In order to be used in scholarly practice and dissemination, 3D models produced as source-based hypothetical 3D historical reconstructions, should follow the basic principles of the scientific method (Kuyper, 1991) documenting the criteria adopted for the construction and representation of the 3D model in the most transparent and transmissible way. Accordingly, a hypothetical 3D reconstruction (model) produced should guarantee the geometric accuracy and qualification (constructive aspects), the use of sources and documentation, and the quality of historical (re-)construction (traceability), the compatibility with the publication in 3D repositories (accessibility), delivering 3D data exchange formats (interoperability), and ensure the graphic output communicates the subject-related content (including uncertainty level) transparently throughout the 3D model.

With this background in mind, the **Scientific Reference Model** (SRM) is a proposition for a traceable scholarly method for hypothetical 3D reconstruction implemented within an accessible 3D referential model (Kuroczyński et al., 2022). SRM can be considered a predecessor of CDM that focuses on the visual representation of the model, its appearance and materiality as a result of texturing and exposure. The impact of the SRM is based on the presentation of the low-threshold, complete process chain, from the object and sources analysis to the web-based publication of the 3D model, delivering applicable guidelines for the 3D community, including professionals and non-experts. The overarching idea behind the SRM is, on the one hand, the accessibility and reusability, following the FAIR-Principles (Wilkinson et al., 2016). On the other hand, the SRM ensures documentation of knowledge and the assessment of the cognitive value of a referential 3D model, produced in accordance with the fundamental principles of the scientific and subject-specific methods, as in the case of the CDM. Therefore, SRM constitutes an applicable methodology aimed at offering heritage scholars a potentially useful three-dimensional reference tool. Its origin and derivatives are expressed in Figure 1.

The SRM is not a generic answer to all kinds of projects and their individual requirements. In Open Science the SRM may serve as a common denominator based on minimal standards, starting from (a) data acquisition, (b) data processing, (c) modelling and (d) publication, accompanied by infrastructure as service. Therefore the SRM supports interoperability through standardisation as the first step of object-based research and initial access to the knowledge underpinning the hypothetical 3D reconstruction, thus fulfilling the postulate: no dissemination and reusability without publication.

Standardisation includes not only the descriptive and administrative data accompanying the model in the 3D repository, but also the discussion of 3D data exchange formats beyond the optimised and converted 3D file format for web-based 3D-viewer.

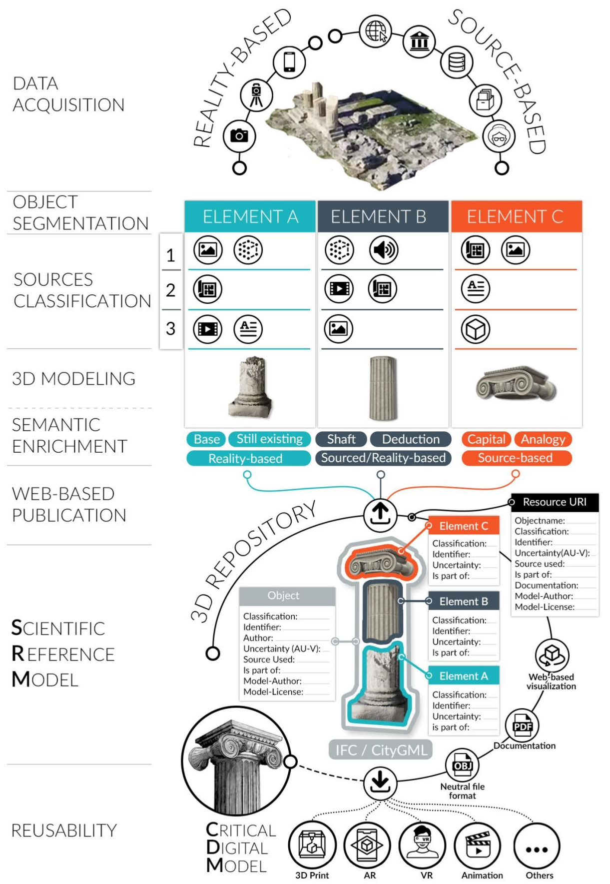


**Figure 1.** Data-driven SRM and its derivatives. An overview (AI MAINZ/Piotr Kuroczyński and Igor Bajena, 2023, CC BY-NC-SA).

These have so far been neglected in the context of historical hypothetical 3D reconstruction. Here we can choose from two interesting solutions: the International Foundation Class (IFC) from civil engineering (ISO 16739-1:2018) and the City Geography Markup Language (CityGML) from urban planning (Open Geospatial Consortium, 2021). Both data formats are widely applied standards and have been successfully used as 'serious 3D' for object-based planning, implementation and operation. Realising the advantages of these model-based information carriers ensures interoperability, sustainability and reusability. The introduction of the above-mentioned standards and formats increases the efficiency in design, construction and maintenance of the built environment.

The SRM serves scholarly and publishable investigations into non-extant built environments of cultural significance. The source-based analysis of the material object and its structural components leads on the one hand to the identification and segmentation of the building elements in parallel to the classification of the identified sources for the reconstruction. On the other hand, the identification, segmentation, and classification provide the basis for identifying the uncertainty levels of particular elements and in sum of the whole object. The uncertainty level results from the modelled level of detail (geometry) and the underlying accuracy and reliability of the sources (information).

The segmentation of object into typological and structural elements, supports the semantic enrichment of the model in required levels of granularity. The segmentation allows to reveal the topological relationships, identified by controlled vocabularies, such as the Getty Art and Architecture Thesaurus (AAT) (The Getty Research Institute, 2017) and other Linked Data resources. Furthermore, it gives us the opportunity to attach information according to the sources consulted, individual interpretation, as well as the evidence of uncertainty: at the single element level and at the average and/or weighted level of the entire model.

The SRM aims primarily at the provision of such a 3D model that can be located and reused with ease. What follows is an attempt to demonstrate the practical use of the SRM method applied to reconstruction of the wooden Olkeniki Synagogue[1]. The documentation, visualisation and publication of the SRM and its reusability are discussed in detail.

## 2. DOCUMENTATION AND VISUALISATION

A crucial aspect of the methodology behind the SRM and CDM is the documentation of the decisions that led to the hypothetical 3D reconstruction of the historic building. In order to ensure the source-based model constitutes a reusable output, it is indeed necessary to declare the underlying choices and hypotheses.
This involves the descriptive information associated with a digital object (metadata) including the details about the object's creation, its physical characteristics, its historical context, and its provenance, as well as the data generated during the creation process of the digital object (paradata), highlighting the relationships between the research sources and the outcomes, in a combination of historical research, expert subject knowledge, and digital technologies.

In order to preserve metadata and paradata, some tools have been developed in recent years, such as Sciedoc, a web-based tool that enables the documentation of the sources along with the statement about the reconstruction process, as well as the documentation and representation of variants with argumentation related to their plausibility, in a process called RAM – Reconstruction Argumentation Method (Grellert et al., 2019). An ongoing follow-up project worth mentioning is the Infrastructure for Documentation and Virtual Reconstructions (IDOVIR) being a collaborative and open-source online service for recording decisions and reasons for a reconstruction, the possible variants and qualitative analysis in the form of a textual argumentation (Wacker et al., 2022).

Of particular importance, in this context, is the documentation and the visualisation of uncertainty, which becomes a significant aspect of scholarly approach aiming at facilitating the re-use of the model (Cazzaro, 2022). When evaluating the uncertainty of hypothetical digital reconstructions of artefacts, there are a few factors that need to be considered. These include the accuracy and completeness of the available data (sources), the quality of the reconstruction method used, and the expertise of the individuals involved in the reconstruction process. Different parameters come into play also in the reconstruction process, where an uncertainty level can be assigned to the shape of an element, as well as to its position, dimensions, material, and historical period. This has led to the creation of different uncertainty levels, based on different evaluation criteria, and to their integration into more complex scales that consider a combination of these parameters.

One possible way of defining a simple and easy to communicate scale for evaluating uncertainty is connected to the process adopted for reconstruction of an element according to CDM, considering a range of degrees from the most certain (for extant elements) to the most uncertain (purely hypothesised). A particular colour and a numerical value correspond to each level on this scale. A challenge, at this point, is represented by mapping uncertainty both to the overall reconstruction and to the individual constituting elements, according to the object segmentation. This is possible by grouping the geometries that compose the model at different hierarchical levels, in such a way that both the groups corresponding to each single element and the macro-group representing the entire building can be associated with the related attributes. In this regard, uncertainty of the entire building is assigned according to the Average Uncertainty weighted on the Volumes of the elements (AU-V).

Most visualisation methods carry a certain bias, so their selection should be intentional and reflect the assumptions made at the start of the reconstruction process. CDM addresses this question by explaining the relevance and the consequences of using realistic and unrealistic shadings in a hypothetical reconstruction. The transposition of two-dimensional graphic style into a three-dimensional one also requires explanation made available within the final 3D model, being a 'compromise' representation that conveys the intentions of the original creator, based on evidence of existing drawings. In the case of acquiring reality-based sources, such as photographs (historical or contemporary) or laser scans, the reconstruction of the materials can differ significantly. The SRM does not enforce specific methods of visualisation (textures and exposure), accepting identification of materials on the model, e.g. through graphic symbols, enabling further development of reconstruction after the SRM is published, providing the referencing of the original. The problem of uncertainty concerns not only the geometry, but also the object's surface colour, material and finish. This is why SRM places emphasis on documenting the choices of the visualisation methods and materials selected, as well as the level of inaccuracy of textures and colours.

The documentation should be delivered in conjunction with the model. The complexity of 3D models leads to the conclusion that the most appropriate method appears to be the preservation of metadata and paradata directly in the 3D file format itself. Hence, the underlying concept of 'serious 3D'. In light of the established principles of data sharing, 3D files should be saved in interoperable data exchange formats covered by the relevant standards, which do not overlap with the native formats of 3D hypothetical reconstructions, in particular, the above-mentioned standards, namely the IFC for individual buildings and the CityGML for cities and landscapes. Although none of these standards were ultimately designed to document hypothetical 3D reconstructions, their capabilities in this regard have been already tested in scholarly projects (Kuroczyński et al., 2021). A major advantage of these standards is the interoperability and the ability to access the semantically enriched 3D data sets through diverse IFC and CityGML viewers, without the need for commercial software. However, this solution is not without its flaws, as these

[1] The SRM method was developed within research projects at the AI MAINZ – Institute of Architecture at the Hochschule Mainz and applied to academic courses run by the Faculty of Architecture at the Warsaw University of Technology in the summer semester of 2022. The Olkeniki Synagogue was reconstructed, documented and published by student Olga Ślepowrońska under supervision of the authors affiliated with the Hochschule Mainz.


https://doi.org/10.5194/isprs-archives-XLVIII-M-2-2023-895-2023  

formats do not support textures that are normally not required in the field of the construction industry. However, the SRM demonstrates the validity of using standardised 3D formats as carriers of geometrical information along with meta- and paradata, as a first step in the creation of a reference system, to which texture studies, according to CRM methodology, can be appended at a later stage.

Although the choice of 3D modelling software must be entirely free, the delivery of 3D data exchange formats is strongly recommended by the SRM publication. In this way, the first step toward interoperability, access and reuse of 3D data can be taken. Considering the primary objective of the use of the formats mentioned, the package of information to be included in the file should be agreed. The package chosen may not necessarily be the standard metadata set of IFC or CityGML files. The SRM proposal relates to two levels of the model hierarchy. The top level contains information about the historic object and its digital reconstruction (ID card of the 3D model). The bottom level contains more detailed information about the reconstruction and classification of individual elements, based on object segmentation and classification. The agreed metadata proposal for the upper level of the 3D model was based on an analysis of 3D repositories, taking into account the relevant authority files and controlled vocabularies (Bajena et al., 2021) creating connections between model and online resources with persistent identifiers, based on the Linked Open Data (LOD) principles (Berners-Lee and O’Hara, 2013). For the elements in the bottom level of hierarchy, it was decided to document the classification based on the Getty AAT, as well as the sources used and the level of uncertainty according to the previously elaborated scale.

Adapting the model to the CityGML standard for the SRM required exporting the file to SketchUp format. Here, the attribution of a hierarchy had to be manually arranged: the various elements were grouped according to their boundary surface type and marked as ‘building parts’, while the entire building was placed as a top-level group. At this point, the standard attributes could be assigned both to the entire building and to the building parts. Some generic attributes were also created, including the level of uncertainty. The GML file has been finally exported and could be opened with the free FZK Viewer, as shown in Figure 2.

The preparation of the SRM in IFC format requires object-oriented modelling software, such as Building Information Modelling (BIM) programs or BIM add-ons. Then, the creation of the model hierarchy and the division into individual elements is done semi-automatically. The metadata required modification of the object properties options and manual assignment to the individual object elements. It is important to note that metadata which are not part of the IFC standard, such as ‘level of uncertainty’ or ‘used sources’, must be added also to the IFC properties during the export. The final IFC file may later be opened with the free BIMcollab viewer presented in Figure 3.

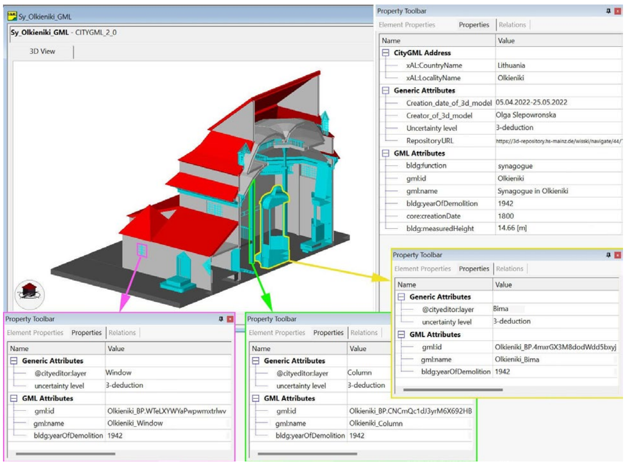

**Figure 2**. Section of Olkieniki Synagogue SRM, CityGML in FZK viewer (AI MAINZ/Irene Cazzaro, 2023).

**Figure 3**. Section of Olkieniki Synagogue SRM, IFC in BIMcollab viewer (AI MAINZ/Igor Bajena, 2023).

## 3. PUBLICATION

The SRM only comes into effect through the publication and subsequent provision of the 3D data, enriched with information. The adequate web-based publication plays a crucial role in fulfilling this requirement. Existing international guidance concerning publication of data on the web, mentions a list of the requirements regarding long-term preservation of data, open access, traceability of the reconstruction process and reusability of 3D models. Despite these requirements, the majority of 3D models, even those created under the auspices of public research institutions, are not in the public domain. Published models are often subject to restrictive copyright, making them difficult to access. Guided by Open Science, SRM has the task of creating conditions for the practical (re-)use of published models.
The current market for web-based 3D repositories offers a large range of different solutions centred around diverse aspects of 3D model documentation and preservation (Champion and Rahaman, 2020). Therefore, the choice of publication platform had to be preceded by identification of various criteria, such as provision of appropriate quality of visualisation, scholarly documentation of the reconstruction decisions and used methods, as well as the possibility of sharing files, metadata and paradata. At the same time, the platform would have to be suitable for use by students, preferably simple to use and intuitive.

The selected criteria led to the recognition that, despite the wide variety of data repositories, there is no ideal solution that addresses the issues of concern. On the other hand, creation of a completely new platform may jeopardise knowledge dissemination, which is easier to achieve when publishing data on established and widely recognised platforms. Therefore, it was considered to use a few open platforms to address different issues and to cross-reference them. To avoid the risk of high complexity of this process, it was decided to limit the number of repositories by identifying key objectives: scholarly documentation of the reconstruction process, visualisation and preservation of the 3D model, as well as knowledge dissemination.

Although, as already shown, the 3D model itself can be a carrier of comprehensive information, it is good practice to prepare appropriate documentation according to the mentioned RAM process. Making this documentation available in a suitable form is equally important, therefore one should strive to make it as interoperable as possible, as the assessment scheme prepared by Berners-Lee (2012) advises. The documentation can be made available on the web as a simple PDF for easy access. Structuring the file, using a non-proprietary format, identifiers and embedding the data (in a wider context through cross-referencing) can further enhance the relevance and interoperability of the documentation. Special mention should be made here for the IDOVIR service, which has been introduced to meet the requirements of the highest level of the Berners-Lee scheme. This scheme may be used in professional and scholarly reconstruction projects, as well as in academic teaching in higher education.

Novel solutions of this kind have many benefits, but initially may not reach a wider audience. Dissemination of knowledge is a critical part of the research, which should reach the largest possible communities. For this reason, the use of the popular and open to all online encyclopaedia, Wikipedia, is recommended as a model solution. While scholars question the quality of some of its content, there is no doubt that in many cases it is the first (and often the last) resource in the search for knowledge. Therefore, the SRM method described encourages not only to use Wikipedia as a search tool for information at the beginning of the research, but also for supplementing the existing articles with the outcomes of research in both textual and graphic formats, as well as 3D files.[2] Wikipedia also allows the addition of references to other platforms used, contributing significantly to the ease of locating research data in less popular databases and repositories.

However, it is not the documentation or the difficulty of finding the data that poses the greatest challenge in the publication process, but the reliable and sustainable preservation of the data. This question is complex, involving not only a declaration of copyright and uploading a 3D file, but also consideration of future use scenarios and dedicated audiences, ensuring interoperability of published content. The latter may require visualising the model also for those without specialised software to view 3D files (Albrezzi et al., 2022). When considering the potential future use of 3D models, SRM demonstrates as good practice making the model available in diverse 3D file formats: the proprietary (native) file format accompanied by further data exchange formats. Based on the 5-star deployment scheme for sharing data on the web (Berners-Lee, 2012), a similar hierarchy has been developed for shared 3D formats (Figure 4).

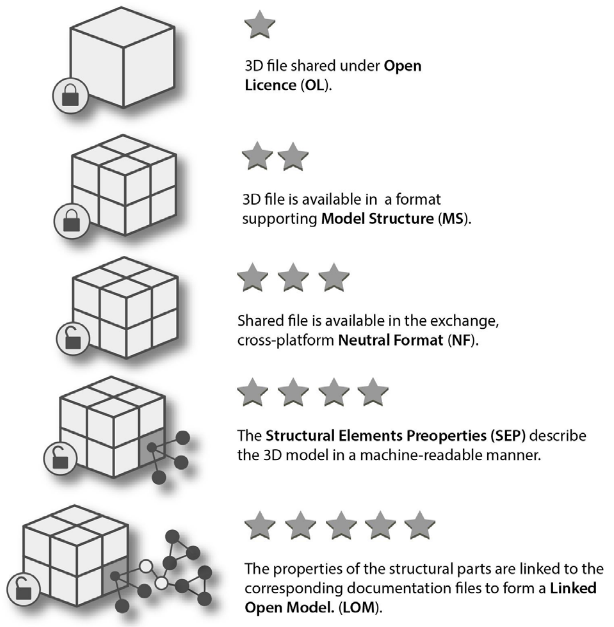


**Figure 4.** Assessment schema for 3D formats in terms of their interoperability, based on the criteria of the 5-star deployment schema presented by Tom Berners-Lee in 2012 (AI MAINZ/Igor Bajena, 2023).

The first step is to share 3D files under an Open Licence (OL) in their native format at its primary resolution. Despite the access limitations that may arise with proprietary formats, sharing the original data can allow for further scholarly research, analysis and further development of the 3D model.

The second level is achieved by sharing formats that support Model Structure (MS). Most native formats, particularly for software that support object-oriented modelling (e.g. BIM), have built-in options for grouping elements, creating layers or a whole project hierarchy. If no structure was implemented during modelling, it is recommended to organise and structure objects in a 3D file before publishing it for ease of understanding and use.

One more star is given for the additional use of a Neutral Format (NF). In practice, this means exporting the file to a data exchange format that is supported as import by most software (such as DAE or GLB). This allows the file to be integrated , while preserving the given file structure. At the same time, using neutral standardised formats can contribute to the long-term preservation of data, which is not possible with native formats and rapid technological development (as new versions of software come out on average every year, dropping support of old file formats).

The level four is achieved by using Structural Elements Properties (SEP), which stands for metadata and paradata (alphanumerical information) assigned to each structural element of the model. This can be achieved by using the already mentioned 3D data exchange formats such as IFC or CityGML.

The final step is to link the alphanumerical information within the semantically enriched 3D model with external data – to give a broader context and contribute to the development of the Linked Open Data (LOD) by creating a Linked Open Model (LOM). A model prepared in this way — having its own structure

[2] At the time of writing, Wikimedia supports only STL files for 3D printing, https://diff.wikimedia.org/2018/02/20/three-dimensional-models/

and associated metadata in an open, neutral format and containing links to external data on the web — represents a well-prepared product that can be further processed by humans and machines.

It is good practice to provide visualisation of the model on web-based 3D viewers alongside the provided formats. In this way models can remain open to those who do not have access to 3D software. Nevertheless, it should be recognised that the model visualised in the browser window is not a perfect reflection of its original. It is just a simplified derivative of the main model. To optimise 3D data for web display, a series of steps must be taken, starting with exporting the file to formats supported by viewers, followed by internal conversion and compression of the file in the repository itself. This process can often alter the model's structure, geometry or textures. For many web repositories, the model displayed in the browser is derived in the glTF format, or its binary version GLB. It is becoming the most desired owing to small file size and the possibility of containing all of the 3D scene elements, namely materials, node hierarchy or cameras in a single compressed file.

The characteristics presented above were used by the DFG 3D-Viewer project in the design of a prototype 3D repository dedicated to digital 3D models of material cultural heritage (DFG 3D-Viewer Development Team, 2021). In addition to providing visualisation through a specially developed viewer (based on three.js) and determining the conditions that must be met by the published model, a set of metadata necessary to publish the model in the repository was also determined. The main aim of the project, however, was to provide an infrastructure allowing published content to be aggregated into data repositories such as the German Digital Library or Europeana (European Commission, 2008), using the Metadata Encoding and Transmission Standard (METS) and Metadata Object Description Schema (MODS) (Bajena and Kuroczyński, 2023). The mentioned repository was tested during an academic course in wooden synagogue reconstruction at the Warsaw University of Technology. The lessons learned from this research will be applied in the creation of a 3D repository within the framework of the EU project CoVHer, focused on SRM publication and the reuse of the modular software framework based on the DFG 3D-Viewer.

To evaluate the SRM the published model of the Olkieniki Synagogue was tested for reuse and further development. The student model was downloaded in the native format of the ARCHICAD (BIM supporting software), in which minor corrections were made to the geometry and new parameters were given, related to the documentation of the reconstruction. Thus prepared, the model was published as a next version in the 3D repository, making the IFC format available under an open licence (Figure 5).

Subsequently the updated version was downloaded as IFC and imported into the open source software Blender using the BlenderBIM Add-on (Blender Community, 2020), providing access to the original geometry and alphanumerical information in the form of properties of individual objects. The bimah and aron hakodesh were then reconstructed in more detail (a higher level of accuracy based on sources), documenting the changes in the IFC properties and referencing the original SRM through a parameter with a web-link to the published first version (Figure 6).
Finally, the further developed SRM was published in IFC format under a new URI in the 3D repository, providing the opportunity to refer to and further work on the latest version of the 3D model, referencing the previous versions.


**Figure 5**. Documentation and publication of the Olkieniki Synagogue SRM (2nd version) in the 3D Repository of DFG 3D-Viewer, https://3d-repository.hs-mainz.de/ (AI MAINZ, 2023).

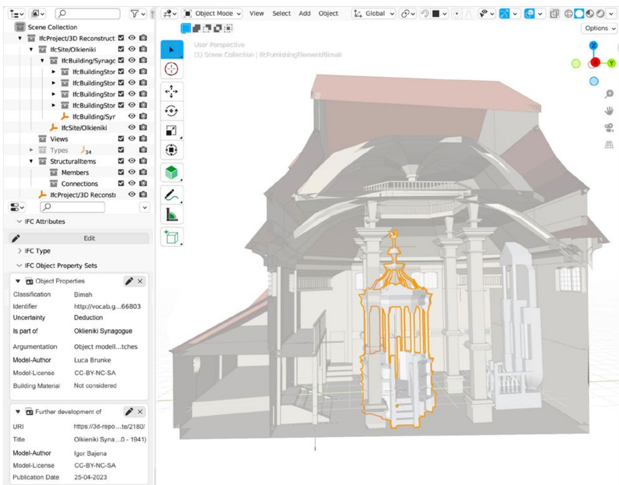

**Figure 6.** Reuse of the Olkieniki Synagogue SRM (2nd version) and reconstruction of the bimah and aron hakodesh in higher level of detail using BlenderBIM Add-on. (AI MAINZ/Luca Brunke, 2023).

The final challenge of the proposed methodology is to assess the quality of the work. As has been shown, the whole process is complex and the evaluation of the scholarly value of a study consists of many factors, ranging from the documentation of the methods used, the sources and their interpretation, to the technical characteristics of the 3D file and shared formats.

Initial work in this direction has been completed in CDM, setting evaluation criteria that will be assessed using check-box forms.

Meeting a certain number of requirements can result in certification of the model in terms of scholarly quality of work. In the future, it is planned to introduce a semi-automatic assessment of the 3D model on the basis of the data published in the online 3D repository created in the course of the CoVHer project.

## 4. CONCLUSION

The SRM aims to address the urgent need for structured and standardised provision of 3D data to ensure the seriousness of the results of a hypothetical historical 3D reconstruction, thus recognising this kind of scholarship. This paper aims to demonstrate the potential of established 3D data exchange formats and to illustrate the application of the SRM concept to a case study.

The great potential lies in web-based publication (data sharing), the structured and comprehensible working method, its documentation and preparation of the 3D data using sustainable and interoperable 3D data formats (re-usability). The SRM is a promising methodology for access to the models, referencing the authors and projects and serving manifold SRM derivatives.

The SRM should be seen as an initial referential model for further applications, as a basic, low-threshold commitment to a new way of working, a digital and spatial humanist way of working, dedicated to the guiding theme of Open Science and Linked Open Data.

The SRM is under further development, evaluation and implementation in higher education in the ongoing EU project Computer-based Visualization of Architectural Cultural Heritage (CoVHer). The mid-term goal is to agree on a common approach, ensuring access and reuse of the digital Cultural Heritage through standardisation, documentation and web-based publication.

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