

# Tools for Digital Presentations of Cultural Heritage Artefacts

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## ABSTRACT

As digital libraries gain influence in the field of cultural heritage preservation, there is an increasing need for tools which allow users to explore these collections for educational purposes, leisure and the furthering of public cultural heritage discourse. Digital presentations of collection content are the ideal platform to achieve this as they motivate interaction with collections and generation of new perspectives and narratives on cultural heritage artefacts. Many tools have been developed to facilitate presentation creation, but the key issue they face is catering to a diverse base of users. Potential users have varying technical backgrounds, interest in and experience with digitised collections. Complex tools which support creation of rich digital presentations in the vein of their physical counterparts could alienate more casual users, and simpler tools do not cater to cultural heritage experts. This paper analyses several tools that support creation of digital presentations, including their underlying technology and presentation styles, to determine an appropriate approach to the design of a tool for digital presentation authoring which caters to as wide a user base as possible and can be used in the context of digitised cultural heritage collections.

## KEYWORDS

digital libraries, digital exhibitions, virtual exhibitions, cultural heritage preservation, digital humanities

## 1 INTRODUCTION

Cultural heritage is defined as the legacy of physical artefacts and intangible attributes of a society that are inherited from past generations, maintained in the present and preserved for future generations[31]. With rapid technological advances, the focus of the maintenance and preservation aspects of cultural heritage has become digitisation of cultural heritage artefacts. Digitised objects include text, images (and in some cases 3D models) of physical artefacts, sound recordings and videos. Digital libraries are defined as managed collections of such objects, accessible over a network with services to explore their contents[25]. A famous example is the Europeana collection, created by the European Union to consolidate many European cultural history archives[34].

Detractors have raised concerns about the authenticity or essence of cultural artefacts being lost in the digitisation process[18, 31]. However, the advantages of digitization are numerous, with theoretically global access to collections which previously required physical presence to examine chief among them[33]. Standards for metadata and structural design of digital libraries, such as the Dublin Core Metadata Element Set and The Open Archives Initiative (OAI) protocol, have been developed to ensure integrity

of digitised artefacts and interoperability within cultural heritage sectors[6].

However, digital archives do not exist simply to store these digitised objects – presentation is also an important factor to ensure preservation for future generations, as it promotes collections to cultural heritage experts and the general public[5]. This outward-facing aspect concerns accessibility of the objects contained in archives and allowing users to explore them in context, that is highlighting their place in the collection, related objects and so on. Digital presentations, an umbrella term for the assembly of narratively or thematically linked objects from a digital collection, are the ideal expression of this goal[29].

## 2 BACKGROUND ON DIGITAL PRESENTATIONS

Many advocates for digitised cultural heritage preservation acknowledge the need for collections to have an outward-facing or “presentation” component[5, 8, 25]. At the advent of digital libraries, this function served to make historical objects and records accessible to those with research or professional interest in the collections, such as academics and curators. Presentation was thus concerned primarily with functionality and did not offer much more than searchable lists of records[8]. However, more complex digital presentations were already standard offerings from notable museums and art galleries such as the Louvre and the Smithsonian, in the form of filmed tours on CD-ROMS[36].

By 1997, David Silver, founder of the Resource Center for Cyberculture Studies, noted trends in the online exhibitions that at the time attempted to expand on these contained tours and provide a more engaging presentation experience. He defined three categories of such online exhibitions[36]. Firstly, the style he calls the “virtual version” attempts to simulate or mirror a physical collection. The “missing wing” category includes related materials that expand on a collection but for space, time or money reasons were not present in the physical version, such as objects from similarly themed collections in another country. Lastly, the “hyperreal-site” defines what was at the time a new concept: a digital presentation that exists entirely within and on the World Wide Web with no notion of replicating an existing territory or space. All three types are expected to be hypertextual, meaning they must make use of cross-referencing between related digital objects, and dynamic, meaning easily redesigned/reconfigured with additions and subtractions supported. As digital libraries, and as a result digital presentation of their content, gained popularity in the field of cultural heritage preservation, experts attempted to standardise these concepts and definitions. The following subcategories of digital presentations – which modify and extend the basic definitions discussed and will

be used in this paper — were devised by the Digital Exhibitions Working Group, a focus group affiliated with the European cultural heritage collection Europeana[16]:

**Digital exhibition:** a collection of digital media objects (images, audio files, video etc.) assembled in a collection which constitutes a logical combination of materials based on different criteria: subject, author, time period and so forth. An element of user interaction is expected (such as clicking for navigation).

**Virtual exhibition:** this term is used mainly to refer to a (usually 3D) reconstruction of a physical environment in which the objects/works are displayed, for example a 3D reconstruction of an art gallery exhibition. Its purpose is to give the experience of visiting a physical space. This is an expansion of what Silver envisioned as the “virtual version”.

Other groups, such as the International Network for Digital Cultural Heritage e-Infrastructure (INDICATE), developed standards and best practices for digital presentation creation and articulated the unique benefits of these exhibitions for galleries, libraries, archives, and museums (the GLAM sector)[29]. Notable advantages found by this group and other authors are as follows:

### 2.1 Fewer barriers to entry and easier personalisation

Digital exhibitions present an opportunity to address issues of access which prevent many people from visiting real exhibitions. The most obvious advantage of Web-hosted exhibitions is reaching a potentially worldwide audience, which would not be possible for physical exhibitions. If done properly (i.e. with attention to guidelines and best practices laid out by groups such as INDICATE) digital exhibitions also have the ability to circumvent access issues to physically impaired groups, such as those with visual and auditory impairments. Digital presentation creation tools should provide options to change exhibition layout and aesthetic easily, for example colour scheme to cater to those with colour-blindness and font style/size for those with limited vision or dyslexia[29]. It is also easier to integrate digital tools for voice narration and translation of artefact descriptions and metadata, where in physical exhibitions this may have required extra hardware or software.

### 2.2 Contributions from underrepresented communities

The increased accessibility mentioned above makes it possible to engage the communities whose cultural heritage is explored in specific digitised collections. This is essential as they have a unique stake in preservation and are invaluable to metadata generation in terms of additions, corrections etc. to archival information[35]. Cultural heritage experts acknowledge that for a long time, archives and museums have been custodians of cultural history and their records and perspectives on certain communities do not always reflect reality[29, 35]. Involvement of these communities is now increasingly possible due to tools which allow them to express their own perspectives through digital presentations.

### 2.3 Ability to cater to different informational needs

As mentioned, digital collections face the same issue as their physical counterparts of needing to cater to a wide variety of users who want to engage with the contents in different ways[32]. Many digital presentation tools provide a means to do this by exploiting tagging systems in the digital collections and providing pre-defined templates for different content presentation styles[39].

### 2.4 Persistent exhibitions

If properly stored, digital exhibitions can be accessed in their original state for much longer periods than is possible physically. The competition for space and public desire for change necessitates that physical exhibitions are only active for limited time, and thereafter can only be viewed in part through image records/websites unless they are staged again. Degradation of fragile artefacts is also a limiting factor[24]. Long-lasting exhibitions are beneficial to the cultural heritage field’s goal of preservation — not only of artefacts but meaning and narratives ascribed to them — for future generations[29].

Tools which provide these general benefits and others specific to their implementation will be explored in this paper. Both digital and virtual exhibition creation tools will be addressed, although digital exhibition tools will be the focus due to their higher prevalence. Tools are categorised by the type or “style” of digital presentation they allow: virtual exhibition systems, with the output exhibitions in the style defined in section 2; content curation systems, which present exhibition content in a simple website style; and systems that facilitate the creation of thematic paths.

## 3 ANALYSIS OF DIGITAL PRESENTATION AUTHORING TOOLS

### 3.1 Virtual exhibition systems

Skueomorphism, or the design of digital (usually graphical user interface) objects that mimic their real-world counterparts, has been present in Web design since its inception – notably save icons represented by floppy discs and trash by wastepaper baskets[30]. As noted by Silver when this style of digital presentation emerged, the familiarity of the design likely results in easier navigation and exploration of the exhibition. It has the additional benefit of motivating visits to the real-life exhibits (by those who are able), as users are made aware of what the physical collection offers and are more prepared for archival visits and related research[36].

Today, virtual exhibitions in this style use 3D virtual reality (VR) and augmented reality (AR) technology to simulate physical exhibitions. Research of the European museum sector have shown that the advances of Web technology and 3D visualisation tools address both issues of “disconnectedness” and inauthenticity many find with current digital exhibitions and accessibility issues of physical exhibitions[20].

*3.1.1 ARCO - An Architecture for Digitization, Management and Presentation of Virtual Exhibitions.* The ARCO project[38] (2001) presents a complete toolset for the creation of virtual exhibitions, including image-processing software for creating 3D models of

artefacts, content management tools and visualisation tools for staging VR and AR exhibitions. It is designed for museums and galleries with the intention that curators use the subset of the tools they require, for example an exhibition of 2D art would only require the content management and visualisation tools to create and populate the 3D staging space.

The content management and visualisation subsystems are of interest for this report. Data objects are uploaded from existing collections or generated by the content production system and their metadata attributes are stored in the database as XML documents. Exhibition designers can then import, export and manipulate the data through use of the ARCO Content Management Application (ACMA)[38].

The ARCO system provides flexibility in presentation visualisation methods. Its content visualisation software allows staging of exhibitions in VR or AR environments[38]. The end user is able to browse the contents remotely through the Web via a VR interface. A custom ARCO AR application, the Augmented Reality Interface (ARIF), was created to be used in place of a Web browser for viewing AR exhibitions (see Figure 1). As mentioned in a 2008 evaluation of ARCO[37], end users are limited to those with some technical skill due to these VR and AR elements.

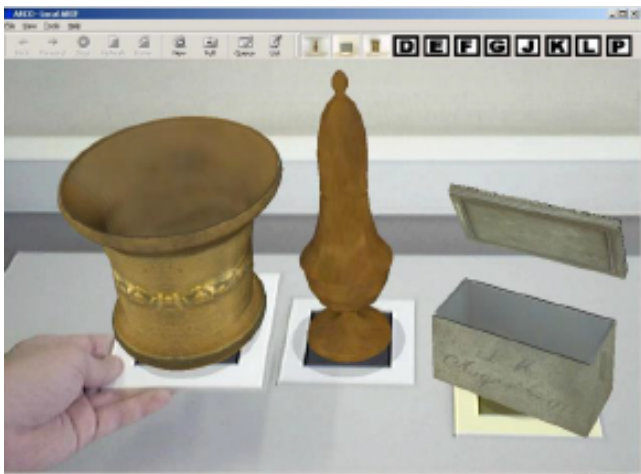


Figure 1: The ARIF in action[38]

**3.1.2 ViMEDEAS - Virtual Museum Exhibition Designer using an Enhanced ARCO Standard.** ViMEDEAS is a toolset that expands on the ARCO standard[1]. It has a similar modular architecture to ARCO, with subsystems that address 3D modelling, content management and visualisation. Its designers — Biella, Luther and Baloian — sought to address issues experts and end-users raised with the ARCO system, mainly extension of the visualisation tool to include room descriptions and the need for hierarchically structured resources, environmental data and rights management.

ViMEDEAS introduces a new metadata standard for objects, ViM-COX — an XML-based metadata set designed for virtual exhibitions and entire virtual museums[1]. It provides more freedom than

ARCO by extensions to metadata standards that include room arrangements, illumination and assets (windows, partition walls, furniture, etc.) for more immersive and lifelike virtual exhibitions. Another addition to ARCO is collection of user data from virtual tours to allow modification of exhibitions according to user interaction[2].

## 3.2 Content curation systems

Digital exhibitions as defined earlier (narrative-focused digital presentations which do not replicate physical environments) do not technically require specialised tools to create — when digital libraries first went online, curators and hobbyists used standard blog and website creation tools for this purpose[36]. Benefits of this format include the ability to exploit Web-specific technology and concepts in a way that would be impossible in physical exhibitions and intrusive in virtual environments which seek to mimic the real world.

Content curation systems function similarly to these initial tools and methods, but are usually built to adhere to popular metadata standards for easier importing and organisation of digital artefacts[17]. Digital presentations are created in the form of websites, with presentation navigation functionality provided by standard browser operations and hyperlinking.

**3.2.1 WordPress.** WordPress is a content management system (CMS) known primarily for its blog-publishing capabilities[21]. WordPress comes in two versions: Wordpress.com is a hosted blogging service and Wordpress.org is free blogging software that can be downloaded and locally hosted.

Since WordPress is a familiar tool outside of the GLAM sector, it is potentially easier for those with limited IT expertise to use, when compared to other available tools [3]. However, WordPress does not adhere to any GLAM metadata standards out of the box[21] and could thus be regarded as insufficiently rigorous for domain expert use. The Scriblio plug-in for WordPress mitigates this by allowing data to be structured according to the Dublin Core metadata standard for better searching and browsing, and allows for basic exhibition creation using hyperlinks[3].

**3.2.2 Omeka.** Omeka is a CMS that markets itself primarily to archives and libraries. Similarly to WordPress, Omeka comes in two versions: Omeka.org is the locally hosted, open source package and Omeka.net is a paid, account-based service which provides Web hosting and administrative support[17]. Both versions allow the creation of template-based exhibition sites, with a robust keyword-tagging system that aids content organisation and viewer navigation. Many Omeka plug-ins have been developed to perform a variety of functions, from batch importing images to timeline visualisations of collections[17].

Cultural heritage experts have expressed appreciation for Omeka.net's intuitive authoring interface and quick publishing capabilities[23]. Omeka.org, however, requires some IT expertise to set up since an operating system, Web server and SQL database are required[17]. Omeka site themes are designed to be responsive, allowing for an optimal viewing experience on desktop and mobile devices[17], as seen in Figure 2. Both Omeka versions allow some modification of these themes via an administrative interface, however, knowledge

of HTML and CSS is needed if the user intends to make significant changes or create their own theme[17].

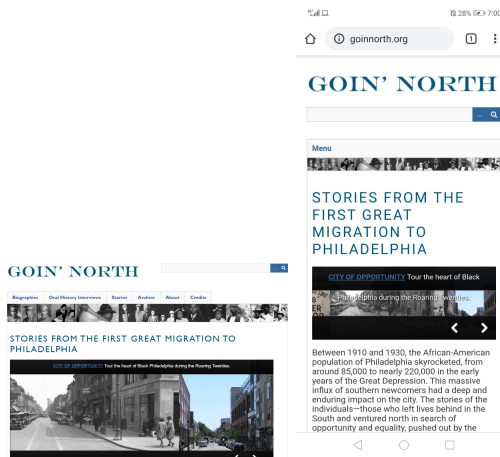


Figure 2: The desktop (left) and mobile (right) views of the Goin' North site (<https://goinnorth.org/>), created using Omeka. Images by author.

### 3.3 Path creation systems

As noted by Furuta et al[10], the path or guided tour metaphor is ideal for online navigation due to its familiarity to most Web users. The hypertextual paradigm of the Web is also well-suited to path-like traversal[11]. The path metaphor has thus become a popular design choice for exhibition creation tools for the GLAM sector[13]. Resources displayed in such a digital presentation are connected in some logical fashion specified by a path author, and viewers explore the presentation by "travelling along the path". Core elements common to all path creation systems are nodes, the building blocks of a path; connections, the relationships between them as defined by the path author; annotations, additional information attached to a node; and navigation tools to traverse the path[14].

**3.3.1 Walden's Paths.** In the late 1990s, the Walden's Paths project proposed the idea of guided paths to enable students to navigate the Web[9]. The system allows users — the targeted audience being primary and secondary school teachers — to link existing webpages in an ordered list to create a digital presentation on a topic. The core of the Walden's Paths architecture[11] is the Path Authoring Tool, which allows users to locate webpages with relevant information, order them to form a path and provide annotations to fill informational gaps. The now defunct Path Server acted as an intermediary between the user's Web browser and the servers providing path materials. It stored local information specific to the paths to allow viewers to step along, diverge from and rejoin the path at any point. The viewing tool provides traversal mechanisms and an overview of the path to orient the viewer.

Feedback from teachers regarding the value of the Walden's Paths tools was positive. Their comments indicated that they saw the paths as an effective way to connect materials from disparate sources and increase student engagement with the material[9, 11].

Users raised concerns about the unclear distinction between source material and annotations — which could lead to intellectual property issues — and this feedback motivated redesign of the path viewing interface, which can be seen in Figure 3[11].

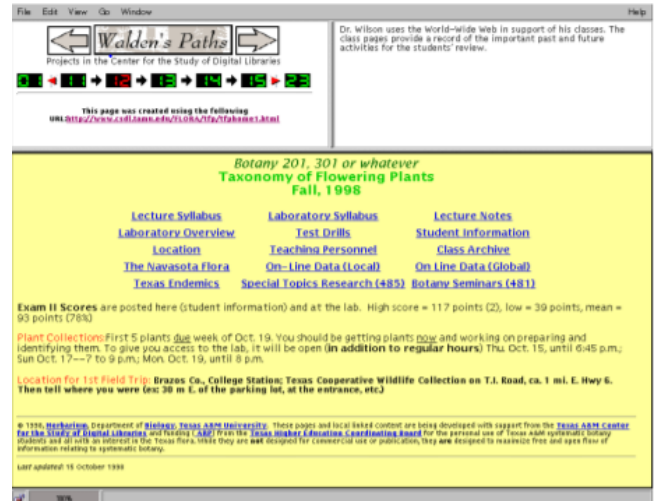


Figure 3: The Walden's Paths viewing tool[11]

**3.3.2 PATHS (Personalising Access To cultural Heritage Spaces).** The PATHS project[13] provides a path-authoring tool to allow exploration of the Europeana collection. The system regards each digital artefact as a node component, which includes original metadata as well as annotations and recommendations. Path creators set a trail through the items, which users can follow in a linear fashion or join at any point of the path, since each node is discoverable in the search interface. Users can also diverge from a path and return to their last-visited node at any point[13].

A unique feature of PATHS is its incorporation of tools to create links between collection items and external contextual materials such as Wikipedia pages. Rather than being an afterthought, these materials are intended to form part of a node — in fact, discovery of relevant external materials was part of the path creation use case[14].

Unlike some other tools which cater to domain experts with little IT experience, the PATHS project also involved non-expert end-users from the requirements finding stage, which resulted in an intuitive interface for path creation that according to PATHS developers requires neither domain nor IT expertise to use[15].

**3.3.3 MOVIO (MOstre Virtuali Online).** In 2011, the Italian Ministry of Culture commissioned the development of open source toolkit MOVIO, which allows archives and cultural institutions to create and publish digital exhibitions. MOVIO offers a content management system — CMS MOVIO — which enables the archive to import and catalogue resources in a manner adhering to the Dublin Core metadata model[27].

The Ontology Builder component allows creation of thematic paths. The tool defines digital objects as entities linked to other objects

via relationships, allowing users to create logical paths connecting them[28]. The path may then be represented as is or located in relation to a timeline or a map. The Storyteller tool incorporates a "narration line", which may contain additional media objects, actual voice narration and user interaction elements. Each narration item has a permalink to be quoted or shared by an exhibition viewer. The MOVIO APP and MOVIO HUB provide access to the catalogue of virtual exhibitions.

Ease of use was a key consideration in the building of MOVIO – the backend was designed to be usable by those with no IT expertise[28]. An article in the European cultural activities journal *Uncommon Culture* recorded the feedback of museum curators and archive managers across Europe who used an early version of the MOVIO toolkit[26]. This feedback revealed that all users found the functionality to be exciting and novel, with most agreeing that the backend required only general computing skills to use. Users also appreciated the focus on multilingualism, with support for translations built in at every level. However, some curators found the Ontology Builder unintuitive, with the creation of relationships between entities proving particularly complicated[26].

#### 4 COMPARISON OF TOOLS

The tools discussed have varied approaches to facilitating the creation of digital presentations. There is not yet a standard comparison metric despite extensive literature on the topic, since tool selection depends heavily on the end-goal of the exhibition, which can run the gamut from light entertainment to presentations of academic research[5]. For the purpose of creating an exhibition authoring system that accommodates as many user groups as possible, the following criteria will be used to analyse tools discussed:

*Audience.* What user group is the tool aimed at – domain experts (curators and academics), casual users or both?

*Complexity.* Does the system require extensive IT expertise to create or view exhibitions? Tools are designated "low" complexity if they require little IT expertise to use, "medium" if they have some features that evaluators report require IT expertise and "high" if evaluators and/or tool designers recommend that IT experts be involved in setup or use of the tool.

*Authoring Platform.* What are the platforms the authoring tool runs on? Desktop, mobile or both?

*Viewing Platform.* What are the ideal viewing platforms for published exhibitions?

*Collaborative Potential.* Does the system have dedicated collaborative features, such as co-editing?

*Shareability.* Does the system allow easy sharing of published presentations, for example via a link?

*Customisability and Restrictions.* Does the system impose templates and/or themes for digital presentations?

*Domain specificity.* Can the authoring tool be used to create an exhibition for any GLAM collection ("universal"), or is it built for a specific collection ("domain specific")?

*Metadata standards.* Does the system adhere to a widely-accepted GLAM metadata standard (such as Dublin Core) out of the box?

**Table 1** on page 7 compares the tools according to the above criteria. For all tools discussed, basic exhibition creation features are open source, although hosting and premium feature costs are a factor for WordPress and Omeka. Software price is therefore not a comparison criterion.

Selection of an appropriate tool for digital presentations depends on the goals of the user. If the presentation is intended for a formal or academic setting, Omeka, PATHS and MOVIO are ideal due to their adherence to metadata standards. For use in the classroom, low complexity tools with some customisation and collaboration features, such as WordPress, Omeka and Walden's Paths, are ideal. The strengths and limitations of virtual exhibition tools make them best suited to larger GLAM institutions which have budget to hire experts to work with curators in the design of exhibitions which fully utilise these tools' features.

#### 5 THE FUTURE OF DIGITAL PRESENTATIONS

Constant advancements in technology are resulting in improvements to digital presentation tools, regardless of category. More immersive and life-like virtual exhibitions can be created as a result of advancements in the 3D graphics field[12]. In the case of content curation systems, innovative additions are constantly being developed to address user needs, such as the Omeka Everywhere suite for integration of touchscreen tables for in-museum digital presentations[19]. Recent research has even investigated the automation of exhibition creation from public archives[22].

Shifting definitions and requirements mean that work on standardising digital presentations has become even more important to ensure the quality of future tools[8]. To this end, the Digital Exhibitions Working Group has defined a digital exhibition metadata element set (DEMES)[16], although this survey of the literature found that it has not yet been widely adopted.

#### 6 SUMMARY

With the proliferation of digital libraries and collections across the Internet, the number of digital presentation tools has grown in kind. Variety of user groups presents a challenge to tool creators: their software must allow those with little to no IT expertise to author engaging presentations that do not compromise greatly on exhibition complexity. Different approaches to this task include integration of 3D elements and implementation of Web-specific technologies for immersive viewer experiences.

For our purposes, virtual exhibition (VR and AR) software will not be considered due to accessibility and complexity issues mentioned and lack of programmer experience and skill. Focus will be on the development of a direct manipulation tool to create exhibitions, with output formats likely being PDF files and HTML pages. These technologies are intended to cater to a wide creator and viewer base.

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**Table 1: Comparison of tools**

<i>Criterion</i>	ARCO	ViMEDIAS	WordPress	Omeka	Walden's Paths	PATHS	MOVIO
Audience	Experts	Experts	Both	Both	Casual users	Both	Both
Complexity	High	High	Low	Low	Low	Medium	Medium
Authoring Platform	Desktop	Desktop	Desktop	Desktop	Desktop	Both[13]	Both[27]
Viewing Platform	Desktop	Desktop	Both	Both[17]	Desktop	Both[13]	Both[27]
Collaborative Potential	No	No	Yes	Yes	No[4]	Yes	Yes
Shareability	No	No	Yes	Yes	No[4]	Yes[15]	Yes
Customisability and Restrictions	N/A	N/A	Templates and Themes	Templates and Themes	N/A	Themes	Templates
Domain specificity	Universal	Universal	Universal	Universal	Universal	Domain specific	Universal
Metadata standards	Yes[38]	Yes[1]	No	Yes[17]	No	Yes[7]	Yes