

# Toolkits for Creating Digital Exhibitions of Cultural Archives and Historical Databases

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## ABSTRACT

In an increasingly technologically driven world, the curation of digital databases of cultural artefacts has been the recent approach to preserving history. With these existing digital databases has come the need to view and adapt them into a format for viewing heritage collections. In order to share these historically rich collections, the need for tools for the creation of virtual exhibitions and digital presentations arose. These exhibitions would be used as a platform for education and cultural enrichment. Presenting these exhibitions in a digital format is the next logical step in the evolution of sharing cultures and historical artefacts. The ability to share past histories and grow these collections in an accessible format as a digital exhibition is ideal. Thus far, various toolkits and applications have been developed to provide such a service; however, the appeal of these tools to a variety of digitally literate users had not been universally successful. This paper identifies the functionalities of various tools, and their usability in order to determine the best method of addressing the design of a tool for the creation of digital exhibitions whilst appealing to a user base comprised of users of different levels of digital literacy.

## KEYWORDS

Digital exhibition, museum toolkit, curator, virtual exhibitions, thematic paths, metadata standards, semantic content management systems, historical archives.

## 1 Introduction

The purpose of digital exhibitions in our virtual world is becoming increasingly important and apparent. In South Africa, the role of history is being made more integral in our lives, as a Department of Basic Education ministerial task team is advocating for history to be made a compulsory subject by 2023. [34] The curation of historical artefacts and compiling it into digital archives and databases including text, images, 3D models of physical items, audio and videos for the purpose of creating and viewing exhibitions. These collections provide new generations of users the ability to interact with historical artefacts and to create historical exhibitions with new diverse narratives. [4] The biggest concern with the digitisation of historical archives is the integrity of the items being digitised and the authenticity of the databases that they

are being stored in. However, the evidence in support of the digitisation of these archives is overwhelming in comparison. The significant advantages of embracing technology in this regard is seen in the successful digitisation of archives such as the United Nations' UNESCO project [31] and the Europeana collection [36] curated by the European Union. International standards and measures exist to ensure the reliability of works and archives. The Federal Agencies Digitization Guidelines Initiative (FADGI) [22] exists purely for maintaining the reliability of sources and the experience of viewing them. The South African Digitisation Initiative (SADI) [30] was established for "the implementation of well-constructed strategies, policies, standards and best practices" when converting cultural artefacts for digital databases.

Digitising these archives not only lends itself to safely preserving our history and cultural heritage, but also creates the opportunity for the exhibition of these artefacts through a digital portal, thus providing the opportunity for revenue generation. [15, 25] The presentation of these collections is an advantage for sharing our cultures in a format that allows users to highlight an object's historical significance and link the roles it plays throughout history, thereby creating a narrative. [4] A viewer can explore the exhibit and archive as a journey, immersing themselves in the context of the archive and the impact of the time on the culture and its generations. [2]

## 2 Functionalities of Digital Exhibitions

### 2.1. Accessibility and Customisability

The role of exhibitions and historical archives is to educate and enrich our society with our cultural heritage. Access to physical exhibitions is not always possible for a number of reasons. Web-based and digital exhibitions can provide opportunities for people to access exhibitions where they may not have had a chance otherwise, as well as reaching a wider audience online. With the use of specific guidelines and standards for curation of digital exhibitions [5], the general public can have access to high fidelity exhibitions without needing to go to a museum. [27] This also provides an opportunity to reach groups and audiences that were previously disadvantaged by the traditional format of viewing an exhibition. [8] Reaching the viewers through either Web-hosted

exhibitions or downloadable exhibitions. [5] People that suffer impairments and disabilities can access the digital content when considerations are made. [8]

## 2.2. Preservation

The advantage of a physical exhibition curated by a museum is that it allows a viewer to engage with the material in a real-world environment and a thematically ordered setting which tells a story. However, exhibitions in museums are not always permanent. The digitisation of exhibitions and historical archives allows for viewers preserve exhibitions for generations to experience. [15] Considerations for preserving a museum exhibition is allowing content to be added after time to expand on the experience of the exhibit, or when new sources come to light. It must be flexible with editing capabilities.

## 2.3. Additions of sources from the community

Historical archives have limited access to what their records provide, and narratives are sometimes one-sided. [10] By making a toolkit available to the public that is usable without extensive technical knowledge of computer systems, small underrepresented communities and other members of society can make contributions to digitised databases by creating exhibits. New sources of text, audio and images as well as different perspectives and narratives can emerge for a richer and more diverse cultural heritage. [26]

## 2.4. Metadata supported

Metadata is used to link other resources of a similar nature to make them more searchable and accessible on the Web. [27] The Dublin Core Metadata Initiative (DCMI) is a project aimed at standardising and creating frameworks for the purpose of resource discoverability. [27]

## 3 Virtual and digital exhibition tools.

### 3.1. ARCO

*Architecture for Digitization, Management and Presentation of Virtual Exhibitions.* [11] ARCO is a virtual exhibition creation tool that is highly regarded for its consideration of metadata types and standards. [7] The software has functionality for photogrammetry so that a user can scan a physical object and create a 3D rendered object from it. There are tools for managing the content and organisation of the exhibit. ARCO is a relatively flexible presenting tool. The application software allows for the creation of 2D, VR or AR exhibitions. The exported product of this tool, specifically the 2D and VR, can be viewed through a Web browser; however, a separate tool was created for viewing an exported AR presentation. [11] In Figure 1 there is an example of an ARCO produced exhibit with 3D scanned cultural artefacts displayed.

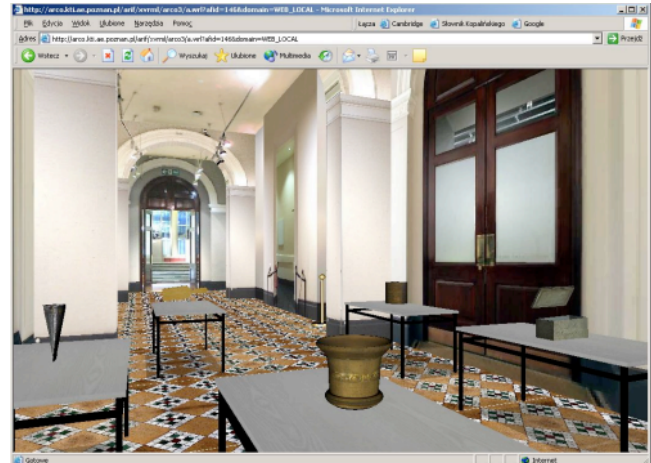


Figure 1: ARCO 3D visual creator interface [11]

The ARCO interface allows the user to manage their exhibits and the order in which artefacts are viewed and detailed. [11] In Figure 2 the ARCO interface shows the hierarchy management for a cultural artefact with a window for viewing the cultural artefact.

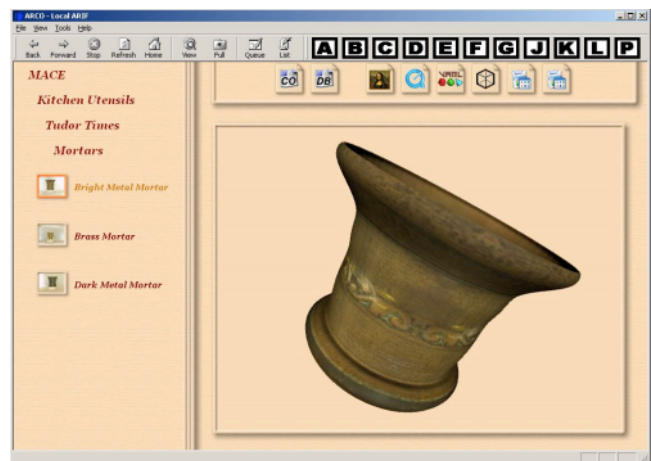


Figure 2: ARCO Web-based visualisation of cultural artefact [11]

### 3.2. ViMEDEAS

*Virtual Museum Exhibition Designer using an Enhanced ARCO Standard.* [7] The ViMEDEAS toolkit was an extension of the existing ARCO toolkit. They share an architecture style as well as the ability to manage both 2D, VR and AR exhibitions, and 3D modelling. The aim of ViMEDEAS was specifically to restructure the resource organisation system of ARCO to a hierarchical structured view of resources. [7] It makes considerations for six different resource types: geometric object, visual object, dynamic object, room or lighting, experiment and historical object. Each type has a different interaction type associated with it to provide different functionality in the exhibit environment. [7] ViMEDEAS has a content management service integrated in order to provide

additional document, artefact management and database searching functionalities, this makes it more accessible to more casual users, compared to professional curators, academic researchers and field experts. [7]

### 3.3. MOVIO

(MOstre Virtuali Online): A Toolkit for Creating Curated Digital Exhibitions. MOVIO was developed with a more user-friendly approach in mind, considering the perspective of the users. [29] The accessibility and ease of creating exhibitions was considered and was made available for both desktop and mobile with a mobile application called MOVIO APP. [28] MOVIO makes use of thematic paths for building relationships between cultural artefacts in the exhibit. MOVIO is also a semantic content management system. This is how the contents of an exhibit are accessed and sorted. Users can add their own artefacts in different file types: audio, video, images, documents. [29] In Figure 3 is the interface of the MOVIO application for editing the home page of an exhibit. The user can access the structure of the exhibit in the pane and can access the option to export the exhibit for the mobile application in the far-left pane.

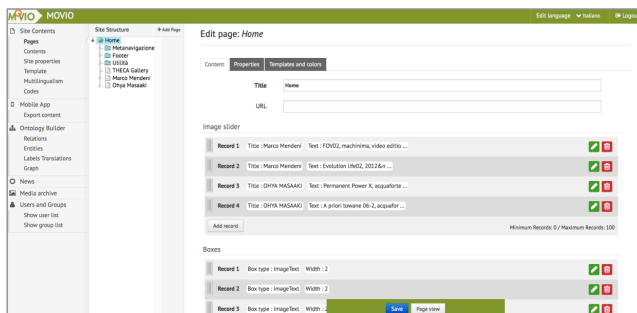


Figure 3: MOVIO home editing interface [19]

In Figure 4 the MOVIO interface for the media archive is shown. The media archive is all of the digital media that the user can upload and access to incorporate in their exhibit. [19] There is search functionality and the archive can be filtered according to file type.

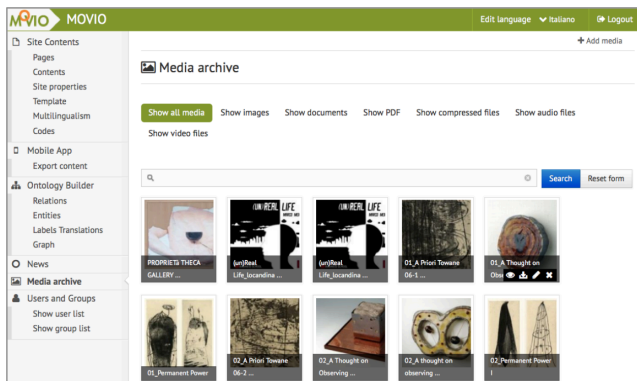


Figure 4: MOVIO interface for the media archive [19]

### 3.4. VAES

Virtual Archival Exhibition System is a Java and XML-based digital exhibition creator tool. [23] VAES is a tool for the creation of digital presentations for viewing on a Web browser. The exhibition creation tool has a direct manipulation interface for higher accessibility. It is compliant with Dublin Core metadata standards and supports four types of artefacts: text-based, photographs, videos and audio. [23] There are three approaches to creating a virtual exhibition with the VAES system. The first is a layered approach of information regarding the artefacts in the exhibit. Another is rearranging the content of the exhibition page and the final is making use of pre-existing templates to create an exhibition. [23]

### 3.5. Omeka

Omeka is a tool for the creation of 2D digital exhibitions online or downloadable. It is intended for a variety of users, professional museum curators and students. [33] Omeka is a tool for creating online digital exhibitions. It is open-source and freely available. It is metadata supported. Omeka has functionality to create exhibits from scratch or use one of many predefined templates, called “themes”. The functionality of Omeka can be extended through the use of plugins. [33] Omeka can be downloaded or hosted on Omeka.net, their dedicated hosting platform. It supports many digital file types: audio, video, images, text and customisable objects. [33] In Figure 5 is an example of the “themes” or templates available to users starting a digital exhibit.

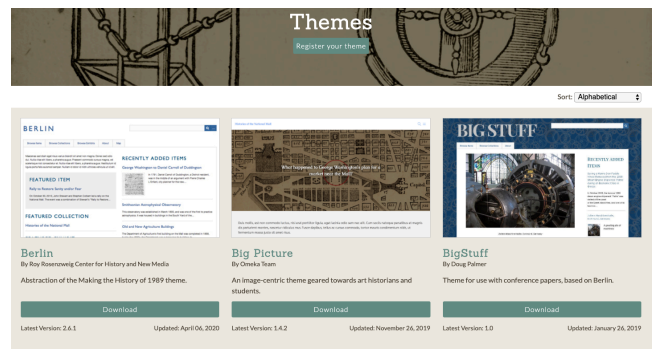


Figure 5: Omeka collection of themes as templates for digital exhibition creation [32]

In Figure 6 the Omeka interface for creating an exhibit is shown. The window shows an option to select one of the templates via a drop-down selection. Sets of items, the class of artefacts included in the exhibition can be accessed via the far-left pane.

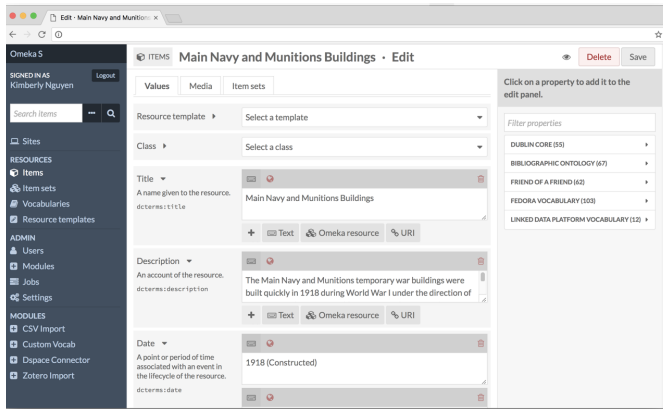


Figure 6: OMEKA interface for exhibition creation [32]

### 3.6. Collective Access

Collective Access is a freely available and open source tool for the curation of digital exhibitions. It offers support for multiple metadata schemes, namely Dublin Core, PB Core and PREMIS. [3] Collective Access is divided into two separate sections, one for management of data with an interface for cataloguing artefacts and the other section developed for searching and accessing items. [3] Collective Access supports multiple file types for digital objects: text, audio, video, images and the ability to create user-defined object types for flexibility. [3] In Figure 7 the interface for allocating the type of an artefact is shown. The object's type can be hierarchical, the names defined and a description for the object. Identifiers can also be used for searchability.

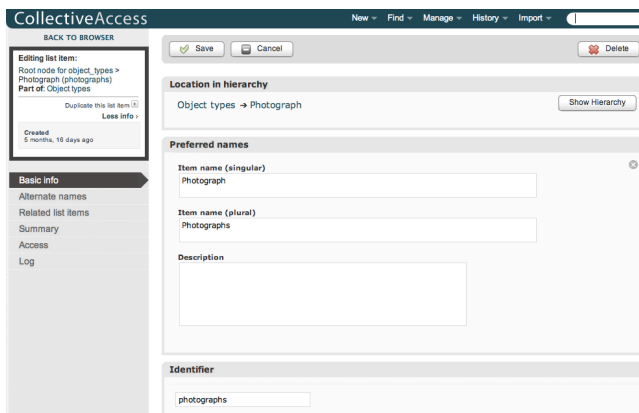


Figure 7: Collective Access object defining interface [16]

### 3.7. CollectionSpace

CollectionSpace is an open source tool that is available for free download. It does not offer any online hosting. It has metadata support; however, it is more a tool for content management that is used in tandem with a digital exhibition creation tool. [24] It does provide the ability to link items into thematic paths or relationships. It supports multiple data file types for artefacts: images, text, video and audio. Figure 8 shows the searching functionality of

CollectionSpace. The search functions of CollectionSpace are by object type and can be refined and filtered. It also makes use of the relating features of objects to make better matches. [24] The interface of CollectionSpace is designed to be clean and simple. [24] There is functionality for sharing artefacts between museums as part of its management system.

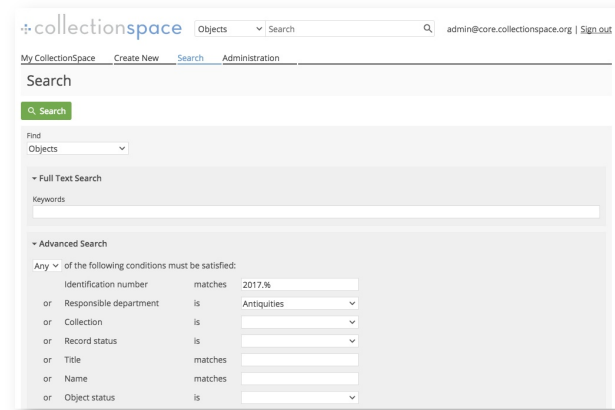


Figure 8: CollectionSpace search functionality interface [37]

### 3.8. CONTENTdm

This toolkit offers a free trial, however, is not freely available. Limited tools and features are available before upgrading is required. The tool is highly operable and allows for robust digital archive management. [9] It is designed for professional museum curators and exhibitionists. The CONTENTdm workflow is flexible and extensible because it is Web based. The types of objects supported in CONTENTdm range from text, audio, video and images. There is importing functionality to add new artefacts and objects into exhibitions. [9]

### 3.9. Content Pro

Content Pro is much like CONTENTdm. It is metadata supported. It acts more as a digital asset and content management system with some minor capabilities for the curation of exhibits but is likely to be used in conjunction with a more in-depth tool. [9] It supports multiple file types and the creation of custom object types. The tool is Web based and offers hosting for flexibility and ease of use. [9]

### 3.10. SVG Curated Exhibits

This approach focuses on using Scalable Vector Graphics (SVGs), an XML-based standard for the creation of digital exhibitions. Organisationally, the tool is effective and comprehensive, but requires a much higher level of technical understanding for more beginner and casual users. [14] The tool is a step away from Flash-based exhibitions. It is able to make complex exhibitions and also convert existing exhibitions made with other tools into SVG based ones. [14] SVGs are vector based but can embed raster images. The SVGs are searchable because they are text-based, however, some

graphics are not because it is not universally supported. [14] Creating type and object hierarchies is simple in SVG-based exhibitions because of the relation to XML architecture. [14]

## 4 Analysis of tools

The aim of this paper is to find the best approach in creating an easily accessible tool for a wide user base regardless of technical skill level, because of this focus the assessment criteria of a tool's success is primarily how usable and learnable a tool is, as well as how accessible it is. These factors will be looked at in terms of:

1. Accessibility (i.e. Operating Platforms)
2. Usability
3. Learnability
4. Cost
5. Metadata supported

### 4.1. Accessibility

The tools are available for download and are accessible for most desktop and Web browsers. MOVIO is the best tool in this regard because it is also available for mobile download and exhibition viewing. [28]

### 4.2. Usability

The majority of these tools are essentially usable by museum curators. The tools such as MOVIO, ViMEDEAS and VAES were made for research purposes and thus include features designed from the perspective of researchers with professional academics and curators in mind. Omeka is a more usable tool in this regard as it has good reviews from general purpose users. [33] CollectionSpace

is also a more usable application as it is integrated with Web hosting services such as WordPress which is accessible and learnable. [24]

### 4.3. Learnability

The majority of tools covered in this paper are products of research projects and thus are intended for more professional and thus digitally literate users. Omeka is a tool that is easily learnable, it has good documentation for reference, tutorials and templates for easier access to beginner users. [33] Collective Access and CollectionSpace also make use of templates and themes. [3, 24] SVGs require a higher level of digital literacy because they depend on users being able to edit and understand XML code. [14] VAES makes use of a direct-manipulation interface that allows a wider range of digitally literate users to create exhibitions. [23]

### 4.4. Cost

All of the tools are open source and free, except for CONTENTdm which is proprietary and has a free trial before requiring the user to upgrade. [9] Omeka has functionality for plugins to allow more features and operations, depending on the creator, these plugins could have a cost. [33] Omeka is free, however, if hosting on Omeka servers with Omeka.net, there is a limit to the storage. Upgrading the size of storage incurs and cost. [33]

### 4.5. Metadata Supported

All of the tools support metadata and all of them support the DCMI.

**Table 1: Comparison and Analysis of the digital exhibition tools.**

<i>Criteria</i>	<i>Accessibility</i>	<i>Hosting</i>	<i>Usability</i>	<i>Learnability</i>	<i>Cost</i>	<i>Metadata Supported</i>
ARCO [11]	Desktop.	Downloadable.	Low; heavy criticism regarding features and design.	High level of digital literacy required.	Free, open source.	Yes.
ViMEDEAS [7]	Desktop.	Downloadable.	Reasonably usable; some features.	Requires a high level of computer expertise.	Free, open source.	Yes.
MOVIO [29]	Desktop and mobile.	Downloadable.	Reasonably usable; some features novel and interesting, others criticised.	Requires a high level of computer expertise.	Free, open source.	Yes.
VAES [23]	Desktop.	Downloadable.	Reasonably usable; direct manipulation interface.	Low, direct manipulation interface.	Free, open source.	Yes. Dublin Core supported.

Omeka [33]	Desktop.	Yes, and downloadable.	Reasonably usable; good documentation on features and tutorials.	Quite learnable. Direct manipulation interface. Tutorials and guides for beginner users.	Free, open source. For extra storage when Webhosting, upgrades require a fee.	Yes. Dublin Core and MODS metadata supported. Customisable item type cataloguing.
Collective Access [3]	Desktop.	Yes, and downloadable.	Reasonably usable; online support and documentation.	Reasonably learnable. Some higher-level computer expertise required but has documentation.	Free, open source.	Yes. Dublin Core, VRA, CDWA/CCO, MARC (planned), can customise standards.
CollectionSpace [24]	Desktop.	Yes, and downloadable.	Reasonably usable; some integration with WordPress.	Low, has WordPress functionality, access to guides online.	Free, open source. Has a "Try Before You Buy" to test the features before downloading.	Yes. Dublin Core and customisable schemas supported.
CONTENTdm [9]	Desktop.	Yes, and downloadable.	Low, criticism with regards to some features.	High, made for professional curators and takes liberties with regards to understanding computer operations.	Proprietary, has a free trial, but then requires upgrade.	Yes.
Content Pro [9]	Desktop.	Yes, and downloadable.	Low, criticism with regards to some features.	Relatively high. Some features for professional curators are complex.	Proprietary.	Yes.
SVGs [14]	Desktop.	No.	Low, criticism with regards to some features.	Very high. Requires a great deal of understanding of code and computer expertise. Need to directly manipulate XML code.	Free, open source.	N/A.

## 5 Summary

After analysis of the tools available and the preferred requirements for usability and accessibility, an application with a similar user interface to that of VAES is favourable. A tool that implements a drag-and-drop or direct manipulation GUI opens the toolkit to a variety of users that have different levels of technical understanding and digital literacy. Omeka is also a tool that is accessible and favourable in design for reaching a wider user base. Omeka has clear and extensive documentation and tutorials as well as templates to appeal to more casual users. The current landscape of tools available and some discussed in this paper have a greater focus on creating an environment for professional researchers and digital curators who generally have more expertise in operating these types of applications.

Virtual exhibitions exported as virtual and augmented reality presentations require a high-level understanding of computers and computer operations, as well as access to equipment and separate platforms for viewing these presentations. Keeping in line with trying to make a toolkit that is widely accessible and usable, VR and AR will not be the approach taken.

The preferred presentation export files to keep the toolkit accessible and usable by a broad spectrum of users is PDF files and HTML Webpages. This viewing format is preferable because most users are already familiar with the file type and the learnability of these formats is manageable.

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