# Communicating Museum Collections Information Online: Analysis of the Philosophy of Communication extending the Constructivist Approach

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## Abstract

Cultural heritage institutions are spending considerable effort and resources in order to provide online access to their collection catalogues and collection management systems, usually through their institutional websites. This improves accessibility and supports research and engagement by diverse user groups, as well as meeting the increasing expectation by audiences that this type of information will be freely and easily available online. However, cultural organisations have not responded to these needs in the same way and have been employing different web tools and features to present their collections online. In this paper we argue that the technological implementation choices as well as the type of content provided reflect also the philosophy of communication of the institution itself. We used the constructivist approach's learning theory and theory of knowledge and combined these interrelated epistemological and cognitive perspectives to analyse the communication philosophy of a large number of museum online catalogues. The paper presents the research carried out initially in 2007-9 and then again in 2017, studying the provision of collections information online by different types of museums across Europe and in the USA. This enabled us to establish categories of presentation types and study the changes over time. The results highlighted the major shift towards participatory practices which have been transforming the cultural heritage world over the last years.

## CCS Concepts

•Cross-computing tools and techniques →Evaluation/Measurement/Metrics •World Wide Web →Web applications •World Wide Web → Web interfaces •Information systems applications →Digital libraries and archives •Information retrieval →Users and interactive retrieval →Search interfaces •Applied computing →Arts and humanities →Fine arts

## Keywords

museum online catalogues; museum digital collections; communication strategy; web technologies

**ACM Reference format:**

Ion Gil-Fuentetaja and Maria Economou. 2018. Communicating museum collections information online: analysis of the philosophy of communication extending the constructivist approach. *ACM J. Comput. Cult. Herit.* XXXX, XXXX. XXXX (XXXX 2018), 13 pages.
DOI: XXXX

## 1. INTRODUCTION

Over the last two decades an increasing number of cultural heritage institutions have been providing online access to information about their collections in an effort to increase accessibility and support research, education, and public engagement. This followed the wider radical changes which had started affecting the museum world since the 1970s forcing cultural organisations to shift their attention from their collections to their visitors. The 'new museology' discourse around the social and political role of museums which was pushing for new communication models and style of expression [1; 55 - 3] had a significant impact also in the digital activities of museums. The transformation in the cultural heritage world meant that museums changed from being seen as safe-keepers of collections to gradually becoming education, information, and entertainment centres, expected to provide different types of experiences to a varied audience [4-6]. Contemporary museums started increasingly relying on different types of media to convey their stories while using various digital platforms in their exhibits, narratives, and interactions with visitors [7, 8].

These rapid social and technological developments, particularly since the millennium, made cultural institutions aware of the necessity of creating and maintaining a digital presence on the web for more wide-reaching and effective communication. Consequently, a growing number have been investing considerable effort and resources in providing access to their online digital catalogues as part of their web

presence. In order to answer the increased expectations from web users, museums have been exploring different ways of offering added functionality and greater versatility in the provision of collections information on their web sites [9].

This meant that they started moving beyond the provision of simple static webpages, offering initially textual information from their catalogues, which was later complemented by digital images and other audio-visual material. This type of online catalogue was based on the digital collections information system (CIS) that was used by curators, conservators and other specialists, or in some cases, was the web front-end to the in-house system without any or with minimal additional steps taken to clean up the data before making it publicly accessible. Collections information systems have more recently been called collections management systems (CMS) reflecting the move from the simple inventory or descriptive catalogue to a system for managing the collections, their intrinsic and associated knowledge, as well as their movement, lending, borrowing, disposal and other related activities, together with their role in creating and sharing knowledge [10]. The common assumption among cultural heritage institutions was traditionally that this is a more specialized tool, complementing the general information provided about the collections, often in the form of highlights or online exhibitions, and other interpretive digital materials provided online at the websites of cultural institutions for a non-specialist audience. However, assumptions of this kind have usually not been tested with systematic research on the profile of online catalogue users and the way these are being constructed by cultural institutions and used in practice by end users.

At the same time, the appearance and spread since the millennium of social media and the information and knowledge architecture of Web 2.0 brought to the fore the idea of the collaborative, participatory museum [11 12], and the shift of its role from repository to forum [13], focusing on communities of users actively creating and contributing, and not just consuming collections information [14]. Crowdsourcing or citizen science initiatives in cultural heritage have brought together communities of interested individuals ready to work towards a specific aim, such as transcribing, digitising, translating, or describing cultural heritage content [15, 16]. These developments have been transforming the cultural heritage sector and affecting museum websites and online catalogues, yet the nature of this transformation has not been studied in depth.

Some early publications addressed issues related to the design and use of cultural websites in general (e.g., [17]) and their role in encouraging physical visits to the museums [18] or compared physical and online visits from a theoretical perspective [19]. Other studies examined the informational value [20], accessibility, usability [21], interface design or user needs of museum websites as a whole [22, 23]. There has also been a lot of work in information retrieval, interpretation of user interaction and the evaluation of digital libraries in general (e.g. [24, 25]), but the standard evaluation benchmarks which have been developed in information retrieval usually focus on a ‘single document, genre, language, media-type, and searcher stereotype that is radically different from the unique content and user community of a particular digital library’ [26].

But when we want to understand and study in depth the real use and impact of museum websites and online catalogues, as with any technological solution, it is important to examine the triangulation between three different actors, namely institutions, technologies and end users, in this case, online visitors [27]. Therefore, the specific technological solutions or communication strategies that museums adopted on the web have to be carefully analysed in relation to all actors and parameters and their complex interrelationships, since they have profound consequences for the cultural organisation on the digital sphere, becoming the clear reflection of the fostered philosophy of communication of the institution itself.

This paper makes a significant contribution in this area as museum websites online collection catalogues have not been analysed in sufficient depth and breadth. It addresses the need to systematically examine a substantial number of museum websites from different countries, in this case across Europe and North America; analyse changes over a long period of time, taking into account these complex interrelationships; and link theory and practice, particularly learning and knowledge theories, to study the provision of online collections information in the context of the organisation’s communication paradigm. The paper is based on the findings of a research project which was initially set up in 2007-2009 with an FP6 Marie Curie EST grant to investigate the online provision of museum catalogues, the users’ profile and pattern of use. This was later expanded with additional case studies, comparing the original findings with new ones from 2017. This allowed the examination of change over time, an important aspect rarely addressed in digital heritage research.

## 2. RESEARCH METHODOLOGY

In order to study comprehensively the development and use of museum websites and online collections it was necessary to analyse both the way museums are communicating on the web, as well as how this online content is consumed by its intended audience. Therefore, the two main objectives of the research were to a) study the implementation of different web technologies and models by the cultural institutions themselves and analyse their underlying communication philosophy, and b) identify the patterns of use of these museum websites by online visitors. Following this line of action, the project covered the following stages: first, study a large sample of online museum catalogues from around the world in order to establish a typology of how the information was organized and presented [28]; second, carry out an email survey with the museum staff of the organizations with the most complex type of online catalogue that offered some kind of searching tool [29]; and third, select a small number of case studies from this group to analyse their web access logs in depth in order to trace user profiles and usage patterns [30].

The results presented in this article relate to the first stage of the project, which includes a brief comparison of the original data of 2008 with an updated analysis of the websites performed in late 2017. One of the most important things to bear in mind when interpreting the results obtained during the two stages of analysis is their different socio-technological juncture. While during the 2008 analysis, most of the technological solutions were based on the initial static understanding of the Internet and social networking in cultural heritage was only an emerging phenomenon [14, 32], the second phase was carried out during a very different technological reality. In fact, mobile subscriber penetration increased during that period from less than 40% to 67.6% of the population worldwide, and from about 2.6 billion to 5.14 billion unique subscribers at the end of 2017 [33, 34]. Similarly, Internet users increased from 1.6 billion (23.5% of the world population) at the end of 2008 to 4.2 billion (54.4%) at the end of 2017 [35]. While active social media unique users more than tripled since 2008 reaching 3.2 billion worldwide, representing 42% of the global population [33]. Therefore, it is important to understand the distinct social and technological realities that museums were facing during the two separate research stages.

The first step of the research process involved carrying out an extensive literature review, which supported the selection and empirical evaluation of museum websites. This helped to identify the different models of presentation of museum collections and digital catalogues. The different ways of presenting online collections and the implementation of particular features were analysed in terms of the model of communication they represented and the ways they supported visitors' exploration, learning processes and knowledge construction. In this process, we hypothesized that the philosophy of communication of the institution would be reflected on the design and implementation of the web technologies they selected to communicate contents to their audience, and tested this empirically with a large sample of museum websites. In order to answer the research question, this phase of the research use critical examination of the websites by the researchers and did not include any qualitative data collection about user experiences.

## 2.1 Theoretical approach: extending the constructivist model

Following a constructivist approach, we found useful to define the communication philosophy of every institution in relation to two different but closely interrelated theoretical approaches, namely, the learning theory and the theory of knowledge, combining epistemological and cognitive perspectives [36]. According to the constructivist model, how learning theory is adopted by each museum delimits the degree of intervention of the institution on the learning process of the individuals, with the two extreme perspectives when communicating contents to the audience being complete user freedom on one hand, and complete institutional intervention on the other. In the direct intervention approach, content is filtered by the staff and specialists of the institution, who are the ones deciding which is the most significant or useful to make available to the users to support their learning process. In other words, the model in this case is that institutions process the most suitable information in order to improve the learning process of passive users. The opposite perspective which gives complete freedom to the users, conversely, supports users in choosing themselves among all the contents available at the institution which are made freely and easily available to them. In this perspective, users are the ones who are selecting and differentiating contents according to their learning needs.

Additionally, the theory of knowledge as employed by the constructivist model [36] was also used as another key parameter to interpret the implementation of web technologies by museums. This theory identifies two main antithetical paradigms for understanding how knowledge is perceived, which also underpins the way cultural institutions are presenting their contents. On one end is the realist vision of the theory of knowledge which supports that knowledge exists outside the individuals and consequently, can only be presented to users, providing true, objective and equal knowledge for everyone. The idealist vision of the theory of knowledge, on the opposite side of the spectrum, affirms that knowledge is constructed by the learner personally or socially. Therefore, the information presented has to be processed by each individual in order to be assimilated and fit it into their conceptual framework, which results in variations on the constructed knowledge depending on every individual.

George Hein, one of the main theoreticians of the constructivist museum, took the positioning of cultural institutions on these learning and knowledge theory axes as key factors determining their philosophy of communication [36]. Following the intersection of these axes, Hein identified four archetypical distinct theoretical models of philosophy of communication expressed among different institutions, namely the didactic museum, the discovery museum, the stimulating museum and the constructivist museum (Fig. 1). After being adapted to the current study, these models can be briefly described as follows: In the didactic museum, which believes in the acquisition of external knowledge, this is driven by the intervention of the institution through selection and differentiation of the online content to be displayed for the users. The discovery museum, on the other hand, allows users to freely acquire this external independent knowledge by providing several choices of navigation through the presentation of extensive contents. The third model, the stimulating museum fosters the construction of knowledge by users according to their background, but this is driven mainly by the institutional intervention of curators and museum staff. Finally, the constructivist museum is the one that allows users to freely navigate through the contents of the institution in order to construct their own knowledge.

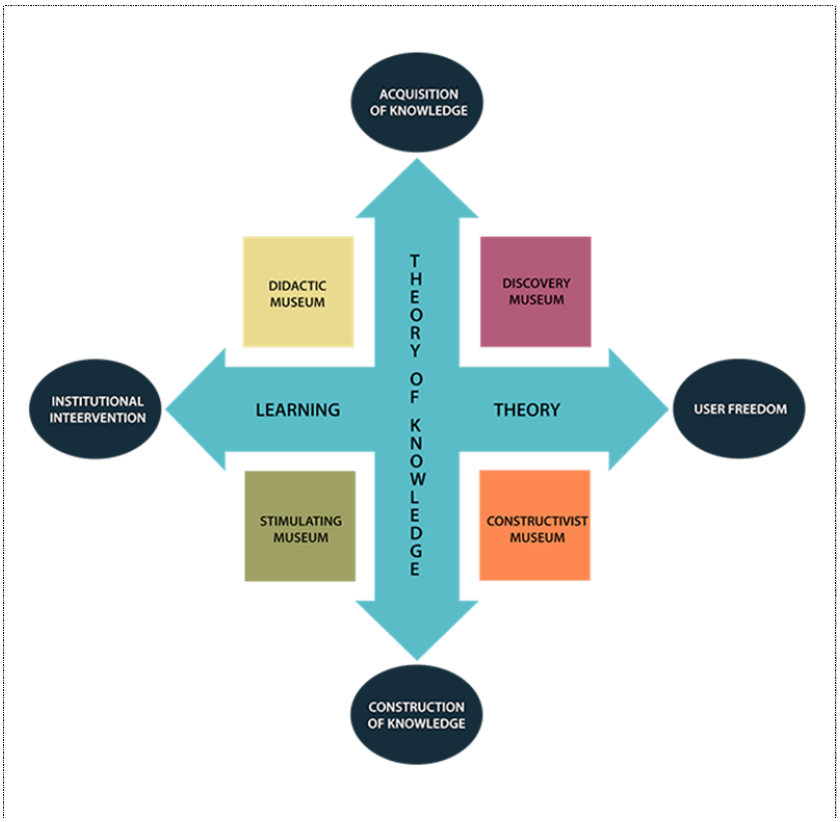


**Fig. 1.** Archetypical models of philosophy of communication of museums

This model proposed by Hein has been widely accepted [37-44], although lately some updates have been suggested following the evolving trends in communication and museology [42]. However, not all of the four aforementioned models of museum communication have been implemented to the same extent and most researchers advocate for the constructivist museum model as it fits best the increasing influence of technologies in all the processes linked to museums and their communicative and educative role [43].

Even though these models were originally proposed for the physical environment of museums, we argue that they can also be applied to the digital sphere and tested their usefulness for the analysis of museum websites, and particularly the online presentation of the collections, and the communication paradigm these relate to [32]. At the first stages of our research analysis we related the extremes at either end of the two axes with the implementation of different features of the museum websites. In this sense, the degree of intervention of the institutions on the learning process was linked to the browsable or searchable character of the museum online content, as well as with the amount and type of online content provided [32]. Therefore, institutional intervention which implies active selection by the institutions of the presented contents was understood as a museum website with browsable collection content, while user freedom was related to searchable museum content.

Likewise, in relation to the theory of knowledge, the realist vision of acquiring knowledge was associated with a model of transmission of information by museums to users which are given a passive role, while personal construction of knowledge by the online visitors requires a broader and more comprehensive presentation of information supported by the museums so that users can fit and adapt this to their existing mental structures according to their needs [32].

Following the expansion of social media and participatory practices, we identified another model in our analysis which has evolved based on the principles of the constructivist museum, the participatory one, in which users are given an active contributor's role in many processes of the institution [11]. In this model, institutions become even more audience-centred, a place where not only visitors can construct their own meaning but also where the voice of the user informs and influences processes of the museum itself. Or, in other words, the museum becomes a place of creation, sharing and connection for visitors and content in order to improve active engagement [11].

Similarly to the long-established four archetypical models of museums, this new participatory one can also be identified by the specific features characterising its online communication. The impact of Web 2.0 and its capacity to allow multiple interactions at large scale [45],

has expanded the constructivist museum concept, not only by emphasizing a more active user model, but also by reinforcing its role in the communication processes of the institutions themselves.

## 2.2 Terms and Categories Used in the Analysis

Arising from these theoretical models of museums described in the previous section, the empirical framework of the research was designed to shed some light on the use of web technologies to communicate cultural contents around the four original main constructs and an additional one for the more recent update of the data. To assist the analysis, each construct has been translated into specific features of the institutional webs (Fig. 2)[1]. The main parameters of institutional intervention, user freedom, acquisition of knowledge and construction of knowledge were translated into empirical variables considering the following features: presentation of the holdings, existence and type of searching tool, presentation format and the presence of educational resources. and the presence of educational resources.

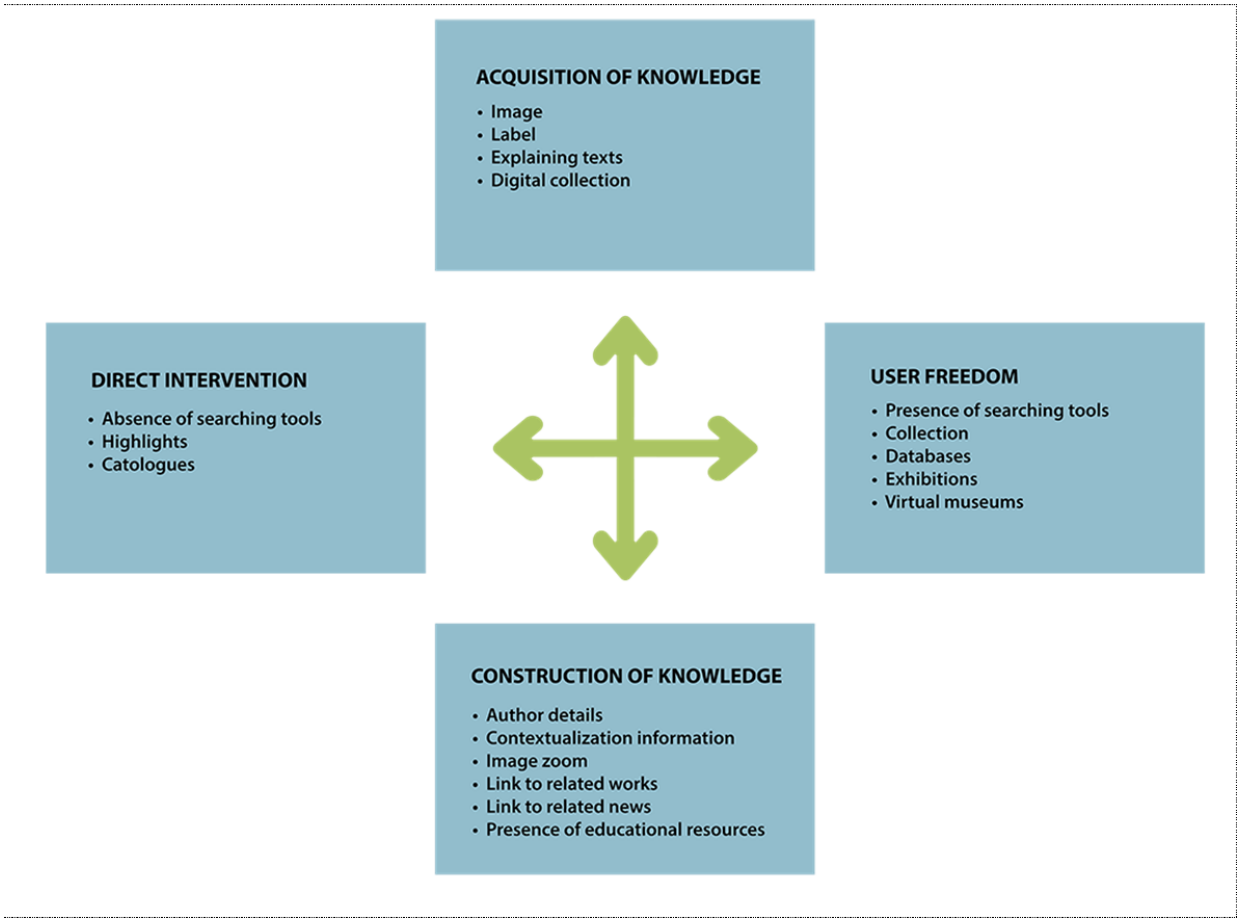


**Fig. 2.** Empirical model of the research

Regarding the presentation of the holdings, the variables have been designed from the perspective of the learning theory and take into account both the amount of the collection presented, as well as the way these contents are delivered. Depending on the extent of presented content from the collection, the option labelled as 'highlights' refers to the presentation of a selection made by the institution's staff of part of the holdings, whereas 'collections' refers to the largest part of them being presented.

Analysing the way contents are delivered, the related variables have also been designed on the basis of the learning theory. In this sense, we made a clear distinction between 'catalogues' and 'databases', identifying the first ones as having a browsable character, presenting

[1] For a more in-depth description of the empirical framework, see [32].

different areas, sections or groupings of the collection made by the institution, while databases are searchable and enable visitors to access their desired content in a more focused and targeted way using specific search terms. Equally, some other presentation options have been identified. Briefly, these options have been labelled as online 'exhibitions' when they structure contents in coherent groupings and as 'virtual museum' when they aim to present a digital version of the whole institution.

All these variables are linked to one of the two main axes that lead the analysis, the learning theory one. On the one hand, highlights and catalogues identify a trend of institutional intervention, while collections, databases and more complex presentations allow a greater degree of user freedom.

The presence of a searching tool and the level of search it supports also relates with the learning theory, since the existence of any kind of search gives users a higher degree of freedom to access the contents they want. Furthermore, the searching tools have been classified as simple, advanced, complex or combined tools.

In relation to the theory of knowledge axis, the research analysed the way content is delivered to users, examining whether the related features identified support more the acquisition or the construction of knowledge. Briefly, the following terms and categories were identified when examining presentation features. 'Images' represent the digital facsimile of the physical content. 'Labels' are the digital equivalent of the physical labels of the collections presenting facts related to the identity of the cultural content. 'Explanatory texts' offer in greater depth details about the object, such as technique, composition, topic, and so on, while 'author details' present information about the artist or the person or group who created the object. The 'contextualization' category refers to the information about the context (historical, social, artistic, etc.) in which the object was created or to more specific contextual information about the topic that the object is dealing with. If the website allows zooming into the digital image of the objects, this was labelled as 'image zoom'. Moreover, if websites deliver additional information related to the content or the author, this was tagged as 'link to related works'. Another variation of this category is the 'link to related news', which can contain information about ongoing or recent news related to the content. The simplest type of presentation of the contents is the merely informative and descriptive one that addresses the realist vision of the acquisition of knowledge. The more complex and comprehensive types, however, allow users to adapt the presented content to their mental structures and consequently, are linked to the personal construction of knowledge.

Finally, the provision of educational resources on the institutional websites was characterised as an identifiable feature of support of construction of knowledge by the users, due to the reinforcement of the learning processes these foster. Among the websites investigated which provided some kind of educational resource, the features ranged from the simple schedule and contact information to more sophisticated publications, downloadable activities to be carried out in the gallery, virtual activities or innovative edutainment options.

Additionally, due to the expansion of participatory approaches among cultural institutions, the presence of social media was taken into account as another variable linked to user freedom and the construction of knowledge as they offer the possibility of participation by the users in the museum's communication processes[2].

## 2.2 Selection of the Sample

The initial research defined the sample of museum websites to analyse using the Virtual Library museums pages (VLmp) in its 2008 version, an early leading directory of online museums around the world. The website was initially created in 1994 by Jonathan Bowen (originally at the Oxford University Computing Laboratory) and titled Virtual Library of Museums (VLM) and was later supported by the International Council of Museums (ICOM) [46]. The directory was developed and organized in a distributed manner by country, with around twenty people and organisations in different countries maintaining various sections, such as the Canadian Heritage Information Network (CHIN) maintaining the section on Canada or the Museum Documentation Association (MDA) and later the Collections Trust maintaining the UK section. The directory is currently organised as a wiki and is hosted at wikia[3]. The entries that appeared on the early versions of VLmp were sent voluntarily by the museum staff filling one simple web form, with slight variations according to the origin of the institution and they currently follow the standard conventions for wiki contributors.

Practical linguistic and time constraints limited the initial analysis to museums from Spain, the United Kingdom, Germany, Greece and the USA. Apart from the USA, in the rest of the countries studied, the online museums analysed were all the ones that appeared in the VLmp list in 2008. Regarding the American ones, however, because of the large number of museums listed, the project determined that the analysed sample would include only art and history museums (according to the VLmp categorisation). The total amount of museum websites analysed was 1921, which was divided as follows: USA 955, United Kingdom 518, Germany 299, Spain 138 and Greece 11[4].

After an initial review during the first stage of the research, some of the cases were discarded from further analysis for the following reasons: a) the website did not work or was under construction; or b) the website did not fulfil the minimum requirements for the analysis

[2] The presence of social media was not taken into account during the first stage of the research in 2008, because they were not a common feature among cultural institutions.

[3] http://museums.wikia.com/wiki/Virtual_Library_museums_pages (last accessed September 10, 2018).

[4] The latter included the web portal of the Hellenic Ministry of Culture (http://odysseus.culture.gr/; last accessed September, 10 2018), which links to over 280 public museums, as well as a number of private collections in Greece.

in relation to the presentation of collections information. In order to fit with the focus of our research, only those websites presenting at least some highlights of the collection with some minimum data about them were taken into account. For example, those websites, which only had a paragraph describing the collection or only a few photographs, were not included in the analysis. After this first analysis, the final sample studied in greater depth consisted of 219 entries. Most of the 219 museums selected for the analysis were art museums (78.5%) in English-speaking countries (USA 50.2% and UK 25.6%).

The same final sample of 219 entries was consulted during late 2017 in order to identify potential transformations of the websites and the related philosophy of communication of the museums. At this stage of the research the final sample was a little smaller than the previous one, since five institutions did not have a website anymore and another eight museums did not provide access to their digital collections any longer, not fulfilling the minimum criteria for the analysis. Therefore, the final sample to update the data consisted of 206 entries. The average profile of the selected institutions remained similar, with a majority of art museums (77.7%) in English-speaking countries (USA 51.5% and UK 24.3%).

## 3. RESEARCH FINDINGS

This section presents both the results obtained during the first phase of the research in February 2008, as well as the updated data from November 2017. Therefore, the comparison between the results obtained at these two phases give a good indication of the evolution of museums' websites in the last decade.

The first item of analysis of the research has been in both cases the identification of digital collections and resources on the analysed websites. Even though the two measurements show an overwhelming majority of websites that combine both the digital collections of the institution and some educational resources, their percentage has grown by a little over ten points (Table 1). Therefore, while in 2008 the websites combining these two types of digital resources represented nearly eight out of ten entries, in the more recent analysis they are nearly nine out of ten websites in the sample. The rest of the entries in both phases are websites that only present their digital collections, without any kind of educational resource.

**Table 1. Provision of online digital collection and educational resources on museum websites (%)**

| | 2008 | 2017 |
|---|---|---|
| **Digital collection only** | 21,9 | 11,7 |
| **Educational resources only** | 0,0 | 0,0 |
| **Both** | 78,1 | 88,3 |

Regarding the existence of searching tools related to the collection, the presence of sites without any kind of search has decreased by more than ten percent (Table 2). However, there is still a third of the whole sample that does not have any searching tool, not allowing users to search freely among the displayed contents. In contrast, the share of sites providing a simple searching tool or one combining different degrees of search has increased 5.9% and 11.1% respectively. In this sense, the existence of any searching tool represents two thirds of the sample studied in the second phase.

**Table 2. Provision and type of searching tool on museum websites (%)**

| | 2008 | 2017 |
|---|---|---|
| **None** | 43,8 | 33,5 |
| **Simple** | 16,4 | 22,3 |
| **Advanced** | 5,0 | 1,5 |
| **Complex** | 4,1 | 1,0 |
| **Combined** | 30,6 | 41,7 |

Analysing the type and structure of the digital presentation of museum collections online, there has also been a clear evolution. Although collections and highlights were present in about three fifths of the sample already in 2008, the second measurement has identified that the presence of catalogues and databases has increased from below half of the sample to about three fourths and two thirds of the sample respectively (Table 3). This increment is also accompanied by a significant growth in the presence of virtual exhibitions (22.3%), collections (17.8%) and highlight (8.4%). Therefore, during the update of the data, the research has identified that catalogues, databases,

highlights and collections appear in the majority of the analysed sample, together with digital exhibitions which appear in nearly two out of five websites.

**Table 3. Type of presentation of digital collection on museum websites (%)**

| | 2008 | 2017 |
|---|---|---|
| **Catalogues** | 47,5 | 76,2 |
| **Databases** | 41,1 | 63,6 |
| **Highlights** | 63,0 | 71,4 |
| **Collection** | 59,4 | 77,2 |
| **Exhibitions** | 16,0 | 38,3 |
| **Virtual museum** | 8,2 | 9,2 |

On the other hand, when examining the way contents are presented, the different options have remained quite stable, except for the decrease in use of author details (-17.6%), image zoom (-15.6%) and explaining texts (-6.2%) (Table 4). The existence of links to related works, conversely, has experienced an increase of 5.4%, being present in one out of six websites of the second sample. Therefore, apart from links to related works, it appears that the more developed ways of presenting and exploring museum collections content were less present during the second measurement.

**Table 4. Means of presentation of digital content on museum websites (%)**

| | 2008 | 2017 |
|---|---|---|
| **Image** | 95,0 | 98,5 |
| **Label** | 91,3 | 92,7 |
| **Explaining text** | 52,3 | 46,1 |
| **Author details** | 39,9 | 22,3 |
| **Contextualization** | 10,1 | 4,9 |
| **Image zoom** | 32,1 | 16,5 |
| **Link to related works** | 10,1 | 15,5 |
| **Link to news** | 2,3 | 1,5 |
| **Other** | 4,1 | 1,0 |

Finally, when dealing with educational resources, which as mentioned above, have increased to 88.3% in 2017, the schedule and contact information remain the most popular option of education provision (Table 5). In fact, nearly all the museums with any kind of digital educational resource display this information on the website. The highest increase in type of educational resources has been found in the publications, because they represent now nearly half of the sample of online museums with educational resources, while they did not even reach a third of it during the first phase of the research. Edutainment activities, on the contrary, are the feature that has suffered a decrease of 7.2%. Consequently, traditional forms of educational resources such as publications or in-situ activities have globally gained more prominence, while more innovative ones such as edutainment activities have receded in general terms.

**Table 5. Type of educational resources identified on museum websites (%)**

| | 2008 | 2017 |
|---|---|---|
| **Schedule and contact** | 95,9 | 98,9 |
| **Publications** | 32,2 | 48,4 |
| **In-situ activities** | 26,3 | 27,5 |
| **Virtual activities** | 12,3 | 14,8 |
| **Edutainment activities** | 8,8 | 1,6 |
| **Other** | 1,2 | 0,0 |

As mentioned before, during the second measurement, social media have also been taken into account. 87.9% of the overall sample included some form of social media. Among these, the most popular social media applications were, as expected, Facebook (97.2%), Twitter (91.2%), Instagram (68.0%), YouTube (56.4%), Pinterest (26.5%) and any kind of blog related to the museum (24.3%). The rest of the options were present in less than one out of five cases of this delimited sample.

Once all these features had been measured and identified during the first stage of the research in 2008, a cluster and factorial analysis was performed in order to see if there was any grouping among the analysed cases, as well as to verify if the potential groups of websites corresponded with the archetypical models proposed by the constructivist literature for the physical institutions [32]. According to the statistical processes, four groups were clustered by the presence of educational resources, the existence of any searching tool, the extent and structure of the digitally displayed collection and some advanced options of presentation of the contents. Analysing the features implemented by the websites in each group and responding to the empirical framework that linked each feature to the theoretical debates on the philosophy of communication of museums, we deduced that the obtained four clusters corresponded to the archetypical models outlined in the literature (Table 6).

**Table 6. Summary of cluster definition of museum websites' analysis**

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 |
|---|---|---|---|---|
| **Type of digital resources** | Digital collection | Digital collection<br>Educational resources | Digital collection | Digital collection<br>Educational resources |
| **Searching tools** | None | None<br>Simple | Advanced<br>Complex<br>Combined | Advanced<br>Complex<br>Combined |
| **Presentation of collection** | Highlights<br>Catalogues<br>Collection | Highlights<br>Catalogues<br>Collection | Collection<br>Databases<br>Catalogues<br>Highlights | Collection<br>Databases<br>Catalogues<br>Highlights<br>Exhibitions |
| **Presentation of contents** | Images<br>Labels | Images<br>Labels<br>Explaining texts<br>Author details<br>Image zoom | Images<br>Labels<br>Explaining texts<br>Author details<br>Contextualization<br>Link related work | Images<br>Labels<br>Explaining texts<br>Author details<br>Contextualization<br>Link related work |
| **Educational resources** | No | Schedule and contact<br>Publications<br>In-situ activities | No | Schedule and contact<br>Publications<br>In-situ activities<br>Virtual activities<br>Edutainment activities |
| **Identification of cluster** | Didactic museum | Stimulating museum | Discovery museum | Constructivist museum |

For comparability of the data and continuity of the research, we examined the same clusters again in the later analysis, which showed that there has been a shift in the philosophy of museum website communication in the last decade (Table 7). During the first measurement in 2008, the model of the stimulating museum was adopted by nearly half of the sample of the analysed websites (46.3%), while the constructivist one was portrayed by less than a third (31.7%) and the didactic museum by one out of six entries (14.7%). The discovery museum model, on the other hand, had a limited presence in the analysed sample (7.3%). Therefore, in 2008 three out of five analysed websites implemented a philosophy of communication based on the notion of a greater institutional intervention. However, it is also interesting to note that more than three fourths also adopt a technological implementation linked to the construction of knowledge.

The second measurement, conversely, shows a different trend of technological implementation. In fact, three out of five websites of the sample (62.6%) have adopted the constructivist museum model's philosophy of communication. Additionally, stimulating museums

represent a fourth of the sample (25.7%), whilst the rest of the entries are distributed between didactic museums (7.8%) and discovery ones (3.9%). Consequently, user freedom is supported in two thirds of the updated sample. Moreover, websites with technological implementation influenced by the perspective of construction of knowledge represent nine tenths of the sample.

As mentioned before, the theory suggests that currently participatory museums are opening their communication processes to digital users. Even though social media are present in each cluster, constructivist museums make more extensive use of them, with more than nine tenths employing some type (93.0%), followed by the stimulating (83.0%), the discovery (75.0%) and the didactic one (68.8%). Therefore, the use of social media is popular among museums of all clusters. Some types of social media, however, are more common than others in some of the clusters. In fact, two constructivist museums host two thirds of all the registered blogs (63.6%), where more developed contents are blended with options for user interactions.

**Table 7. Museum websites according to clusters of museum archetypes (%)**

| | 2008 | 2017 |
|---|---|---|
| **Didactic museum** | 14,7 | 7,8 |
| **Stimulating museum** | 46,3 | 25,7 |
| **Discovery museum** | 7,3 | 3,9 |
| **Constructivist museum** | 31,7 | 62,6 |

Looking at the data from a country perspective[5], some clear differences can also be highlighted from this temporal comparison (Table 8). While in Spain (40%), Germany (60%) and the United States (60,9%) the stimulating museum was the model adopted by most museum websites with the general focus being on institutional intervention, nearly half of the sample from the United Kingdom (48.2%) was implementing a philosophy of communication based on the constructivist museum model with overall emphasis placed on user freedom.

Analysing the updated data from this geographical perspective, the previously mentioned differences become increasingly blurred. In 2017 the most popular type of website is the constructivist one in all countries, with more than half of the group circumscribed in this cluster (Spain 51.7%, Germany 57.9%, United States 64.2% and the United Kingdom 68.0%).In all the countries more than eight tenths of the sample supported the construction of knowledge perspective with special emphasis on user freedom. Consequently, this transformation has also produced a more homogenised philosophy of museum communication of compared to the previous situation.

**Table 8. Archetype of museum website by country (%)**

| | Germany | | Spain | | UK | | USA | |
|---|---|---|---|---|---|---|---|---|
| | 2008 | 2017 | 2008 | 2017 | 2008 | 2017 | 2008 | 2017 |
| **Didactic museum** | 20,0 | 5,3 | 30,0 | 10,3 | 17,9 | 6,0 | 8,2 | 8,5 |
| **Stimulating museum** | 60,0 | 31,6 | 40,0 | 31,0 | 17,9 | 20,0 | 60,9 | 26,4 |
| **Discovery museum** | 5,0 | 5,3 | 0,0 | 6,9 | 16,1 | 6,0 | 4,5 | 0,9 |
| **Constructivist museum** | 15,0 | 57,9 | 30,0 | 51,7 | 48,2 | 68,0 | 26,4 | 64,2 |

Summarising, the comparison of data gathered in 2008 and in 2017 has demonstrated that institutional websites of museums have evolved during this period. Having the main gravitational point on the construction of knowledge in both measurements, the perspective on the learning theory has inversely shifted from the institutional intervention towards user freedom. Consequently, the main group of museum websites has become the constructivist ones, while during the first stage of the measurement the most popular was the stimulating one.

## 4. DISCUSSION AND FURTHER IMPLICATIONS

Digital technologies are increasingly being adopted by cultural institutions in diverse ways in order to try to engage different audiences, as well as to improve accessibility of their holdings. The proliferation of these online collections is addressed to meet the evolving and increasingly more sophisticated needs and expectations of potential digital visitors. However, the philosophy of communication of digital

[5] Greece was not taken into consideration in this analysis, because it has only two cases in the final sample. As mentioned in Section 2.2, the sample was restricted to these countries due to practical linguistic and time constraints in the initial 2008 analysis and for comparability of result in the 2017 one.

contents differs among museums and, even when not immediately obvious, has lasting influence on their technological implementation schemes.

The research was designed to identify different ways online museum collections have been designed and have evolved during the last decade. An initial analysis of the grouping of the analysed websites confirms that in the digital sphere museums replicate the archetypical models that the constructivist literature proposes for the physical cultural institutions.

A comparison of results of the two phases of measurement indicates a clear evolution on the way museums present their online contents. During the second stage, the share of museums that, apart from their digital collection, also delivered some kind of educational resource increased by more than ten percentage points. Within these contents, similarly, there has been a significant increase of online publications provided. Similarly, the presence of some kind of searching tool is higher, even though a third of the sample has still not implemented any. Catalogues, databases, collections and exhibitions are also more present in the analysed sample, but, conversely, the way contents are presented have become less developed than in the previous stage, with fewer author or context details, among others. On the contrary, links to related works have increased, probably because, after the implementation of digital databases, the linking of different parts of the databases is a straightforward process that does not require too much effort.

Comparing the spread of the different clusters in the analysed sample, the shift of the centre of gravity becomes evident. While other archetypical models experienced a decrease in different degrees, the constructivist museum model gained three tenths of new cases. We can therefore infer that there has been a clear move from other models towards less institutional intervention so that users can freely construct their knowledge according to their own needs and expectations.

Finally, both the examination of the literature and cultural heritage practice suggest the rise of a new theoretical model of museum, namely, the participatory one. In order to test the strength of this model in the digital sphere, the research measured the presence of social media during the second phase of the measurement in late 2017. The results affirm that the share of websites with social media is significantly high. Moreover, their presence in the different clusters is also remarkable, but the stimulating museum model and the constructivist one are the ones with an overwhelming presence of social media. In fact, in the case of the latter, more than nine out of ten of museums examined make use of them and two thirds support blogs in their websites.

The systematic examination of a large sample across several European countries and the US in this study confirmed the idea of a growing participatory museum in the digital sphere. This is an important contribution which has implications for research, practice, and policy in this field, as all too often reports on digital initiatives in cultural heritage rely on anecdotal evidence and personal impressions rather than systematic research. The study showed that most museums clearly felt the need to move from highly curated websites which controlled the way users encounter their collections and associated information towards more open systems that allowed online visitors to build their own path around the material provided according to their needs and that they have started encouraging more active user participation and possibilities for co-creation. These are important findings for the institutions not following this paradigm as well as for future planning and policy in the field as a whole as they also indicates the expectations from museum audiences and what is becoming gradually the norm for the cultural offer.

The findings also raise important questions about the reasons and motivations for these developments. Is the increasing adoption of social media by museums motivated largely by the need to widen their audience base and reach new constituencies, reflecting the significant changes taking place in society at large at the same time? This would be a relatively safe interpretation of the data. As the study included two phases of analysis performed during two different socio-technological junctures, the increase of participatory models in the online presence of museums seems the logical reflection of the evolvement of society as a whole during this ten-year period. The drastic increase in the degree of penetration of smartphones, other mobile devices and social networks worldwide shows that users are more willing to connect with each other and be more participatory in different aspects of their daily life. Extending George Henri Rivière's metaphor of ecomuseums as mirrors of society [47], these findings indicate that museums are not isolated from this more widely developing transformation and have transformed their communication models to meet the requirements and expectations of users in the growing participative interconnected reality. The results obtained from this research indicate that museums and the evolution of their philosophy of communication are accurate witnesses and testimonies of the socio-technological changes of society.

But have these developments also led to a change in how museums and cultural heritage in general is constructed and experienced? Is this change reflecting a genuine invitation by museums to a growing number of users to participate in this construction, encouraging 'openness not closure of interpretation and valuation, making flux, uncertainty and doubt critical' [48]? Who is driving the changes? Are these coming from the museums themselves or by different users or a combination of these two? Can we really talk about communities of users, the way the participatory paradigm is encouraging us to, and what are the characteristics of these communities? The participatory model is certainly spreading among museums and the study showed that there is a growing number of examples on how this is manifested and supported on museum websites. The study recorded the uptake, reflecting the potential of the constructivist approach and participatory practices and the intentions of a large number of institutions covering a long period of time and including a large sample across different countries. But is this being realised in practice?

The mere existence of social media on museum websites does not necessarily mean that this new model of museum is being implemented. It is not only the presence of social media on its own that enforces the implementation of the model of the participatory

museum, but the way these new digital tools are used. Consequently, this idea needs to be further researched by analysing the type of interaction, the contents shared and the type of participation that the use of these tools supports. Having laid the important groundwork with this extensive analysis, future research can further build upon this foundation and examine in depth the exact nature of participation and communication between museums and their audiences.

## Acknowledgments

The early stage of the research was performed within the wider research network CHIRON: Cultural Heritage Informatics Research Oriented Network, 2004-2008, which was funded by the European Community's Sixth Framework Programme under contract number MEST-CT-2004-514539 and a matching funds grant from the Greek General Directorate of Research and Technology, 2008-2009.

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